Breeding the black rhinoceros at Dvur Kralove Zoo

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Black rhinoceros
Diceros bicomis
(Linnaeus, 1758)

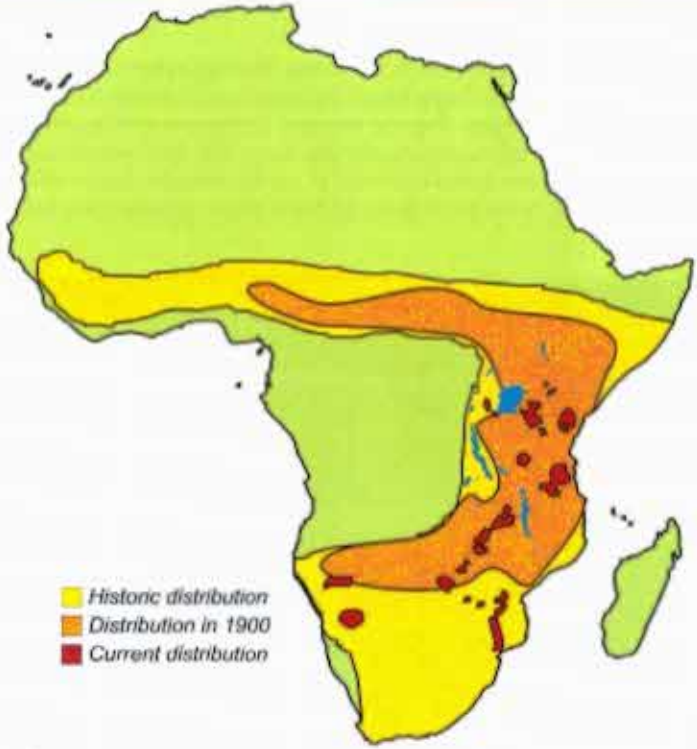
Taxonomy:

Class:	Mammals *(Mammalia)*
Order:	Odd-toed ungulates *(Perissodactyla)*
Family:	Rhinoceroses *(Rhinocerotidae)*

(dh)

Distribution

Originally, the black rhino inhabited most of Africa south of the Sahara with the exception of the Congo Basin and the equatorial forests of Western Africa. The range extended in the territory of 33 current African countries; however, the black rhino became extinct in some areas by 1900, especially those of Western and Southern Africa, and occurred in only 23 states (PENNY 1988). After 1900, this rhino was completely driven to extinction in additional eighteen countries, namely Chad, the Central African Republic, Nigeria, the Democratic Republic of Congo, Angola, Ethiopia, Mozambique, Swaziland, Cameroon, Somalia, Sudan, Burundi, Ivory Coast, Uganda, Malawi, Zambia, Botswana and Rwanda. Unfortunately, this tendency continued so they now only exist in isolated patches in 10 countries; in fact, natural populations have only survived in five of these, namely Kenya, Namibia, Zimbabwe, South Africa and Tanzania. Over 1,000 individuals still live in South Africa and Namibia, more than 500 in Kenya and Zimbabwe, and above 100 in Tanzania. In other countries (Swaziland, Malawi, Zambia, Botswana and Rwanda), there is a few dozen animals or only solitary animals at the most (EMSLIE *et al.* 2007), 2007). At the same time, Swaziland, Malawi, Zambia and Botswana are the countries where the species had become extinct and subsequently reintroduced (EMSLIE *et al.* 2009). Reintroduction schemes are also underway in countries where the species has not been exterminated in full, as in Tanzania (HOLECKOVA 2009).



Black rhinoceros - distribution map
(according to the International Rhino Foundation - IRF, and PENNY 1988)

Biological data (www.wikipedia.org, www.rhinos-irf.org, www.rhinoresourcecenter.com, www.arkive.org, www.animalinfo.org, GOLTENBOTH et al. 1995)

Weight:	800 - 1,400 kg (a 1,820kg animal was the maximum on record); males are usually larger and weighing more than females
Wither height:	132-180 cm
Horn length:	Longer anterior horn 42-140 (usually 50 cm), posterior horn 20-55 cm; quite rarely, a small third horn may occur
Record sizes:	Anterior horn 291.5 cm, posterior horn 227 cm (TRENSE 1989).
Body length incl. head:	3-3.8 m
Oestrus cycle:	21-28 days (25 days - SCHWARZENBERGER 1995b)
Gestation period:	440-470 days (SCHWARZENBERGER 1995b), or also 419-479 days
Number of young:	1
Birth weight:	25-50 kg
Eyes opening:	At birth
Nursing period:	Up to 2 years
Sexual maturity:	Males 4-8 (10) years (up to 10 years in the wild if territory is available), females 3.5-7 years
Reproductive age:	Females in the wild 30-35 years, males 35-40 years
Longevity:	Usually 35-40; rarely up to 49 years in captivity

Subspecies

Four subspecies of the black rhino are distinguished (www.rhinos-irf.org, www.arkive.org, www.iucn.org, www.panda.org):

South-western or **Cape black rhinoceros *Diceros bicornis bicornis* (Linnaeus, 1758)** is an arid-adapted subspecies native to Namibia, southern Angola, western Botswana and south-west of South Africa. The largest current population is found in Namibia, where the annual increase has been 5% and where the killing of rhinos was last recorded in 1853 (www.panda.org); minor populations have been restored in south-western South Africa. It is planned to reintroduce this subspecies in the Addo Park in South Africa, once individuals of the eastern subspecies are displaced (EMSLIE and BROOKS 1999).

A south-central black rhinoceros (Diceros bicornis minor) in Kruger National Park, 1997 (dh)

An eastern black rhinoceros (Diceros bicornis michaeli) in Ol Pejeta, Kenya, 2009 (dh)

South-central black rhinoceros *Diceros bicornis minor* (Drummond, 1976) is currently the largest subspecies, with historical distribution from western and southern Tanzania to the south through Zambia, Zimbabwe and Mozambique to the northern and eastern part of South Africa. It also probably occurred in southern Democratic Republic of the Congo, northern Angola, and eastern Botswana. Today, its stronghold is South Africa and to a lesser extent Zimbabwe, with smaller numbers remaining in southern Tanzania (EMSLIE and BROOKS 1999). Reintroduction activities take place in Botswana, Swaziland, Malawi, Botswana and Zambia.

Eastern black rhinoceros *Diceros bicornis michaeli* Zukowsky, 1964, has longer, more slender and more curved horns than the other subspecies, and is reputedly more aggressive. Some eastern black rhinos have distinctive skin ridges on their sides giving them a 'corrugated' appearance. Historically, this subspecies was distributed from southern Sudan, Ethiopia, and Somalia towards the south through Uganda, Rwanda and Kenya into northern-central Tanzania. Its current stronghold is Kenya, with small numbers still found in Tanzania and one non-native population in South Africa. In 1961, 4 (2.2) individuals were relocated from the Kiboko territory, Kenya, outside the historical range to the national park of Addo Elephant in South Africa (FITZJOHN 1993), making up a population of about 40 animals by the end of the century. The animals were moved to private game reserves within the historical range in South Africa and into a protected sanctuary in Tanzania (Mkomazi). Today, this subspecies occurs is found in Kenya, where there is the largest population, in Tanzania, and Rwanda where probably one animal has survived (EMSLIE *et al.* 2009). This subspecies was given its scientific name from Michael Grzimek (ROBINSON 2000).

Western black rhinoceros *Diceros bicornis longipes* Zukowsky, 1949 was once ranging through the major part of savannah zones of Western and Central Africa, but recently only a small last population now remains in northern Cameroon and a few western black rhinos remain in Chad (EMSLIE and BROOKS 1999). In 2002, 10 to 12 animals lived in Cameroon, but since 2006, this rhino is considered extinct (EMSLIE *et al* 2007).

Habitat

The black rhino inhabits a variety of habitats, ranging from the deserts of Namibia to rather moist mountain forest areas of Kenya. They primarily range in wooded grasslands and acacia savannahs, forest steppes, bush and broadleaved woodlands. The abundance of animals depends on the carrying capacity of habitats, this being the highest in the savannahs and succulent valleys of lowland areas (www.rhinos-irf.org, www.arkive.org).

Diet

Black rhinoceroses feed on the leaves and twigs stripped from a variety of woody plants and herbs using their prehensile finger-like upper lip. This adaptation is designed to grazing on leaves and twigs of shrubs and trees. They also eat fruits and various plants of the savannah, with grasses being last on the menu if choice is poor (MILLS and HES 1997). Their diet consists of up to 220 different plant species, especially small acacias, various spurges, succulents and many ever-green woody plants. Black rhinos can live up to 5 days without water (www.rhinos-irf.org, www.arkive.org, www.iucn.org).

Ecology

Territorial and semi-social animals to some extent, they tend to be less social and more aggressive than the white rhinoceros (WALKER *et al.* 1968). Home ranges of individuals overlap. Bulls lead a solitary life once adult, being not as social as cows, although they can tolerate other rhinos from time to time. Females and juveniles live social life. Sometimes, satellite males may reside within one another's territories. Ranges of adult females overlap; female black rhinos are actually not as solitary as often reported. The size of the home range depends on the habitat, season and availability of food and water, and increases depending on sex and age. Generally, there are smaller home districts and greater density of animals in habitats where there is a large quantity of food and water available. In Serengeti, home ranges are around 43 and 133 km^2, while in Ngorongoro it is between 2.6 to 44 kilometres. The black rhino likes to rest on specific points, which are usually elevated places.

Very fast runners, they can reach speeds of up to 56 km/h (VOELKER 1986). Walking through the vegetated area to reach water resources, they use the same paths as elephants. When grazing, they also use narrow tracks. They emerge to graze in the morning and at dusk, because at the hottest time of the day they are most inactive, resting and sleeping in the shade or wallowing in the mud. Mud bathing is an important part of their biology because it helps them to cool the body temperature and protects against parasites. If mud is not available, they wallow in the dust. Watering places are usually visited in the late afternoon.

Despite excellent hearing and sense of smell, they are short-sighted and only able to see some six metres. Certainly, they cannot make out objects more than 20 metres away; however, they are capable of sensing a human standing down wind from 750 m (VOELKER 1986). They are curious and often aggressive towards other animals and humans. The black rhino has a reputation for being extremely aggressive; they attack out of fear, confusion, and panic, with the cause being their poor eyesight when sensing danger. They have even been observed in charging tree trunks and termite mounds. The sharp assaults are pretended rather than being a real aggression, as rhinos will drive against everything suspected; once satisfied that there is no danger to them, they soon calm down afterwards. They can even attack cars of tourists.

They display no aggression to other species and any provocation is feigned. Bulls sometimes fight heads and horns against each other, but usually avoid each other if at all possible. Females are not aggressive to each other. Despite their aggressiveness, they have no natural enemies, perhaps with the exception of Nile crocodiles, where attacks were not confirmed. A young black rhino may fall foul of spotted hyenas or lions (MILLS *et al.* 2003).

Black rhinos are a long-lived species. Females reach sexual maturity at the ages of 4-7, while in males this takes place at 7-10. Reproduction occurs throughout the year but births tend to be mostly towards the end of the rainy season in more arid environments. Maximum number of births falls in Kenya into the period from September to November, while in South Africa birth mainly takes place in April to July. Every 23 to 28 days females enter heat (SCHWARZENBERGER *et al.* 1993a). Rhinos are used to pile their dung. Once a male finds faeces of an oestrous female, he is scraping and spreading the pile of dung, thereby hampering the other adult males to pick up the female's scent trail; then he follows the female. Adult males and females live together only during the mating season.

Courtship behaviour before mating includes snorting and sparring with the horns. Typical courtship behaviour is called bluff and bluster, where the rhino will snort and swing its head from side to side aggressively before running away repeatedly. Breeding pairs

A black rhino female with a five-month-old calf, Mkomazi, Tanzania - 2009 (dh)

stay together for 2-3 days and sometimes even a week. They mate several times a day over this time and copulation may last more than a half an hour. A single calf is born fully developed and can follow its mother around after just three days, with whom it stay together for 2-3 years until the next calf is born. The calf starts to take solid food as early as the age of several weeks. Mothers mostly guide the young following her from behind. The calf is nursed by the cow for 18 months (SCHENKEL and GRZIMEK 1990); the cow comes into oestrus again and is mated by the male while still accompanied by the calf. Female calves may remain with its mother after the birth of another rhino, forming small groups. Male calves are driven off by mothers after the birth. Cows may have at least 7 and a maximum of 12 calves if the reproductive age ends when the cow is 30-35 years, but even up to 18 calves (14 on average), if the cow is capable of reproducing until 40 years (SMITH and READ 1992). The life expectancy in natural conditions (without poaching pressure) is from 35-50 years (www.wikipedia.org, www.rhinos-irf.org, www.arkive.org, www.iucn.org).

Population status and development

In the year 1900, probably 2-3 million black rhinos lived in Africa (WEINBERGER 2007), this species being world's most numerous rhinoceros, but was however rare or locally extirpated in the western part of Africa at that time due to intense uncontrolled hunting by white huntsmen (PENNY 1988). Killing rhinos for their horn was common in many countries in the late 1950s (GRZIMEK 1966); at the same time, there were still 100,000 black rhinos around 1960 (EMSLIE *et al.* 2009). As a result of poaching and loss of habitat, these numbers declined to around 70,000 and 65,000 animals in the late 1960s and 1970, respectively; at that time, the Kenyan population still totalled 18,000 black rhinos (EMSLIE and BROOKS 1999). In the 1970s and 1980s, a number of African countries turned politically and economically unstable, leading to an increase in poaching and militarization. As the three Asian rhino species neared extinction and the sources of rhino horn for the local markets became exhausted, focus was shifted onto the African rhinoceros. The main reason of the commercial interest in rhino horn was its use in traditional Asian medicine, especially in China, plus as handles for ritual daggers in the Middle East, chiefly in Yemen. The horn price exceeded in the second half of the 1980s $ 500 per 28.35 grams (1 oz) (VOELKER 1986).

By the end of the '80s, the population in the wild had dwindled to less than 15,000, with numbers of black rhinos being estimated at just 2,300 in 1993 (www.iucn.org). The period between 1970 and 1993 saw 96% of them disappear from the wild (EMSLIE and BROOKS 1999).

In 1980, the largest populations, each numbering more than a thousand animals, ranged only in five states, with the largest of them being the one in Tanzania, with 3,795 individuals, from which a mere of 32 animals were left by 1995. In 1980, 1,500 rhinos still

A black rhino on an oil picture by Thomas Baines dated 1874 (the art collection of Sanlam - ROOKMAKER 2008)

An illustration of a black rhino by Roualeyn Gorgon Cumming from 1850 published in The Life of Hunter (ROOKMAKER 2008)

roamed Kenya, which in four years was only 550 animals and in 1987 even a mere 381 individuals. In the Central African Republic, there were still 3,000 animals in 1980; about 11 years later, only 5 were left and since 1992, the black rhino is extinct in this country. In Zambia, the rhino population in 1980 was estimated at 2,750 animals and Zimbabwe was probably still home to 2,500 individuals (however, official figures were lower than that). While in Zambia, the species was in all probability extinct in 1995, in Zimbabwe 315 animals left in 1995. In 1987, last three black rhinos were recorded in Sudan and they are now extinct in that country since that time. Simultaneously, two countries - South Africa and Namibia - avoided a decline in their black rhino population in the years 1980-1997 thanks to the working wildlife protection and law enforcement, with virtual zero level of poaching. In 1980, a total of 930 individuals were roaming these two countries, representing only 6% of the worldwide stock. Increase in the numbers can be seen from the IUCN data, according to which in 1996 1,024 and 598 black rhinos lived in South Africa and Namibia, respectively, making a total of 1,622 animals (HES Mills, 1997), while in 1997 the numbers of South African and Namibian black rhinos totalled 1,750 animals, representing 67% of wild populations (EMSLIE and BROOKS 1999).

Applying the strictest level of protection to the remaining population brought a gradual increase in the numbers, so in 2001 there were 3,100 black rhinos in the wild. According to the latest IUCN data from June 2008 (IUCN 2009), the population increased from 3,750 individuals in 2005 to 4,200 in 2008. Over these 3 years, the stock grown by 450 individuals, while several new populations emerged or were founded/relocated, such as in North Luangwa National Park, Zambia. The main population constituting 98% of all wild black rhinos ranges in four countries - Zimbabwe, South Africa, Namibia and Kenya (www.panda.org). The numbers have also increased in other states with reproducing populations with the exception of Zimbabwe, where there was a slight decline due to illegal hunting.

In Zimbabwe, problems started to emerge in the late 1980s and early 1990s, when poachers began to penetrate across the border, killing 75% of the south-central black rhino population (*D. b. minor*). Zimbabwe was then home to 2,000 individuals, which was one of the largest populations in the world. Poaching however continued and in 1993, only 370 black rhinos remained in Zimbabwe, with even just 315 in 1996 (HES and MILLS 1997). Afterwards, a national conservation strategy was developed, under which zones with high-intense protection were set up inside national parks and private game reserves. This successfully increased the stock to 500 individuals, which was the third largest population of black rhinos in Africa, of which 25% are kept inside national parks and the remaining 75% are held in commercial farms and game reserves. However, many national parks are under-equipped to face the well-armed poachers coming from Zambia, Angola and Botswana (www.rhinos-irf.org).

It was during the period 2000-2005 when they recorded a total of 136 illegal cases of killing of black rhinos, with 90% of the cases taking place in three countries - Zimbabwe, South Africa and Kenya. It should be mentioned that in 2003-2005, the Democratic Republic of Congo accounted for 59.1% of poaching recorded in both rhino species, Zimbabwe's portion and that of Kenya was 12% and 3.3%, respectively, Botswana accounted for 2.8% and South Africa for 0.4%, while in Namibia, Tanzania and Swaziland did not record any case of poaching (MILLEDGE 2007).

Since then the situation has worsened in South Africa, where poaching had virtually never existed in the past, in particular after the abolition of the fence on the north of Kruger National Park. In late 2008, about 40 white rhino were killed in this park by militarily armed poachers from Vietnam (CURRIE pers. comm.).

The worst situation today exists in Zimbabwe, where in 2008, poachers killed a total of 88 rhinos (southern white and south-central subspecies), this representing more than 10% of the local population counting 800 animals. By May 2009, additional 18 black rhinos had been killed, when the animals were hunted by well-organised and armed gangs of poachers equipped with cars and radios, plus superb legal assistance. Poachers were not only massacring the rhino, but even seeking to shoot those protecting the animals. These gangs are involved in illegal smuggling of rhinoceros horns as well as diamond and gold across the Zimbabwe border (IRF, 2009). The situation in Zimbabwe was termed "**Zimbabwe rhino crisis,**" and thus rescue operations began, aiming to raise funds and to relocate rhinos to safer areas. In addition, three poachers from the five-member gang of rhino poachers were hunted down and shot in Lowveld, Zimbabwe, in May 2009, after they had fired at police and rangers (IRF 2009).

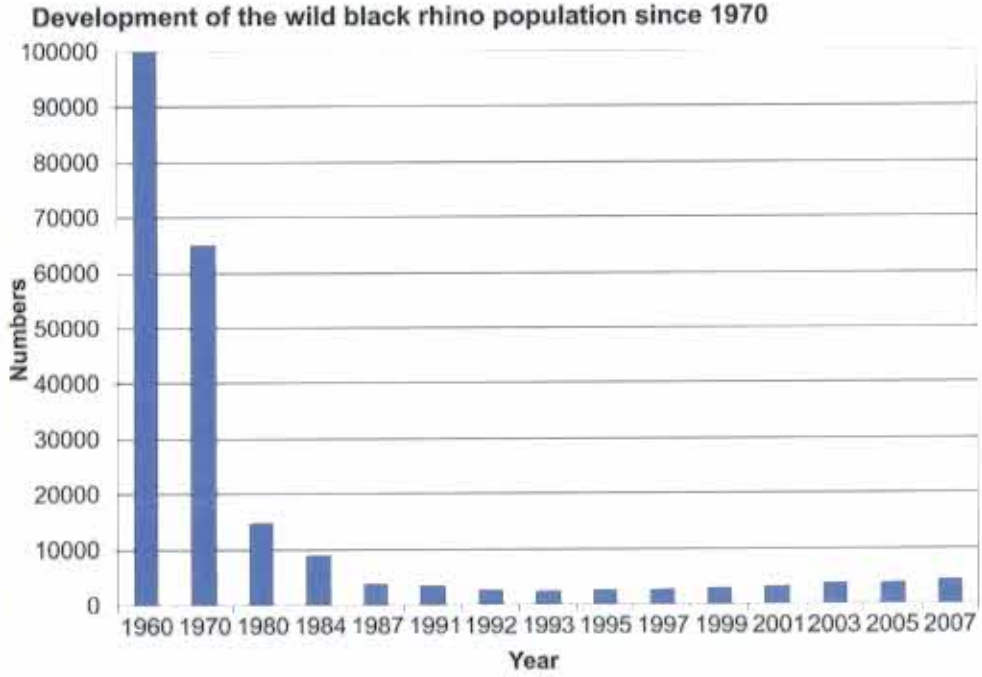
In cooperation with Zimbabwe conservation representatives, the International Rhino Foundation (IRF) has developed a scheme to protect the black rhino in South Africa, which includes the following:

- Protecting rhinos in private conservancies and national park intensive protection zones;
- Re-establishing populations in protected wild habitat in places, especially Botswana, where the species had previously been extirpated but which now seems secure for reintroduction;

- Translocation of rhinos from zoo collections to free-range facilities to hold them in semi-wild situations to produce additional rhinos for the reintroduction programmes. This way, a male black rhino from White Oak Conservation Center, Florida, along with a female from the Frankfurt Zoo have already been successfully introduced to the wild into Marakele National Park in South Africa where they have produced several calves.

To save the rhinos, IRF announced a fundraising campaign and organised a petition calling for stopping the illegal trade in black rhino horn for traditional Chinese medicine (www.13point7billion.org), with less than 460 south-central black rhinos remaining in Zimbabwe according to the May 2009 report (IRF, 2009). The governments of Zimbabwe, Botswana and South Africa signed the memorandum of understanding under which a cross-border protected area should be established for the rhino, formed in South Africa by the Venetia-Limpopo Nature Reserve with an area of 340 km^2 and Mapungubwe National Park with an area of 220 km^2, both stretched over land owned by De Beers, the South African company. Fences between these areas will be dismantled to allow for interconnecting. The Northern Tuli Game Reserve and 36 ranches with a total area of 700 km^2 will be appended on the Botswana part. On the Zimbabwe part, the territory of Tuli Safari and adjacent wildlife ranches with a total area about 500 km^2 will be added. A fundraising campaign has been underway to support this International Rhino Foundation's project (www.rhinos-irf.org). By early August 2009, IRF had raised over 120,000 USD, which was used to pay for a move of 46 black rhinos; in addition, eight poachers were killed from May to August 2009 (IRF 2009).

Ol Pejeta, Kenya (dh)



Development of the black rhino population in the wild

(MILLS *et al.* 2003, EMSLIE 2005 and 2007, EMSLIE *et al.* 2009, www.iucn.org, www.rhinos-irf.org)

Year	1800	1900	1960	1970	1980	1984	1987	1991	1992	1993	1995	1997	1999	2001	2003	2005	2007
Num.	Over 1 million	Several hundred thousands	Over 100 000	65 000	14,785	8,800	3,665	3,450	2,475	2,300	2,410	2,600	2,700	3,100	3,610	3,750	4,230

The abundance of the black rhino per African country in the period 1980-2005 (according to EMSLIE and BROOKS 1999, EMSLIE *et al.* 2007, EMSLIE 2009)

Country	1980	1984	1987	1991	1992	1993/4	1995	1997	1999	2001	2003	2005	2007
Angola	300	90	?	50	50	10	?	0 ?	0	0	0	0	0
Botswana	30	10	<10	< 10	5	4	0 ?	0 ?	0	0	5	5	7
Cameroon	110	110	30 ?	50	35	27	7	10	10	8	5	0 ?	0
Central African Rep.	3,000	170	10	5	0	?	?	?	0	0	0	0	0
Chad	25	5	3	0 ?	0	?	?	?	0	?	0	0	0
Ethiopia	20	10	?	0 ?	0 ?	5	1	0 ?	?	4	0	0	0
Kenya	1,500	550	381	398	414	417	420	424	420	430	439	540	577
Malawi	40	20	25	5	0 ?	2	2	3	7	7	8	10	16
Mozambique	250	130	?	50	50	45	?	13	?	0	0 ?	0 ?	0 ?
Namibia	300	400	449	479	489	583	598	707	695	893	1,238	1,141	1,435
Rwanda	30	15	15	?	15	10	4	4	6	0	1	1	1
Somalia	300	90	?	0 ?	0	?	?	?	0	0	0	0	0
SA	630	640	677	771	819	897	1,024	1,043	1,074	1,179	1,284	1,379	1,488
Sudan	300	100	3	?	?	0	?	?	0	0	0	0	0
Swaziland	0	0	6	4	6	4	9	10	10	10	15	16	18
Tanzania	3,795	3,130	275	185?	127	132	32	46	47	49	66	101	123
Uganda	5	0 ?	0	3	0	0	0	?	0	0	0	0	0
Zambia	2,750	1,650	> 106	40 ?	40	33	0 ?	0 ?	0	0	5	6	16
Zimbabwe	>1,400	>1,680	>1,775	1,400	425	381	315	339	435	524	536	527	558
DRC	0	0	0	0	0	0	0	0	?	0	0	0	0
Côte d'Ivoire	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**14,785**	**8,800**	**3,665**	**3,450**	**2,475**	**2,550**	**2,410**	**2,600**	**2,704**	**3,100**	**3,610**	**3,726**	**4,240**
Total countries	**18**	**17**	**14**	**14**	**12**	**14**	**9**	**9**	**9**	**8**	**10**	**10**	**10**

Natural populations have survived in Kenya, Namibia, South Africa, Zimbabwe and Tanzania. Reintroduced populations exist in Malawi, where the black rhino had become extinct (1992), Rwanda (prior to 1957), Swaziland (in the late 19 century), Botswana (1995) and Zambia (1995). The species is declared extinct in Uganda (1983), the Democratic Republic of the Congo (1986), Somalia (1987), Sudan (1991-1993), Angola (1995), the Central African Republic (1992), Chad (1991), Mozambique (2002), Côte d'Ivoire (after 1960), Ethiopia (about 1997) and Cameroon (2006) (EMSLIE and BROOKS 1999, EMSLIE *et al.* 2007). There are sporadic and unverified reports of individual animals from Mozambique, Rwanda, Sudan and Ethiopia (EMSLIE *et al.* 2007). In late 2007, Africa had 131 populations of the three surviving black rhino subspecies with a total of 4,230 animals (EMSLIE 2009).

Conservation

Since 1977, the black rhino has been listed in the Annex I (A) of CITES, which prohibits any international trade in live animals and their derivatives, i.e. horn in particular, as well as products thereof. In the IUCN's 2007 Red List (IUCN Red List 2009), the species is categorised as "critically endangered", the south-western subspecies (*D. b. bicornis*) being classified as vulnerable (VU) and the three remaining subspecies are listed as critically endangered (CR). Additionally, the International Union for Conservation of Nature (IUCN) announced on 7 July 2006 that the western subspecies (*D. b. longipes*) had been extirpated, with some last 10 to 13 animals remaining in 2002 (EMSLIE *et al.* 2007).

To reduce illegal hunting, the CITES regulations were implemented into the rules and legislation of a number of African countries during the 1990s. An effective direct protection became crucial to preserving the remaining rhino population. Many surviving rhinos are now concentrated in fenced territories, protected areas and intensive protection zones, where they can be effectively guarded. Constant overseeing and checks of the animals provided data allowing for the management of the rhino population with the aim of rapid growth. This resulted in surplus animals being relocated to establish new populations in the native range areas of the species, as well as outside them, with subsequent reducing the numbers produced in certain areas and increasing the efforts to increase biological control with a view of increasing the growth rate within the metapopulation. In addition, the increasing efforts also led to the integration of local communities in a common conservation struggle. In many countries, black rhinos are now managed by a variety of stakeholders, such as private sector and governments, which increases the long-term security of the species. Pro-active conservation associated with stock breeding control is expensive and costs USD 1000-1200 per km^2/year (MILLS and HES 1997, EMSLIE *et al.* 2007). Unlike the southern white rhino, black rhinos held by private landowners are mostly managed under the custody of the government. There are a number of African regional conservation initiatives such as SADC (South African Development Community) regional scheme for the protection of rhinos, the SADC Rhino Management Group, etc. The IUCN SSC African Rhino Specialist Group is coordinating the continental rhino conservation in Africa (www.iucn.org, www.wikipedia.org, www.rhinos-irf.org, www.arkive.org).

The protection of rhinos is related to the political stability of countries. A successful protection strategy was recommended by the IUCN SSC AfRSG. National rhino strategies and policies have been adopted by Botswana, Kenya, Namibia, South Africa, Tanzania, Zambia and Zimbabwe; the one of Swaziland was under development in 2007 (EMSLIE *et al.* 2007). To set out procedures for re-introduction and relocation of rhinos, an IUCN guide was developed (EMSLIE, AMIN and KOCK 2009).

Targeted protection is necessary for stabilisation and growth of the black rhino population. The strict protection in fenced facilities - often a product of cooperation between the government and the private sector - together with heavily protected unfenced zones as part of large areas has met the greatest success. In some states, dehorning was also used to reduce the interest of poachers. In 1997, Yemen joined the Washington Treaty (CITES) that prohibits trade in rhinoceros horn, which caused the demand for rhino horn greatly reduced in the Middle East. Therefore, the population of black rhinos increased in 2001 to 3,100 animals in six out of the eight range states. These animals are mostly kept in strictly protected areas. The African Rhino Specialist Group to the International Union for Conservation of Nature (IUCN) provides guidance on the protection of African rhinos; it created a detailed Action Plan including extensive information and strategic recommendations for rhino conservation (www.rhinos-irf.org, www.iucn.org).

Development of the black rhino population in the wild, 1984-2007

(Foose 1993, Penny 1988, IRF, Emslie 2000, 2007, Potter and Emslie 2002, Dollinger and Geser 2008, Emslie *et al.* 2009, Emslie 2009)

Species (subspecies) / Wild population	1984	1993	1997	1999	2001	2003	2005	2007
South-western *(D. b. bicornis)*	737	560	740	740	943	1,310	1,221	1,550
Eastern *(D. b. michaeli)*	490	500	485	485	498	520	639	700
South-central *(D. b. minor)*	1,467	1,300	1,365	1,365	1,651	1,770	1,866	1,995
Western *(D. b. longipes)*	About 10	40	10	About 10	8	5	0 ?	0
Black rhinoceros (*Diceros bicornis*)	**2,704**	**2,400**	**2,600**	**2,700**	**3,100**	**3,610**	**3,726**	**4,240**

Conservation activities

Generally, rhinos came to the brink of extinction due to illegal hunting for their horn and loss of habitat. Black rhinos have been particularly threatened by poaching for international trade in their horns that are demanded for two reasons. The first is traditional Chinese medicine, which uses a powder made from the horn for the resurrection (recovery) of patients treated for fever and coma. The efficacy of the rhino horn to treat the diseases has not been confirmed by medical science. The second of the reasons is the one of using horn for ornamental purposes in certain Middle Eastern countries, where it is a highly prized material for the manufacture of jambiya, a hand-carved Yemeni ceremonial dagger with rich decoration. In June 2007, the first case of the sale of a black rhino horn for medical purposes was documented in the U.S., confirmed through genetic testing of a specimen confiscated in a traditional Chinese medicine shop in Portland, Oregon.

Civil unrest and guns freely available in Africa had a negative impact on the protection of African rhinos. Black rhino populations in Angola, the Central African Republic, Chad, Mozambique, Rwanda, Somalia, Sudan and Uganda diminished as a result of war and civil unrest since the 1960s. Trading in arms obtained in exchange for rhino horn and ivory that resulted in increased poaching determined by the growth of poverty in times of civil wars, as well as reduced levels of protection of the rhino population by redirecting financial resources outside the area of wildlife had a detrimental effect. Changes in the natural environment were another cause for the decline in the rhino stock. The reasons listed above caused the wild population of black rhinos to decrease by 96% between 1970 and 1992 (www.wikipedia.org, www.rhinos-irf.org, www.arkive.org, www.iucn.org).

Black rhinos - a cow with its calf, Ol Pejeta, Kenya - 2009 (dh)

Recent development of the black rhino population in the wild (according to EMSLIE *et al.* 2007, EMSLIE 2009)

No.	Country	Number of subspecies	South-western subspecies 2005 / 2007	Eastern subspecies 2005 / 2007	South-central 2005 / 2007	Total 2005	Total 2007	Balance
1	SA	3 - South-central, south-western, eastern	80 / 113	41 / 54	1,258 / 1 321	1,379	1,488	+ 109
2	Namibia	1 - South-western	1,141 / 1,435	-	-	1,141	1,435	+ 294
3	Kenya	1 - Eastern	-	540 / 577	-	540	577	+ 37
4	Zimbabwe	1 - South-central	-	-	527 / 558	527	558	+ 31
5	Tanzania	2 - Eastern and south-central	-	57 / 67	44 / 56	101	123	+ 22
6	Swaziland	1 - South-central (after reintroduction)	-	-	16 / 18	16	18	+ 2
7	Malawi	1 - South-central (after reintroduction)	-	-	10 / 16	10	16	+ 6
8	Zambia	1 - South-central	-	-	6 / 16	6	16	+ 10
9	Botswana	1 - South-central	-	-	5 / 7	5	7	+ 2
10	Rwanda	1 - Eastern (after reintroduction)	-	1 / 1	-	1	1	-
	Total	3 subspecies	1,221 / 1,550	639 / 700	1,866	3,726	4,240	+ 514

1. The Republic of South Africa (SA)

In 1930, South Africa had only two natural populations of the south-central subspecies of the black rhino (*D. b. minor*) kept in the iMfolozi and uMkhuze reserves. From 1962 to 1970, 180 animals were moved into the KwaZulu Natal protected areas. In 1971, 10 pairs of black rhinos were donated to Kruger National Park, followed by additional 47 pairs, whose founders came from Zimbabwe. The population established this way grown to become the world's second largest population of the black rhino (EMSLIE *et al.* 2009). Cross-border translocation of animals helped to restore the population of the south-western subspecies (*D. b. bicornis*) as well (EMSLIE *et al.* 2009).

In 1962, an out-of-range population of the eastern subspecies (*D. b. michaeli*) was set up in South Africa, in Addo National Park, with seven individuals imported from the territory of Makueni, Kenya. Of these, only four animals became founders of the new population. By the end of 2007, there were 54 rhinos in the Addo Park. This stock is moved to sites within the native range of the subspecies in Tanzania - Mkomazi and Ngorongoro (EMSLIE *et al.* 2009).

In 2005 (EMSLIE *et al.* 2007), South Africa was home to 80 individuals of the south-western subspecies (*D. b. bicornis*), 41 animals of the eastern subspecies (*D. b. michaeli*) and 1,258 south-central black rhinos (*D. b. minor*). In 2007, it was already 113 south-western, 54 eastern and 1,321 south-central black rhinos (EMSLIE 2009). South Africa is the most important range state of the black rhino, as on 31 December 2007, nearly 1,488 individuals representing 35% of global wild population lived in the country, with an annual increase of almost 4%.

2. Namibia

In 2005 (EMSLIE *et al.* 2007), 1,141 individuals of the south-western subspecies (*D. b. bicornis*) lived in South Africa, while in 2007 the numbers reached even 1,435 animals (EMSLIE 2009). Namibia is the most important range country for the south-west (Cape) subspecies of the black rhinoceros, with enduring stability and protection of wildlife. As per 31 December 2007, there lived 1,435 animals representing almost 34% of global wild population, with an annual population increase of nearly 13%.

3. Kenya

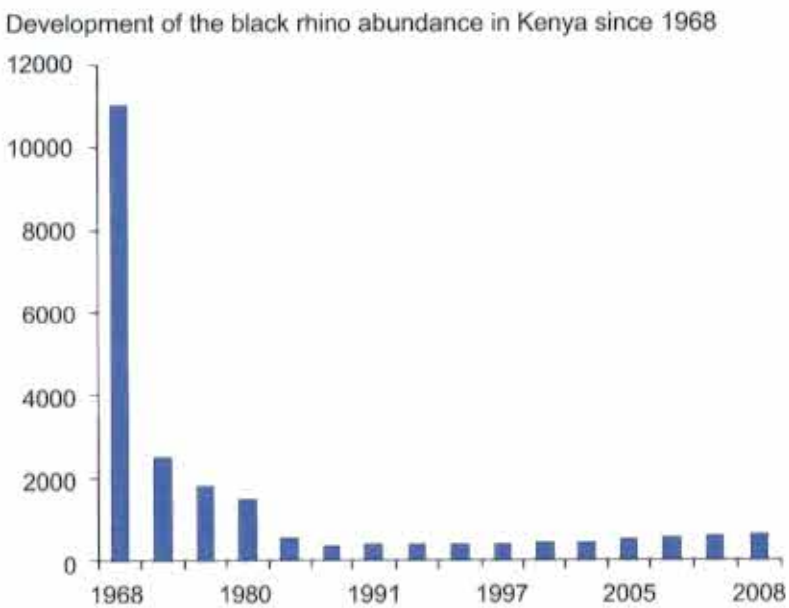
Kenya is home to only a single form of a rhino, the eastern black rhinoceros subspecies (*D. b. michaeli*). In the early 20 century, 1000 rhinos were shot in Kibwezi because of agricultural development. In the 1970s and 1980s, the rhino population declined from 20,000 to less than 400 remaining animals due to poaching. The chief strategy preventing the numbers further decline was relocation of the rhinos into fenced sanctuaries, with the first established in 1980. Lewa Wildlife Conservancy, where they achieved an annual increase of the population over 13% in 2004, became one of the most successful of these. By the end of 2007, the population had increased to 577 animals (EMSLIE *et al.* 2009).

In Kenya, a governmental programme of rhino protection and population growth has been developed and underway (OKITA-OUMA 2007), owing to which the numbers have successfully increased. The reason for implementing the scheme above was that Kenya still had 20,000 rhinos by 1970, from which 98% was extirpated as a result of poaching to less than 350 animals in the 1980s. In 2008, Kenya had already 609 black rhinos, which represents 87% of the world's free-ranging population of the eastern subspecies. The aim is to increase the number to 700 individuals by 2011 and to 2,000 animals in the future. Rhinos are kept in protected areas and their protection is implemented through an effective security system, including armed patrols monitoring every individual rhino, where each animal is on average seen every 3rd day (Ol Pejeta/Lewa Conservancy). Any missing animal is traced using telemetry, aerial search and specially trained tracking dogs (CRAIG pers. comm.). Kenya is holding the third-largest population of the black rhino and at the same time the largest population of the eastern subspecies. On 31 December 2007, there lived 577 animals, representing 13.6% of the global free-ranging population of the species and more than 82% of the eastern subspecies. The population's annual increase in 2005-2007 and 2007-2008 was almost 3.5% and 5.5%, respectively.

Eastern black rhinos, Ol Pejeta, Kenya (dh)

Development of the black rhino abundance in Kenya since 1968

Year	1968	1970	1977	1980	1984	1987	1991	1992	1995	1997	2002	2003	2005	2007	2008
Numbers	11,000	2,500	1,800	1,500	550	381	398	414	420	424	430	437	539	577	609



An eastern black rhino (D. b. michaeli) in Kenya - Lewa Wildlife Conservancy, 2009 (dh)

A young black rhino (D. b. michaeli) in its typical habitat - Ol Pejeta Conservancy, Kenya, 2009 (dh)

4. Zimbabwe

In the beginning of 1990s, poaching around the Zambezi River increased and therefore a number of rhinos were relocated to safer locations of the country (EMSLIE *et al.* 2009).

In 1998, 28 rhinos were moved from KZN to the SE Zimbabwe private game sanctuary, and thus established a growing population, which is soon to become a source of animals for further re-introduction projects (EMSLIE *et al.* 2009). In 2005, there lived 527 individuals of the southern subspecies (*D. b. minor*). In Zimbabwe, a private sanctuary was founded with 71 rhinos imported into the area of 3000 km^2 (EMSLIE *et al.* 2007).

Zimbabwe is the place of survival for the fourth-largest wild population of the black rhino with poaching being the biggest threat. In 2007, the total numbers were formed of 558 individuals, representing more than 13% of global wild population, while nearly 30% of the southern subspecies. The small annual increase of 2.9% is due to loss of animals by poaching (EMSLIE 2009). The situation in Zimbabwe deteriorated in 2008 and 2009, when poachers killed dozens of animals (for more details, see Zimbabwe rhino crisis on page 18).

5. Tanzania

In Tanzania, there are two subspecies of the black rhinoceros: the south-central black rhino (*D. b. minor*) in the south and the eastern black rhino (*D. b. michaeli*) in the north of the country. The local situation as regards the black rhino was even worse than in Kenya, as in 1980, the country had 3,795 individuals, while in 1987 it was a mere 275 and in 1995 only 32 black rhinos were remaining (EMSLIE and BROOKS 1999). By 2005, the number had increased to 101 (EMSLIE *et al.* 2007), from which 57 individuals were those of the eastern and 44 of the south-central subspecies. In 2007, there were 123 rhinos in Tanzania, which consisted of 67 eastern and 56 south-central black rhinos (EMSLIE 2009).

From 1974 to 1978, there were about 700 eastern black rhinos (*D. b. michaeli*) in Serengeti National Park covering an area of 12,920 km^2, where the population density was one rhino per 19 km^2. In contrast, a much denser population lived in the Ngorongoro Crater, with one rhino per 3.1 km^2, which corresponded to the habitat carrying capacity of both sites. At that time, this involved a single population that inhabited both Serengeti National Park and the Ngorongoro Conservation Area including Olduvai Gorge, extending to the territory of Maasai Mara in Kenya in the north. Presumably, this population expanded to the Kenyan national parks Amboseli and Tsavo. Intense poaching led to the mutual isolation of the rhino populations of these national parks. In the national parks of northern Tanzania, poaching became a serious problem after 1975, resulting in a dramatic decrease in the numbers of rhinoceroses in the country. This left a mere 50-100 animals in Serengeti by 1980, of which about 20 occurred in Moru Kopjes, southern Serengeti (ROBINSON 2000).

In the Olduvai Gorge, they recorded 69 rhinos in 1966 of which however none had remained by 1980. In the Ngorongoro Conservation Area established in 1959, poaching began in the early 1970s and culminated in the late 1980s. In the years 1964-1966, there were 108 individuals in the crater, while subsequently only 14 permanent and 7 migrant animals were recorded in the period from 1980 to 1988. Despite significantly reduced by anti-poaching patrols in the area of Serengeti and Ngorongoro since that time, poaching did not stop completely. In 1993, the only Tanzania's viable population of the eastern subspecies remained in the Ngorongoro Crater, comprising 14 to 18 individuals. Isolated rhinos remained in Serengeti, with five animals being a maximum. Several animals might have survived in one to two parks of northern Tanzania. In November 1993, a joint project of the Ngorongoro Conservation Area Headquarters and the Frankfurt Zoological Society was launched, where the crater was confirmed to have had only 13 remaining rhinos, which involved two adult males, 6 adult females and 5 subadult animals, with probably still a few rhinos staying along the crater walls. In January 1993, a subadult male left the crater and appeared in the Serengeti's Moru region in 1995, encountering two adult females. From 1988 to August 1995, no cases of poaching were recorded in Ngorongoro until Amina, a rhino female, was killed, leaving a calf, an 8 months old male Richard. However, the Ngorongoro population was not on increase. After the death of Amina, Richard was kept in a boma until 2 December 1997, when he was sent as a 2.5- year-old animal to Addo National Park, South Africa, since returning the male into the crater would be running the risk of the male being killed by another male. At the same time, the Frankfurt Zoological Society donated the Serengeti Ecosystem a female named Akuru; born at Frankfurt Zoo, this animal belonged to the southern subspecies, and therefore went to Marakele National Park in South Africa. In exchange for Richard and Akuru, two individuals born in Addo National Park were imported to Tanzania at the end of 1997 (CHAUSI 1998). In the years 1997-2000, three rhinos died of natural causes in the crater, and the population increased to 17 animals. In the same year, seven rhinos stayed in Muru Kopjes, Serengeti (ROBINSON 2000). Each of the animals has a radio installed in the horn and is constantly monitored (MORKEL pers. comm.). Since the beginning of the Ngorongoro project, there has been a single case of a rhino killed by poachers in 1995. Currently, Ngorongoro is home to 24 rhinos.

A male eastern black rhino (D. b. michaeli) in Ngorongoro, Tanzania, 2007 (dh)

The Ngorongoro Crater, Tanzania, is the place where a single population of the black rhino has survived, the picture shows an old male, 2009. (dh)

A skull of a young black rhino snarled by poachers, Arusha National Park, Tanzania - 2009 (dh)

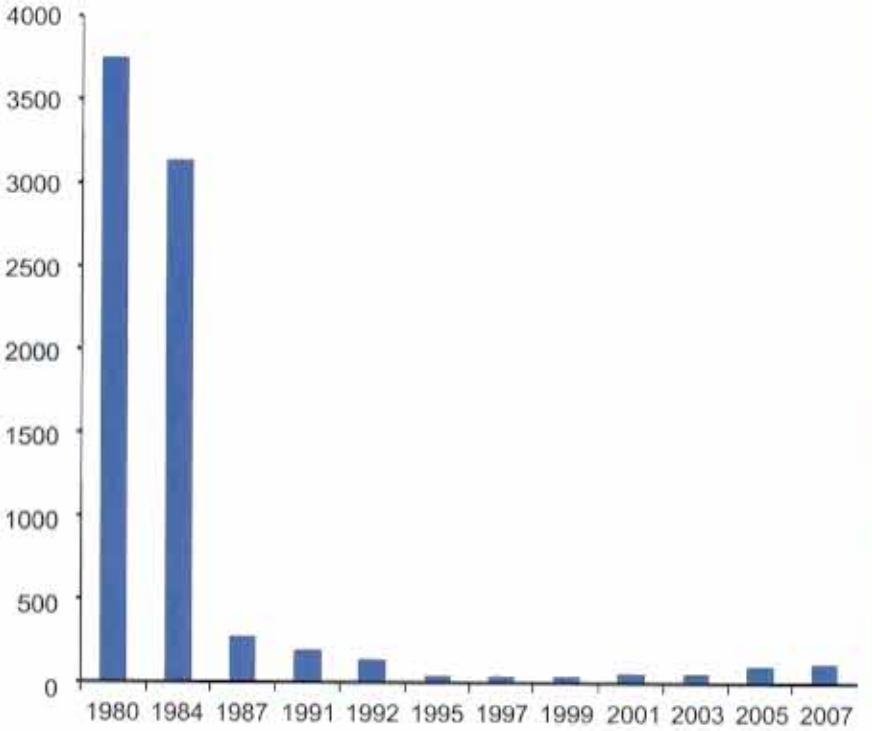
A reintroduced eastern black rhino (D. b. michaeli) in Mkomazi National Park, Tanzania - 2009 (dh)

In Tanzania, there is even the third population of the eastern subspecies, which was established through reintroduction from Addo National Park, South Africa (4 pairs) and Dvur Kralove Zoo (3 animals) into Mkomazi National Park in 1997, 2001 and 2009. This involves a group of 13 rhinos kept in a fenced holding area of several tens of km^2 (HOLECKOVA 2009).
Reintroduction of rhinos into the Grumeti Game Area, which is a territory of over 416 km^2 adjoining Serengeti National Park and integrated within a larger migration ecosystem of Serengeti-Mara, presents another Tanzanian project. Within the project above, they fenced a hill with an observatory point designed for holding black rhinos. The first couple - five years old - was imported from Port Lympne Zoo, UK, to the Sasakwa-Grumeti Reserve on 12 June 2007. It should be noted that male Limpopo is a son of female Etna born in Dvur Kralove (DK 13). As early as 2008, female Laikipia got pregnant. The reason for the project was the fact that poachers nearly wiped out the entire natural population as the Serengeti-Mara Ecosystem had contained about 1,000 black rhinos and in 2007, fewer than 100 individuals were left across northern Tanzania. As a result of protection measures, the population began to increase; nonetheless, it exists in the form of isolated patches. The goal of the reintroduction efforts is setting up a new group and increasing genetic diversity. The entire area is protected against the tsetse fly using a special system of traps (SMRCEK and HOLECKOVA 2008).
Tanzania had 123 black rhinos on 31 December 2007, which represents less than 3% of the global free-ranging population. The annual increase was nearly 11%, which was influenced by reintroductions.

Development of the black rhino abundance in Tanzania since 1970

Year	1970	1980	1984	1987	1991	1992	1995	1997	1999	2001	2003	2005	2007
Numbers	10,000	3,795	3,130	275	185 ?	127	32	46	47	49	66	101	123

Development of the black rhino abundance in Tanzania since 1980



Ol Pejeta, Kenya, 2009 (dh)

Reintroduction of black rhinos (*D. b. michaeli*) into the Grumeti Reserve, Tanzania, in September 2007

Tanzanian Grumeti Reserve - the mound in the back of the elephants was assigned to keeping the black rhino. (dh)

Male Limpopo in Grumeti, Tanzania, is son of Etna (DK 13). (dh)

The territory as such is protected to prevent entry of elephants, with a boma placed inside it. (dh)

Limpopo inside the enclosure three months upon the male's arrival in Tanzania (left) and the boma (right) (dh)

6. Swaziland

In Swaziland, the black rhinos were exterminated as a result of poaching. In the late 20th century, reintroduction projects began concerning both black and white rhinos. In 1996 (MILLS and HES 1997), nine individuals of the southern black rhino subspecies (*D. b. minor*) ranged in the country. By the end of 2005, the numbers had grown to 16 (EMSLIE *et al.* 2007). The founders were imported from Zimbabwe and South Africa (EMSLIE *et al.* 2009). In the late 2007, the population had reached 18 (EMSLIE 2009).

7. Malawi

In 2005 (EMSLIE *et al.* 2007), 10 individuals of the south-western subspecies (*D. b. bicornis*) lived in South Africa, while in 2007 the numbers reached even 16 animals (EMSLIE 2009).

8. Zambia

Zambia was a stronghold for the south-central black rhino (*D. b. minor*), of which a population lived in the Luangwa Valley, but was wiped out by poaching in the 1970s (KAMPAMBA 2003). In collaboration with IUCN SSC's AfRSG, a reintroduction programme was implemented in North Luangwa National Park, where six individuals of the south-central form ranged in 2005; over the two subsequent years, additional 10 animals were moved in. In the early 2007, the founder population had already 15 animals. Parties involved in this reintroduction project, in addition to Zambia Wildlife Authority, included the Frankfurt Zoological Society, South Africa National Parks and the Namibian Ministry of Environment and Tourism. These organisations provided rhinoceroses (EMSLIE *et al.* 2007).

9. Botswana

In 2005 (EMSLIE *et al.* 2007), five individuals of the south-western subspecies (*D. b. bicornis*) lived in South Africa, while in 2007 the numbers reached even seven animals (EMSLIE 2009).

10. Rwanda

In 2005 (EMSLIE *et al.* 2007), there lived a single individual of the eastern form (*D. b. michaeli*) that died in 2006. According to official but unconfirmed sources, another animal is believed to have been ranging here (EMSLIE 2009).

In Swaziland, both rhino species became extinct through poaching. Following adoption of a law punishing poaching by death, the country has become a safe place for reintroduction of rhinos. (dh)

A young eastern black rhino, Ol Pejeta Conservancy, Kenya, 2009 (dh)

CAPTIVE BREEDING

First zoo animal: 1868 London, the UK
First animal born and reared in the zoo situation: 1941 Brookfield Zoo, Chicago, the USA

The first animal in captivity, i.e. in Europe since Roman times, was male Theodore imported by the legendary German animal dealer Carl Hagenbeck to London Zoo, England, on 11 September 1868 (BERTRAM 1983, EDWARDS 1996). On arrival, Theodore was as big as a large pig. Caught in Eastern Sudan in February 1868, this animal died on 12 April 1891 of stomach cancer when it was 24 years old (EDWARDS 1996). The oldest animals as listed by the International Studbook are two individuals (a pair) imported into Bronx Zoo, New York, the USA. Both animals were captured in Uganda in 1906. The female named Victoria (Stdbk #699) was supplied by Ruhe, a German animal dealer, while the male named Spoke (Stdbk #700) was imported by Bourne, an English company. While Victoria stayed in New York until 1931 and lived to be 26 years old - a great age for that time, the male died already in 1910 before reaching his adult age (GOLTENBOTH and OCHS 1999). That was probably the reason that the animals never reproduced.
The first individual born in captivity - male Georgie-Joe - was born in 1941 in Brookfield Zoo, Chicago, the USA, to female Mary belonging to the south-central subspecies (*D. b. minor*). In Europe, the first black rhino was born on 12 October 1958 in Frankfurt a/M. This was female Lemuta who later gave birth twice and reared one calf. This rhino lived for 13 years and died in 1971.
The act of foundation of the international studbook was initiated by the International Union of Directors of Zoological Gardens (IUDZG) in 1966. It was managed jointly for both species of African rhinos (International Studbook for African Rhinoceros *Diceros bicornis* / *Ceratotherium simum*) by Berlin Zoo, Germany, with Professor Heinz-Georg Klos, then director of Berlin Zoo, being the first studbook keeper. Since that time, data were collected throughout the stock of zoo-based African rhinos and summarised by Prof Klos in 1976, when the first edition of the studbook was released (FRESE 1993). As of 2001, the studbook has been split and published as two parts, one of which has been attending to the black rhino, while the other concerns the white rhino (FRADRICH and OCHS 2001). Currently, the Black Rhino International Studbook is kept by Dipl Biol Reinhard Frese and Berlin Zoo. The latest edition was published in 2009 (FRESE 2009); according to this release, the studbook historically registered 1,021 (485,497.22) black rhinos prior to 2 December 2009, of which the living population consisted of 299 (131.146.22) animals.
The chief issue of breeding black rhinos in captivity is not reproduction of this species - they breed quite well already in the fifth generation. Rather, their insufficient longevity is the case, as they suffer from various health problems including haemolytic anaemia (breakdown of red blood cells) and die relatively young, which relates to the fact they are dietary specialists and rather nervous animals.
This has also been evidenced by the gradual increase in population in captivity, when the annual increase in a period of 35 years (1969-2004) was 2.64%, as is apparent from the data of international studbooks (KLOS and FRESE 1981, 1983, 1987, 1991 and

Theodore at London Zoo in 1885 (M J Fortune Nott)

Theodore at London Zoo in 1890 (L Medland), from: EDWARDS 1996.

1993, GOLTENBOTH and OCHS 1995, 1997 and 1999, OCHS 2001, OCHS and LANGE 2005) and the table on page 32 and 33. While captive collections held in 1969 a total of 144 (73.71) black rhinos, in 2004 it was by 92% more, i.e. 277 (125.146.6) animals.

The abundance of the black rhino in captivity, 1969-2009 (according to the International Studbook)

Year	Num. as per 1 Jan	Total born	Year	Num. as per 1 Jan	Total born	Year	Num. as per 1 Jan	Total born
1969	144 (73.71)	6 (4.2)	1978	187 (84.103)	7 (5.2)	1990	204 (91.113)	13 (6.7)
1970	143 (72.71)	11 (2.9)	1979	181 (83.98)	10 (6.4)	1992	208 (92.116)	11 (8.3)
1971	143 (69.74)	5 (2.3)	1980	179 (82.97)	5 (4.1)	1994	206 (94.112)	15 (7.7.1)
1972	156 (77.79)	8 (3.5)	1981	172 (78.94)	8 (4.4)	1996	238 (109.129)	14 (7.7)
1973	161 (76.85)	4 (1.3)	1982	174 (82.92)	7 (2.5)	1998	235 (105.130)	11 (1.9.1)
1974	170 (76.94)	4 (1.3)	1983	180 (83.97)	8 (4.4)	2001	275 (125.144.6)	18 (9.9)
1975	171 (76.95)	8 (4.4)	1984	182 (86.96)	4 (3.1)	2004	277 (125.146.6)	11 (5.4.2)
1976	183 (81.102)	5 (2.3)	1985	180 (85.95)	7 (2.5)	2009	299 (131.146.22)	12 (1.4.7)
1977	186 (82.104)	11 (8.3)	1986	181 (82.99)	6 (3.3)			

According to the 1993 International Studbook (FRADRICH and FRESE 1993), 105 (48.57) black rhinos, i.e. 46% out of 228 (111.117) animals imported reproduced in captivity, while the same was achieved in a total of 54 (27.27) individuals, i.e. 23.4%, out of 231 (112.119) captive-born rhinos.

The International Studbook (GOLTENBOTH and OCHS 1995) reports that 223 captive black rhinoceroses lived in 1994, of which 58 individuals, i.e. 26%, were animals more than 20 years old, while the rest of the captive stock (74%) were younger animals, with 99 individuals (44.4%) under 10, and the remainder counting 66 animals (29.6%) between 10 and 20 years. At the same time, 20 births were registered in the course of 2 years (1993-1994), which is 10% as regards the entire population and 5% per year. This is in contrast with the situation in the southern white rhino, where in the same year 694 animals were held, with those over 20 years numbering 374 individuals, i.e. 53.9% of the population. In addition, only 23 births were recorded over the two preceding years (3.3% as regards the entire population, while the annual birth rate was a mere 1.66%). In the Indian rhino, the total population in captivity in 1994 consisted of 134 individuals, and 11 births were registered in the 1993-1994 period (8.2% with respect to the entire population and 4.1% annually). The comparison of all three species makes clear that the best breeding performance in captivity is that of the black rhino (5% per year). The latest issue of the International Studbook (FRESE 2009) shows that between 2005 and 2009 (prior to 2 December 2009), 67 (25.25.17) calves were born and 30 (11.19) individuals died.

The data in the International Studbook (OCHS 2005) show that in 2004, a total of 930 black rhinos were registered in two subspecies (eastern and south-central), while the current population consisted of 277 individuals, which is by 55 animals more than in 1995 (an increase of almost 25% in 9 years). More details on the 1995, 2004 and 2009 breeding performance are summarised in the following table, which shows an increase in the eastern subspecies numbers of 15.2% in 5 years and reduced numbers of the south-central subspecies by 15%. The total population of black rhinos in captivity increased since 2004 by almost 8%.

Analysis of black rhino stock development in captivity, 1995-2009 (HOLECKOVA 1996, LANGE and OCHS 2005b)

Subspecies in captivity	Total registered stock 1995	Imported from the wild 1995	Total born in captivity 1995	Breeding animals 1995	Total living animals 1995	Total living animals 2004	Total living animals 2009
Eastern ssp. *D. b. michaeli*	460 (222.233.5)	201 (93.108)	259 (129.125.5)	78 (29.49)	173 (78.92.3)	210 (91.114.5) + 21.4%	242 (99.121.22) + 15.2%
South-central ssp. *D. b. minor*	82 (40.42)	61 (28.33)	21 (12.9)	14 (6.8)	49 (20.29)	67 (34.32.1) + 36.7%	57 (32.25) -15%
Total	542 (262.265.5)	262 (121.141)	280 (141.134.5) i.e. 51.7%	i.e. 41.4%	222 (98.121.3)	277 (125.146.6) + 24.8%	299 (131.146.22) + 7.9%

An indoor exhibit at Brookfield Zoo, Chicago, 2009. In the house that dates back to 1929, the first captive black rhino was born in 1941. The picture from 2009 is showing a female of the south-central subspecies (D. b. minor). (dh)

Black rhino (D. b. minor) enclosure, Brookfield Zoo, Chicago, the USA; the picture is showing a stud male, 2009. (dh)

Analysing the black rhino breeding performance in captivity by region reveals that the population increased by 79 individuals, i.e. 39.9% (2.85% per year) in 14 years (from 1990 to 2004). Although the majority of animals were still kept in North American zoos, the number of animals kept in Europe increased, while that in Asia declined. The largest increase of the stock was observed in Africa - for insight, see the following table.

The abundance of the black rhino in captivity per region (according to the International Studbook)

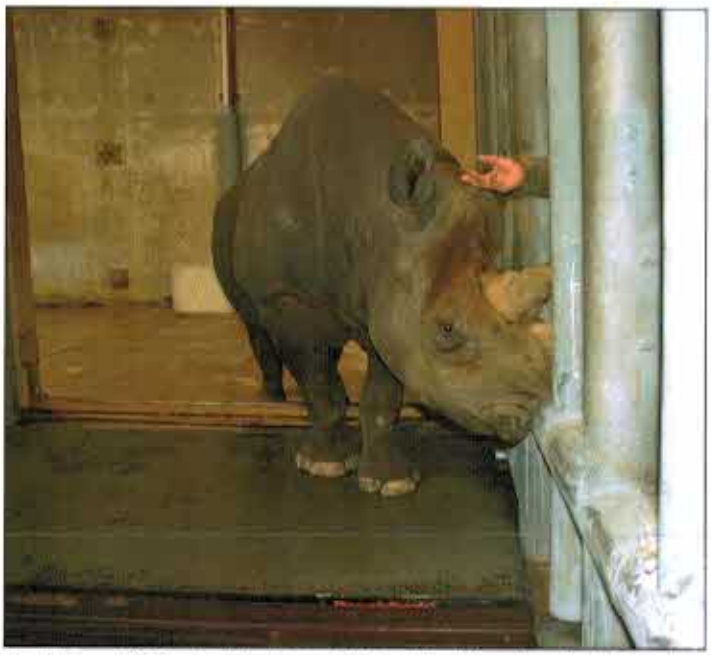
Region	1990 (no. of individuals/ %)	1994 (no. of individuals/ %)	1998 (no. of individuals/ %)	2000 (no. of individuals/ %)	2004 (no. of individuals/ %)
North America	85-42.9%	92-41.3%	102-43.4%	109-39.6%	110-39.7%
Europe	55-27.8%	62-27.8%	73-31.1%	74-26.9%	75-27.1%
Asia	41-20.7%	41-18.4%	28-11.9%	33-12%	28-10.1%
Africa	9-4.5%	12-5.4%	16-6.8%	46-16.7%	52-18.8%
South and Central America	6-3%	4-1.8%	4-1.7%	1-0.4%	0-0%
Australia	2-1%	12-5.4%	12-5.1%	12-4.4%	12-4.3%
Total (increase in %)	**198**	**223 (99.121.3) (+12.6%)**	**235 (105.130) (+ 5.4%)**	**275 (125.144.6) (+ 23.3%)**	**277 (125.146.6) (+24.2%)**

The following table summarising the data per region with respect to the eastern black rhinoceros shows that in 2004 there were no breeders in Australia and South/Central America. The most numerous stock was that of Europe where 15 zoos held 73 animals, i.e. almost five individuals on average per holder. In North America (which in fact concerns the USA), 71 animals were held by 28 different collections (2.5 animal per institution). The only African holder is the Lewa Wildlife Conservancy with their 40 animals, where animals are managed under fully natural conditions.

Eastern black rhino (*D. b. michaeli*) **stock in captivity per region** (according to the International Studbook)

Region	1992	2000	2004
North America	69 (36.33) - 24 collections	67 (40.60) - 28 collections	71 (40.31) - 28 collections
Europe	57 (21.36) - 11 collections	72 (24.48) - 15 collections	73 (26.47) - 15 collections
Asia	24 (13.11) - 13 collections	27 (11.16) - 9 collections	26 (11.15) - 9 collections
Africa	6 (3.3) - 5 collections	33 (11.18.4) - 4 collections	40 (14.21.5) - 1 collection
South and Central America	5 (2.3) - 3 collections	1 (1.0) - 1 collection	0
Australia	1 (0.1) - 1 collection	1 (1.0) - 1 collection	0
Total	**162 (75.87) - 57 collections**	**201 (88.109.4) - 57 collections**	**210 (91.114.5) - 53 collections**

Summary information on the world's largest breeders of the eastern black rhinoceros is provided under the table on page 35, which shows that Dvur Kralove Zoo has been the most important black rhino holder since 1982, which as of 2000 applies to England's Port Lympne for Europe and Lewa Wildlife Conservancy globally, where the latter is not a zoological park, but a nature reserve in Kenya with reintroduced (restored) population.



An indoor exhibit for the black rhino (D. b. michaeli) equipped with a scale at Lincoln Park Zoo, Chicago - the picture is showing male Nakili, 2009 (dh)

Black rhino (D. b. michaeli) house at Zurich Zoo, Switzerland; 2007 (dh)

The world's major holders of the eastern black rhino (*D. b. michaeli*) - according to the International Studbook

Institution	1982	1994	2000	2004
Dvur Kralove	9 (3.6)	14 (5.9)	14 (4.10)	15 (5.10)
Berlin Zoo, Germany	6 (1.5)	9 (7.2)	6 (1.5)	7 (1.6)
Cincinnati, USA	6 (3.3)	3 (2.1)	3 (2.1)	2 (1.1)
Tehran, Iran	6 (3.3)	5 (2.3)	0	0
Hiroshima, Japan	5 (3.2)	5 (1.4)	7 (3.4)	8 (4.4)
Nagoya, Japan	5 (2.3)	1 (1.0)	2 (1.1)	2 (1.1)
Denver, USA	5 (2.3)	3 (2.1)	3 (2.1)	3 (2.1)
Zurich, Switzerland	5 (2.3)	5 (2.3)	4 (1.3)	4 (1.3)
Port Lympne, UK	4 (2.2)	10 (6.4)	19 (7.12)	19 (7.12)
Chicago Brookfield, USA	3 (1.2)	5 (3.2)	5 (2.3)	5 (3.2)
Chester, UK	2 (1.1)	3 (1.2)	5 (1.4)	7 (3.4)
Lewa Wildlife Conservancy, Kenya	-	-	29 (10.15.4)	40 (14.21.5)
Kansas City, USA	-	0	4 (2.2)	5 (2.3)
Colombo, Sri Lanka	4 (2.2)	0	0	0
Detroit, USA	4 (2.2)	1 (1.0)	1 (1.0)	1 (1.0)
Lisbon, Portugal	4 (2.2)	0	0	0
Magdeburg, Germany	4 (2.2)	2 (0.2)	4 (1.3)	4 (1.3)
Mysore, India	4 (2.2)	4 (0.1.3)	2 (1.1)	2 (1.1)
Beijing, China	4 (1.3)	3 (1.2)	0	0
Sydney, Australia	4 (2.2)	0	0	0
Whipsnade, UK	4 (2.2)	2 (1.1)	2 (1.1)	2 (1.1)

Historically, only two of the four black rhino subspecies have been held in captivity. The comparison between 2004 and 1995 shows that there was a reduction in the number of collections from 75 to 68, while the number of animals increased by 55 (24.8%) up to 277 individuals in 9 years. Of these, 210 (75.8%) belong to the eastern subspecies, and 67 (24.2%) are those of the south-central form.

The abundance of the black rhino in captivity per subspecies (according to the International Studbook)

Year	Num. of collections	Num. of individuals	Eastern ssp. *D. b. michaeli*	South-central ssp. *(D. b. minor)*
1995	75	222 (98.191.3)	173 (78.92.3)	49 (20.29)
2004	68	277 (125.146.6)	210 (91.114.5)	67 (34.32.1)
Balance 2004-1995	- 7 (90.1%)	+ 55 (124.8%)	+ 37 (121.4%)	+ 18 (136.7%)

Black rhinos (D. b. michaeli) - a hand-reared four-year-old female Lola and her two-year-old brother Elvis with their keeper in Lewa Wildlife Conservancy, Kenya, 2009 (dh)

The youngest sibling of the black rhinos (D. b. michaeli) hand-reared in Lewa, Kenya, 2009. All the young were born to a blind female mated by a free-ranging male; they were abandoned by their mother when only a few weeks old. (dh)

A black rhino (D. b. michaeli) in a new enclosure at the zoo in Saint Louis, USA, in 2009 (dh)

Overall view of the black rhino enclosure at Saint Louis Zoo, USA, 2009 (dh)

European black rhino holders

Black rhino enclosure (D. b. michaeli) - male Vungu with females Salome (DK 23) and Rufiji, Howletts, England, 2008 (dh)

In Europe, the south-central black rhino (Diceros bicornis minor) is held only at Frankfurt Zoo, Germany - 2008. (dh)

The only stock of the south-central black rhino (Diceros bicornis minor), a female with a calf. Frankfurt Zoo, Germany, 15 June 1994 (lh)

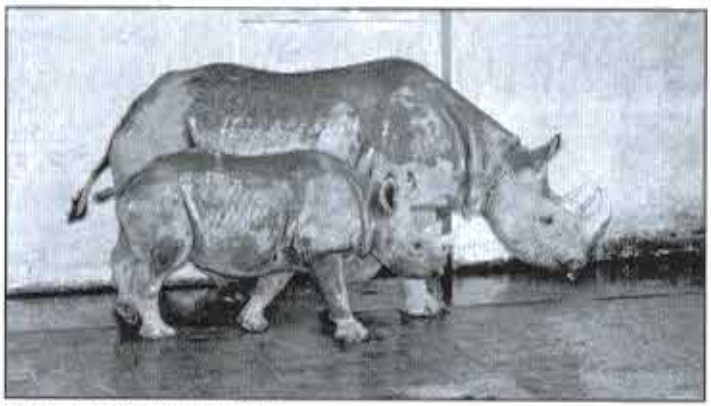
Breeding facilities for the black rhino (D. b. michaeli) in Port Lympne, England. 1998 (dh)

Little Mweru with its mother Nakuru at Port Lympne Zoo, England (az)

European eastern black rhino holders

Hannover, 6 July 1995 (lh)

Leipzig, 11 June 2002 (lh)



Osnabruck, 23 June 1998 (lh)

Berlin Zoo, 8 May 1991 (lh)

Berlin Zoo, 2 October 2009 (lh)

Zurich Zoo, 13 June 1992 (lh)

EEP

The European black rhino conservation breeding programme (EEP) was established at German Berlin Zoo in 1990 that managed the programme until 2006. Since 2007, this EEP has been under the management of Chester Zoo, the UK. At the beginning, the EEP was coordinated by Dr Reinhard Goltenboth who was then replaced by Dr Andreas Ochs. In 2007, Mark Pilgrim of UK-based Chester Zoo took over. As per 1 January 1993, 55 (21.34) black rhinos were held by 12 collections, 3 (2.1) calves were born during the year on 31 and December 1993, the stock consisted of 54 (21.33) individuals (GOLTENBOTH 1994). In the same year, only three animals older than 30 years lived in Europe.

On 1 January 1998, 16 zoos associated within the EEP held 69 (24.45) individuals belonging to the eastern subspecies (*D. b. michaeli*) except 3 (1.2) individuals of the south-central subspecies (*D. b. minor*) at Frankfurt Zoo. Throughout the year 1997, 8 (1.7) calves were born, from which 6 (0.6) were reared. It should be noted that 2 calves were born and reared at Dvur Kralove Zoo alone (GOLTENBOTH 1997). Upon 1 January 1999, 72 (23.49) animals were held in 15 zoos within the EEP. In 1998, 5 (1.4) calves were born and reared, representing 6.9% of the stock. By comparison, the EEP population consisted of 77 (27.50) black rhinos in 18 collections as per 31 December 2006 (PILGRIM 2007), with 5 (3.2) calves born in 2006, which represents 6.7% of the stock as per 1 January 2006 numbering 75 (25.50) animals. According to the most recent figures, a total of 78 (29.49) black rhinos were held in 16 zoos on 1 January 2009, of which 2 (1.1) belonged to the south-central subspecies (Frankfurt) and the remainder, i.e. 76 (28.48) animals, to the eastern form (PILGRIM 2009). . Over 11 years, the black rhino EEP population increased from 61 (24.37) individuals in 1995 to 77 (27.50) and 78 in 2008, respectively, representing an absolute increase of more than 26% (GOLTENBOTH 1996, PILGRIM 2008 and 2009). At the same time, there was a decline in the population as a result of the reintroductions to Africa over the same period (OCHS 2005, SMRCEK and HOLECKOVA 2009) carried out by the zoos in Frankfurt (two females in 2000 and 2004, respectively) and Howletts (a pair in 2007).

Development of EEP black rhino population

Year (source)	Status as per 1 Jan	Status as per 31 Dec	Number of zoos	Total born	Total reared
1995 (Goltenboth 1996)	61 (24.37)	61 (22.39)	15	5 (2.3)	5 (2.3)
2006 (Pilgrim 2008)	75 (25.50)	77 (27.50)	17	5 (3.2)	3 (1.2)
2008 (Pilgrim 2009)	76 (26.50)	78 (29.49)	16	3 (3.0)	3 (3.0)

Davu chasing Etosha DK 30 (dh)

Analysis of black rhino stocks in the zoos within the EEP (GOLTENBOTH 1995, PILGRIM 2007 and 2009)
* South-central subspecies - *D. b. minor*; the remainder are holders of the eastern subspecies, *D. b. michaeli*

No.	Zoo	Numbers as per 31 Dec 1993	Numbers as per 6 Sep 2007	Numbers as per 1 Jan 2009
1	Berlin Zoo, Germany	6 (1.5)	7 (1.6)	8 (2.6)
2	Chester, UK	4 (2.2)	7 (3.4)	8 (3.5)
3	Dvur Kralove, CZ	14 (5.9)	14 (5.9)	17 (7.10)
4	Frankfurt, Germany*	2 (1.1)	2 (1.1)	2 (1.1)
5	Hannover, Germany	2 (1.1)	3 (1.2)	3 (1.2)
6	Leipzig, Germany	2 (1.1)	3 (1.2)	3 (1.2)
7	London, UK	3 (2.1)	0	0
8	Magdeburg, Germany	4 (2.2)	5 (1.4)	4 (1.3)
9	Port Lympne, UK	9 (4.5)	15 (4.11)	15 (4.11)
10	Rome, Italy	1 (0.1)	0	0
11	Tallinn, Estonia	2 (1.1)	1 (1.0)	1 (1.0)
12	Zurich, Switzerland	5 (1.4)	4 (1.3)	2 (0.2)
13	Howletts, UK	0	3 (1.2)	3 (1.2)
14	Doué-la-Fontaine, France	0	3 (2.1)	4 (2.)
15	Cologne, Germany	-	2 (1.1)	1 (1.0)
16	Krefeld, Germany	0	3 (2.1)	3 (2.1)
17	Paignton, UK	0	3 (1.2)	2 (0.2)
18	Pont-Scorff, France	0	2 (1.1)	2 (1.1)
	Total	**54 (21.33)**	**77 (27.50)**	**78 (29.49)**

Breeding in Czech and Slovak zoological parks

The first live black rhino in Czechoslovakia was, according to the studbook, male Max (Stdbk #650), which was acquired by the circus of Kludsky family in 1932 and sold by the same holder to Prague Zoo in 1933. Max was wild-caught somewhere in East Africa and died in 1940 from pneumonia when he was 10 years old. The second Prague's black rhinoceros was male Max 2 (Stdbk #42), who arrived in 1954, but its origin is veiled in mystery. Max 2 died in 1969 and lived for 17 years. Female Isis (Stdbk #43) was imported in 1959 to join Max 2; the female never reproduced and was sold to Brink, the Dutch company, in 1972; Brink sent this animal to Rio de Janeiro where Isis, however, died of stress soon after arrival. All of these three Prague's individuals belonged to the eastern subspecies and died without offspring (GOLTENBOTH and OCHS 1999).

The subsequent stock history relates to the wild-caught animals from imports organised by Dvur Kralove in the early 1970s, where a pair of black rhinos was supplied to Lesna Zoo (1976). Because male Addo died in Lesna after two years, female Satara returned to Dvur Kralove in 1979, where she however died as well in 1981 without offspring. The only successful black rhino holder amongst Czech and Slovak zoos is Dvur Kralove, who has been holding the species continuously since 1972, successfully producing offspring for 32 years.

Black rhino stock in Czech zoos - overview prior to 1 January 2009

Zoo	Holding period	Import	1st birth	Most recent birth	Total born	Total reared	Status as per 1 Jan 2009
Dvur Kralove	1972-2008	19 (11.8)	1977	2007	33 (13.20)	29 (11.18)	17 (7.10)
Lesna	1976-1981	2 (1.1)	-	-	0	-	0
Prague	1933-1972	3 (2.1)	-	-	0	-	0
TOTAL	1972-2008	24 (13.10)	1977	2007	33 (13.20)	29 (11.18)	17 (7.10)

Female Etna (DK 13) with its first calf at Port Lympne Zoo, UK (az)

BLACK RHINO AT DVUR KRALOVE ZOO

Black rhino imports

Dvur Kralove acquired eastern black rhinoceroses (*Diceros bicornis michaeli*) from the wild in Kenya; this action was carried out by the zoo alone in 1972, when 10 (4.6) juveniles about one year old caught in Tsavo National Park were imported, with additional 3 (1.2) animals one to three years old, of which female Sabi was caught in the Isiolo region, while the origin of male Addo and female Satara is not known exactly.

Of the animals above, a pair (Lord and Lenka) was supplied in 1972 to Jacksonville Zoo in the U.S. Male Murray left to Wroclaw in 1974, from where he returned to Dvur Kralove in 1980; this animal was eventually supplied together with female Sabi to Zurich Zoo, Switzerland, in 1983. The pair, Addo and Satara, was sold in 1976 to the Moravia-based Lesna Zoo, Zlin, from where the female however returned in 1979 to Dvur Kralove following the death of the male. From all rhinos imported to Dvur Kralove from Africa, male Murray held in Tallinn Zoo, Estonia, died in 2009 when 39 years old; female Jimmi lived over 39 years in Dvur Kralove and female Sabi lived 36 years in Zurich.

From 1978 to 2008, six males were gradually introduced into the collection: one-year-old Isis (F2) from Cincinnati Zoo, the USA (1978), thirteen-year-old Mabu (F1) from Magdeburg and seventeen-year-old Cody (F2, born in Australia) from Berlin, Germany (both males arrived in 1992), a five-year-old Mweru (F2) from Port Lympne, England (2001), and, finally, two-year Davu (F3) from the German Krefeld Zoo and sixteen-year-old Baringo II (F3) from England's Port Lympne in 2008.

In 2007, male Jimm (DK 3) reared in Dvur Kralove returned from the Swiss Zurich Zoo, to which he was loaned a year before within the breeding cooperation.

A total of 20 (12.8) individual eastern black rhinos were imported to Dvur Kralove, of which 13 (5.8) were wild-caught in Kenya. Two of the animals above (1.1 - Murray and Satara) were imported two times. 5 (3.2) animals left for good to other zoos and 10 (4.6) individuals died in Dvur Kralove. Out of the animals imported, 5 (5.0) still live in Dvur Kralove. For more details, refer to the table on page 43-44.

Black rhino capture in Kenya (az)

A young black rhino in the boma, Kenya (az)

Imports of black rhinos to Dvur Kralove Zoo prior to 31 December 2009

(Stdbk # - animal number within the International Studbook; M - male, F - female. Names in brackets were used in other zoos.)

No.	Sex	Name	Stdbk #	Arrival	Birth	Departure/Death (†)	Comments
1	M	Lord	169	22 Aug 1971 Kenya	January 1970 Kenya, Tsavo NP	22 Jun (3 Aug) 1972 Jacksonville, USA 22 Apr 1978 San Antonio, USA † 22 Jun 1978 San Antonio, USA	Lived 29 years
2	M	Ken	170	22 Aug 1971 Kenya	January 1970 Kenya, Tsavo NP	† 8 Nov 1979 Dvur Kralove	Lived 9 years
3	M	Murray (Murry)	171	22 Aug 1971 Kenya 2 Oct 1980 Wroclaw, Poland	February 1970 Kenya, Tsavo NP	29 Oct 1974, Wroclaw, Poland 23 Apr 1983 Zurich, Switzerland 12 Sep 1988 Tallinn, Estonia	Lived 39 years
4	M	King	172	22 Aug 1971 Kenya	1970 Kenya, Tsavo NP	† 22 Apr 1978 Dvur Kralove	Lived 8 years
5	F	Zina	173	22 Aug 1971 Kenya	1969 Kenya, Tsavo NP	† 26 Jun 1978 Dvur Kralove	Lived 8 years
6	F	Elsa	174	22 Aug 1971 Kenya	1970 Kenya, Tsavo NP	† 7 Apr 1978 Dvur Kralove	Lived 8 years
7	F	Jimmi	175	22 Aug 1971 Kenya	February 1970 Kenya, Tsavo NP	† 21 Aug 2009 Dvur Kralove	Lived 39 years
8	F	Lenka (Bonnie)	176	22 Aug 1971 Kenya	1970 Kenya, Tsavo NP	22 Jun 1972 Jacksonville, USA 14 May 1978 Columbus, USA † 17 Apr 1982 Columbus, USA	Lived 12 years
9	F	Tuty	177	22 Aug 1971 Kenya	1970 Kenya, Tsavo NP	† 24 May 1978 Dvur Kralove	Lived 8 years
10	F	Jarca	178	22 Aug 1971 Kenya	February 1970 Kenya, Tsavo NP	† 8 Sep 1996 Dvur Kralove	Lived 26 years
11	F	Sabi	217	26 Jun 1974 Kenya	1972 Kenya, Isiolo Region	23 Apr 1983 Zurich, Switzerland † 13 Apr 2008 Zurich, Switzerland	Lived 36 years
12	M	Addo	216	2 Jul 1974 Kenya	1971 Kenya	20 Apr 1976 Lesna, CR † 31 Jan 1978 Lesna, Czechoslovakia	Lived 7 years
13	F	Satara	218	2 Jul 1974 Kenya 14 Jul 1978 Lesna, Czechoslovakia	1973 Kenya	20. Apr 1976 Lesna, Czechoslovakia † 24 Apr 1981 Dvur Kralove	Lived 8 years
14	M	Isis/Bubba	268	17 Nov 1978 Cincinnati, USA	3 Nov 1977 Cincinnati, USA		
15	M	Mabu	277	1 Oct 1992 Magdeburg, Germany	23 Jan 1992 Magdeburg, Germany	† 15 Oct 1996 Dvur Kralove	Lived 17 years
16	M	Cody	260	10 Dec 1992 Berlin, Germany	20 May 1975 Sydney, Australia	† 19 May 1999 Dvur Kralove	Lived 24 years
17	M	Mweru	659	29 Nov 2001 Port Lympne, UK	12 Sep 1996 Port Lympne, UK		
18	M	Davu	970	3 Apr 2008 Krefeld, Germany	19 Feb 2008 Krefeld, Germany		

No.	Sex	Name	Stdbk #	Arrival	Birth	Departure/Death (†)	Comments
19	M	Jimm	283	16 May 2008 Zurich, Switzerland	18 Mar 1979 Dvur Kralove		
20	M	Baringo II	483	6 Jun 2008 Port Lympne, UK	3 Dec 1992 Port Lympne, UK		
Total individuals imported: 20 (12.8), of which male Jimm returned to Dvur Kralove after having been loaned to Zurich Zoo.							

Stock founders

The information obtained from the studbook (OCHS 2005) and others (TOMASOVA 2005) shows that there are 27 (14.13) founders represented in the Dvur Kralove stock, of which 22 (10.12) comes from Kenya (born between 1941-1973), 2 (2.0) from Tanzania (born 1944 and 1970), 2 (1.1) from an unspecified site of East Africa (born about 1953) and 1 (1.0) from Addo National Park, South Africa (born 1975). The exact origin is unknown in 12 (7.5) founders, of which 6 (5.3) were caught in Tsavo National Park, Kenya, 1 (0.1) in Isiolo, Kenya, 1 (0.1) in the territory of the Tana River, Kenya and 1 (1.0) in Arusha National Park in Tanzania. The male imported from Addo National Park in South Africa is a descendant of four individuals introduced into South Africa from the Makueni region, Kenya, in 1961. A brief overview of the founders is provided in the table on page 44, covering all black rhinos imported from the wild directly to Dvur Kralove that reproduced further. This involves a total of 8 (4.4) founders, of which 6 (2.4) bred in Dvur Kralove, while two (2.0) reproduced in other collections (the USA and Switzerland). In addition to the proven breeders, the table further includes two potential studs - Davu, a male imported to Dvur Kralove in 2008, still not fully mature, and female Bashira, a yearling loaned to Chester Zoo, England.

Founders represented in the Dvur Kralove stock (according to the International Studbook, LANGE and OCHS 2005b)

No.	Stdbk #	Sex	Name	Birth	Zoo	Relationships to Dvur Kralove breeding individuals *
1	9	M	Kibo	1969 Kenya, Tsavo NP	Gelsenkirchen, Germany Hannover, Germany Magdeburg, Germany Hannover, Germany	Father of Mabu
2	18	M	Bwana Mkubwa	1962 Kenya	Whipsnade, UK London, UK Port Lympne, UK	Grandfather of Mweru
3	20	M	Willie	1949 Kenya	Bristol, UK	Great-grandfather of Baringo II
4	21	F	Stephanie	1949 Kenya	Bristol, UK	Great-grandmother of Baringo II
5	56	M	Johnny/Freeman	1953? East Africa	Cincinnati, USA Oklahoma, USA	Grandfather of Isis
6	57	F	Opal	1953? East Africa	Cincinnati, USA	Grandmother of Isis
7	99	M	Ferdinand	1944 Tanzania, Arusha NP	Sydney, Australia	Grandfather and father of Cody
8	100	F	Peggy	1941 Kenya	Sydney, Australia	Grandmother of Cody
9	120	M	Boyle	1961 Kenya	St. Louis, USA	Grandfather of Davu

No.	Stdbk #	Sex	Name	Birth	Zoo	Relationships to Dvur Kralove breeding individuals *
10	121	F	Olive	1962 Kenya	St. Louis, USA Oklahoma, USA	Grandmother of Davu
11	153	F	Kenia	1966 Kenya	Magdeburg, Germany	Father of Mabu
12	166	M	Klaus	1970 Tanzania	Leipzig, Germany Berlin, Germany	Grandfather of Davu (father of Nane)
13	***169***	***M***	***Lord***	***1970 Kenya, Tsavo NP***	***Dvur Kralove***	*Had 4 descendants in the USA*
14	**170**	**M**	**Ken**	**1970 Kenya, Tsavo NP**	**Dvur Kralove**	Father of Sali, possible father of Elvira
15	***171***	***M***	***Murray***	***1970 Kenya, Tsavo NP***	***Dvur Kralove***	*Had a single descendant in Zurich*
16	**172**	**M**	**King**	**1970 Kenya, Tsavo NP**	**Dvur Kralove**	Father of Jimm, possible father of Elvira
17	**174**	**F**	**Elsa**	**1970 Kenya, Tsavo NP**	**Dvur Kralove**	Mother of Elvira
18	**175**	**F**	**Jimmi**	**1970 Kenya, Tsavo NP**	**Dvur Kralove**	Mother of Jimm, Jessi a Jane Lee
19	**178**	**F**	**Jarca**	**1970 Kenya, Tsavo NP**	**Dvur Kralove**	Mother of Jaga
20	194	F	Naivasha	1970 Kenya	Howletts, UK Port Lympne, UK	Grandmother of Bashira
21	**195**	**F**	**Rukwa**	**1970 Kenya**	**Howletts, UK** **Port Lympne, UK**	Grandmother of Mweru, mother of Baringo II
22	**217**	**F**	**Sabi**	**1972 Kenya, Isiolo Region**	**Dvur Kralove**	Mother of Sali, grandmother of Davu
23	240	F	Mzima	1973 Kenya, Tana River District	Del Garda Zoo Berlin, Germany	Grandfather of Davu (father of Nane)
24	247	M	Ralph-Embu	1970 Kenya	Hannover, Germany Cincinnati, USA	Father of Isis
25	534	M	Gareth Edwards	1975, Addo NP, SA	Port Lympne, UK	Father of Mweru
26	582	M	Peter-Meru	1951 Kenya	Rotterdam	Great-grandfather of Baringo II
27	583	F	Sonny	1949 Kenya	Rotterdam, Netherlands Arnhem, Netherlands	Great-grandmother of Baringo II

Bold: animals imported to Dvur Kralove from the wild
Italics: animals imported to Dvur Kralove from the wild with descendants in other zoos
Blue: includes potential breeders - male Davu and female Bashira
Stdbk # - animal number in the International Studbook

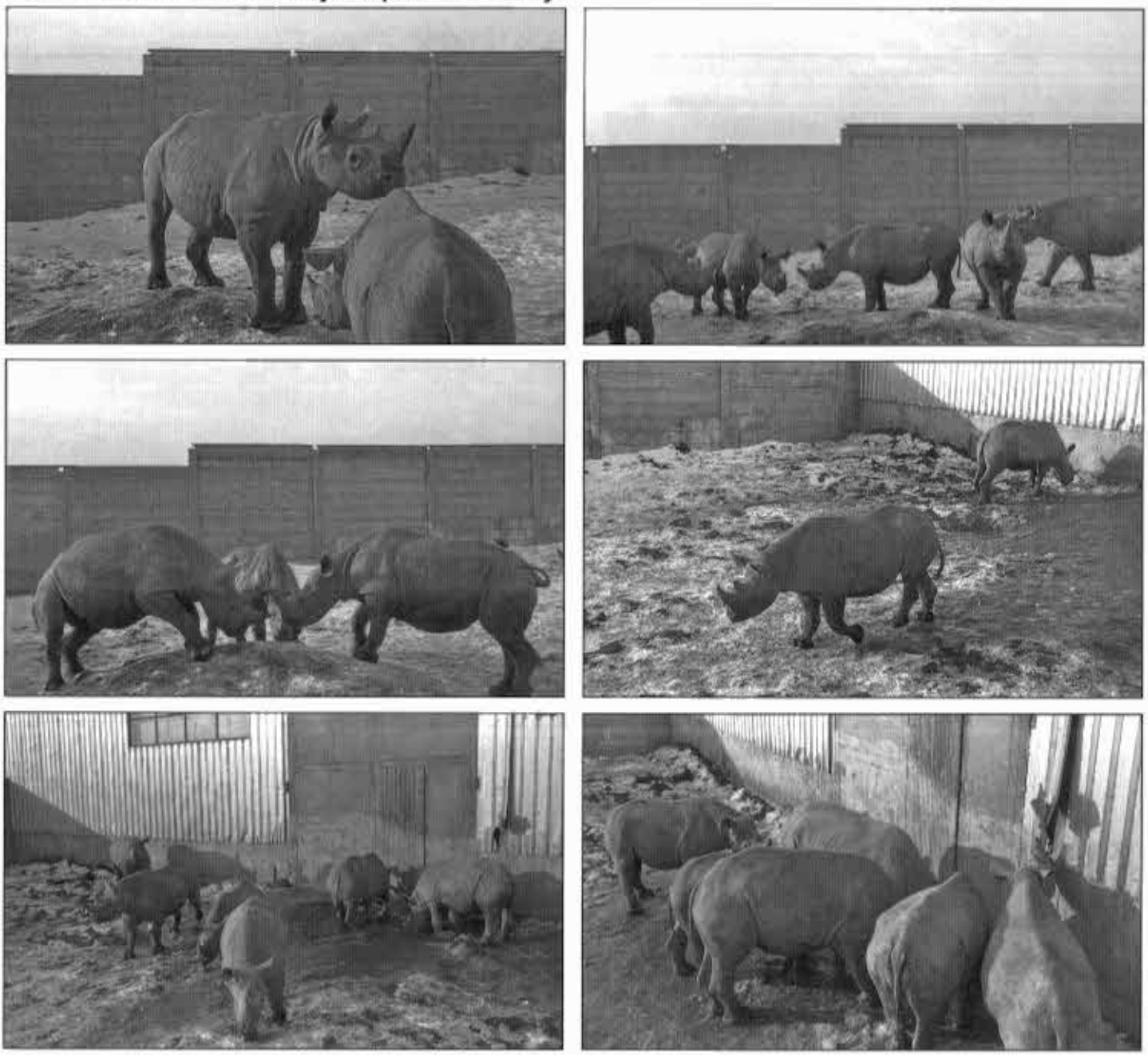
RHINO HOUSING FACILITIES

Quarantine and wintering facilities

Following the import from Africa in the early 1970s, black rhinos were first placed in the quarantine, which was a steel heat-insulated barn with indoor wood-fenced boxes. For white rhinos, a similar simple barn made of bricks that served as the first wintering facility for giraffes, white rhinos and other species and subsequently as a central store was used over the first two winters. This building has in part been accommodating giraffe housing needs since 2000.

A black rhinoceros after arrival in the quarantine facility. 1971 (jv)

Black rhinos in the enclosure by the quarantine facility



Black rhinos in the quarantine facility enclosure, the 1971/1972 winter (pb)

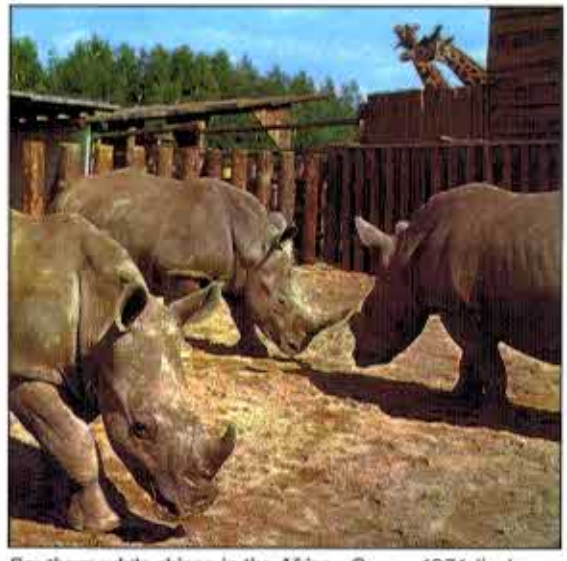
Aerial view of the zoo grounds with facilities used for housing rhinos (dh)
A - Rhino house No. 1. B - Rhino house No. 2. Enclosures by the block of old rhino houses: C, D & E - enclosure #1, 2 & 3
F - Rhino house No. 3. Enclosures by the new rhino house: G, H, I & J - enclosure #1, 2, 3 & 4
1 - Black rhino quarantine facility
2 - Southern white rhino quarantine facility

Enclosures by the quarantine facility serving for black rhinos from 1986 to 1990 (dh)

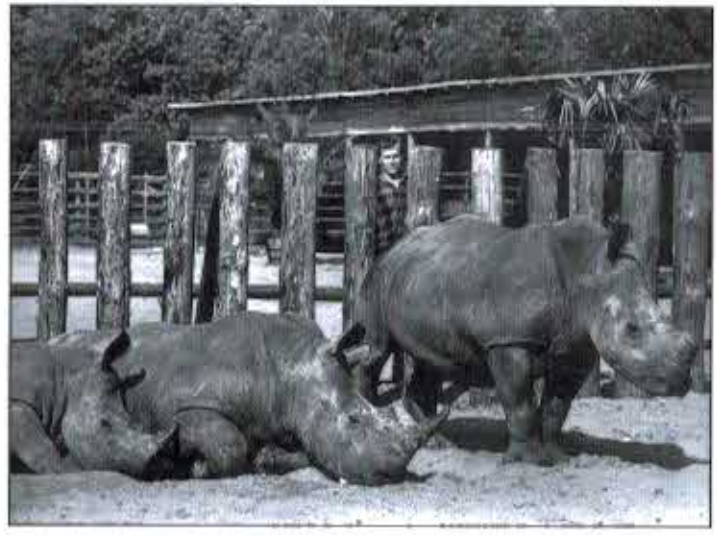
The African Camp Exhibit

In summer, the rhinos - more specifically, the southern whites and black rhinos - were housed from 1970 up to autumn 1972 in the African Camp Exhibit designed as the bomas where the animals were held back in Africa in the period of capture. Unlike the wintering grounds and the quarantine, the exhibit was available to the zoo visitors. In this African Camp Exhibit, rhinos were first held from June to November 1970. This involved 4 white rhinos (1.3) that were placed in this area immediately upon their arrival from Africa and spent the subsequent winter in the building used later as a store. In 1971 and 1972, the African Camp already housed in summer both white and black rhinos. Afterwards, the rhino enclosures were removed to provide a space for a giraffe house built later, while all rhinos were spending the 1972 winter in the rhinoceros house.

Southern white rhinos in the African Camp (jh)



Southern white rhinos in the African Camp, 1971 (jov)

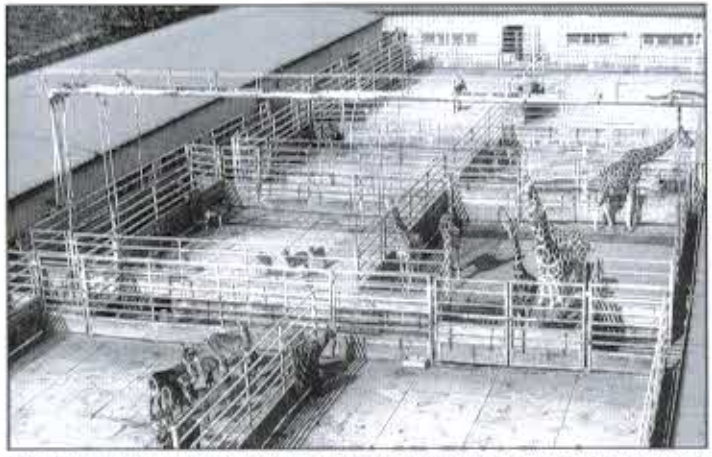


Black rhinos in the African Camp, 1972 (az)

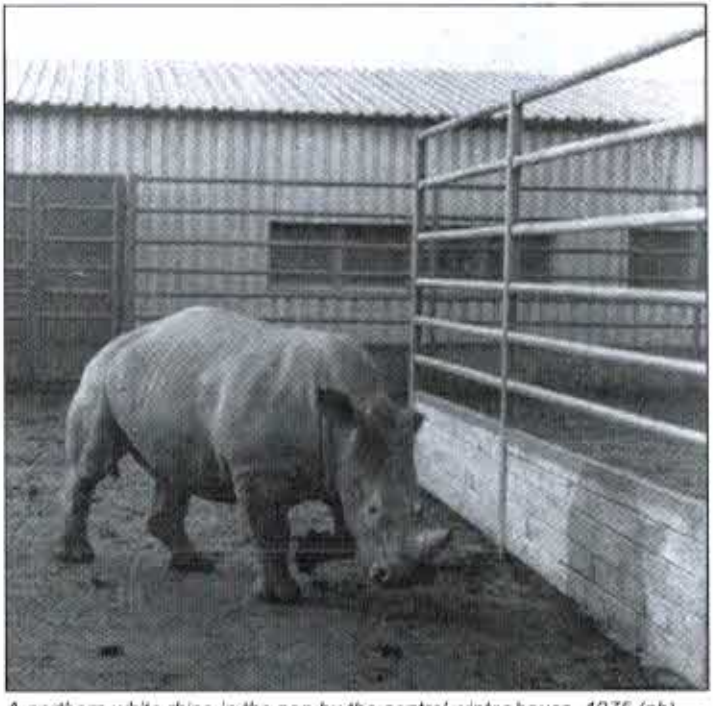
Central wintering facility

Throughout the black rhino management history, more specifically from 1974 to 1981, the central wintering facility was used for keeping the species. In addition, it was used for northern white rhinos from September 1975 to May 1977. The block consisted of heat-insulated steel barns with indoor stalls constructed from timbered metal fence sections, with each barn opening into a system of pens with surfaces covered by concrete panels, where each pen served as an outdoor enclosure.

A northern white rhino in the pen by the central winter house, 1975 (pb)



The central wintering facility with pens used as outdoor enclosures for the rhinos (az)



A northern white rhino in the pen by the central winter house, 1975 (pb)

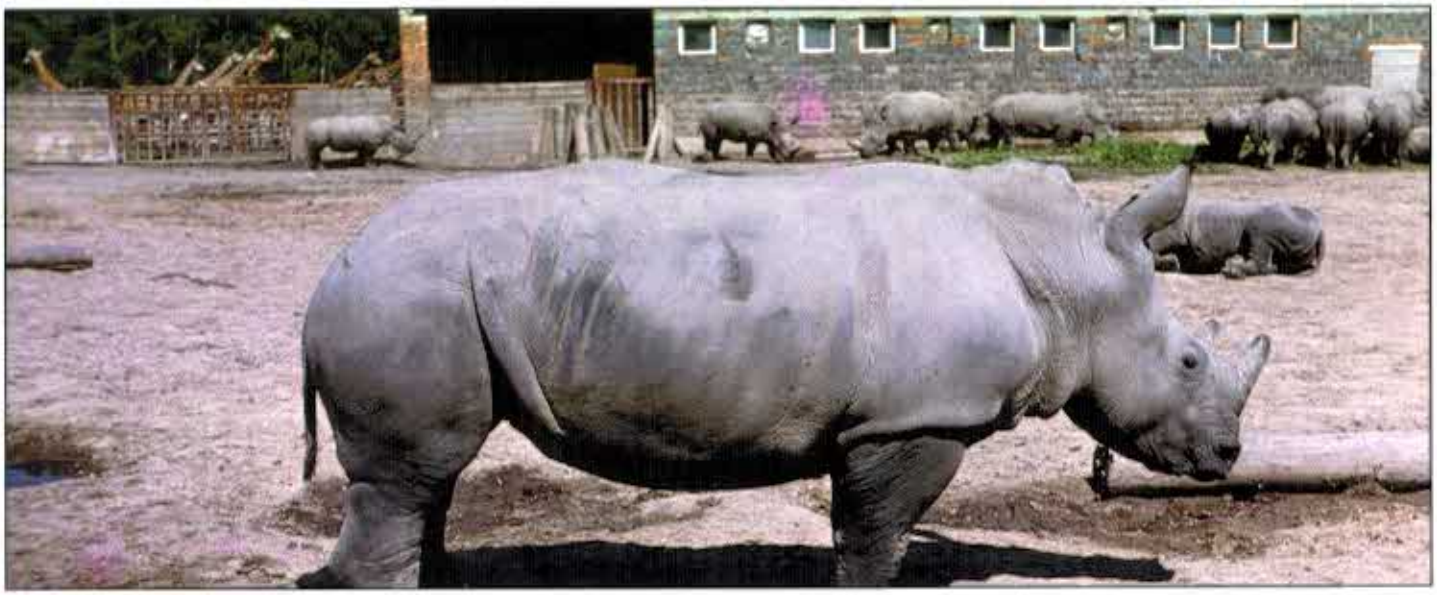
The former rhino pen and barn in 2004 (dh)

Rhino house 1 used for black rhinos since 1990

From the 1972 winter on, rhinos already used to spend colder periods of the year in the rhino house No. 1, though the house was still not finished, while in summer all used to go out into the adjoining enclosure.

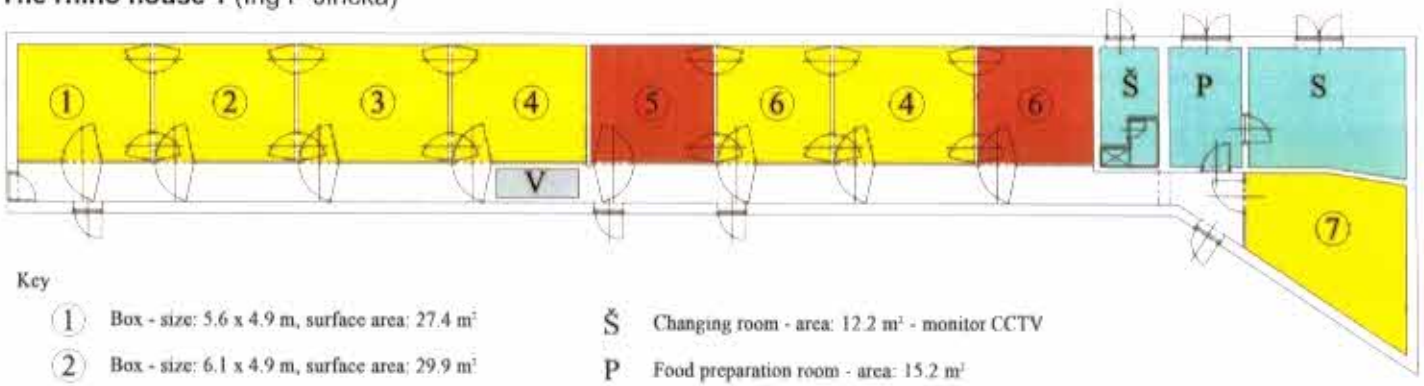
Used from the late 1972, the rhino house 1 still had only four stalls in service in 1973 and was fully completed in 1974. Sized 59m x 9m and 4.5 m high, this facility neighbours with two outdoor enclosures about 1,235 m^2 each and a 221m^2 pen. The indoor area is heated to 18 °C; each indoor stall has an area 5.1m - 6.4m per 4.9 m (VAHALA *et al.* 1993, JIRICKA pers. comm.). The total surface area of the facility is 545 m^2, where the indoor part covers 253 m^2, split in nine breeding stalls, two of which are most frequently used as maternity boxes. The housing capacity is up to nine adults in summer when the animals can go out, while in winter eight adults is the maximum, as at least one stall must be available to allow for handling when cleaning takes place.

The first rhinoceros house around 1972, with southern whites and black rhinos in the outdoor enclosure (vd)



In 2009, the facility housed two adult males (Jimm DK 3 and Baringo II) and three adult females (Jessi DK 5, Elba DK 19 and Jiddah DK 17) plus their calves (Dzanty DK 33, Eva DK 34 and Jasmina DK 35), of which two youngest animals lived there together with their respective mothers. There is a pen neighbouring with the house and separated from the enclosures by gates made of metal tubing and a planted area lined with brickwork. In 2008, a scale was installed in the indoor corridor of the house; up to this time, weighing the housed rhinos was not possible.

The rhino house 1 (Ing P Jiricka)



Key

1. Box - size: 5.6 x 4.9 m, surface area: 27.4 m²
2. Box - size: 6.1 x 4.9 m, surface area: 29.9 m²
3. Box - size: 6.4 x 4.9 m, surface area: 31.4 m²
4. Box - size: 5.8 x 4.9 m, surface area: 28.4 m²
5. Box - size: 5.1 x 4.9 m, surface area: 25.0 m²
6. Box - size: 4.8 x 4.9 m, surface area: 23.5 m²
7. Box - extension, surface area: 35.6 m²

Š Changing room - area: 12.2 m² - monitor CCTV

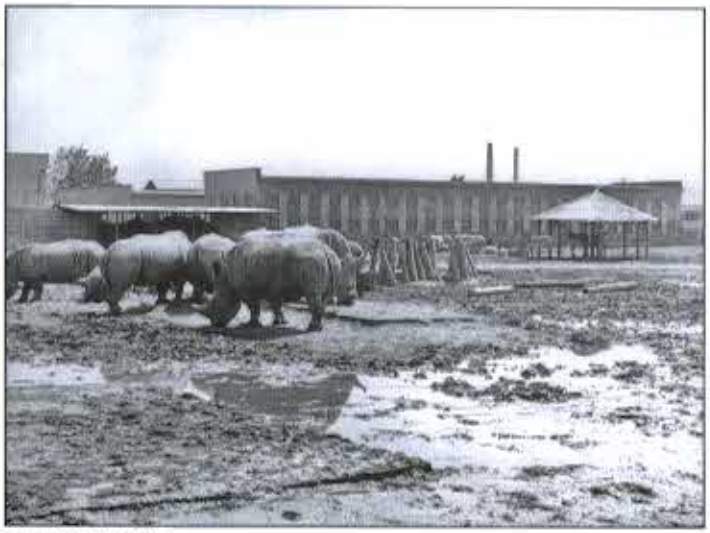
P Food preparation room - area: 15.2 m²

S Hay store - area: 33.9 m²

Calving boxes

V Scale

Total area of boxes for rhinos 253.1 m²



Southern white rhinos inside the enclosure in front of the rhino house 1 in the early 1970s (az)

The rhino house 1 in 2009

The first rhino house indoors, 2009 (dh)

A corridor for rhinos (dh)

Male Dzanty in the box #3 (dh)

Female Jessi in the calving box #5 (dh)

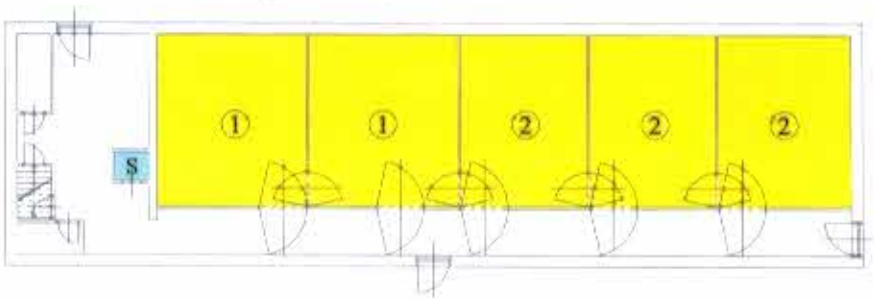
Male Jimm in the box #7 (dh)

Monitoring activities indoors via CCTV, the picture shows Bc J Hruby. (dh)

Rhino house 2, used for black rhinos from 1973 to 1990

The rhino house 2 was constructed in 1973 and 1974. Originally, it was designed for zebras, but due to space issues concerning housing of subadult rhinos, it was used for housing of black rhinos that continued to stay here until 1990. A brick two-storey building with a total area of 260 m^2, the house has sizes 30 m x 9 m x 5.3 m and a hay-loft. As ceiling of the indoor stalls is significantly lower (2.7 m) than in the rhino house 1, this building was used for black rhino breeding. Since finishing the new rhino house in 1990, the building above was operated as a rhino house only occasionally. There is an enclosure with an area of over 1420 m^2 adjoining the house, which can be entered by rhinos kept in the house No 1 as well. With 5 stalls 4.5-6 m large and a total housing surface area of 143 m^2, the building can accommodate up to 5 adult animals or up to five groups of subadults.

The rhino house 2 (Ing P Jiricka)



Key

(1) Box - size: 5.2 x 6.0 m, surface area: 31.2 m^2

(2) Box - size: 4.5 x 6.0 m, surface area: 27.0 m^2

S Hay supply chute

Total area boxes for rhinos 253.1 m^2

One of the stalls at the rhino house 2 - female Elsa with its daughter Elvira, 1977 (lh)

The rhino house 2 indoors in 2009 (dh)

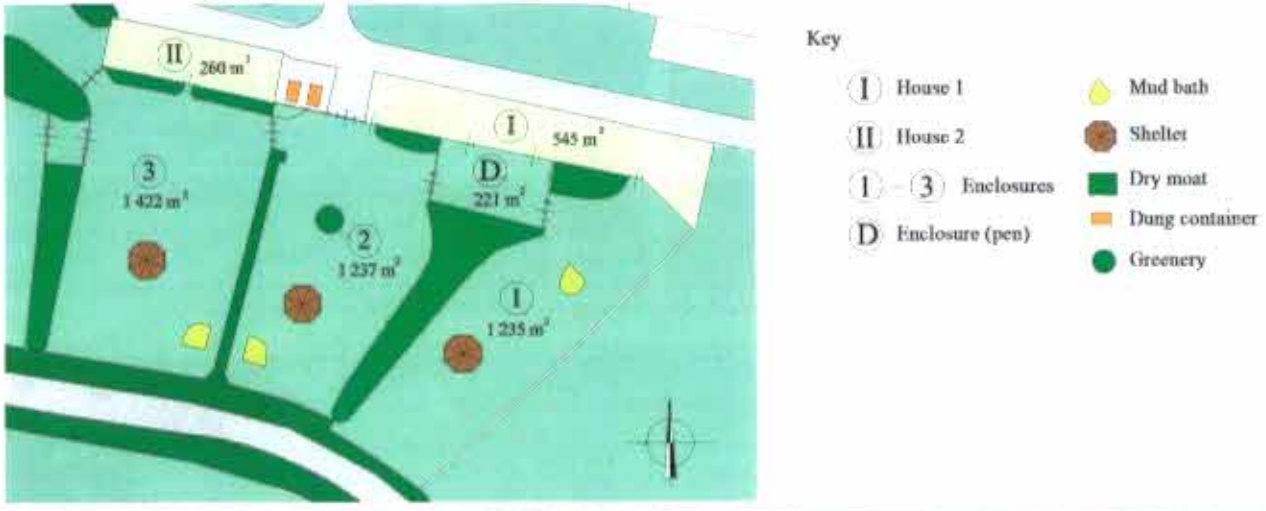
Rhino house 2 and the adjoining enclosure with black rhinos, 1977 (az)

The same enclosure in 2009 (dh)

Enclosures by the block of two original rhino houses

From autumn 1972 up to 1975, rhinos used to go outdoors into a single large enclosure in front of the rhino houses, where they were staying together. In 1976, this area was split to form three enclosures and a pen. The walls separating the enclosures were later partly replaced by U-shaped ditches and partly by vegetation planted in the area enclosed by two backfilled brick walls 200 cm high. The enclosures adjoining both houses are separated from each other by either a U-shaped ditch or an elevated area of a drop-like platform covered by vegetation and lined by brickwork. The animals are separated from visitors by a ditch, which originally was of a U-shaped form, but in 2000, it was gradually sloped along the enclosure 3. Additionally, the U-shaped ditch along the eastern side of the enclosure adjoining the giraffe paddock (formerly a one of zebras) was removed, with now a gradually sloped ditch and a brick wall about 1.2 m high from the side of giraffes and rhinos, respectively, separating both enclosures. Each of these outdoor exhibits contains a shelter providing shade and protecting from rain, and a mud bath filled in summer with water. For more details, see the plan and photographs.

The block of original rhino houses (Ing P Jiricka)



Enclosures in front of the rhino house 1 and 2, isolated by areas with a drop-like platform containing still immature greenery and separated from each other by a U-shaped dry moat (zc)

Enclosures in front of the original black rhino block

The gate into the enclosure with grass spread to avoid damage by overheating and a plank to prevent any young to go through (dh)

Viewing the enclosure #2 through the gate (dh)

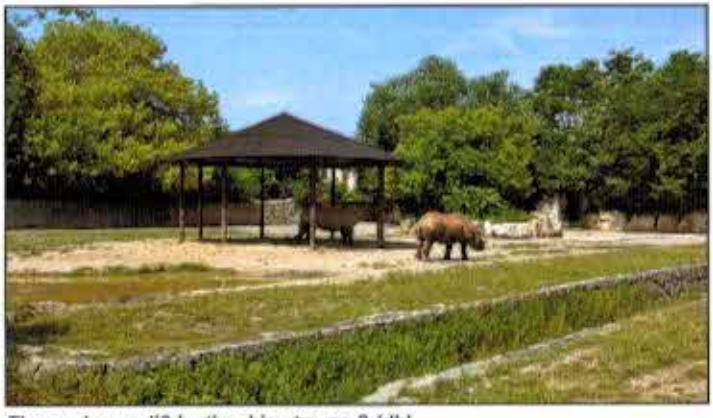
The enclosure #2 in 2000, when a U-shape ditch was replaced by a gradually sloped dry moat and a brick wall was built between the giraffe and rhino enclosures (mp)

The pen by the house 1 with a surface area of 221 m^2 includes gates from both sides that open into the enclosures (dh)

The enclosure #3 with Jiddah and Dzanty inside (dh)

Ema Elsa DK 26 in the mud bath of the enclosure #2, 2002 (dh)

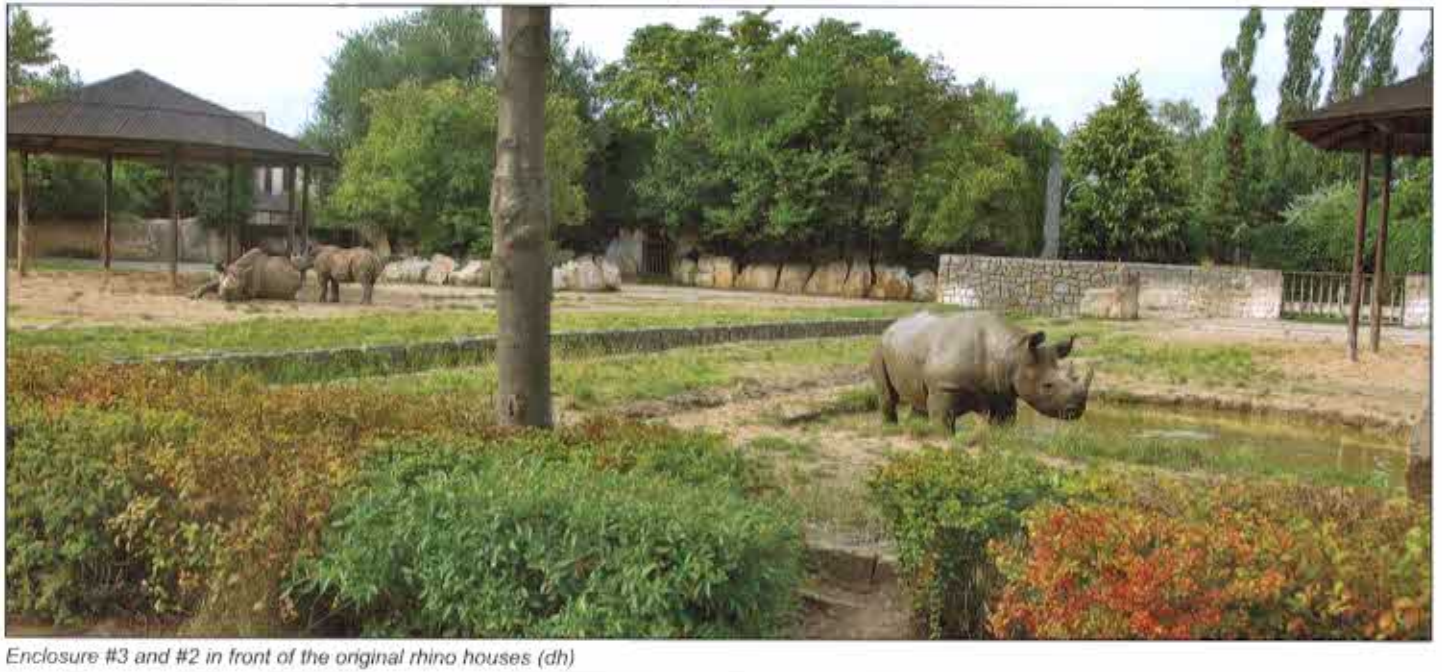
The enclosure #3 and the U-shaped dry moat between the enclosure 2 and 3 by the old rhino house block (dh)



The enclosure #3 by the rhino house 2 (dh)

Enclosures in front of the original black rhino block

The enclosure #3 with a mud bath; the house is masked by vegetation (dh)



Enclosure #3 and #2 in front of the original rhino houses (dh)

Rhino house 3 (the new house) used for keeping white and Indian rhinos, and a part of black rhinos

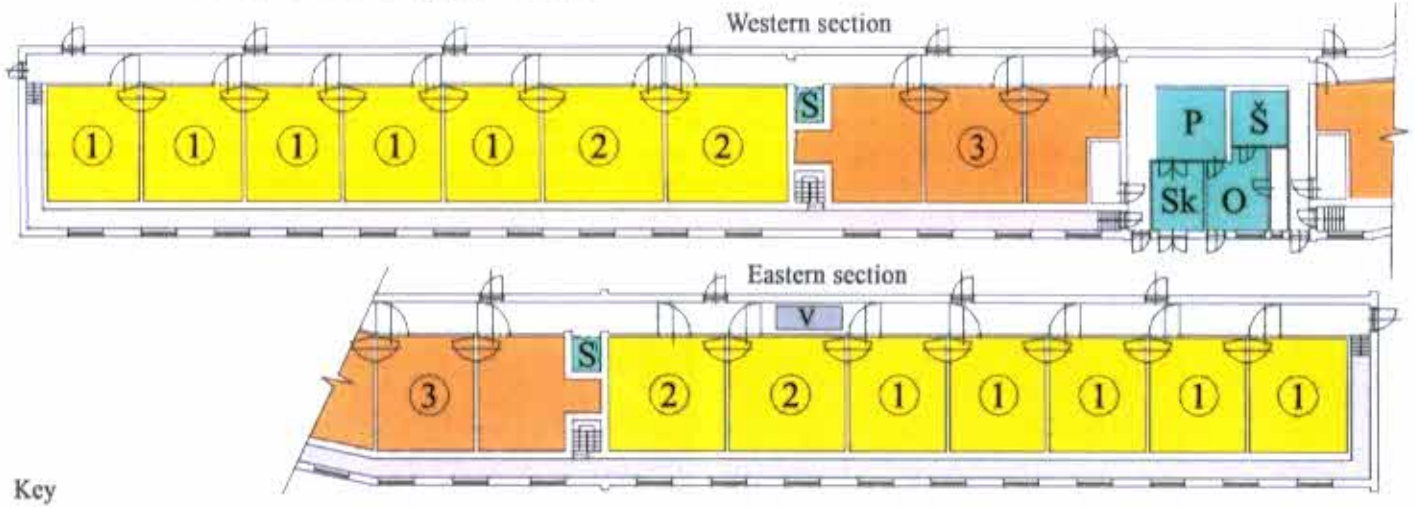
In 1986-1990, a new rhino house was built, providing housing for white rhinos, Indian rhinos and several black rhinos. There are five enclosures adjoining the house with a surface area ranging from 830 to 2,978 m^2, of which black rhinos normally used those three lesser paddocks. In 1997, the outside transfer corridor of the house 3 was supplied with a scale. Each of those enclosures contains a shelter and a mud bath that in the enclosure 4 was converted to form a naturalistic pool for Indian rhinos in the early 1990s. The house as such, with sizes 126 m x 10 m x 6.3 m, has two wings with 10 stalls each and a loft including a hay-loft. The building can house up to 18 adult rhinos. Each stall as such is 5-6 m by 5.9 m in area. In each wing, three stalls make together a triple box which suit for keeping a pair, which was the case of Indian rhinos or a group of juveniles, e.g. black rhino nurseries.

Construction of the rhino house 3, 1988 (left, zc) and 1989 (right, pch)

The new rhino house in the construction period prior 1990 (pch)

The rhino house indoors, with an inspection corridor and stalls, 2009 (dh)

The new rhino house, numbered 3 (Ing P Jiricka)



Key

1	Box - size: 5.0 x 5.9 m, surface area: 29.5 m²	P	Food preparation room - area: 13.3 m²	Š	Changing room 8.1 m²
2	Box - size: 6.0 x 5.9 m, surface area: 35.4 m²	Sk	Store - surface area: 9.5 m²	S	Hay supply chute
3	Triple box, surface area: 85.8 m²	O	Keeper room - surface area: 12.7 m²		Triple box
				V	Scale

The first black rhinos were brought into the house from the new quarantine in October 1990. This involved male Eli and pregnant female Jessi that on 23 June gave birth to her first offspring and the first calf born in the facility. In 1990, all white and Indian rhinos from the zoo's collection were moved into the new house.

In 2009, this facility termed a new rhino house provided housing to 2 Indian rhinos, 6 northern white rhinos and 9 black rhinos - males Isis, Mweru, Jamie DK 29, Jabu DK 31 and female Jimmi, Jola DK 21, Jane Lee DK 22, Deborah DK 27, Maisha DK 28 and Etosha DK 30. The black rhinos reside mainly in the eastern wing, where they normally have available 7 to 10 stalls. The total surface area of the facility is 1,237 m^2, from which 608 m^2 are indoor boxes, while enclosures cover 7,733 m^2. The enclosures are furnished with shelters; in three of them, there are mature trees protected with sandstone blocks, three enclosures contain mud baths and two of them used in particular as Indian rhino enclosures have natural pools. The enclosures also contain means of separating - a planted area lined with brickwork termed a droplet or a wall or also U-shaped ditch, that in addition is used for separating the enclosures from the visitor area except for the largest enclosure, where a gradually sloped ditch was constructed in 1994-1996; in the same period, gates to interconnect all enclosures were installed and shelters erected. In 1994, an outdoor scale was installed in the external corridor by the house in front of the enclosure 3, followed by a scale placed in the internal corridor of the eastern wing in 2008, which allows for rhino weighing.

The rhino house parameters are in line with established and recommended husbandry standards, as following the recommendations of the Central Animal Welfare Commission to the Czech Ministry of Agriculture (HOLECKOVA and DOUSEK 2000), as the area of an enclosure for two rhinos and an indoor stall for a single animal should not be lesser than 500 m^2 and 20 m^2, respectively. Recommended indoor temperature should 18 °C.

According to the black rhino husbandry recommendations (GOLTENBOTH *et al.* 1995), the area of an indoor box for a single black rhino should be at least 30 m^2, with the wall length at least 5 m and stall clearance at least 3.5 m, while the separating walls should be 2 m in height. Stall temperature should range from 18° to 20° C. Each adult animal should have its own box. Two adult black rhino pairs should have three enclosures available, at least 200 m^2 each. Each adult male should have its own enclosure, while females can be held in an outdoor enclosure both separately or by two.

Enclosures by the rhino house 3 (Ing P Jiricka)

Aerial view of Dvur Kralove Zoo (dh)

The new rhino house

Rhino house No. 3, 2009 (dh)

Outer corridor of the rhino house 3 (dh)

Food preparation area at the rhino house 3 (dh)

A box in the eastern wing - black rhinos Jola and Jabu (dh)

Three young in one of the triple box sections, 2008 (dh)

The enclosure #5 by the new rhino house with northern white rhinos, 2009 (dh)

Enclosures by the new rhino house

The enclosure #1 of the rhino house 3 (dh)

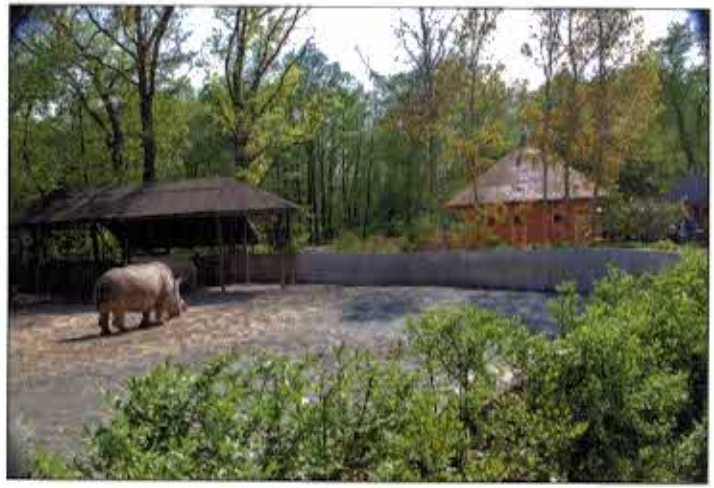
The enclosure #4 with the enclosure #3 (in the back) of the rhino house 3 (dh)

The enclosure #2 of the rhino house 3 (dh)

A female northern white rhino by a rubbing structure, enclosure #5 (dh)

There is a U-shaped ditch between the enclosure 3 and 4 by the new rhino house (dh)

Dung containers by the new rhino house (dh)



The enclosure #5 by the new rhino house with northern white rhinos (dh)

The enclosure #3 (dh)

A mud-bathing black rhino in the enclosure #2 by the rhino house 2

Elba, a black rhino female, taking a mud bath in the enclosure #2 by the old rhino house (th)

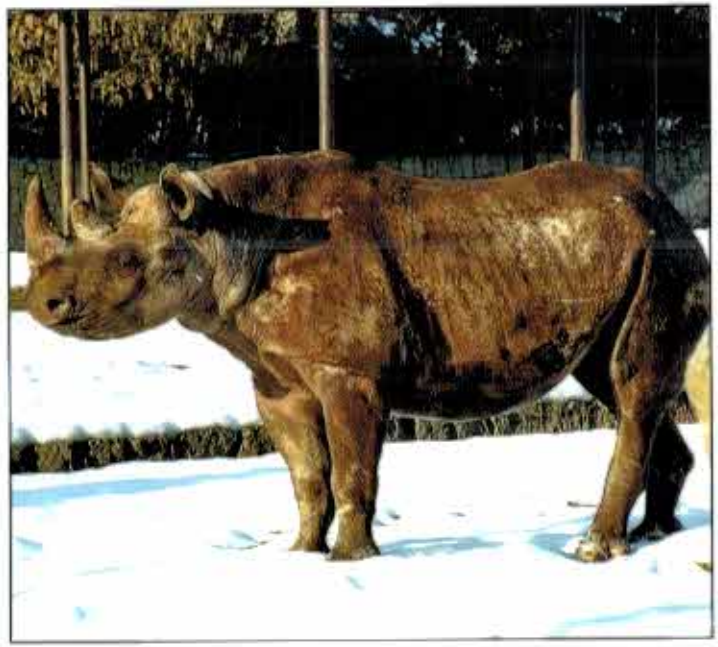
Male Mweru mud bathing in the enclosure #2 by the new house (dh)






Rhinos in the snow

Black rhinos in the snow (th)



Black rhinos enjoying the snow (dh)

BLACK RHINO STOCK HISTORY

The quarantine

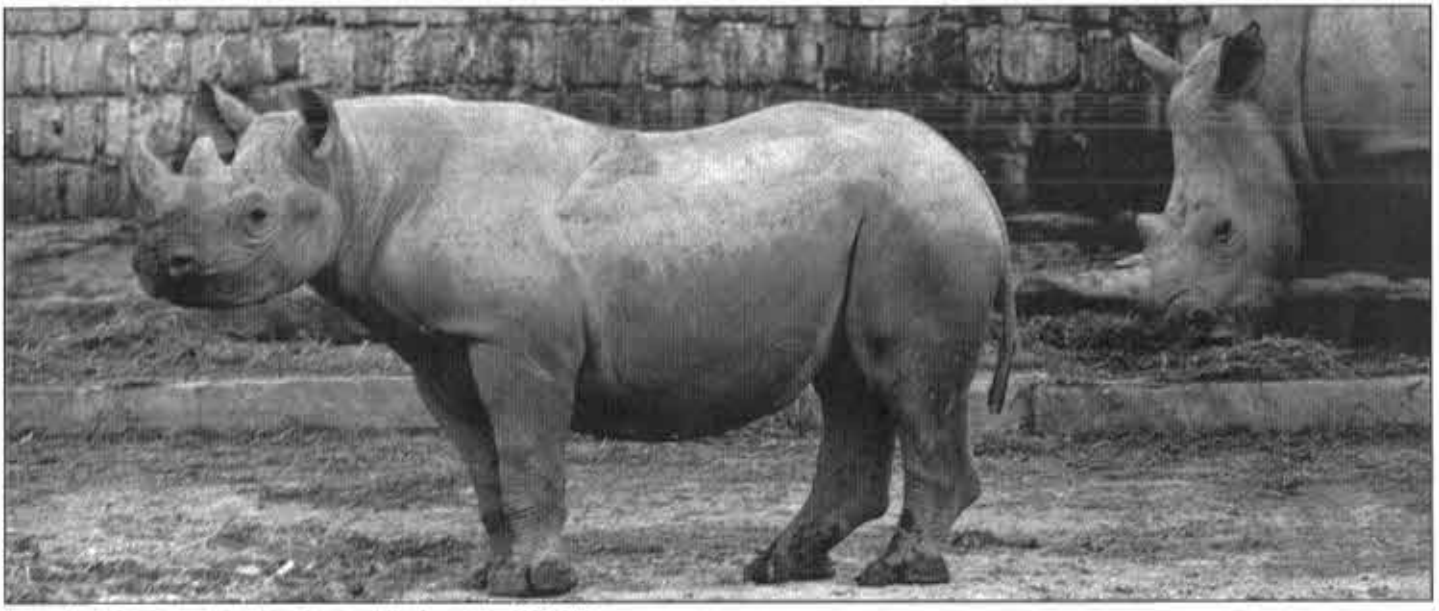
Once imported from Kenya, black rhinos were placed in the so-called old quarantine (BEDNAR personal communication), today's wintering facility for East African ungulates. The ten (4.6) animals caught in Tsavo National Park were imported in 2 transports: 27 July 1971 (2.0 - Ken and Lord) and 23 August 1971 (2.6 - King, Murray, Zina, Lenka, Elsa, Jimmi, Tuty and Jarca) and initially divided into 2 groups (2 and 8 animals). Afterwards, all the animals stayed together within a single group both indoors and outdoors, prospering and growing despite the relatively primitive housing and in particular temporary enclosures. The basis of the diet was a milk-based polenta supplemented with various kinds of cereals, vegetables, fruits and browse. In 1972, two (1.1) individuals from the group - Lord and Lenka - were sold to Jacksonville Zoo, the U.S., where Lord later became the father of 4 young and lived to be 29 years. Lenka lived 12 years and died without offspring. The rhinos were housed in the quarantine facility until 1973.

Rhino house 1 (later on: the white rhino house, today the black rhino house)

In 1973, all of the eight (3.5) black rhinos were moved into the premises of the new rhino house that was then under development (today known as the black rhino house), where the whole group lived in a box of size 6 x 6 m. In other 2 boxes, there lived two groups of southern white rhinos - a total of 10 (2.8) animals. In summer, all the three groups of rhinos went together into a single enclosure, while in winter they alternated each other, staying outdoors only during the cleaning. At that time, the first attempt of mating was recorded in black rhinos (Ken and Elsa - 18 March 1973). In July 1973, another pair of southern white rhinos was introduced (a new import from Africa), enlarging the group of rhinos staying together outdoors to 20 animals - 8 black rhinos and 12 white rhinos, structured as follows:

- 8 (3.5) black rhinos
- 7 (2.5) older southern white rhinos
- 5 (1.4) younger southern white rhinos

Mixed stock of black rhinos and white rhinos; on the right top of the picture: the rhino house 1 under construction, 1973 (jh)



A black rhino with a white rhino by the rhino house 1, 1974 (lh)

Black rhinos in the enclosure of the rhino house 2 (lh)

Rhino house 2 (then the black rhino house; originally built for zebras) - 1973

As the indoor rhino housing was insufficient for the growing young animals, a part of the animal house built originally for zebras was put into operation in the late 1973, to which black rhinos were moved in December 1973. In this facility, the condition of skin improved in all individuals. Because the boxes inside the house were smaller than those in the previous facility, mutual aggressiveness of animals increased, with Jimmi being attacked in particular. All 8 (3.5) individuals (King, Ken, Murray, Elsa, Zina, Tuty, Jimmi and Jarca) stayed there permanently together. Already on 30 October, mating was first observed.

Central wintering facility, barn III

In 1974, additional black rhinos were imported from Kenya. First, it was female Sabi (imported on 26 June from the Isiolo region) and then two animals (1.1) - Addo and Satara (imported on 2 July from unspecified locations). These animals were quarantined in the barn III at the central wintering facility. All were transferred to the rhino house 2 already on 31 August 1974.

Rhino house 2 (then the black rhino house; now the zebra house) - 1974 to 1978

On 31 August 1974, the black rhino group was enlarged by adding 3 (1.2) individuals imported from Kenya the same year and quarantined in the central wintering grounds. Subsequently, the herd of black rhinos consisted of 11 (4.7) individuals. On 29 October 1974, male Murray from this group was sold to Wroclaw Zoo in Poland. The rest of the herd was split into two groups held separately in two boxes as follows: 3 (1.2) - Addo, Sabi and Satara and 7 (2.5) - Ken, King, Zina, Elsa, Jimmi, Tuty and Jarca. All these animals still went together into a single enclosure shared additionally with white rhinos; in winter, the groups alternated each other, staying outdoors only during the cleaning.

In January 1975, the trio became restless and Sabi was often attacked, so was separated into a separate box on 13 January. Nonetheless, all black rhinos still walked outdoors together. From June 1975, Sabi stayed in the house within a larger group made up of 8 (2.6) individuals.

At that time, the beginning process of sexual maturation started to show through mating attempts observed (Elsa and King, Satara and Addo), as well as through mutual struggles and injured animals. This led to additional splitting of the herd indoors in the early 1976, into 3 groups as follows:

- 2 (1.1) - Addo, Satara
- 5 (1.4) - Ken, Zina, Elsa, Tuty and Sabi
- 3 (1.2) - King, Jimmi, Jarca

All animals still walked outdoors together and continued attempts at mating were observed (Tuty and King, Elsa and King, Tuty and Ken).

During the spring 1976, the outdoor area was converted into 3 separate enclosures. At the time of construction of enclosures, rhinos could not walk out for several weeks, which resulted in stiffening their fighting with each other, associated with numerous injuries, especially those of mouth. As of May 1976, the black rhinos started walking in their own enclosure and stopped being united with white rhinos. The first mating was recorded on 20 July, 1976, when female Elsa was first mated by Ken, and then by King still on the same day. As subsequently proved, Elsa became pregnant on that day; the father of the young (Elvira) is still unknown. In the later half of 1976, continued mating was observed (Tuty and Ken - repeatedly, Zina and Ken, Sabi and King - attempts).

In 1976, aggression among the rhinos escalated, with beginning maturity of the animals being responsible without doubts. Jimmi became the most attacked female with her nasal septa broken from the attacks of the males, so had to be permanently separated from the group as of 12 July 1976 and stayed indoors.

King became another seriously wounded animal (17 February 1977), when the other male Ken injured male's groin and broke his spermatic cord. From that day on, King was separated leaving the number of black rhinos going out together on 6 (1.5) - Ken, Zina, Elsa, Tuty, Jarca and Sabi. Subsequently, Ken repeatedly mated Tuty and Sabi.

As in the late March 1977 Elsa who had been staying with the group appeared to be pregnant, she was put aside into a separate box on 22 March 1977. Consequently, solo living Jimmi had to be moved into the central wintering grounds to make space for Elsa. On 15 July, the female was followed by King who had been held apart from others.

In the meantime, Sabi got pregnant on 15 April 1977 following mating with Ken. After separating Elsa, the herd consisted of 5 (1.4) animals - Ken, Zina, Tuty, Jarca and Sabi. The only female who had not been mated was Jarca. This rhino was repeatedly attacked by Ken, hurting the female in the groin (10 August and 6 September 1977). Ken tried to mate the female for the first time on 12 September, with no attempts recorded any later; however, Jarca's injuries in the groin continued (28 November and 15 December 1977). Tuty was last mated by Ken on 9 October 1977.

On 2 October 1977, Elsa gave birth to the first black rhino calf - a female - at Dvur Kralove Zoo (**Elvira DK 1**). The female's ration was enriched with vegetables, fruit and milk powder. Despite the positive developments within the stock, problems began to appear with male Ken losing weight extremely. On 10 December 1977, this male had to be separated from the females. His diet was improved and the rhino subsequently almost broke through the separating wall to the box with Elsa and her calf inside on 14 December. Therefore, the male was reunited with the females (Zina, Jarca, Tuty and Sabi). In the late December 1977, only four females went out together. Elsa shared the box with her daughter Elvira, as did Ken and Tuty, and the remaining 2 boxes were inhabited by 3 females (Zina, Jarca and Sabi). From 27 Jan-

Elsa with the 27-day-old Elvira DK 1, 29 Oct 1977 (lh)

Elvira at the age of 7 months, 21 May 1978 (lh)

uary, Sabi was separated into a single box because of showing strange behaviour from time to time, which probably was due to pregnancy. At the same time, the majority of animals exhibited health problems. Ken was still rather lean, with Zina and Jarca bleeding once their mouth was injured, because the wounds were constantly renewed. In addition, it was clear in March 1978 that Elsa was in a very poor condition as well. In early April, it became apparent that the female had stopped lactating (dried milk was removed from the female's diet on 22 November 1977, then served over a short period in December and displaced again in January 1978). Despite the treatment employed as well as increased and diversified diet, Elsa died on 7 April, which for Elvira meant losing her mother at the age of 6 months. Consequently, this infant rhino began to suffer from diarrhoeas. The calf was treated with antibiotics and was given rice porridge and varied diet containing amongst others powdered milk, bananas, oat flakes, fruit and vegetables. She was also fed milk from a bottle and received Glukopur.

From today's perspective, oversimplification of feeding, inadequate to dietary requirements of a lactating female and those of adult animals appears to have been the most likely cause of death of Elsa and decondition of other rhinos, because from July 1975, the summer diet was altered (simplified) to concentrated food, browse and green fodder and similarly, from July 1976, the diet over the summer season was again reduced to concentrated feeds, green fodder and browse.
Because the health of Ken and Tuty was still not satisfactory, both animals were crated and carried to the central wintering house (19 April 1978) and male King brought on 20 April from the same facility to join the rest of the females (Zina, Jarca and Sabi). Unfortunately, King was anaesthetised using Immobilon due to the transport and his condition was not very good after the operation; consequently, the male died on 22 April of entangled intestines as a result of the narcotising, loading and transporting.
In May and June 1978, Zina continued to suffer bleeding from the mouth. This situation had been lasting for several months due to injury after the attack of Ken. In June, her health deteriorated. This animal was repeatedly investigated and then treated from 21 June. Despite all efforts, Zina died on 26 June. Even though haemolytic anaemia appeared to be the cause, the death might have been associated with prolonged bleeding, weakening the body.
Sabi began lactating on 30 June, giving birth to a female on 5 July 1978 **(Sali DK 2)**, which the female reared without any problems. Elvira, already a 10 months old rhino at that time, was still kept on her own. Since July 1978, this female rhino was joining Jarca outdoors; subsequently, both females walked out together on a regular basis and as of October, Jarca became Elvira's permanent

babysitter as there was no adult black rhino, with which this adult female could be united. Therefore, both female rhinos continued to be kept together not only outdoors, but also inside the house. On 17 November 1978, male Isis was imported (born on 3 November 1977 in Cincinnati, the USA) to become a future stud male.

Central wintering facility, barn IV - 1977 to 1978

On 22 March 1977, female Jimmi was moved to the barn IV at the central wintering facility, joined by male King moved about 4 months later (15 July 1977) into the same building following his recovery from injuries suffered in February of that year. King and Jimmi were united and continued to be kept together permanently indoors and outdoors. Both animals prospered on that location, even though enjoying dismounting their fencing both indoors and outdoors almost every day, as the fences were good enough to hold antelopes or zebras but not adolescent rhinos. There the pair was kept fully undisturbed, particularly in summer; the animals could range outdoors and indoors and vice versa not only during the day but even at night. The first mating of King and Jimmi was recorded on 19 August 1977 and at the end of 1977 Jimmi became pregnant.

Because the animals kept at the central wintering grounds did very well, it was decided in April 1978 that Ken, being a problematic animal in terms of health, and female Tuty would be moved into the house and King relocated to the rhino house in order to mate the remainder of the females. While the two animals with disorders (Ken and Tuty) were crated without problems at the rhino house, which took place on 19 April, the similar action involving King full of power failed; breaking the crate door and forcing the gate of the house, the male had to be left in the outdoor enclosure from the 19 to 20 April. Therefore, the rhino was anaesthetised (darted by Immobilon) on 20 April and then loaded in a very complicated manner and transported to the rhino house. Unfortunately, this animal subsequently died as a result of the transfer.

The blood test proved that Ken and Tuty were suffering from haemolytic anaemia, which began to be treated on 20 April 1978. Because the health of Tuty improved, the treatment was stopped in case of the female and continued only in the male. Tuty got suddenly worse and died literally from day to day on 24 May. Testing Ken's blood samples confirmed that the male was still not in good health, so the treatment continued in the subsequent months.

Rhino house 2 (then the black rhino house; now the zebra house) - 1979 to 1980

On 6 April 1979, the 17-months-old male Isis was united with Jarca (9 years) and Elvira (1.5 years); this trio was kept together until 12 October, when Jarca was separated and the juveniles joined Sali, a young female separated from the mother when 15 months old. As Sabi and Jarca had skin and condition problems, they were examined and Sabi was re-treated. In summer 1980, Sabi was repeatedly apathetic, as did Jarca. These females were not treated, only carefully monitored and given diverse food. From October 1980, Jarca and Sabi walked out together.

In January 1977, the basic ration composed of hay, concentrated food, browse and dried twigs and shoots, sometimes supplemented with carrots, apples and beets. In the second half of 1978 (after the death of Elsa and Zina), the diet was completely changed and the concentrate served until that time replaced by other types of feedstuffs that had worked upon the arrival of black rhinos at the zoo in the early 1970s.

Central wintering facility, barn IV - 1979 to 1981

At the beginning of 1979 (on 18 March), Jimmi gave birth at the wintering facility to her first calf - a male (**Jimm DK 3**) that was reared by his mother without any problems. Jimm is the only descendant of the wild-caught male King provided Ken was the father of Elvira.

On 13 July 1979, female Satara from Lesna Zoo, where their male Addo had died, was transferred to the wintering grounds and subsequently united with Ken on 8 August. . Mating attempts were recorded as early as August in the case of this pair, but confirmed mating took place on 27 September. However, diarrhoea occurred in both rhinos and thus they had to be treated, which for Satara continued in November. Ken, however, was not treated at that time and suddenly died (8 November 1979). Before the male died, he was breathing with great difficulties, so the question is whether the cause of death was pneumonia or haemolytic anaemia. After Ken's death in November 1979, there was another change in the black rhino diet, which from that time on comprised of oats, hay, vegetables, browse and soil with sea salt and Plastin.

During the 1980, Jimmi and Jimm did well at the wintering facility, but Satara experienced health problems from time to time including black urination deemed a conclusive effect of haemolytic anaemia.

In April 1981 (13 Apr), 25 months old Jimm was separated from his mother Jimmi, crated and transported to the oldest rhino house. The same was scheduled for Satara on that day, who however broke the gate and crating failed. On 17 April, Jimmi was successfully immobilised and transferred to the black rhino house where she was subsequently kept alone, i.e. without Jimm. Similarly, Satara was anaesthetised on 24 April; sadly, this rhino died of cardiac collapse at the wintering facility in the course of immobilisation. Since that time black rhinos were never kept in the central wintering grounds again.

Rhino house 1 (then the white rhino house, now the black rhino house) - 1980 to 1981
Early in the 1980s, the black rhinos were kept at the rhino house 2 (now the zebra facility), while the rhino house 1 with its larger number of stalls was used for holding white rhinos. From time to time, black rhinos were located in this bigger building as well. Since the zoo lacked an adult male to join the rhino females following the deaths of King (1978) and Ken (1979), a wild-caught male Murray was imported on 2 October 1980 from Wroclaw Zoo in Poland, to which this rhino had been supplied by Dvur Kralove in 1974. After the male arrived, he repeatedly vomited. Upon arrival, Murray was placed at the white rhino house and moved into that of the black rhino by driving via outdoor enclosures on 27 April 1981.

Rhino house 2 (then the black rhino house; now the zebra house) - 1981 to 1983
The year 1981 was marked by constant improvement and monitoring diet of black rhinos. In April, the young male Jimm was brought into the house from the central wintering facility, followed by his mother Jimmi. On the day of transfer (13 Apr), Jimm was immediately united with the trio consisting of Isis, Elvira and Sali, but had to be separated at night. Socialising Jimm, when the male was gradually getting familiar with other rhinos, was an extensive procedure that lasted until 22 May. Once completed, the four young rhinos born from 1977 to 1979 continued staying together both indoors and outdoors. From April 1981, all black rhinos were kept only in the house 2, in five stalls, with females Jimmi, Jarca and Sali as well as male Murray kept separately, and four juveniles - Isis, Jimm (DK 3), Elvira (DK 1) and Sali (DK 2) grouped together. Murray was repeatedly united with Jimmi since May, with mating attempts observed in this pair already since June. At the end of 1981, the rhinos were split into 3 groups that stayed together permanently, with the first of these formed by Murray and Jimmi, the second comprising females Sabi and Jarca and the third group made of four (2.2) calves.
During 1982, Murray and Jimmi alternated each other in refusing to walk outdoors for many months. The situation improved in 1983, when the pair already walked out on a regular basis; however, only mating attempts were observed from February to April instead of real mating as such. On 22 April 1983, Murray and Sabi were sold to Zurich Zoo, Switzerland, where both rhinos subsequently reproduced. Sabi lived in Zurich for 36 years and died in 2008. Murray was sent to Tallinn Zoo in 1988, where this rhino died in 2009.
Because the four rhino calves (males Isis and Jimm and females Elvira and Sali) had reached maturity and mating attempts were observed at the end of 1981 (Isis and Elvira, Jimm and Elvira), the group was split in pairs as of March 1982 (Elvira and Isis, Jimm and Sali). Since only 5 stalls were available inside the house, the pair consisting of Isis and Elvira was moved to the house of the white rhino.

Rhino house 1 (then the white rhino house, now the black rhino house) - 1982 to 1983
On 18 March 1982, a young pair Isis and Elvira (DK 1) was relocated into the house inhabited by white rhinos from the neighbouring facility. From April 1982, Elvira and Isis regularly mated until Elvira became eventually pregnant on 20 February 1983. Elvira was 5 years and 4.5 months, and Isis was even one month younger. These rhinos were transferred back to the rhino house 2 (the black rhino house) in April 1983.

Rhino house 2 (then the black rhino house; now the zebra house) - 1983 to 1984
In April 1983, a pair (Murray and Sabi) was sold to Zurich Zoo, Switzerland. Because of the vacancy inside the house following the pair's departure, the pair made of Isis and Elvira was relocated into the facility from the white rhino house. On 5 May 1983, Jimmi was added to the couple above, being first mated by Isis as early as 10 days (15 May) and then on a regular basis until 6 September, when Jimmi got pregnant. Interestingly, Isis was trying to continue mating the pregnant Jimmi over the following 3 months. At that time, pregnant Elvira was kept in a separate box on her own (without Isis). The black rhino herd consisted of 6 (2.4) animals (males Isis and Jimm, females Jimmi, Jarca, Elvira and Sali). Due to a lack of space, Jimm and Elvira were moved at the beginning of 1984 to the rhino house next door (the rhino house 1).

Rhino house 1 (then the white rhino house, now the black rhino house) - 1984 to 1986
On the last day of January 1984, Jimm was forced into the outbuilding of the house 1 via enclosures, followed by pregnant Elvira a few days later (on 6 February); there the female gave birth to a male on 15 May 1984 (**Eli DK 4**). Eli was weaned from his mother on 18 August 1986, i.e. when 27 months old, and moved into the new quarantine facility along with Jimm (DK 3) and subsequently female Elvira (DK 1).

Rhino house 2 (then the black rhino house; now the zebra house) - 1984 to 1990
As of 15 May 1984, Isis and Sali were periodically introduced to each other and subsequently began to mate, which took place from 23 May 1984 until 21 April 1985, and might have continued even in May, when however mating was not observed. At that time, Sali became pregnant for the first time at the age of 6 years and 1.5 months.

Meanwhile, Jimmi bore its second calf at the house on 12 December 1984 - a female (**Jessi DK 5**). Jessi stayed with her mother until 9 September 1986, was weaned at month 21, and almost 2 years later (06 Apr 1988) carried away to the new quarantine, where this rhino replaced female Elvira.

On June 28 1986, Sali gave birth to her first calf - a male (**Sado DK 6**), whose father was Isis. Subsequently (on 9 September), Jimmi was introduced to Isis on 19 September once separated from her daughter Jessi, with the first mating taking place already 21 days after the weaning (on 30 September), but Jimmi became pregnant as late as 1.5 years after in February 1988 (13 Feb). Jimmi's third calf - a male **(Jos DK 7)** was born on 21 May 1989. This rhino was weaned from the mother at 11 months of age (19 April 1990) and Jimmi was subsequently forced via the outdoor enclosure to the rhino house 3 (New rhino house).

The young Sado was separated from the mother Sali in the late 1987 when he was 14 months, because Sali suffered erosions in the mouth and lost milk. Sali was introduced to Isis on 23 March 1988, with the first mating recorded on 18 April. Sali got pregnant on 28 June 1988 and on 1 October 1989 gave birth to her third calf - a female **(Sany DK 8)**.
Elvira was transferred into the house from the new quarantine facility on 6 April 1988 and was since kept alone or united with Isis together with female Jarca; however the male was very aggressive towards the females, so the introduction process was always stopped after some time. This took a year, and Elvira began eventually walking outdoors with Isis on a regular basis as of 4 May 1989. Mating followed on 23 and 29 May, where Elvira became pregnant upon the second mating event and bore her second descendant on 24 August 1990 - a female **(Eimi DK 9)**. Once the 11 months old Eimi was weaned (on 31 July 1991), Elvira was transferred by driving via enclosures from the house 2 into the house 1.
Jarca's experience with males in the female's adolescence period was very negative; after the death of King and Ken, this rhino was long kept as a companion to the young Elvira, who had lost her mother at the early stage (in 1978), and later also with the young male Isis who came to Dvur Kralove from the U.S. as a yearling. Once Isis reached maturity, this male began repeatedly attacking Jarca, and therefore this female rhino stayed alone for many years until intensive efforts on the reproduction of this female began around 1989 (VAHALA *et al.* 1995). Throughout 1989, urine was collected from females, including Jarca, and tested in London in order to identify hormonal cycles. Jarca was anaesthetised on 5 May 1989 and underwent the gynaecological examination. To facilitate the introduction to Isis, Jarca was first united with Elvira (on 16 August 1989) and subsequently with Isis (18 August 1989). However, the whole process had to be stopped for permanent Isis attacks. In November 1989, Jarca was hormone-stimulated for the first time, receiving Regumate - 37.5 ml/day over a 12-day period.
Since putting together with Isis failed, Jimm (DK 3) was transferred to the adjacent white rhino house from the new quarantine on 21 December 1989, and subsequently Jimm started the first contacts with Jarca in the outdoor enclosure as of 26 December. Both rhinos were sniffing each other through the enclosure fence and taking turns in walking into the same enclosure. In March (on 5 Mar), Jimm was

Elvira mating with Isis, 3 May 1989 (lh)

Jimmi and two-month-old Jos DK 7, 17 July 1989 (lh)

moved by driving into the box adjacent to that of Jarca at the black rhino house, so both rhinos stayed next door to each other. On 15 March 1990, Jarca was anaesthetised and re-examined. Until the end of month, the female received the second batch of hormonal stimulation to induce oestrus (Regumate, 50 ml/day over the period of 14 days). Jimm and Jarca were tranquilised using Diazepam and introduced to each other for the first time on 1 April 1990 and as it went quite smoothly, the process continued, with the first attempt at mating observed on 2 April. The first actual mating took place on 22 April 1990, when Jarca was 20 years old. The pair continued to mate on a regular pasis, but Jarca still could not get pregnant. Therefore, 60 ml of TPGS (vitamin E dissolved in fat) per day was administered to the female over the period of 10 days in February 1991. In April, Jarca was darted with Supergestron; however, only mating attempts followed. As the white rhino house had been vacated by relocating the white rhinos to a new house, the trio consisting of Jimm, Sali (who was pregnant at that time) and Jarca was driven in July 1991 to the rhino house 1 that has since been used for housing black rhinos.

New quarantine facility - 1986 to 1990

The rhino section at the new quarantine facility began to be used for black rhinoceroses from 18 August 1986, when two young males (Jimm - 7 years and Eli - 27 months) were moved there from space reasons. Shortly after, female Elvira was added into the facility, who was however relocated to the rhino house 2 (black rhino house) about 1.5 years after (on 6 April 1988), replaced by a young female Jessi (3 years and 4 months old) transferred to the new quarantine facility on the same day. On 23 August 1989, Jessi was put together with Eli; this pair stayed there together permanently, both indoors and outdoors. In December (21-12) 1989, Jimm was moved out of the new quarantine grounds and taken to the rhino house 1 (white rhino house). Mating of Jessi and Eli was observed as early as 14 September 1989, and the female became pregnant for the first time on 8 April 1990 at the age of 5 years and 4 months. As the quarantine facility was too far from the rhino house, animals were monitored especially during cleaning. In the late October the same year, Jessi (24-10) and Eli (25-10) were moved one by one to the new rhino house. Subsequently, the rhino section at the new quarantine was cancelled; currently, it serves as wintering grounds and breeding facility for pelicans.

Rhino house 1 (then the white rhino house, now the black rhino house) - from 1990 on

During 1990, all white rhinos were moved into the new house (rhino house 3) and their former facility, having undergone a process of renewal in 1990-1991, has since been used solely for housing black rhinos . Some of the black rhinos were kept permanently only in this house, while others, especially males and juveniles, used to be moved in crates to the new rhino house and back. The operations of black rhino moving berween the facilities was motivated by spatial and breeding reasons and proved well in weaning. Weaned calves departed to other zoos over time. Breeding females that were held at the rhino house 1 from 1990 until the death comprised Elvira, Sali and Jarca.
Elvira lived in the house after having weaned her daughter Eimi (31 July, 1991). As this female had not yet finished lacation, her milk was collected and frozen for potential artificial rearing. On 15 August, Elvira was put together with Jimm and female Jarca. Mated as early as 31 August, this female rhino got pregnant a month later and subsequently bore her third calf on 12 August 1992 - a female **(Etna DK 13)**. Etna was weaned at the age of fifteen months (10 March 1994). Elvira became pregnant once again in 1995 (3 Jun) following mating with male Cody, but aborted after 2 weeks (21 June 1995), when she was 17 years. Since then this female rhino was never pregnant again and died on 25 February 1995 when less than 18.5 years old.

On 7 July 1991, Jimm and females Jarca and Sali were moved into the reconstructed rhino house 1; Sali was already pregnant and gave birth to her third calf on 24 February 1992 - a female (**Sara DK 12**, fathered by Jimm). Sara was weaned when aged 14 months (5 April 1993) and immediately moved into the new rhino house. As Sara was reared, milk was collected from Sali and frozen for potential artificial rearing of other rhinos in future. These preliminary arrangements for possible artificial rearing were carried out in connection with the successful efforts to get Jarca pregnant.
On 10 December 1992, male Cody born at Sydney Zoo, Australia, was brought into the house. Highly valuable in terms of genetics, this 17-year-old male rhino however never bred before that time. From April 1993 on, efforts of bringing this rhino together with female Sali DK 2 were underway, which was followed by uniting the animals outdoors; unfortunately, Sali was attacking the male, even knocking Cody to the ground (21 April). Subsequently, both rhinos were held together only for short periods, until Cody attempted to mate Sali on 11 May. Since then, the pair shared the enclosure in an already calm manner. On 29 May, Cody repeatedly tried to mate Sali, but could not insert the penis due to a lack of experience. Assistance from a keeper was necessary and then brief mating followed. The next day Cody already mated without keeper's help, but yet fell from the female sideways on the ground in one case. Mating repeated in the subsequent months until Sali got pregnant on 16 July and bore her fourth calf - a male **(Sauron DK 16)** the following year (24 October 1994). Sali gave two else births - first it was a female born on 20 August 1997 (**Ssang Yong - Musso**

DK 20, fathered by Jimm), while the second time (25 January 2000) it was a female again (**Salome DK 23**, with Jimm as the father again). Sali reared all of her calves successfully, and died in 2006 at the age of 28 years.

As already mentioned, Jarca was moved into the rhino house 1 on 7 July 1991, accompanied by Sali and Jimm. The female continued being put together with Jimm, with the first mating following the move taking place on 7 August 1991. Within the next oestrus period Jarca became pregnant (1 September 1991) and gave birth to a female (**Jaga DK 14**) on 14 December 1992. Despite weighing only about 26 kg, the calf was vital. Jarca had relatively little milk - this female gave the first birth at age 22. In addition, Jaga herself was unable to suck, so was initially bottle-fed by horse milk and then by rhino milk. However, to avoid losing contact with the mother, who was quiet and did not maltreat the calf, Jaga was separated only for the feeding. Later on, the calf was fed through the bars in the presence of the mother. The history of the artificial rearing is described on page 132.
Jaga was weaned on 10 March 1994, i.e. when 15 months old and immediately put together with Etna, a female of the same age weaned from her mother (Elvira) the same day. After weaning Jaga, Jarca started being put together with Cody in the outdoor enclosure as of 3 April, accompanied by Elvira. This took place in a relaxed manner every day, with Cody first mating Elvira (9 April 1994) and subsequently Jarca (24 April). In May (29 May), Cody mated Elvira during the day, attempting to mate Jarca as well; on 14 July, he demonstrably mated both females in a single day. Jarca got pregnant on 2 September 1994 and bore a male (**Jonas DK 18**) on 4 December 1995, who however was unable to stand up and weighed only 23 kg. Jonas was hand-fed alike Jaga, but died after 6 days. This male was the only live-born black rhinoceros in the history of Dvur Kralove's collection that was not reared with success. Jarca was never pregnant again and died in 1996 at the age of 26.

Female Eimi (a daughter of Elvira DK 1 and a granddaughter of wild-caught Elsa) lived from her birth in 1990 at the rhino house 2. Weaned from the mother when 11 months old (on 31 July 1991), this female rhino was left without the mother at the rhino house 2, from which she was moved into the house 1 on 12 Oct 90. In April 1994, preparations for putting Eimi together with Cody began, and thus both rhinos were kept next to each other inside the house (from 16 April on). Cody was trying to mate Eimi as early as 2 May, which met with success on 23 May 1995. Eimi got pregnant on 8 May 1996 and gave birth to her first calf - a female (**Elba DK 19**), which was reared by the mother without any problems.

Eight days upon weaning Elba, Eimi joined Jimm DK 3 (8 August 1997), with several mating attempts registered in this pair until the end of the year. Eimi failed to get pregnant even in 1998, and in May 1999, she began to suffer health problems manifested with black urine. Although the female was treated, similar problems occurred in 2000. In June of the same year, Eimi joined Jiddah (DK 17), a nearly six-year-old female, and both were subsequently put together with male Sauron (DK 16). In August, Sauron tried to mate Eimi, but eventually became very aggressive. Mating attempts were recorded also in the following oestrus periods; the first real mating occurred on 28 November 2000. The pair continued mating in 2001, when Eimi (DK 9) became pregnant again on 10 June. On 24 August 2002, this female gave birth to a stillborn calf - a female (**DK 25**); later on, Eimi suffered health problems again during 2003 and died suddenly and unexpectedly in 2004, aged just 14 years. Possible causes of death could include the excess of iron in the diet and subsequently in the body. Iron was administered to each of black rhinos following problematic deaths that occurred in the late 1970s as a precaution against haemolytic anaemia. As iron deposits in organs were demonstrable in several dead animals, this supplement was subsequently removed.
Female Elba that became a breeding female following mating with Jimm in 2001 has been living at the house since her birth in 1996. After a single mating session on 8 April 2001, this female became pregnant and bore a female on 2 November 2002 (**Emma Elsa DK 26**). Subsequently, this female got pregnant again with the same male and gave birth to another female on 2 September 2006 (**Etosha DK 30**). Etosha was weaned from the mother in spring 2008 at the age of 21 months and joined the newly imported male Davu; then both of them were relocated to the new rhino house in the mid-2009.
Elba was introduced in the summer 2008 to a new male Baringo II imported from Port Lympne while in oestrus and immediately bred by the male (on 26 July). Getting pregnant a month later (20 August 2008), this female rhino bore her third descendant on 8 December 2009 - a female (**Eva DK 34**).
In 1996, a 1.5-year-old female Jiddah (DK 17) weaned from her mother Jessi was moved into the house from the rhino house 3 (new rhino house), joining there Sauron (DK 16) of the same age and 3.5-year-old female Jaga (DK 14) the next day (15 May). The assumption that the pair would become a breeding pair in the future did not work out, because Sauron got very aggressive with his adult age getting near, attacking Jiddah repeatedly until the female became scared of the male. As involving the young female in breeding was necessary, Jiddah was eventually put together with Jimm (DK 3), although both animals were partly related. The calm male Jimm got familiar with Jiddah very quickly thanks to the assistance of Sali as experienced female; the animals were first put together on 9 May 2003 and mating took place for the first time on 12 May 2003. A month later, Jiddah got pregnant and bore a female on 11 November 2004 (**Deborah DK 27**). Three years later, on 24 November 2007, the same female bore a second descendant - a male (**Dzanty DK 33**, fathered by Jimm).

On 6 June 2008, a 16-year-old stud Baringo II was imported from Port Lympne Zoo, England, and was immediately placed in the house. During the year 2009, Jiddah was continuously separated from her son over a part of the day and put together with Baringo for a short period, who mated the female on 18 May. The animals were held together over the next several days, but then the male attacked the female very aggressively (on 21 May) and without any reason, throwing her into the ditch. The uniting process was then stopped and restored only during the oestrus period. The pair subsequently mated on 12 July. Throughout the stock history, Baringo II has been the first male introduced to the females only during their oestrus time since outside this period he is unpredictably a highly aggressive animal. Other breeding males used to walk out with females even several months after the female became pregnant and permanent separation occurred only after the pregnant female had begun to be aggressive towards the male.

Since 1998, Jessi (DK 5) has been kept at the rhino house 1, where this female was paired with Jimm (DK 3) and bore a male (**Jeremy DK 24**) on 21 December 2000. Another partner of this female was Sauron (DK 16) in 2004. Jessi got pregnant and bore another male on 2 January 2006 (**Jamie DK 29**). Having weaned Jamie, then almost an 18 months old animal, Jessi was introduced when in her oestrus period with the new breeding male Baringo II in September 2008; the male had stayed three months in Dvur Kralove at that time, mating female Elba (DK 19) as early as July and August. After mating that took place on 4 September 2008, Jessi became pregnant and bore its sixth calf - a female (**Jasmina DK 35**).
Currently, i.e. at the end of 2009, the following animals are kept at the rhino house 1: breeding males Jimm (DK 3) and Baringo II, and breeding females Jiddah (DK 17), Jessi (DK 5) and Elba (DK 19) with their latest offspring (Dzanty DK 33, Jasmina DK 35 and Eva DK 34). More information about births of each female, including dates of conception and places of birth are summarised in tables on page 110 - 113.

Rhino house 2 (now the zebra house) - from 1990 on
Upon the completion of the new rhino house in 1990, the earlier black rhino facility has not been in use for permanent rhino housing, with the only exemption of providing temporary housing for weaned animals in the early 1990s (Jaga and Etna, 1995).

Rhino house 3 (new rhino house) - from 1989 on
The first black rhino kept in the new rhino house was Jessi, who was moved into the house from the new quarantine facility when this female had already been pregnant on 24 October 1989. On 23 June 1991, this female gave birth to her first descendant - a male (**Jacob DK 10**, fathered by Eli), whom she reared successfully.
After Jacob was weaned at the age of 13 months on 31 July 1992, Jessi was kept alone until introduced in the late 1992 to Mabu, a newly imported male (1 Oct 1992), who mated the female for the first time on 17 December 1992. Jessi got pregnant in August 1993, giving birth to a female (**Jiddah DK 17**) on 15 November 1994. Jessi was also mated by Mabu following weaning of Jiddah, then a 1.5-year-old animal (weaned on 14 May 1996, introduction on 17 May); then this female became pregnant on 1 July 1996 and bore another daughter (**Jola DK 21**) on 25 October 1997. Jola was weaned when 19 months old on 17 March 1999. The projected process of putting together Jessi with Cody was terminated by the male's pre-mature death (19 May 1999, 24 years old) and thus Jessi was relocated to the rhino house 1 (the black rhino house) on 30 June 1999.

Jimmi was separated from her son Jos at the rhino house 1 on 19 April 1990 and transferred by driving to the new house where she subsequently underwent a process of putting together with Isis. The female became pregnant immediately when entered the heat (53 days upon weaning), giving birth to her fourth descendant - another male **(Jasper DK 11)** on 13 September 1991.
In the new rhino house, Jimmi got pregnant again two more times, which for the first time was with male Mabu (08 Feb 1993); however, this mating produced a stillborn male **(DK 15)** delivered on 11 April 1994. Jimmi entered oestrus already 11 days upon the recent birth and was mated by Mabu again, which took place on a regular basis almost until the male's death on 15 October 1996, with the last mating session on 30 May 1995). As the female failed to get pregnant, she was put together with Isis in 1996 and then conceived later in the year (4 Oct 1996). Jimmi bore her last calf (the sixth in the row) - a female **(Jane Lee DK 22)** - on 24 January 1998 when she was 28.

Jane Lee was weaned on month 14 (17 Mar 1999) and Jimmi was mated by Isis repeatedly from April to September 1999. Isis tried to mate Jimmi on a regular basis until spring 2002, but Jimmi got never pregnant again. This could be, amongst others, due to the poor health of the male who continued to lose weight and his condition was critical in the 1999/2000 winter. As the male's behaviour remained unchanged, it was suggested that his diet might be an issue, so the male's ration was reviewed and modified largely, and colloid minerals were applied subsequently with the aim of eliminating iron from the male's body. Isis then fully recovered over time. A single mating attempt was registered even in July 2005, which could probably stem at that time from the situation when Jimmi was assist-

ing the process of socialisation of Isis and the young female Jola, and the male was showing interest in Jimmi despite the fact that it was inexperienced Jola that had her oestrus period. Even though Jimmi was no longer able to reproduce, this rhino shared the outdoor enclosure with male Isis without troubles for years, assisting repeatedly in putting the male together with young females lacking experience (Musso and Jola). Jimmi lived to be 39.5 years and was euthanised due to her old age on 21 August 2009, when she could not stand up any longer.
In 2001, male Mweru was imported into the new house from Port Lympne, England, as a genetically unrelated potential stud; this rhino was six years old at that time. Mweru was put together with females Musso, Jola and Jane Lee, which however turned out to be a difficult and time-consuming process due to the male's aggressiveness; therefore, Musso and later also Jola were put together with Isis, while Mweru was being united only with Jane Lee towards whom the male was showing the least signs of aggression.
Musso (DK 20) became united with Jimmi as of June 2003; once both females got together well in the outdoor enclosure, the process of putting them together with Isis was launched. The state of mutual tolerance between Isis and Musso was slowly getting better; mating first took place as late as a year after, i.e. on 25 August 2004, and repeated the next month (20 Sep). Musso became pregnant, giving birth to a female **(Maisha DK 28**) on 25 December 2005, who was reared by Musso without problems. During the years 2006 and 2007, Musso started showing health problems and her condition deteriorated. When Maisha was 19 months old, her mother Musso died of pneumomycosis aged just 10 years. Subsequently, Musso was found to have iron deposits in her organs, which apparently was a result of administering the mineral in the early years of the female's life.
Further, female Jola (DK 21) kept at the house since her birth (25 Oct 1997) was also socialised with Isis under the assistance of Jimmi during 2005, when Jola was fruitfully mated. Jola first gave birth on 1 February 2007 - to a male (**Jabu DK 31**). Once Jabu was weaned (on 1 November 2008, aged 21 months), Jola was put together with Jane Lee and both females were subsequently introduced to male Mweru (15 May 2009), who first mated Jola on 8 June 2009, during which the female became pregnant as was later confirmed by testing the hormonal derivatives in the female's faeces at the University of Vienna in October 2009.
Mweru had however mated Jane Lee earlier in 2006, who than gave a pre-mature birth on 22 September 2007 to a stillborn calf (**DK 32**) on pregnancy day 393. Since then this female repeatedly mated with Mweru (on 3 and 28 Nov 2007, 12 Aug, 21 Oct and 12 Dec 2008, 14 Apr 2009), but could not get pregnant. Therefore, Jane Lee was anaesthetised and examined by IZW Berlin on 5 July 2009 and found to be of good health; it was hypothesized that problems could have been caused by a negative response to the male's semen in connection with the premature birth of a calf fathered by the same stud. Thus, it was decided that if the female fails to get pregnant in 2009, she would be paired with a different male (Baringo). Jane Lee subsequently mated with Mweru on 22 August and 2 November 2009.
Since 1990, the new rhino house has been home to male Isis; in addition, the wild-caught female Jimmi lived there until her death. Additionally, male Mweru has been staying there since he arrived at the zoo (2001), as well as females Jola DK 21 (born 1997, a daughter of Jessi), Jane Lee DK 22 (born 1998, the last calf of Jimmi) and Maisha DK 28 (born 2005, a daughter of Musso) who have lived at the house since birth. In May 2009, a trio of young animals left the rhino house for a reintroduction project in Tanzania; the group consisted of female Deborah DK 27 (born 2004, a daughter of Jiddah) and males Jamie DK 29 (born 2006, a son of Jessi) and Jabu DK 31 (born 2007, a son of Jola); for more details, see page 153.
In the summer 2009 (4 Aug), a young pair of rhinos - male Davu and female Etosha DK 30 - was transferred to the house from the rhino house 1 (the black rhino house), with subsequent first mating of this pair observed on 22 August, when Davu was only 3.5 years and Etosha 3 years old. On 9 September, female Maisha DK 28 was added to the pair above, being surprisingly mated by Davu very early (10 and 12 September). Mating of both couples continued in the following months as well.
For more details on births and mating, refer to the table on page 112.

Nane and Bashira

Details on all black rhinos ever held at Dvur Kralove Zoo are included in the summary on page 148, showing that the zoo also owned female Nane born on 4 April 1991 at Berlin Zoo; this rhino was acquired based on exchange for male Jacob (DK 10) on 1 October 1993, but subsequently sold to Krefeld Zoo on 23 May 1994, and thus never arrived in Dvur Kralove. Much later - in 2008, Nane's son Davu came from Krefeld to Dvur Kralove Zoo.
In addition, an agreement was signed with Chester Zoo, based on which the first daughter of Ema Elsa DK 26 is expected to come to Dvur Kralove once weaned - female Bashira born in Chester on 15 May 2009, studbook number 992 (FRESE 2009).

As per 31 December 2009, Dvur Kralove had available 11 (5.6) black rhinos, either proven or potential breeders, as follows:
Males: Isis - 32 years, Jimm DK 3 - 30 years, Baringo II - 17 years, Mweru - 13 years, Davu - 4 years
Females: Jessi DK 5 - 25 years, Elba DK 19 - 13 years, Jola DK 21 - 12 years, Jane Lee DK 22 - 12 years, Maisha DK 28 - 4 years, Etosha DK 30 - 3 years

BREEDING INDIVIDUALS

23 (10.13) individuals were involved in reproduction. Females were giving birth 35 times. The number of young in the respective females counts 1 to 6. Males became fathers once up to ten times. The most successful males included Isis and Jimm with 10 calves born and raised. Isis fruitfully mated with five females (Elvira, Jimmi, Sali, Musso and Jola), while Jimm with six (Sali, Elvira, Jarca, Jess, Elba and Jiddah). Sali and Jessi are the most successful females, with six born and raised calves, followed by Jimmi with six born and five raised calves, where Jessi is still in her breeding period and so far have had young with five males (Eli, Mabu, Jimm, Sauron and Baringo II), while Jimmi with three males (King, Isis and Mabu), and Sali with three males (Isis, Jimmy and Cody) as well.

Offspring of particular females and males of black rhinos at Dvur Kralove Zoo prior to 31 December 2009

F / M	Ken	King	Isis	Jimm DK 3	Eli DK	Mabu	Cody	Sauron DK	Mweru	Baringo II.
Elsa	Elvira DK 1									
Sabi	Sali DK 2									
Jimmi		Jimm DK 3	Jessi DK 7 Jos DK 7 Jasper DK 11 Jane Lee DK 22			† DK 15				
Elvira DK 1			Eli DK 4 Eimi DK 9	Etna DK 13			Abortion			
Sali DK 2			Sado DK 6 Sany DK 8	Sara DK 12 Salome DK 23 Musso DK 20			Sauron DK 16			
Jessi DK 5				Jeremy DK 24	Jacob DK 10	Jiddah DK 17 Jola DK 21		Jamie DK 29		Jasmina DK 35
Jarca				Jaga DK 14			† Jonas DK 18			
Eimi DK 9							Elba DK 19			
Elba DK 19				Ema Elsa DK 26 Etosha DK 30						Eva DK 34
Jiddah DK 17				Deborah DK 27 Dzanty DK 33						
Musso DK 20			Maisha DK 28							
Jola DK 21			Jabu DK 31						Pregnancy	
Jane Lee DK									† DK 32	

BREEDING MALES

Overview of breeding male black rhinos at Dvur Kralove Zoo prior to 31 December 2009

No.	Stdbk #	Name	No of calves born	No of calves raised	Success scoring
1	170	Ken	2 (0.2) approx	2 (0.2)	3.
2	172	King	1 (1.0)	1 (1.0)	5.
3	268	Isis	10 (5.5)	10 (5.5)	1.
4	386	Eli DK 4	1 (1.0)	1 (1.0)	5.
5	283	Jimm DK 3	10 (2.8)	10 (2.8)	1.
6	277	Mabu	3 (0.3)	2 (0.2)	2.
7	260	Cody	3 (2.1)	2 (1.1)	2.
8	541	Sauron DK 16	2 (1.1)	1 (1.0)	4.
9	659	Mweru	1 (1.0)	0	6.
10	483	Baringo II	2 (0.2)	2 (0.2)	2.
TOTAL			**35 (13.22)**	**31 (11.20)**	

Ken - born January 1970, Tsavo NP, Kenya; Stdbk #170 († 8 Nov 1979)
Ken became a father of Sali DK 2, but maybe of Elvira DK 1 as well, because he mated Elvira's mother Elsa on the same day as male King. He died as a result of haemolytic anaemia when less than 10 years old.

King - born 1970, Tsavo NP, Kenya; Stdbk #172 († 22 Apr 1978)
As with Ken, King mated with Elsa the same day on which Elsa conceived. Therefore, it is uncertain who was the father of Elvira DK 1. Subsequently, King became the father of male Jimm DK 3. This male died after immobilisation in 8 years.

Elvira DK 1 mating with Isis, 3 May 1989 (lh)

Isis on 29 March 2009, 32.5 years old (dh)

Isis - born 3 Nov 1977, Cincinnati, the USA; Stdbk #268
Isis was imported after the death of King and Ken when he was less than a year in 1978, to become a breeding male. His first mating attempts were recorded at age 4, his first mating in 4 years and 5 months (16 April 1982), and the first fertile mating in 5 years and 3.5 months (20 February 1983). In 1999, the condition of this male significantly deteriorated and everything seemed to indicate that the male would die. Because it was is suspected that the health problems were associated with feeding, the ration was recalculated and it turned out that it had a small but long-term deficit of nitrogen. After changing the composition of the diet and several curing periods to flush iron from the organs, male's condition came to a normal level, his condition improved and the male began to mate again. The above mentioned health complications and the weakness of Isis could be the reason why female Jimmi, with which the male had been paired in 1999 to 2001, never got pregnant despite entering oestrus regularly and lacking any obstacles for pregnancy according to hormonal testing. After recovery, Isis mated female Musso in 2004 in a fertile manner and was last introduced to the breeding female Jola, who was mated by this male on 7 October 2005 in the age of 22 years and 11 months. In total, male Isis has had 10 descendants with five different females and his offspring sex ratio is 1:1.

Eli DK 4 - born 15 May 1984, Dvur Kralove; Stdbk #386 († 26 Feb 1995, Magdeburg)
Eli was the first male from Dvur Kralove collection that was involved in reproduction. In 1990, he was held continuously, i.e. indoors and outdoors, with female Jessi DK 5 in the quarantine premises, where the female was fruitfully mated by the male at the age of 5 years and 11 months (8 April 1990). Eight year old, the male left for Magdeburg Zoo, Germany, in 1992, because of an exchange for male Mabu of Magdeburg collection. Eli died in 1995 when he was less than 11 years. In Magdeburg, he became father for the second time.

Jimm DK 3 - born 18 Mar 1979, Dvur Kralove; Stdbk #283
Jimm is the third black rhinoceros and the first male born in Dvur Kralove. The first time he tried to mate was the age of 2 years and 10 months (24 January 1982), but then lived for several years on his own. In 1990, he was grouped with two females (Jarca and Sali), which he began to mate regularly. Jimm's first fertile mating occurred with Sali at male's age of 11 years and 8 months (22 November 1990). The male last became a father in 2007 after fertile mating (20 August 2006) with female Jiddah DK 17, when he was 27 years and 5 months. In 2007, Jimm was loaned to Zurich Zoo, Switzerland, to replace the breeding male that died. At first everything went well, and Jimm was already trying mate a female. After 3 months, he began having health problems that were exhibited by a strange behaviour accompanied with attacks, unwillingness to move and production of unusual sounds (he seemed to have

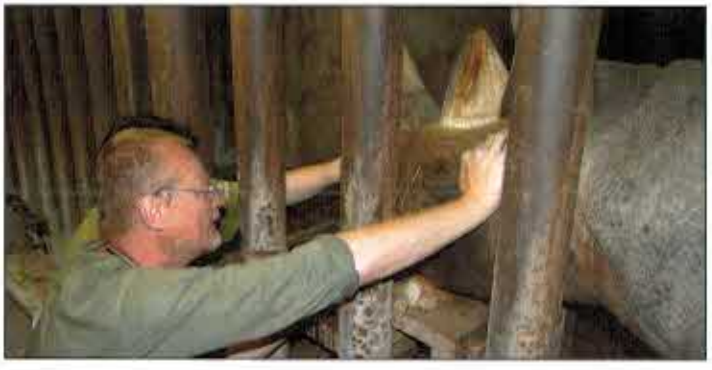

Jimm DK 3 mating Elvira DK 1, 1990 (az)


Jimm DK 3 having arrived from Zurich on 12 August 2008 (dh)

Tooth surgery, Jimm DK 3, May 2008 - prior the treatment, surgery, post-treatment checks (ms)








become insane). Jimm was anaesthetised and examined, where infection was detected in the cerebrospinal fluid. Therefore, it was suspected that there is a tumour in male's head, and Jimm was seriously considered for culling. On the basis of cooperation between Zurich and Dvur Kralove and on-site consultations, it was decided to return the male to Dvur Kralove. Corticosteroids were administered to stabilize male's health. A few days after arrival in Dvur Kralove, Jimm was found to have inflammation of a molar in the upper jaw. He was anaesthetised and operated. Because rhinos cannot open their mouth as hippos do, the operation had to be carried from the outside and a drill was used to open the inflammation deposit. Jimm recovered (see page 82) and has so far fathered 10 calves from six females, where the sex ratio of his offspring is 2:8 in favour of females.

Mabu - born 23 Jan 1979, Magdeburg, Germany; Stdbk #277 (†15 Oct 1996)
Mabu was obtained in exchange for the breeding male Eli DK 4 in 1992 as a 13-year-old animal. Introduced to multiple females, his fertile mating occurred only with two of them (Jimmi and Jessica DK 5). Mabu left 3 descendants of whom two were raised (Jessi's descendants). The male died as a result of pneumonia in 1996 when less than 18 years old. The post-mortem examination revealed haemosiderosis of all organs.

Cody - born 20 May 1975, Sydney, Australia; Stdbk #260 († 19 May 1999)
Male Cody was imported from Berlin Zoo in 1992 as genetically valuable offspring of a sire captured in Arusha National Park, Tanzania (Ferdinand, Stdbk #99), who was at the same time male's grandfather on the part of Cody's mother. Male's grandmother (Peggy, Stdbk #100) was wild-caught in Kenya as well. Cody was born in Sydney, Australia, where he lived without offspring until thirteen years old. In 1988, he was moved to Berlin Zoo, where any attempts to include the male into breeding failed over the next four years. Therefore, late in 1992 this male was sent to Dvur Kralove, where he turned out to be quiet and submissive to the females, but could not mate. Coupling of this male with females was not difficult; Cody could even jump on oestrous females, but was unable to insert his penis. Therefore, keepers had to help him repeatedly. Once Cody gained experience with successful mating, he could mate females without assistance and became a breeding male. Cody gradually mated with 4 females (Elvira DK 1, Sali DK 2, Jarca and Eimi DK 9), which got pregnant. 3 calves were born plus a stillborn calf in a single case (Elvira). Only two Cody's descendants were raised, male Sauron DK 16 (mother Sali) and female Elba DK 19 (mother Eimi), who subsequently participated in Dvur Kralove breeding schemes. Cody's last fertile mating occurred

Elvira DK 1 mating with Cody 4 May 1994 (dh)

Keeper M Kober assisting Cody in mating Sali DK 2 (jv)

on 23 May 1995, when he was 20 years old. His worsened health could be the reason why his mating attempts in 1997 with female Jaga DK 14 failed. This male died in 24 years in 1999, probably due to pneumonia and renal plus intestinal inflammation.


Cody trying to mate Jaga DK 14, 19 Sep 1997 (dh)

Sauron DK 16 - born 26 Oct 1994, Dvur Kralove; Stdbk #541 († 24 Sep 2007)

As a descendant of Cody, Sauron was intended for future breeding and therefore paired with female Jiddah DK 17 of the same age once weaned; the pair was expected to begin breed after reaching sexual maturity. However, Sauron has become unexpectedly aggressive to Jiddah at the age of 5 years and 4 months in early 1999, seriously attacking the female repeatedly. The pair had to be split and Sauron coupled with an experienced female Eimi DK 9 in 2000, i.e. when six years old, whom the male mated in a fertile manner on 10 June 2001, when he was 6 years and 8 months old. Unfortunately, the calf was born dead. In 2004, Sauron was paired with an experienced female Jessi DK 5. This coupling produced the only Sauron's descendant - male Jamie DK 29. Sauron suddenly died of pneumonia in 2007 when he was just 13 years old. In addition, haemosiderosis of organs was found in this animal as well.


Sauron DK 16 (dh)

Mweru - born 12 Sep 1996, Port Lympne, England; Stdbk #659

In 2001, Mweru was imported from England, a five-year animal at that time, in exchange for female Salome DK 23. Mweru's father was imported from Addo National Park in South Africa. Introduction of Mweru to three females (Jane Lee DK 22, Jola DK 21 and Musso DK 20) together began in 2002. However, the male was too aggressive and the introduction process was temporarily paused. Eventually, he got used to female Jane Lee, whom he first mated when he was less than 9 years old (30 June 2005). Jane Lee conceived on 25 August 2006, when Mweru was 10 years old, but the calf was born dead. In 2009, this male successfully mated female Jola, which is expected to deliver in September 2010; therefore, no calf has been produced by this male.

Mweru in 2006 and 2008 (dh)

Baringo II - born 3 Dec 1992, Port Lympne, England; Stdbk #483

Baringo was imported as a 15-year-old but still non-breeding male from UK-based Port Lympne Zoo on 6 June 2008. Previously, he also lived at Chester Zoo, England. Baringo was introduced to female Elba DK 19 already on 26 July, i.e. about 6 weeks upon male's arrival, mating the female successfully. Elba conceived a month later, just like Jessi DK 5 who got pregnant after a single mating in

Baringo (dh)

Baringo features a third horn on the forefront (dh)

September 2008. So far, Baringo has become a father to 2 young while in Dvur Kralove. Baringo has turned out to be suitable for joining with females only during oestrus. According to Dvur Kralove experience, other breeding males have always been able to live with females many months without problems; even following fertile mating they could go outdoors with the females and coupling was terminated only after the pregnant female had become aggressive to the male. Baringo's treating the females is unforeseeable; this male sometimes performs unexpected and aggressive attacks. Female Jiddah DK 17 mated by Baringo in 2009 was even thrown down into a ditch by the male. This behaviour may be the reason why this male has had such a low number of offspring considering his age.

Davu - born 19 Feb 2006, Krefeld, Germany; Stdbk #970

Two-year Davu was imported immediately after weaning from his mother from Germany's Krefeld Zoo in April 2008. His mother is Nane who had been a property of Dvur Kralove Zoo from 1993 to 1994; exchanged for male Jasper DK 11, this female never lived in Dvur Kralove, but remained in Germany because it was sold to Krefeld Zoo. Shortly after the arrival, Davu was coupled with female Etosha DK 30; since that time, these rhinos have been living together. Davu first mated Etosha on 20 August 2009, i.e. at the age of 3.5 years. In the summer of 2009, female Maisha DK 28 was added to the couple; this animal was over 3.5 years. Davu first mated Maisha on 10 September 2009, but pregnancy did not occur until the end of 2009.

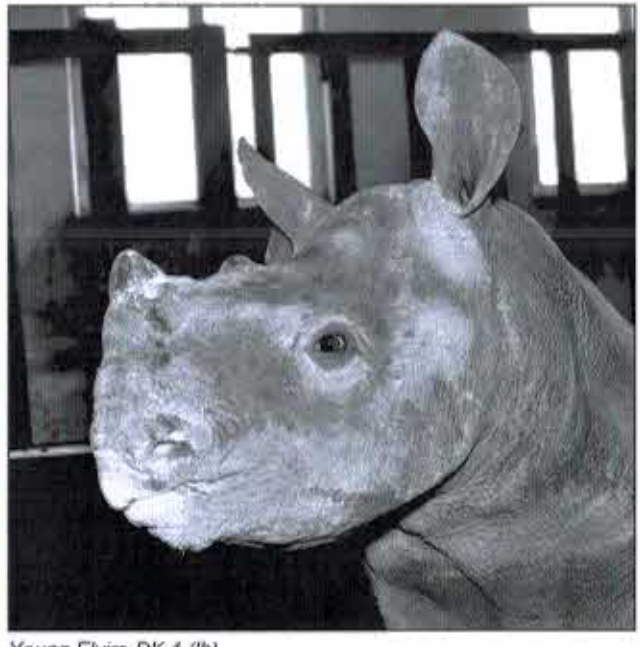
Davu (standing) playing with Etosha DK 30 while mud-bathing, 11 July 2008 (dh)

BREEDING FEMALES

Overview of breeding female black rhinos at Dvur Kralove Zoo prior to 31 December 2009

No.	Stdbk #	Name	No of calves born	No of calves raised	Success scoring
1	174	Elsa	1 (0.1)	1 (0.1)	6.
2	217	Sabi	1 (0.1)	1 (0.1)	6.
3	175	Jimmi	6 (3.3)	5 (3.2)	2.
4	244	Elvira DK 1	3 (1.2)	3 (1.2)	3.
5	282	Sali DK 2	6 (2.4)	6 (2.4)	1.
6	387	Jessi DK 5	6 (3.3)	6 (3.3)	1.
7	178	Jarca	2 (1.1)	1 (0.1)	5.
8	431	Eimi DK 9	2 (0.2)	1 (0.1)	5.
9	619	Elba DK 19	3 (0.3)	3 (0.3)	3.
10	540	Jiddah DK 17	2 (1.1)	2 (1.1)	4.
11	678	Musso DK 20	1 (0.1)	1 (0.1)	6.
12	685	Jola DK 21	1 (1.0)	1 (1.0)	6.
13	689	Jane Lee DK 22	1 (1.0)	0	7.
TOTAL			**35 (13.22)**	**31 (11.20)**	

Davu (far left) playfully chasing Etosha DK 30. 11 Jul 2008 (dh)



Young Elvira DK 1 (lh)

Elsa - born 1970, Kenya; Stdbk #174 († 7 Apr 1978)

No.	Sex	Name	Dam	Sire	Pregnancy date	Birth date	Pregnancy time	House ID; comments
1	F	Elvira DK 1	Elsa	Ken?King?	20 Jul 1976	2 Oct 1977	439 days	House 2, Elsa died on 7 Apr 1978 - Elvira weaned

As Elsa was unexpectedly mated by two males on the same day when she got pregnant, it is not clear whether the father of her daughter Elvira DK 1 is King or Ken. Elsa began to lose weight and died suddenly when Elvira was only a half of the year old. The deteriorating condition and death could be affected by the simplification of the diet and exhaustion by milk production, which can be suggested by two facts: Elsa had lost milk before her death and the young Elvira never suffered health problems after her mother died and the calf was successfully reared. Subsequently, the ration for all animals was improved. Elsa was only 8 years old at the time of death.

Elsa nursing 27-day-old Elvira DK 1 (29 Oct 1977) at the house 2 (lh)

Sabi - born 1972, Kenya; Stdbk #217 († 13 Apr 2008, Zurich)

No.	Sex	Name	Dam	Sire	Pregnancy date	Birth date	Pregnancy time	House ID; comments
1	F	Sali DK 2	Sabi	Ken	15 Apr 1977	5 Jul 1978	456 days	House 2; Sabi lived with the calf till 12 Oct 1979, Sabi left for Zurich on 22 Apr 1983

Sabi got pregnant following mating with Ken and brought up her daughter Sali DK 2 without any problems. In 1983, this female left to Zurich Zoo, where she became a mother two times once again. In total, she delivered 2 sons and 1 daughter. Sabi died as a result of age at the age of 36 years.

Young Sali DK 2 (lh)

Sabi (35 years) at Zurich Zoo, 2007 (dh)

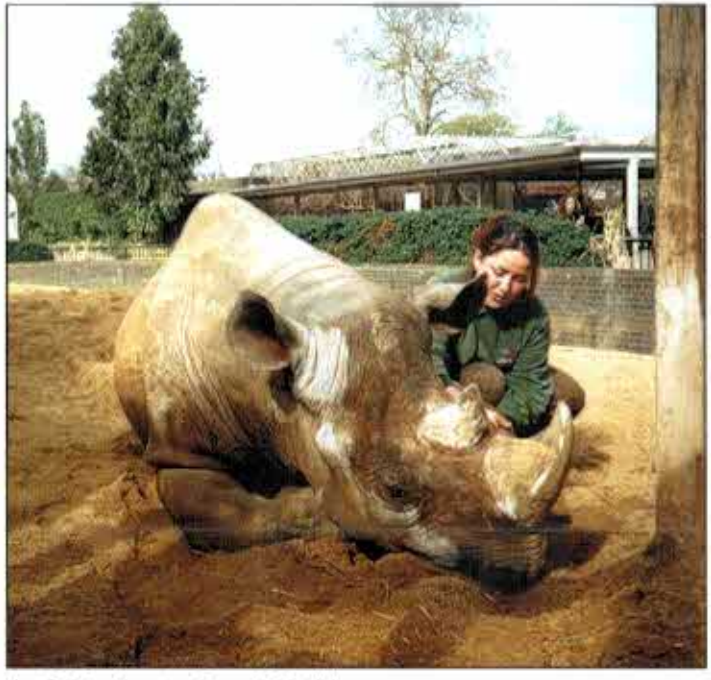
Sabi and Sali DK 2 (lh)

Jimmi - born February 1970, Kenya; Stdbk #175 († 21 Aug 2009)

No.	Sex	Name	Dam	Sire	Pregnancy date	Birth date	Pregnancy time	House ID; comments
1	M	Jimm DK 3	Jimmi	King	6 Dec 1977	18 Mar 1979	467 days	Winter facility IV
2	F	Jessi DK 5	Jimmi	Isis	4 Aug 1983	8 Dec 1984	462 days	House 1
3	M	Jos DK 7	Jimmi	Isis	13 Feb 1988	21 May 1989	463 days	House 2; 28 kg
4	M	Jasper DK 11	Jimmi	Isis	11 Jun 1990	13 Sep 1991	459 days	House 1
5	F	— DK 15	Jimmi	Mabu	8 Feb 1993	11 Apr 1994	427 days	House 3; stillborn, 24 kg
6	F	Jane Lee DK 22	Jimmi	Isis	4 Oct 1996 (?)	24 Jan 1998	441 days	House 3

Jimmi gave birth six times and became a mother of 3 females and 3 males. The next to her last young was stillborn. After weaning of the last calf in 1999, Jimmi was introduced to male Isis, who had mated the female, or at least was trying to. Although the female was in order according to hormonal results, she never got pregnant again. It could be related to the fact that at that time Isis was of very poor health. After several years, Isis completely recovered, but Jimmi had already not cycled properly. She was mated by the male for the last time on 23 September 1999, but occasional interest of the male lasted until 2001. Subsequently, she still lived with this male in the enclosure, assisting the socialisation of other females, more specifically Musso DK 20 and Jola DK 21, with Isis. Jimmi died due to high age when over 39 years old.

Jimmi and 52-day-old Jos DK 7 (17 Jul 1989) (lh)



Jos DK 7 at London Zoo, 1998 (dh)

Jimmi with two-month-old Jos DK 7, 17 July 1989 (lh)

Jimmi on 17 July 1989, 19 years old (lh)

Jimmi on 22 Oct 1986, 16 years old (lh)

Jimmi (left) and Isis, 9 May 1994 (lh)

Isis laying his head on the back of oestrous Jimmi (lh)

Jimmi following the delivery of the last calf, Jane Lee DK 22 on 24 Jan 1998 (dh)

Jimmi and 48-day-old Jane Lee DK 22 (13 Mar 1998) (lh)

Jimmi with her last calf. Jane Lee DK 22; the calf was 8.5 months old (17 Jun 1998) (lh)

Elvira DK 1 - born 2 Oct 1977, Dvur Kralove; Stdbk #244 († 25 Feb 1996)

No.	Sex	Name	Dam	Sire	Pregnancy date	Birth date	Pregnancy time	House ID; comments
1	M	Eli DK 4	Elvira	Isis	20 Feb 1983	15 May 1984	450 days	House 1
2	F	Eimi DK 9	Elvira	Isis	29 May 1989	24 Aug 1990	452 days	House 1
3	F	Etna DK 13	Elvira	Jimm	21 Sep 1991	8 Dec 1992	444 days	House 1
4	?	Abortion	Elvira	Cody	3 Jun 1995	21 Jun 1995	18 days	House 1; abortion

Elvira became not only the first black rhino raised in Dvur Kralove park, but also the first breeding female reared within the stock. It bred 3 young; the last calf was aborted on day 18 following the conception. The female died at 19.5 years, probably due to haemosiderosis and fungi in the lungs. The factors involved in the disease may have included an imbalanced ration.

The first Elvira's calf - male Eli DK 4, age: 5.5 months (3 Nov 1984) (lh)

Elvira DK 1 and Etna DK 4 (29 Jul 1993) (lh)

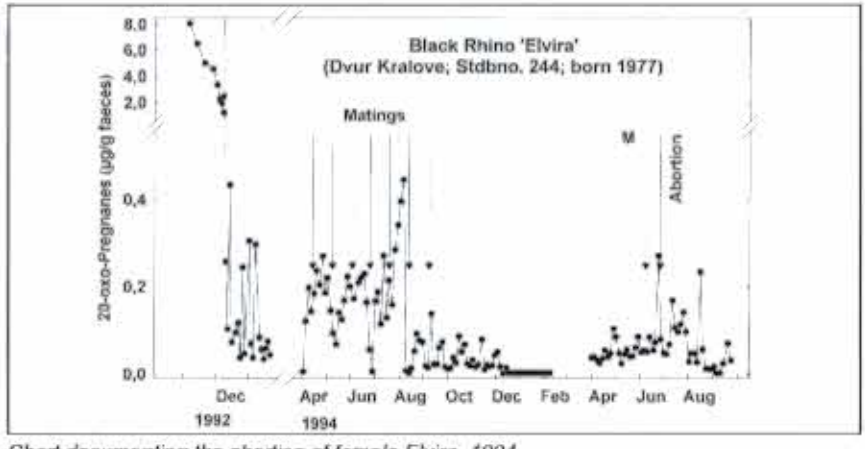


Chart documenting the abortion of female Elvira, 1994

The six-week-old Musso DK 20 with her mother Sali DK 2 on 30 September 1997 (th)

Sali DK 2 - born 15 Jul 1978, Dvur Kralove; Stdbk #282 († 25 Feb 2006)

No.	Sex	Name	Dam	Sire	Pregnancy date	Birth date	Pregnancy time	House ID; comments
1	M	Sado DK 6	Sali	Isis	21 Apr 1985	26 Aug 1986	492 days	House 2
2	F	Sany DK 8	Sali	Isis	28 Jun 1988	1 Oct 1989	460 days	House 1
3	F	Sara DK 12	Sali	Jimm	22 Nov 1990	24 Feb 1992	459 days	House 1
4	M	Sauron DK 16	Sali	Cody	16 Jul 1993	26 Oct 1994	467 days	House 1; 48 kg on day 3
5	F	Musso DK 20	Sali	Jimm	25 May 1996	20 Aug 1997	452 days	House 1
6	F	Salome DK 23	Sali	Jimm	13 Oct 1998	25 Jan 2000	441 days	House 1

Sali successfully bred all of her six offspring - she gave birth to 2 males and 4 females. She conceived for the first time in almost 7 years, and the last time when she was twenty. All of her life she suffered from bleeding erosions in the mouth, which were treated in various ways, of which high doses of vitamin C proved to be the most effective one. Sali died as a result of evidenced haemosiderosis at the age of 28. Her calves were fathered by 3 different males.

Sali with its first offspring - male Sado DK 6 (22 Oct 1986) (lh)

Sali with its last offspring - female Salome DK 23 (lh)

Sali's second calf - female Sany DK 8 (lh)

Sali DK 2 and Sauron DK 16 on day 16 after the birth (dh)

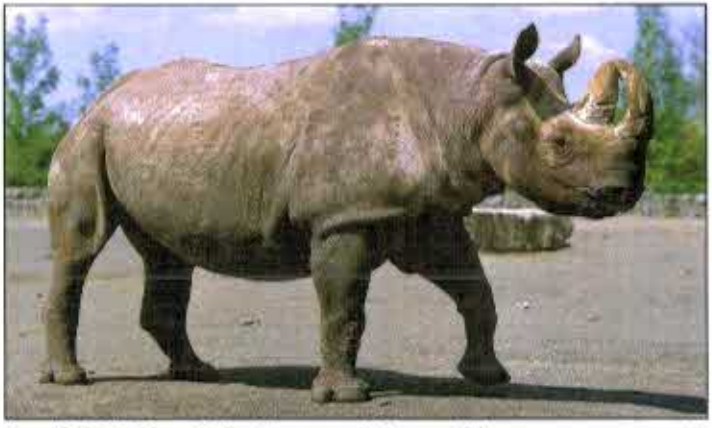
Sali DK 2 with Musso DK 20 (dh)

Jessi DK 5 - born 8 Dec 1984, Dvur Kralove; Stdbk #387

No.	Sex	Name	Dam	Sire	Pregnancy date	Birth date	Pregnancy time	House ID; comments
1	M	Jacob DK 10	Jessi	Eli	8 Apr 1990	23 Jun 1991	443 days	House 3
2	F	Jiddah DK 17	Jessi	Mabu	17 Aug 1993	15 Nov 1994	455 days	House 3; 37 kg
3	F	Jola DK 21	Jessi	Mabu	1 Jul 1996	25 Oct 1997	481 days	House 3
4	M	Jeremy DK 24	Jessi	Jimm	16 Sep 1999	21 Dec 2000	461 days	House 3
5	M	Jamie DK 29	Jessi	Sauron	6 Oct 2004	2 Jan 2006	452 days	House 1
6	F	Judy DK 35	Jessi	Baringo	4 Sep 2008	13 Dec 2009	465 days	House 1

Jessi conceived for the first time when 5 years and 4 months old; most recently it was at the age of 24 years. So far, this female has bore six rhinos - 3 males and 3 females, all of which have been bred. Sires of her pups involved 5 different males.

Jessi DK 5 with its first offspring - male Jacob DK 10, a 2.5-month-old animal, 6 September 1991(lh)



Jessi DK 5 (9 May 1994) at the age of 10 years (lh)

Jessi DK 5 and Jeremy DK 24, 2001 (dh)

Jessi DK 5 and Jola DK 21 at the day of birth, 25 October 1998 (th)

Jessi DK 5 and Jeremy DK 24 (mp)

Jessi DK 5 with Jola DK 21 at the age of 8 months (17 Jun 1998) (lh)

Jessi DK 5 with Jamie DK 29 at the age of 7 months, 2 May 2005 (dh)

Jessi DK 5 and her one-day-old calf Jasmina DK 35, 14 December 2009 (dh)

Jessi DK 5 and Baringo following mating (Jessi with signs of mating on her back), 4 September 2008 (dh)

Jarca WB - born 1970, Kenya; Stdbk #178 († 8 Sep 1996)

No.	Sex	Name	Dam	Sire	Pregnancy date	Birth date	Pregnancy time	House ID; comments
1	F	Jaga DK 14	Jarca	Jimm	1 Sep 1991	14 Dec 1992	470 days	House 1; 26 kg on day 2
2	M	Jonas DK 18	Jarca	Cody	2 Sep 1994	4 Dec 1995	458 days	House 1; died in hand-raising

Jarca was repeatedly attacked by males (Ken and King) when young; after the males died, she was raised together with Elvira DK 1 and Isis imported from the U.S. as a young animal when only 11 months old. All of this had an impact on the fact that she was the only rhino female that was virtually not mated. Since 1989, intensive efforts to make this female pregnant were launched, including re-examination of her genitals, beginning of research in hormonal activities - first using the urine, and later on faeces - as well as application of the vitamin and hormonal stimulation. Introduction of this female to Isis, who was highly aggressive towards her, failed; eventually, Jarca became the first partner to the already 11-year-old male Jimm DK 3, with which the female was coupled with the help of female Sali DK 2. Mated for the first time at the age of 20, Jarca got pregnant after repeated mating attempts a year later. This rhino's first calf - female Jaga DK 14 - was very weak, weighing about 25 kg; therefore, she had to be bottle-fed. Nonetheless, she stayed with her mother, drinking some milk from her as well. The second baby - Jonas DK 18 - was even weaker when born; he was unable to stand and died within a few days despite all the efforts and bottle-feeding. At that time, Jarca was already in a very bad condition and died soon afterwards, less than 27 years old. The cause of this female's death was pneumonia, probably in combination with haemosiderosis of organs.

Jarca (dh)

Jaga DK 14, a 7.5-month-old animal, with her mother Jarca (29 Jul 1993) (lh)

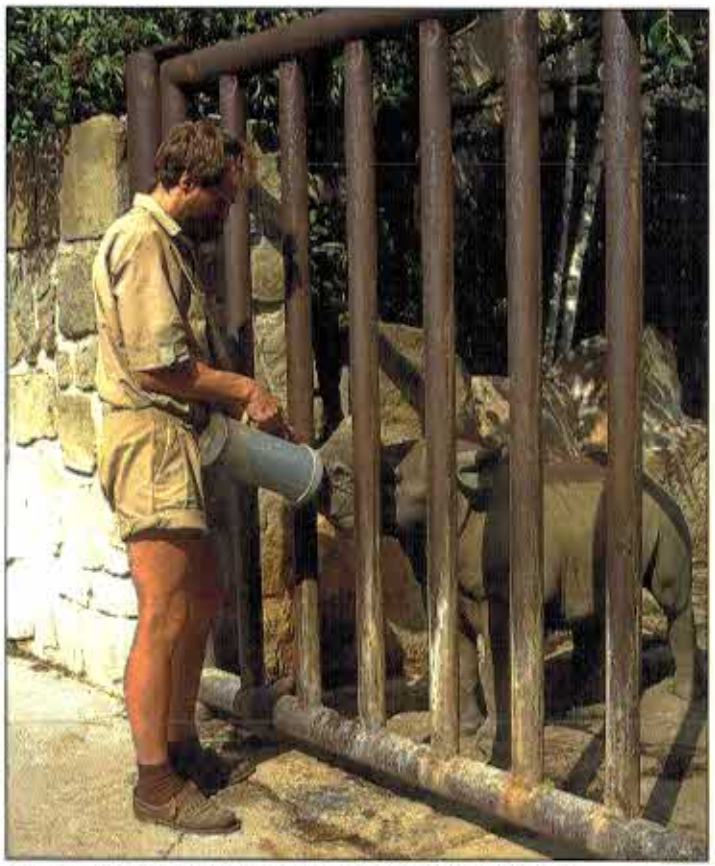
Hand-rearing and feeding Jonas, 6 December 1995 (dh)

Jarca (dh)

Rearing female black rhino Jaga DK 14, 1993-1994

Dr Vahala examining Jarca in 1990 (zc)

Keeper M Kober assisting in establishing contacts between Jaga and Etna with Elvira through the bars, January 1993 (zc)



Jaga being fed outdoors by Pavel Petrzilek, 29 July 1993 (lh)

Jarca with the half-year old Jaga outdoors, 19 June 1993 (lh)

Jaga DK 14 (left) and Etna DK 13 (dh)

Eimi DK 9 - born 24 Aug 1990, Dvur Kralove; Stdbk #431 († 14 May 2004)

No.	Sex	Name	Dam	Sire	Pregnancy date	Birth date	Pregnancy time	House ID; comments
1	F	Elba DK 19	Eimi	Cody	23 May 1995	5 Aug 1996	440 days	House 1
2	F	— DK 25	Eimi	Sauron	10 Jun 2001	24 Aug 2002	450 days	House 1; stillborn, 33 kg

Female Eimi got pregnant for the first time when she was 4 years and 9 months, after a single mating. After weaning her first daughter, this female was mated by Sauron; however, her second daughter was born dead. Since then Eimi was not coupled with any male; later on, she began to have unusual health problems, even though she was in a very good physical state. Eimi died suddenly as a result of haemosiderosis and liver disease, less than 14 years old.

Eimi DK 9 being mated by Cody on 23 May 1995 (th)

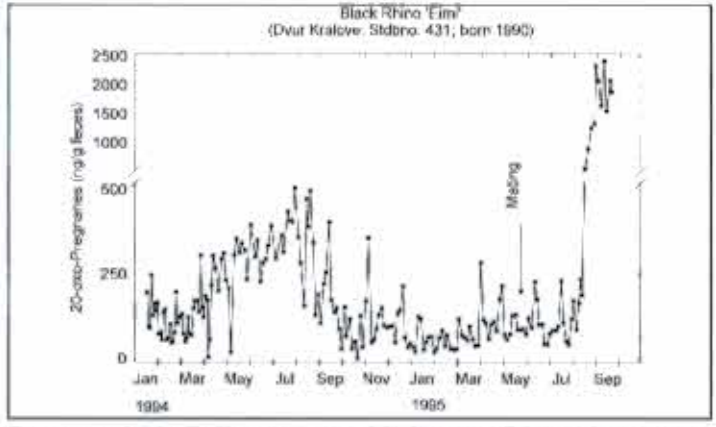


Diagram showing that Eimi became pregnant following mating (Schwarzenberger, 2005)

The chart below (SCHWARZENBERGER 1995) captures the cycle of female Eimi obtained by testing regularly collected faeces. This method was developed by Dr Franz Schwarzenberger, Veterinary University of Vienna, in cooperation with Berlin and Dvur Kralove zoos supplying him faeces of black rhino females (SCHWARZENBERGER *et al.* 1993a, 1993b, 1994, 1995a, 1995b, 1995c, 1996). Within three months after fertile mating, a significant increase in the reference hormonal metabolite can be captured in female faeces, which allows for determining whether the female is pregnant or not using this fully non-invasive method. It is even possible to find that a very low foetus or abortion had been absorbed in the female, as happened in 2004 in females Elvira DK 1 and Jimmi. The charts for Elvira and Jimmi also record a change in the production of this hormone derivative after birth and launch of the cycle.

Eimi DK 9 with Elba DK 19, 1996 (dh)

Eimi with Elba, 1996 (dh)

Little Elba DK 19 in the mud bath (dh)

Elba DK 19 - born 5 Aug 1996, Dvur Kralove; Stdbk #619

No.	Sex	Name	Dam	Sire	Pregnancy date	Birth date	Pregnancy time	House ID; comments
1	F	Ema-Elsa DK 26	Elba	Jimm	4 Aug 2001	2 Nov 2002	455 days	House 1
2	F	Etosha DK 30	Elba	Jimm	17 Jun 2005	4 Sep 2006	444 days	House 1
3	F	Eva DK 34	Elba	Baringo	20 Aug 2008	8 Dec 2009	475 days	House 1

Elba is the first daughter of Eimi DK 9, while also a granddaughter of Elvira DK 1 and great-granddaughter of the wild-caught Elsa. Her father was the genetically valuable male Cody; therefore, this female was retained for breeding. She conceived for the first time when 5 years old. So far, she gave birth three times; each time the calf was a female and fathers involved two different males.

Elba DK 19 with Ema-Elsa DK 26, 2003 (dh)

Elba DK 19 mating with Baringo on 26 July 2008 (jm)

Elba DK 19 with her daughter Etosha DK 30, 2006 (dh)

Elba DK 19 with Ema-Elsa DK 26 1.5 month old, 18 December 2002 (th)

Elba DK 19 with her daughter Etosha DK 30, 7June 2008 (dh)

Elba DK 19 with 6-day-old Eva DK 34. 14 December 2009 (dh)

Jiddah DK 17 - born 15 Nov 1994, Dvur Kralove; Stdbk #540 († 25 Dec 2009)

No.	Sex	Name	Dam	Sire	Pregnancy date	Birth date	Pregnancy time	House ID; comments
1	F	Deborah DK 27	Jiddah	Jimm	5 Jun 2003	11 Nov 2004	464 days	House 1
2	M	Dzanty DK 33	Jiddah	Jimm	10 Aug 2006	24 Nov 2007	471 days	House 1

For Jiddah, Sauron DK 16 was chosen, with which the female was coupled once weaned from her mother. For subsequent male's aggression. Jiddah gained a very bad experience and did not trust males. Thus, she was eventually coupled with calm Jimm, even if this male was in part female's relative. Jiddah bred and gave birth to two calves so far. She did not get pregnant for the first time before she reached 9 years. While rearing her last calf, female's physical condition continued to deteriorate, despite the carefully fixed and nutritionally rich ration. In the summer 2009, she was separated from the calf during the day, introduced to Baringo II, who mated her. Female's health condition fluctuated and gradually worsened until she had to be euthanised in agony, just 15 years old. The cause of her condition was kidney failure.

Jiddah DK 17 with Deborah DK 27, a half-year old female (dh)

Jiddah DK 17 and her nine-month-old son Dzanty. 26 August 2008 (dh)

Deborah DK 27, 4 May 2005 (dh)

Dzanty DK 33, 13 September 2008 (dh)

Putting Jiddah DK 17, Sauron DK 16 and Eimi DK 9 together, 2000

Sauron (left), Eimi (middle) and Jiddah (right) being united (th)

Sauron has started chasing Jiddah (th)

Sauron chasing and homing Jiddah (th)

Musso DK 20 - born 20 Aug 1997, Dvur Kralove; Stdbk #678 († 14 Jul 2007)

No.	Sex	Name	Dam	Sire	Pregnancy date	Birth date	Pregnancy time	House ID; comments
1	F	Maisha DK 28	Musso	Isis	20 Sep 2004	21 Dec 2005	457 days	House 3

Female Musso DK 20 (full name Ssang Yong Musso) got pregnant with Isis in 2004, when she was already 7 years and 1 month. The reason for the relatively high age at first conception was the process of unsuccessful coupling with the too much aggressive male Mweru, which took place 2 years before. Excellent character and mother, no one noticed that this female's condition had slowly deteriorated during the lactation period. She began to have problems with bleeding of the tail end and the large portion of care focused on this part of her body. She died suddenly at just 10 years of age. Partially involved in her death, caused by fungal lung disease, was probably the imbalanced ration in conjunction with the load on the organism through long breast-feeding, which lasted 19 months.

Musso DK 20, eight years old (dh)

Musso DK 20 and Maisha DK 28, 5 March 2007 (dh)

Musso DK 20 with 5.5-month-old Maisha DK 28, 5 March 2007 (dh)

Maisha DK 28 at the age of 2.5 years - 23 July 2008 (dh)

Jola DK 21 - born 25 Oct 1997, Dvur Kralove; Stdbk #685

No.	Sex	Name	Dam	Sire	Pregnancy date	Birth date	Pregnancy time	House ID; comments
1	M	Jabu DK 31	Jola	Isis	7 Oct 2005	1 Feb 2007	482 days	House 3
2	?	? DK 36	Jola	Mweru	8 Jun 2009	Sep 2010	Pregnancy underway	House 3

Jola got pregnant for the first time when 8 years old. The reason was failure to become coupled with the young male Mweru who was too aggressive. Therefore, this female came to be introduced to female Jimmi and later on to Isis, who successfully mated Jola in 2005. Having weaned her first calf, Jola was united with female Jane Lee, and both females together were grouped with Mweru in 2009; then this rhino got pregnant after a single mating (8 June).

Jola DK 21 (dh)

Jola DK 21 and 1.5-year-old Jabu DK 31, 12 August 2008 (dh)

Jola DK 21 and Mweru, 2009 (dh)

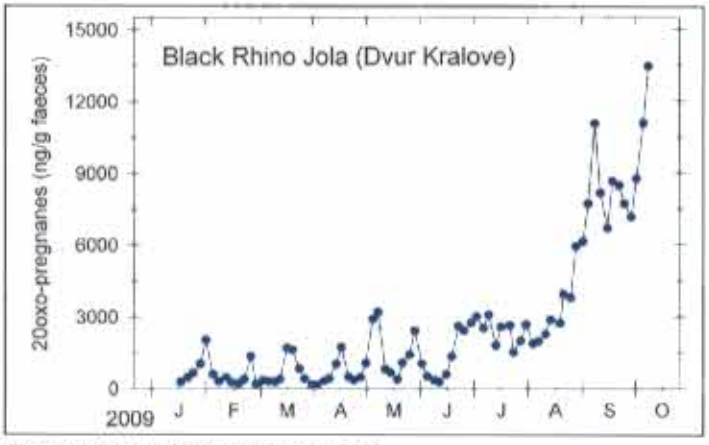
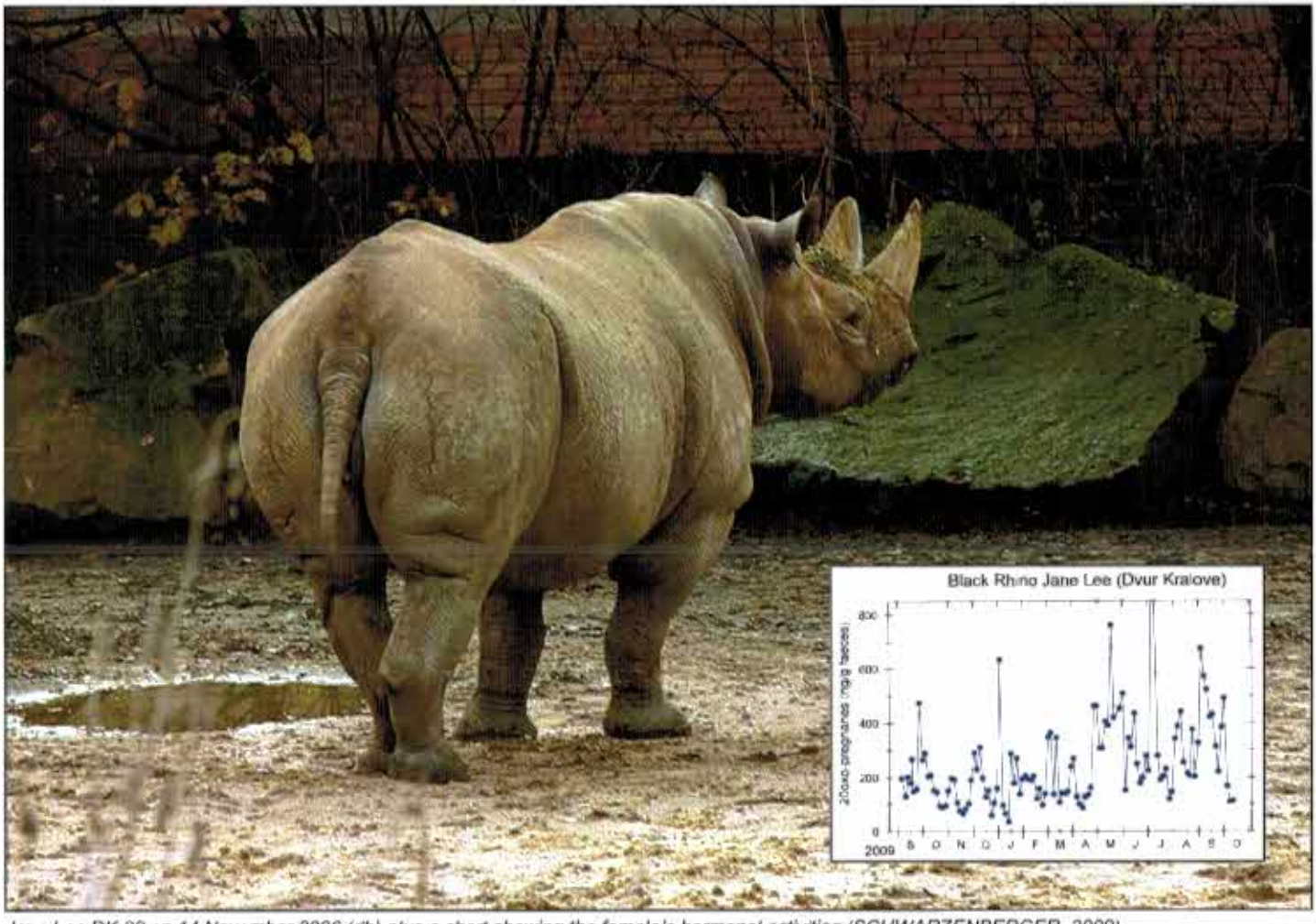


Chart confirming Jola's pregnancy, 2009

Jane Lee DK 22 - born 24 Jan 1998, Dvur Kralove; Stdbk #689

No.	Sex	Name	Dam	Sire	Pregnancy date	Birth date	Pregnancy time	House ID; comments
1	M	— DK 32	Jane Lee	Mweru	25 Aug 2006	22 Sep 2007	393 days	House 3; abortion on day 393, 29 kg

Jane Lee was the only female in the trio (Jane Lee, Jola and Musso), who was able of being coupled with Mweru. The process of coupling lasted 2 years and Jane Lee was mated more than one year before she got pregnant at the age of 8.5 years. Sadly, she gave premature stillbirth about 1.5 months before the due date of birth. Since then this female repeatedly mated with Mweru, but never got pregnant. In July 2009, Jane Lee was examined and found to have her reproductive organs in good order; it was hypothesized by IZW Berlin that problems could have been caused by some kind of an allergic reaction to male's semen in connection with premature birth. It was therefore decided that if the female fails to get pregnant with Mweru in 2009, she would be coupled with another male.



Jane Lee DK 22 on 14 November 2006 (dh) plus a chart showing the female's hormonal activities (SCHWARZENBERGER, 2009)

Mating and births incl. abortions in the black rhino at Dvur Kralove Zoo prior to 31 December 2009 (M - male, F - female)

DK	Sex	Name	Conceived	Birth	Dam	Sire	Birth location / comments
1	F	Elvira DK 1	20 Jul 1976	2 Oct 1977	Elsa	Ken	House 2
2	F	Sali DK 2	15 Apr 1977	5 Jul 1978	Sabi	Ken	House 2
3	M	Jimm DK 3	6 Dec 1977	18 Mar 1979	Jimmi	King	Wintering facility IV
4	M	Eli DK 4	20 Feb 1983	15 May 1984	Elvira	Isis	House 1
5	F	Jessi DK 5	4 Aug 1983	8 Dec 1984	Jimmi	Isis	House 1
6	M	Sado DK 6	21 Apr 1985	26 Aug 1986	Sali	Isis	House 2
7	M	Jos DK 7	13 Feb 1988	21 May 1989	Jimmi	Isis	House 2 / 28 kg
8	F	Sany DK 8	28 Jun 1988	1 Oct 1989	Sali	Isis	House 1
9	F	Eimi DK 9	29 May 1989	24 Aug 1990	Elvira	Isis	House 1
10	M	Jacob DK 10	8 Apr 1990	23 Jun 1991	Jessi	Eli	New house
11	M	Jasper DK 11	11 Jun 1990	13 Sep 1991	Jimmi	Isis	House 1
12	F	Sara DK 12	22 Nov 1990	24 Feb 1992	Sali	Jimm	House 1
13	F	Etna DK 13	21 Sep 1991	8 Dec 1992	Elvira	Jimm	House 1
14	F	Jaga DK 14	1 Sep 1991	14 Dec 1992	Jarca	Jimm	House 1, 26 kg on day 2
15	F	— DK 15	8 Feb 1993	11 Apr 1994	Jimmi	Mabu	New house, stillborn, 24 kg
16	M	Sauron DK 16	16 Jul 1993	26 Oct 1994	Sali	Cody	House 1, 48 kg on day 3
17	F	Jiddah DK 17	17 Aug 1993	15 Nov 1994	Jessi	Mabu	New house, 37 kg
18	-	—	3 Jun 1995	21 Jun 1995	Elvira	Cody	House 1, aborted on day 18
19	M	Jonas DK 18	2 Sep 1994	4 Dec 1995	Jarca	Cody	House 1, died while being hand-reared
20	F	Elba DK 19	23 May 1995	5 Aug 1996	Eimi	Cody	House 1
21	F	Musso DK 20	25 May 1996	20 Aug 1997	Sali	Jimm	House 1
22	F	Jola DK 21	1 Jul 1996	25 Oct 1997	Jessi	Mabu	New house
23	F	Jane Lee DK 22	4 Oct 1996 (?)	24 Jan 1998	Jimmi	Isis	New house
24	F	Salome DK 23	13 Oct 1998	25 Jan 2000	Sali	Jimm	House 1
25	M	Jeremy DK 24	16 Sep 1999	21 Dec 2000	Jessi	Jimm	House 1
26	F	— DK 25	10 Jun 2001	24 Aug 2002	Eimi	Sauron	House 1, stillborn, 33 kg
27	F	Ema-Elsa DK 26	4 Aug 2001	2 Nov 2002	Elba	Jimm	House 1
28	F	Deborah DK 27	5 Jun 2003	11 Nov 2004	Jiddah	Jimm	House 1

DK	Sex	Name	Conceived	Birth	Dam	Sire	Birth location / comments
29	F	Maisha DK 28	20 Sep 2004	21 Dec 2005	Musso	Isis	New house
30	M	Jamie DK 29	6 Oct 2004	2 Jan 2006	Jessi	Sauron	House 1
31	F	Etosha DK 30	17 Jun 2005	4 Sep 2006	Elba	Jimm	House 1
32	M	Jabu DK 31	7 Oct 2005	1 Feb 2007	Jola	Isis	New house
33	M	— DK 32	25 Aug 2006	22 Sep 2007	Jane Lee	Mweru	New house, aborted on day 393, 29 kg
34	M	Dzanty DK 33	10 Aug 2006	24 Nov 2007	Jiddah	Jimm	House 1
35	F	Eva DK 34	26 Jul 2008	8 Dec 2009	Elba	Baringo	House 1
36	F	Jasmina DK 35	3 Sep 2008	13 Dec 2009	Jessi	Baringo	House 1
Total 35 (13.22) calves of which 31 (11.20) were reared, plus there was 1 calf aborted on day 18.							

Jessi DK 5 and five-month-old Jeremy DK 24, 8 May 2001 (th)

BIOLOGICAL DATA

Gestation and length of cycles in females

Given that the mating in the black rhino usually takes several tens of minutes, not only pregnancy data could be obtained but also that on the length of cycles in females. Pregnancy recorded ranged from 427 to 492 days with an average of 458.5. Females cycled in the range of 21 to 29, with an average of 25 days. The maximum-recorded length of mating events was 45 minutes, while a minimum was 7 minutes.

According to the International Studbook (GOLTENBOTH and OCHS, 1997) summarising the captive breeding in the 1904 to 1996 period, when there were 302 and 33 births of the eastern and southern subspecies of the black rhinoceros, respectively, the average gestation period was 455 days. ASSENBERG *et al.* (2008) indicates a gestation period of 440 to 460 days and the length of cycle 21 to 28 days.

Mating, the length of the cycle and pregnancy period in black rhinos at Dvur Kralove Zoo prior to 31 December 2009

No.	Pair	Mating date / time	Cycle length	Birth date	Name	Pregnancy period
1	Elsa x Ken/King	**20 Jul 1976** mated by two males	?	2 Oct 1977	**Elvira** DK 1	439 days
2	Sabi x Ken	21 Mar 1997, **15 Apr 1977**	25 days	5 Jul 1978	**Sali** DK 2	456 days
3	Jimmi x King	19 Aug 1977, **6 Dec 1977** (by night)?	?	18 Mar 1979	**Jimm** DK 3	467 days
4	Elvira x Isis	26. Jan 1983, 17 Feb, **20 Feb 1983**	25 days	15 May 1984	**Eli** DK 4	450 days
5	Jimmi x Isis	15 May 1983, 9.-10 Jun, **4 Aug 1983**	25-28 days	8 Dec 1984	**Jessi** DK 5	462 days
6	Sali x Isis	21 Apr 1985	?	26 Aug 1986	**Sado** DK 6	492 days
7	Jimmi x Isis	**13 Feb 1988** (45 min)	?	21 May 1989	**Jos** DK 7	463 days
8	Sali x Isis	18 Apr 1988 (30 min), **28 Jun 1988** (30 min)	?	1 Oct 1989	**Sany** DK 8	460 days
9	Elvira x Isis	6 May 1989, 23 May, **29 May 1989**	?	24 Aug 1990	**Eimi** DK 9	452 days
10	Jessi x Eli	24.-25. 1., **8 Apr 1990** - struggling, 9 May female chased	25-27 days	23 Jun 1991	**Jacob** DK 10	443 days
11	Jimmi x Isis	10.-**11 Jun 1990** (30 min)	?	13 Sep 1991	**Jasper** DK 11	459 days
12	Sali x Jimm	**22 Nov 1990**	?	24 Feb 1992	**Sára** DK 12	459 days
13	Elvira x Jimm	31 Aug, **21 Sep 1991** (30 min)	22 days	8 Dec 1992	**Etna** DK 13	444 days
14	Jarca x Jimm	7 Aug, **1 Sep 1991**	25 days	14 Dec 1992	**Jaga** DK 14	470 days
15	Jimmi x Mabu	16 Dec 1992, **8 Feb 1993** (29 min)	27 days	11 Apr 1994	— Stdbk #763	427 days
16	Sali x Cody	29 May, 30 May, 26 Jun , **16 Jul 1993** (9+35 min)	21-27 days	26 Oct 1994	**Sauron** DK 15	467 days
17	Jessi x Mabu	18 Mar, 21 May, 20 Jul, **17 Aug 1993** (30 min)	28 days	15 Nov 1994	**Jiddah** DK 16	455 days
18	Jarca x Cody	24 Apr, 20 Jun , 14 Jul, 15 Jul, 7 Aug, **2 Sep 1994**	28 days	4 Dec 1995	**Jonas** DK 17	458 days
19	Eimi x Cody	**23 May 1995** (25 min)	?	5 Aug 1996	**Elba** DK 18	440 days
	Elvira x Cody	**3 Jun 1995** (35 min)	?	21 Jun 1995	— DK 19	Aborted on pregnancy day 18

did not conceive sooner for the first time than when 8.5 years old since she was very severely attacked when five years old by male Sauron DK 16 despite the female grew up with this male once weaned. Jiddah's very bad experience with this male caused that the female had to be coupled with her half-brother Jimmy, who was behaving very quietly in connecting with females. To facilitate coupling with Jimm, Jiddah was first coupled with an experienced female Sali, which in addition caused some delay. That was why the process of coupling with Jimm was taking place with three animals involved, where Sali played a very positive role.
The oldest primiparous female was Jarca, who first gave birth in 22 years, thus getting pregnant between 20 and 21 year of her life. The reason was that even though Jarca as a young female was initially living with males, including young Isis, over a few following years, she was not paired with any male. Subsequently, once coupled with Isis, the female was repeatedly attacked and therefore lived for several years on her own. Since spring 1987, when Jarca was 17, attempts of coupling this female with a male began (VONDRA *et al.* 1994). After being repeatedly stimulated concerning oestrus, using two preparations - Alestrum on 24 September 1987 and PMSG on 12 October 1987, Jarca was repeatedly coupled with male Isis, who was however attacking the female all the time. Therefore, since 1988, Jarca was united with Elvira DK 1, and male Isis was added after 6 days to the females (VONDRA *et al.* 1994). Although females were getting along well with each other, the relationship between Jarca and Isis remained unchanged. On 3 May 1989, Jarca was anaesthetised and her genital organs were examined. Subsequently, regular sampling of female's urine was initiated used for detecting rhino's hormonal cycles (for testing, the samples were shipped to London - Prof Dr K Hodges). From 5 November 1989, preparative REGUMATE was administered to Jarca to induce oestrus, 37.5 ml per day over the period of 12 days (VONDRA *et al.* 1994). In late 1989, the male was replaced and Jarca was coupled with a very calm, but still inexperienced Jimm. First, Jimm was contacted with Jarca in the enclosure over the fence (26/12 - 27/12 1989), and as the animals showed no aggression, Jimm was moved into the neighbouring box within the indoor facility (5 March 1990). Jarca was re-anaesthetised and re-examined, receiving REGUMATE over the period of 12 days from 17 February 1990; this time it was 50 ml/day (VONDRA *et al.* 1994). From 29 March, both animals were administered DIAZEPAM for calming, and on 1 April 1990, they were brought together in the enclosure the first time, which was taking place very quietly with the exception of a single struggle. The next day, Jimm tried to mate the female. As Jarca was obviously in oestrus, the same day she was also coupled with Isis; however, Isis was replaced by Jimm again for sharp struggling. Jimm tried to mate Jarca from 12 to 13 April and then on 21 April 1990, when the first successful mating took place the next day (22 April), which was repeated in the following months (24 June, 26 August, 24 September, 3 December, 2 January 1991, 24 February and 28 March 1991. The next month, mating attempts were recorded by keepers (nonetheless, mating could happen as well) and the mating as such was observed on 7 August and 1 September 1991 (VONDRA *et al.* 1994). To promote the cycle, concentrated vitamin E (TPGS) was administered to Jarca from 13 to 22 February 1991 at a dose of 60 ml/day, with subsequent injection of 8 ml Supergestrogen on 10 April 1991. Simultaneously, Jarca was re-united with female Elvira on 8 August 1991 and the two females then continued going into the same enclosure with Jimm, until early November. Jimm mated both females (Elvira on 31 August and 21 September 1991). From 4 November 1991, faeces samples were collected weekly from each female and subsequently investigated by Dr Schwarzenberger at Veterinary University of Vienna. Both females were confirmed pregnant; they continued going outdoors together up to 10 October 1992 and then separated even in the outer enclosure before the nearing birth (VONDRA *et al.* 1994). For birth, each female had available a delivery double-box with the area of 40 sq m. Each box was fitted with CCTV cameras connected to a video recorder later used for recording the birth. The advanced age of Jarca was reflected in the low birth weight of the young (26 kg - female Jaga DK 14), which was unable to suckle by itself and was hand-raised (for more details, see page 132). The oldest female giving birth was Jimmi, who delivered in 28, thus was successfully mated when nearly 27 years old. Jimmi was still repeatedly mated when 29 years old after weaning of her last calf, but was no longer pregnant. Later on, only a regular interest of the male and mating attempts were recorded in Jimmi, quite regularly until the spring 2002 (the female was 32 years old); most recently this was in July 2005 (Jimmi was 35 years old). Since that time, Jimmi was without any sexual activity but still lived in her enclosure with Isis at that time with no problems. Other females gave birth to a last calf at a younger age, because their reproduction was either terminated prematurely by their death, or are still relatively young and still can reproduce (Jessi, the oldest living breeding female following Jimmi, last conceived in 2008 when 24).

Birth intervals

The table on page 116 summarises data on birth intervals in each female, showing that from 1990 to 2000, the females were often giving birth in intervals of 2-3 years, which was owing to the breeding management, when the calves used to be weaned when around 1 year old and often combined in nurseries comprising individuals of the same age. Before 1990, the intervals used to be longer, which was caused by the death of all breeding males and the absence of a sexually mature male. From 2000 to 2007, the birth interval was less than 4 years up to more than 5 years, which was determined by the separation of calves from their mothers not before the age of 2 years or even later. In addition, sometimes the mating period lasted several months before the female got

pregnant. Two of the females, Jimmi and Sali DK 2, delivered 6 calves before the end of their reproductive period or death. All other females either died before reaching the end of their reproductive age or still live and show cycles.
FRESE (2009) reports the shortest intervals between births (full-term calves only) to be 478 to 527 days, i.e. 16 to 18 months. Therefore, a significantly lesser number of offspring was achieved compared with data from the wild. Throughout the breeding period, females were always coupled only after weaning of their calf as neither a female was ever coupled with a male in the presence of female's young as it is in the wild because of concerns regarding the calf, nor the calf was ever returned to the female following successful mating. Only in 2009, female Jiddah DK 17 was coupled with the male after having been separated from her calf over a short time (for more details, refer to page 105). Making nurseries from 2 to 3 calves of approximately same age proved good. Likewise, bringing adult animals together was successfully carried out repeatedly by combining two and sometimes even three females with a single male. This increased safety, especially in the case of a young inexperienced females that was added to the experienced one (e.g. to Jimmi and Sali DK 2), as well as helped the females to prevent possible attacks by the males together, which in turn was a safer option for them.
The birth interval varied from 2 years and 3.5 months (27.5 months) up to 6 years and 3.5 months (75.5 months), but mostly less than 3 to less than 4 years (29 to 42 months). The average intervals between births in females giving birth at least twice were as follows (N = number of intervals):

Female	Jimmi	Jarca	Elvira DK 1	Sali DK 2	Jessi DK 5	Eimi DK 9	Jiddah DK 17	Elba DK 19	Jola DK 21
Interval	45.2 months	36 months	51.5 months	32.5 months	44.3 months	71.5 months	38.5 months	42.5 months	43 months
No. of intervals	5	1	2	5	5	1	1	2	1

ASSENBERG *et al.* (2008) provide sexual maturity of females and males in the wild between the fourth and sixth, or seventh and ninth year of age, respectively, while females deliver their first calf around the fifth year, or exceptionally, up to about the twelfth year of age. At the same time, cycles begin in the females still during lactation. Gestation period of 440-460 days, as well as the birth interval around 27 months in the wild and 40 months in captivity is indicated in the work above. This difference is explained by probably delayed coupling of females after birth in captivity.
It results from the captive-based data up to the end of 2009 (FRESE 2009) involving 150 males and 579 descendants that the youngest mating males were 3 years and 3.5 months to 5 years old, the highest age in first mating was 15 to 25 years and the oldest mating breeding males were 30 to 35 years, while the maximum number of descendants per male was 10 to 17.

Age at birth and the intervals between births in female black rhinos at Dvur Kralove Zoo prior to 31 December 2009

Female * Born + Died	Birth No.	Birth date, calf	Female age at birth	Female age at mating (app 15 months prior parturition)	Birth interval (years, months)	Raised successfully
Elsa * 1970 Kenya	1.	2 Oct 1977 Elvira DK 1	7 years	App 6 years	—	Yes
Jimmi * February 1970 Kenya	1.	18 Mar 1979 Jimm DK 3	9 years, 1 month	7 years, 10 months	—	Yes
	2.	8 Dec 1984 Jessi DK 5	14 years, 10 months	13 years, 7 months	5 years, 9 months	Yes
	3.	21 May 1989 Jos DK 7	19 years, 3 months	18 years	4 years, 5.5 months	Yes
	4.	13 Sep 1991 Jasper DK 11	21 years, 7 months	20 years, 4 months	2 years, 4 months	Yes
	5.	11 Apr 1994 - DK 15	23 years, 2 months	21 years, 11 months	2 years, 7 months	No
	6.	24 Jan 1998 Jane Lee DK 22	28 years	26 years, 9 months	3 years, 8.5 months	Yes

No.	Pair	Mating date / time	Cycle length	Birth date	Name	Pregnancy period
20	Sali x Jimm	**25 May 1996** (25 min)	?	20 Aug 1997	**Musso** DK 20	452 days
21	Jessi x Mabu	**1 Jul 1996**	?	25 Oct 1997	**Jola** DK 21	481 days
22	Jimmi x Isis	17 Mar, 2 Jun, 5 Sep, 4 Oct 1996 (?)	29 days	24 Jan 1998	**Jane Lee** DK 22	476 days
23	Sali x Jimm	17 Sep, **13 Oct 1998**	26 days	25 Jan 2000	**Salome** DK 23	441 days
24	Jessi x Jimm	23 Aug, **16 Sep 1999** (46 min)	24 days	21 Dec 2000	**Jeremy** DK 24	461 days
25	Eimi x Sauron	27 Mar, 17. 5, **10 Jun 2001** (30 min)	24 days	24 Aug 2002	— F DK 25	450 days
26	Elba x Jimm	**4 Aug 2001** (30 min)	?	2 Nov 2002	**Ema Elsa** DK 26	455 days
27	Jiddah x Jimm	12 May, **5 Jun 2003** (40-45 min)	24 days	11 Sep 2004	**Deborah** DK 27	464 days
28	Musso x Isis	25 Aug, **20 Sep 2004** (30 min)	26 days	21 Dec 2005	**Maisha** DK 28	457 days
29	Jessi x Sauron	12 Sep, **6 Oct 2004** (32 min)	24 days	2 Jan 2006	**Jamie** DK 29	452 days
30	Elba x Jimm	23 May, **17 Jun 2005** (30 min)	25 days	4 Sep 2006	**Etosha** DK 30	444 days
31	Jola x Isis	11 Jul, 7 Aug, **7 Oct 2005** (26 min)	26-27 days	1 Feb 2007	**Jabu** DK 31	482 days
32	Jane Lee x Mweru	15 Jun , 8 Jul, 31 Jul, **25 Aug 2006**	23-25 days	22 Sep 2007	— M DK 32	393 days - abortion
33	Jiddah x Jimm	**10 Aug 2006** (7 a 36 min)	?	24 Nov 2007	**Dzanty** DK 33	471 days
34	Elba x Baringo 2	26 Jul (25 min), **20 Aug 2008** (10+29 min)	25 days	8 Dec 2009	**Eva** DK 34	475 days
35	Jessi x Baringo 2	**4 Sep 2008** (25 min)	?	13 Dec 2009	**Jasmina** DK 35	465 days
Pregnancy range 427-492 days, Cycle lenght 25 (21-29) days						

Sex ratio

Out of the 35 calves born at Dvur Kralove Zoo, 13 animals were males and 22 were females, with male to female ratio 1:1.7. According to the International Studbook (KLOS and FRESE 1987) summarising the births in captivity from 1969 to 1986, there were 127 births with a sex ratio of 62 males and 65 females, meaning the ratio of males to females was 1:1.05. Under normal conditions, a single calf is born, despite the two cases of aborted twins out of the total 590 births prior to the end of 2009 reported by the International Studbook (FRESE 2009).

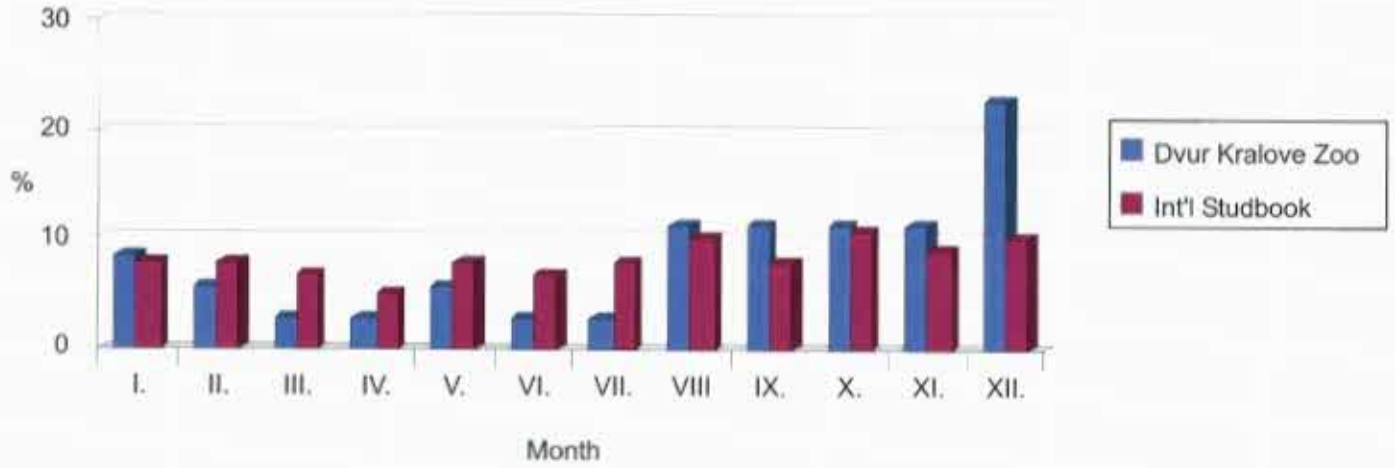
Birth distribution over the year

The births were recorded throughout the year with a maximum from July to December. This is in particular due to breeding the females in times of the year with favourable climate. Similar information is also confirmed by the International Studbook, where most births were recorded in the second half of the year, probably as a result of coupling, thus mating especially in spring and summer months (KLOS a FRESE 1991). The following table shows the distribution of births at Dvur Kralove Zoo and in captivity according to the last volume of the International Studbook (FRESE 2009) summarising the data until 2 December 2009. In the wild, births are distributed throughout the year with a peak during the rainy season in some areas (ASSEBERG *et al.* 2008). 2008). The chart shows the comparison of the data from the studbook and Dvur Kralove Zoo in the percentage of births attributable to each month. The International Studbook data comprise a total of 590 births distributed throughout the year, with 5 to 11% of births per month (FRESE 2009).

The distribution of births over the year in the black rhino at Dvur Kralove Zoo prior to 31 December 2009 and in captivity

Month	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Total
No. of births	3	2	1	1	2	1	1	4	4	4	4	8	35
%	8.6%	5.7%	2.9%	2.9%	5.7%	2.9%	2.9%	11.4%	11.4%	11.4%	11.4%	22.9%	100%
Births in captivity (FRESE 2009)	48	47	43	32	47	41	47	60	46	67	52	60	590
% per month	8%	8%	7%	5%	8%	7%	8%	10%	8%	11%	9%	10%	100%

Birth distribution over the year in black rhino in captivity



Birth intervals and reproductive age

The data from the wild imply that females are sexually mature at the age of 3.8 to 9.1 years, with an average of 6.3 years (SMITH and READ 1992) and deliver in the interval of 2-3.5 years. The birth interval in the females in the Ngorongoro Crater from 1993 to 2003 was 2.88 years on average; the females were first giving birth at the age of 6.9 years (MILLS *et al.* 2003). The shortest birth interval between births of two calves of one female is 24 to 26 months and may take 27 to 30 (max. 39) months (SMITH and READ 1992).

It results from the captive-based data up to the end of 2009 (FRESE 2009) involving 195 females and 592 calves that the age range of the youngest females giving birth was 3 years and 10.5 months to 5 years, the oldest primiparas were 17-25 years old and the oldest females giving birth were 33 to 37 years old, while the maximum number of calves per female was 10 to 14 (Stdbk #213 - Ella, a currently 39-year-old female that has been living in San Francisco, USA, since 1974).

At Dvur Kralove Zoo, there were a total of 13 females that ever gave birth where three of those 13 females first delivered when 6 to 6.5 years old, i.e. conceived when 4 to 5 years old (Sabi, Eimi DK 9, Elba DK 19); the age of 5 to 6 years was one of the first conception in three females (Elsa, Elvira DK 1 and Jessi DK 5). The first conception between 7 and 8 occurred in three females (Jimmi, Sali DK 2 and Musso DK 20). Between 8 and 9, three females conceived (Jiddah DK 17, Jola DK 21 and Jane Lee DK 22). Jimmi and Sali gave the birth later, because they had to wait until Isis, the only male at that time, reached maturity. Isis became a father for the first time when 6 years and 6 months old, meaning he reached the sexual maturity at the turn of the year 4 and 5. For the other females that conceived for the first time only between the year 7 and 9, this involved a late coupling with a male because of a longer process of familiarisation and socialisation as the animals were still young and also excessive caution and delaying the coupling due to the inexperience of some keepers and curators. In Jane Lee, it could be also the influence of sexual immaturity and inexperience of male Mweru, which was coupled with this female, mating her (with subsequent conception of the female) when 7 years and 9 months old. Female Jiddah

Female * Born + Died	Birth No.	Birth date, calf	Female age at birth	Female age at mating (app 15 months prior parturition)	Birth interval (years, months)	Raised successfully
Jarca * February 1970 Kenya	1.	14 Dec 1992 Jaga DK 14	22 years	App 20 years	—	Yes
	2.	4 Dec 1995 Jonas DK 18	25 years	App 23 years	3 years	No
Sabi * 1972 Kenya	1.	5 Jul 1978 Sali DK 2	6 years	App 5 years	—	Yes
Elvira DK 1 * 2 Oct 1977 Dvur Kralove	1.	15 May 1984 Eli DK 4	6 years, 7.5 months	5 years, 4.5 months	—	Yes
	2.	24 Aug 1990 Eimi DK 9	12 years, 11 months	11 years, 8 months	6 years, 3.5 months	Yes
	3.	8 Dec 1992 Etna DK 13	15 years, 2 months	13 years, 9 months	2 years, 3.5 months	Yes
Sali DK 2 * 5 Jul 1978 Dvur Kralove	1.	26 Aug 1986 Sado DK 6	8 years, 2 months	6 years, 9 months	—	Yes
	2.	1 Oct 1989 Sany DK 8	11 years, 3 months	10 years	3 years, 1 month	Yes
	3.	24 Feb 1992 Sára DK 12	13 years, 6 months	12 years, 3 months	2 years, 4.5 months	Yes
	4.	26 Oct 1994 Sauron DK 16	16 years, 4 months	15 years, 1 month	2 years, 8 months	Yes
	5.	20 Aug 1997 Musso DK 20	19 years, 2 months	17 years, 11 months	2 years, 10 months	Yes
	6.	25 Jan 2000 Jane Lee DK 23	21 years, 7 months	20 years, 4 months	2 years, 5 months	Yes
Jessi DK 5 * 8 Dec 1984 Dvur Kralove	1.	23 Jun 1991 Jacob DK 10	6 years, 6.5 months	5 years, 3.5 months	—	Yes
	2.	15 Nov 1994 Jiddah DK 17	9 years, 11 months	8 years, 8 months	3 years, 5 months	Yes
	3.	25 Oct 1997 Jola DK 21	12 years, 10.5 months	11 years, 7.5 months	2 years, 11 months	Yes
	4.	21 Dec 2000 Jeremy DK 24	16 years, 0.5 month	14 years, 9.5 months	3 years, 2 months	Yes
	5.	2. Jan 2006 Jamie DK 29	21 years, 1 month	19 years, 10 months	5 years, 0.5 month	Yes
	6.	13 Dec 2009 Jasmina DK 35	25 years	23 years, 9 months	3 years, 11 months	Yes
Eimi DK 9 * 24 Aug 1990 Dvur Kralove	1.	5 Sep 1996 Elba DK 19	6 years, 0.5 month	4 years, 9.5 months	—	Yes
	2.	24 Aug 2002 — DK 25	12 years	10 years, 9 months	5 years, 11.5 months	No
Jiddah DK 16 * 15 Nov 1994 Dvur Kralove	1.	11 Sep 2004 Deborah DK 27	9 years, 10 months	8 years, 7 months	—	Yes
	2.	24 Nov 2007 Dzanty DK 33	13 years	10 years, 9 months	3 years, 2.5 months	Yes
Elba DK 18 * 5 Sep 1996 Dvur Kralove	1.	2 Nov 2002 Ema Elsa DK 26	6 years, 2 months	4 years, 11 months	—	Yes
	2.	4 Sep 2006 Etosha DK 30	10 years	8 years, 9 months	3 years, 10 months	Yes
	3.	8 Dec 2009 Eva DK 34	13 years, 3 months	12 years	3 years, 3 months	Yes

Female * Born + Died	Birth No.	Birth date, calf	Female age at birth	Female age at mating (app 15 months prior parturition)	Birth interval (years, months)	Raised successfully
Musso DK 20 * 20 Aug 1997 Dvůr Králové	1.	21 Dec 2005 Maisha DK 28	8 years, 3 months	7 years	—	Yes
Jola DK 21 * 25 Oct 1997 Dvur Kralove	1.	1 Feb 2007 Jabu DK 31	9 years, 3.5 months	8 years. 0 5 month	—	Yes
	2.	*Conceived on 8 Jun 2009 DK 36*		11 years, 7.5 months	3 years. 7 months	
Jane Lee DK 22 * 24. Jan 1998 Dvur Kralove	1.	22 Sep 2007 - DK 32	9 years, 8 months	8 years. 5 months	—	No

Age at time of mating in male black rhinos at Dvur Kralove Zoo prior to 31 December 2009

Male * Born	No. of calf	Birth date, calf	Male age at birth of the calf	Male age at time of mating (app 15 months earlier)	Raised succes-sfully
Ken * January 1970 Kenya	1. ??	2 Oct 1977 Elvira DK 1 ??	7 years	6 years	Yes
	2.	5 Jul 1978 Sali DK 2	8 years	7 years	Yes
King *1970 Kenya	*1. ??*	*2 Oct 1977 Elvira DK 1 ??*	*7 years*	*6 years*	*Yes*
	1. (or 2.)	18 Mar 1979 Jimm DK 3	9 years	8 years	Yes
Isis * 3 Nov 1977 Cincinnati	1.	15 May 1984 Eli DK 4	6 years, 6.5 months	5 years, 3.5 months	Yes
	2.	8 Dec 1984 Jessi DK 5	7 years, 1 month	5 years, 10 months	Yes
	3.	26 Aug 1986 Sado DK 6	8 years, 10 months	7 years, 7 months	Yes
	4.	21 May 1989 Jos DK 7	11 years, 7 months	10 years, 4 months	Yes
	5.	1 Oct 1989 Sany DK 8	11 years, 11 months	10 years, 8 months	Yes
	6.	24 Aug 1990 Eimi DK 9	12 years, 10 months	11 years, 7 months	Yes
	7.	13 Jul 1991 Jasper DK 11	13 years, 8.5 months	12 years, 5.5 months	Yes
	8.	24 Jan 1998 Jane Lee DK 22	20 years, 3 months	19 years	Yes
	9.	21 Dec 2005 Maischa DK 28	28 years, 2 months	26 years, 11 months	Yes
	10.	1 Feb 2007 Jabu DK 31	29 years, 3 months	28 years	Yes
Jimm DK 3 * 18 Mar 1979 Dvur Kralove	1.	24 Feb 1992 Sara DK 12	12 years, 11 months	11 years, 8 months	Yes
	2.	8 Dec 1992 Etna DK 13	13 years, 9 months	12 years, 6 months	Yes
	3.	14 Dec 1992 Jaga DK 14	13 years, 9 months	12 years, 6 months	Yes
	4.	20 Aug 1997 Musso DK 20	18 years, 5 months	17 years, 2 months	Yes
	5.	25 Jan 2000 Salome DK 23	20 years, 10 months	19 years, 7 months	Yes
	6.	21 Dec 2000 Jeremy DK 24	21 years, 9 months	20 years, 6 months	Yes
	7.	21 Nov 2002 Ema Elsa DK 26	22 years, 8 months	21 years, 5 months	Yes
	8.	11 Sep 2004 Deborah DK 27	24 years, 6 months	23 years, 3 months	Yes
	9.	4 Sep 2006 Etosha DK 30	26 years, 6 months	25 years, 3 months	Yes
	10.	24 Nov 2007 Dzanty DK 33	27 years, 8 months	26 years, 5 months	Yes
Eli DK 4 * 15 May 1984 Dvur Kralove	1.	23 Jun 1991 Jacob DK 10	7 years, 1 month	5 years, 11 months	Yes
Cody * 20 May 1975 Sydney	1.	26 Oct 1994 Sauron DK 16	9 years, 5 months	8 years, 2 months	Yes
	2.	4 Dec 1995 Jonas DK 18	10 years, 7 months	9 years, 4 months	No
	3.	5 Sep 1996 Elba DK 19	11 years, 3.5 months	10 years, 0.5 month	Yes

Male * Born	No. of calf	Birth date, calf	Male age at birth of the calf	Male age at time of mating (app 15 months earlier)	Raised succes-sfully
Mabu * 23 Jan 1979 Magdeburg	1.	11 Apr 1994 - Early abortion	15 years, 2.5 months	13 years, 11.5 months	No
	2.	15 Nov 1994 Jiddah DK 17	15 years, 10 months	14 years, 7 months	Yes
	3.	25 Oct 1997 Jola DK 21	18 years, 9 months	17 years, 6 months	Yes
Sauron DK 15 * 26 Oct 1994 Dvur Kralove	1.	24 Aug 2002 — DK 25	7 years, 10 months	6 years, 7 months	No
	2.	2 Jan 2006 Jamie DK 29	11 years, 3.5 months	10 years, 0.5 month	Yes
Mweru * 12 Sep 1996 Port Lympne	1.	22 Sep 2007 — DK 32	11 years	9 years, 9 months	No
	2.	? Sep 2010 DK 36	14 years	12 years, 9 months	?
Baringo II * 3 Dec 1992 Port Lympne	1.	8 Dec 2009 Eva DK 34	17 years	15 years, 9 months	Yes
	2.	13 Dec 2009 Jasmina DK 35	17 years	15 years, 9 months	Yes

A female black rhino with a calf and older daughter, Lewa, Kenya (dh)

Weaning

In the wild, the calf is weaned depending on when the female gives the next birth, nursed usually more than a year, while solid food is taken already during the first weeks of life and independence is reached in the age of 2.5-3.5 years (ASSENBERG *et al.* 2008). If the female gives birth, then if the previous calf is a male, it is driven off, while if the previous calf is a female, it usually remains with the mother.

Weaning used to be carried out at Dvur Kralove Zoo within the range of 11 to 25 months, only female Elvira was weaned in a half of year because of her mother's death. If a calf was moved to a different house immediately upon weaning and grouped with other calves, including those of white rhinoceroses, they managed the weaning process very well and in a few days, they already stopped looking for its mother. If, however, a gradual weaning process with the calf living next to its mother posed stress to both the mother and the calf that called the mother for many weeks, which in turn led to the re-union with the mother. From the perspective of future prosperity and breeding potential of the calf, any earlier weaning had no negative influence. Rather, it created an even stronger bond between keepers and the rhino. It was not by chance that females Elvira DK 1 (weaned at 6 months) and Sali DK 2 (weaned at 15 months) could be milked during their lactation periods. Only in one case (female Jiddah DK 17 in 2009) the weaning process was implemented gradually over a part of the day when the young was left inside the house and the mother was coupled with the male in the enclosure, where mating occurred. Weaning in the age of 12-15 months and joining the young into nurseries, immediately after separation from the mother, worked best, where age differences of several months between the calves played no negative role. Detailed information about the weaning of calves is summarised in the table below. Females were weaned between 6-29 months of age, 15.8 months on average. Males were weaned between 10-29 months of age, with average age of 18.2 months.

Weaning of young black rhinos at Dvur Kralove Zoo prior to 31 December 2009

No.	Sex	Name	Birth date	Dam	Sire	Weaning method (Age: M-months, Y-years)	Comment
1	F	**Elvira**	2 Oct 1977	Elsa	Ken/King	7 Apr 1978 - **6M** - Following death of female, alone prior to 21 Jun 78 - Started going outdoors with Jarca	Excellent mother, calm
2	F	**Sali**	5 Jul 1978	Sabi	Ken	12 Oct 1979 - **1Y+3M** - Immediately grouped with Elvira (2Y) and Isis (1Y+11M)	Excellent mother, calm
3	M	**Jimm**	18 Mar 1979	Jimmi	King	13 Apr 1981 - **2Y+1M** - Immediately moved to another house, where immediately grouped with Sali (2Y+9.5M), Isis (2Y+5M) and Elvira (2.5Y)	Breeding male, calm
4	M	**Eli**	15 May 1984	Elvira	Isis	18 Aug 1986 - **2Y+3M** - Stayed alone	Breeding male
5	F	**Jessi**	8 Dec 1984	Jimmi	Isis	9 Sep 1986 - **1Y+9M** - Alone and nervous, will not want to go out	Excellent mother, nervous
6	M	**Sado**	26 Aug 1986	Sali	Isis	22 Nov 1987 - **1Y+3M** - Immediately moved to another house	
7	M	**Jos**	21 May 1989	Jimmi	Isis	19 Apr 1990 - **11M** - Mother moved to a different place, 26 Jun (1Y+1M) grouped with Najin (nearly 1Y) and 1 Aug grouped with Sany (10M)	
8	F	**Sany**	1 Oct 1989	Sali	Isis	1 Aug 1990 - **10M** - Immediately grouped with Jos (1Y+2M) and Najin (11M)	
9	F	**Eimi**	24 Aug 1990	Elvira	Isis	31 Jul 1991 - **11M** - Mother moved to a different place immediately	Excellent mother, calm
10	M	**Jacob**	23 Jun 1991	Jessi	Eli	31 Jul 1992 - **1Y+1M** - Immediately united with Jasper (10.5M)	
11	M	**Jasper**	13 Sep 1991	Jimmi	Isis	31 Jul 1992 - **10.5M** - Immediately united with Jacob (1M)	

No.	Sex	Name	Birth date	Dam	Sire	Weaning method (Age: M-months, Y-years)	Comment
12	F	**Sara**	24 Feb 1992	Sali	Jimm	5 Apr 1993 - **1Y+1.5M** - Immediately moved to a different place, where joined Jacob (1Y+9M) and Jasper (1Y+6.5M)	
13	F	**Etna**	8 Dec 1992	Elvira	Jimm	10 Mar 1994 - **1Y+3M** - Immediately united with Jaga (1Y+3M)	Excellent mother, calm
14	F	**Jaga**	14 Dec 1992	Jarca	Jimm	10 Mar 1994 - **1Y+3M** - Immediately united with Etna (1Y+3M)	Excellent mother, calm; problems with males
16	M	**Sauron**	26 Oct 1994	Sali	Cody	27 Oct 1995 - **1Y** - 7 Nov United with Jaga	Breeding; aggressive at young age
17	F	**Jiddah**	15 Nov 1994	Jessi	Mabu	14 May 1996 - **1.5Y** - Moved to a different place, on 15 May united with Sauron (1Y+6.5M) and Jaga (3.5Y)	Excellent mother, calm
19	F	**Elba**	5 Aug 1996	Eimi	Cody	30 Jul 1997 - **1Y** - Moved to a different part of the house	Excellent mother, calm
20	F	**Musso**	20 Aug 1997	Sali	Jimm	31 Jul 1998 - **11.5M** - Immediately united with Elba (2Y) - not at night	Excellent mother, calm
21	F	**Jola**	25 Oct 1997	Jessi	Mabu	17 Mar 1999 - **1Y+5M** - Immediately united with Jane Lee (1Y+2M)	Excellent mother, more nervous
22	F	**Jane Lee**	24 Jan 1998	Jimmi	Isis	17 Mar 1999 - **1Y+2M** - Immediately united with Jola (1Y+5M)	Nervous
23	F	**Salome**	25 Jan 2000	Sali	Jimm	31 May 2001 - **1Y+4M** - Moved within the same house	Breeding female
24	M	**Jeremy**	21 Dec 2000	Jessi	Jimm	18 May 2003 - **2Y+3M** - Moved within the same house	
26	F	**Ema-Elsa**	2 Nov 2002	Elba	Jimm	6 Apr 2005 - **2Y+5M** - Moved within the same house	Breeding female
27	F	**Deborah**	11 Sep 2004	Jiddah	Jimm	26 Jul 2006 - **1Y+10.5M** - Moved within the same house	Calm
28	F	**Maisha**	21 Dec 2005	Musso	Isis	14 Jul 2007 - **1Y+7M** - Mother died, united with Jamie on 20 July	Calm
29	M	**Jamie**	2 Jan 2006	Jessi	Sauron	20 Jul 2007 - **1Y+6.5M** - Immediately moved to a different place, united with Maisha	Calm
30	F	**Etosha**	4 Sep 2006	Elba	Jimm	8 Jul 2008 - **1Y+10M** - Immediately united with Davu - not at night	Calm
31	M	**Jabu**	1 Feb 2007	Jola	Isis	1 Nov 2008 - **1Y+9M** - Inside the house, getting calm when moved next door to the young trio (Jamie, Maisha and Deborah); 12 Dec joined Deborah (4Y+3M)	Calm
33	M	**Dzanty**	24 Nov 2007	Jiddah	Jimm	16 Oct 2009 - **1Y+11M** - Separated step by step during the day for 30 minutes up to several hours from 6 May (Mother coupled with the male from 18 May)	Nervous when being separated from the mother

Weight in black rhinoceroses

Over the years, a number of weight data have been acquired. Initially, this occurred at random, usually in connection with the transport or deaths of animals; after 1990, the data were obtained specifically, particularly in relation to artificial rearing (VONDRA *et al.* 1994), after-birth inspection of calves and following installation of a weighing instrument inside a new rhino house in 1993, which could be used to take weight in adult animals (HOLECKOVA, 1995). In 2008, scales were installed in both of the rhino houses and weighing became an important instrument for monitoring the condition of the animals. A total of 280 weight data were obtained, including 124 data for males and 156 for females.

Weight of adult animals

In total, over 160 weight-related data were obtained in adult individuals (8 males and 13 females), implicating that the weight of adult males varied from 948 to 1,350 kg, and the mean individual weight ranged from 948 to 1240 kg. Similarly, the weight of adult females varied from 560 to 1292 kg, while the mean weight of individual animals ranged from 560 to 1,280 kg, where the lowest weight values were recorded in animals close to or at the time of death; therefore, they were individuals in a poor physical condition. Further details are summed up in the following tables, showing the average weight of about 1,100 kg in males and 950 kg in females. The collected data can be compared with that from other animal parks (ARKS), where a 5-year-old male Limpopo (Stdbk # 889) weighed 930 kg (Port Lympne), male Quinto (Stdbk # 430) weighed 1,093 to 1,133 kg (Chester), male Pete (Stdbk # 376) 1,100 kg as 12 years old (Washington), female Laikipia (Stdbk # 891), five-year-old, weighed 908 kg (Port Lympne), female Emma (Stdbk # 451) 1000-1065 kg in its year 10 (Whipsnade), 31-year-old female Mtoto (Stdbk # 150) 762 kg (Zurich), 27-year-old female Nzima (Stdbk # 240) 1,160 kg (Berlin) and female Miadi (Stdbk # 396) even 1,200 kg when 11 years old (Washington). These data correspond to those obtained at Dvur Kralove Zoo.

Individual differences in size, thus weight, are significant, particularly in females; therefore, monitoring the weight of individual animals is important. If individual weights incl. changes are not known, this may cause a deficit of nutrition values within the administered diet. This was demonstrated in 1999 in Isis, who had a deficit of nitrogen in the ration, and because of the long duration of this, there was deterioration in male's condition and health problems. At the time of his greatest difficulties, unfortunately, the male was not weighed. After reviewing the diet and changes in feeding, both his health and condition returned to normal (see chart on page 124). It is possible that a similar deficit in the ration could result in weakening of the individual and the subsequent attacks by the infection and mortality (Elvira, Sali, Cody, Mabu, Sauron and Musso).

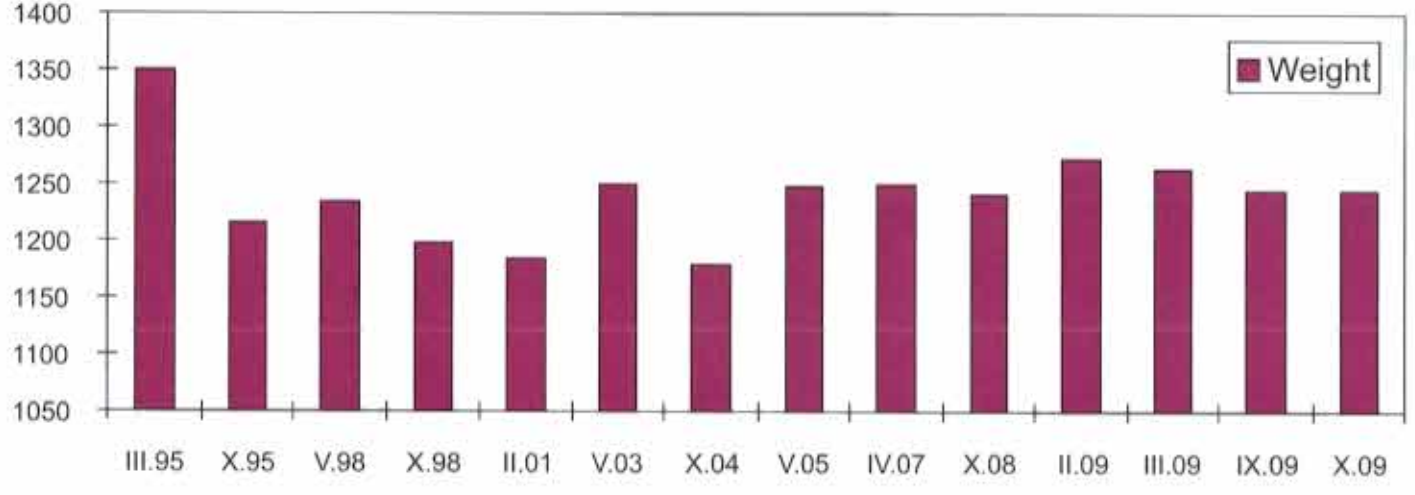
Weights of adult male black rhinos at Dvur Kralove Zoo prior to 31 December 2009

Male	Stdbk #	Weight (kg; min-max)	Average (kg)	No of measurements	Comments
Cody	260	1,060-1,140	1,088	4	Age 11-14 years
Isis	268	1,180-1,350	1,240	15	Age 17-32 years
Mabu	277	948	948	1	Poor condition
Jimm DK 3	283	1,000-1,058	1,028	4	Age 28-29 years
Eli DK 4	386	1,100-1,200	1,150	2	Age 6.5-8.5 years
Baringo II	483	1,071-1,194	1,145.7	14	Age 13-17 years, 3 figures from Port Lympne
Sauron DK 16	541	1,000	1,000	1	Weight at the time of death
Mweru	659	1,114-1,240	1,200	19	Age 5-13 years
Total	8 animals	948-1,350	1,099.5	60	
Control (ARKS)	3 animals	930-1,133	1,048	4	Chester, Washington

Weights of adult female black rhinos at Dvur Kralove Zoo prior to 31 December 2009

Female	Stdbk #	Weight (kg; min-max)	Average (kg)	No. of measurements	Comments
Jimmi	175	915	915	1	Age 38 years
Elvira DK 1	244	668	668	1	Weight at the time of death
Sali DK 2	282	560	560	1	Weight at the time of death
Jessi DK 5	378	940-1,150	1,063	6	Age 11-25 years
Eimi DK 9	431	1,040	1,040	1	Weight at the time of death
Jaga DK 14	456	830	830	1	Age 5 years and 7 months - Port Lympne
Jiddah DK 17	540	923-980	952.5	60	Poor condition
Elba DK 19	619	1,019-1,096	1,057,5	1	Age 12-13 years
Musso DK 20	678	980	980	1	Age 3 years and 8 months
Jola DK 21	685	903-956	932.5	16	Age 11-12 years
Jane Lee DK 22	689	1,251-1,292	1,280	7	Age 11-12 years
Deborah DK 27	924	990-992	991,3	3	Age 4 years and 4-6 months
Maisha DK 28	965	1,099	1,099	1	Age 3 years and 11 months
Total	13 animals	560-1292	951.5	100	
Control (ARKS)	5 animals	762-1,200	1,012.5	6	Port Lympne, Whipsnade, Zurich, Berlin, Washington

Changes in weight in male Isis, 1995 through 2009



Body development

From the weight data obtained, weight gain during growth can be monitored, which was often more than 1 kg per day. In addition, we managed to get several birth weights that ranged from 23 to 48 kg in 7 individuals of both sexes; the average birth weight was 32.4 kilograms. Information on growth was obtained from 10 males and 15 females. Weight gain of growing calves is summarised in the following tables. Females usually attained adult weight between 4 and 5 years of age, while males reached the same between 5 to 6 years of age, which at the same time corresponds to reaching the sexual maturity.

Growth of calves

The male table includes 101 weighing data, of which 65 were found in weighing of eight adult males. Birth weight is based on 4 data from calves aged 1 to 3 days (Jos DK 7, Sauron DK 16, Jonas DK 18 and Davu), of which 1 figure was taken from Krefeld Zoo's data (Davu) and one case was a very weak calf, which the zoo ultimately failed to breed (Jonas DK 18). These data show the average birth weight of 32.75 kilograms. The data on growth of males are based mainly on figures obtained from 4 animals (Jabu DK 31, Jamie DK 29, Dzanty DK 33 and Davu); at the same time, they also include the individual weight figures from additional six males (Sado DK 6, Jos DK 7, Jacob DK 10, Jasper DK 11 and Sauron DK 16). Since the size is animal-specific, with males showing significant differences in adulthood, this fact is reflected in the submitted data as well, with Jamie DK 29 being the largest and Jos DK 7 the smallest of the young males, and Davu was the smallest out of those between 2 and 3 years of age.

Growth of male black rhinos at Dvur Kralove Zoo prior to 31/12/2009

Age	Weight span	Mean weight	Comments
Day 1 to 3	23-48 kg	32.75 kg	n = 4; 1 figure from Krefeld Zoo (Davu)
1 year	350-481 kg	415.5 kg	n = 2; 1 figure from Krefeld Zoo (Davu)
1 year and 2 months	561 kg	561 kg	
1 year and 5.5 months	668 kg	668 kg	
1 year and 6 months	535 kg	535 kg	
1 year and 6.5 months	680 kg	680 kg	
1 year and 8 months	728 kg	728 kg	
1 year and 10 months	690-775 kg	732.5 kg	n = 2
1 year and 10.5 months	786 kg	786 kg	
1 year and 11 months	800 kg	800 kg	
2 years	752-819 kg	785.5 kg	n = 2
2 years and 1 month	720 kg	720 kg	
2 years and 1.5 months	784 kg	784 kg	
2 years and 2 months	798 kg	798 kg	
2 years and 3.5 months	826 kg	826 kg	
2 years and 8.5 months	787 kg	787 kg	
2 years and 11 months	890-1,066 kg	978 kg	n = 2
3 years	864-1,122 kg	993 kg	n = 2

Age	Weight span	Mean weight	Comments
3 years and 1.5 months	800 kg	800 kg	
3 years and 2 months	909 kg	909 kg	
3 years and 2.5 months	1,146 kg	1,146 kg	
3 years and 3 months	1,155 kg	1,155 kg	
3 years and 4 months	927 kg	927 kg	
3 years and 5.5 months	965 kg	965 kg	
3 years and 7 months	973 kg	973 kg	
3 years and 8 months	972 kg	972 kg	
3 years and 9 months	994 kg	994 kg	
3 years and 10 months	1,017 kg	1,017 kg	
Adult	**948-1,350 kg**	**1,099.5 kg**	**8 males; n = 65**

The table for growth in females includes 144 weight figures, from which 100 were found in the weighing thirteen adult females (Jimmi, Elvira DK 1, Sali DK 2, Jess DK 5, Eimi DK 9, Jaga DK 14, Elba DK 19, Jiddah DK 17, Musso DK 20, Jola DK 21, Jane Lee DK 22, Deborah DK 27, Maisha DK 28, DK 15, Jiddah DK 17 and DK 25). The observed birth weight is based on data from 4 calves aged 1 to 4 days (Jaga DK 14, DK 15, Jiddah DK 17 and DK 25), while in two cases, the calf was a stillborn (DK 15 and 25), and another involved a weak and semi-hand-reared calf (Jaga DK 14). These data implicate the average birth weight of 30 kilograms. Growth figures in females are primarily based on data from 5 animals (Jaga DK 14, Jiddah DK 17, Deborah DK 27, Maisha DK 28 and Etosha DK 30). The highest weight - more than 1,000 kg - was reached by female Maisha when still less than 4 years old. The presented data therefore reflect variation in individual size due to the relatively small number of figures. The weight of adult females is influenced by the fact that the lowest weight figures were observed in older females at the time of death; as to healthy young females, Jaga DK 14 was the lightest animal with the weight of 830 kg as found at Port Lympne Zoo at the age of 5 years and 7 months.

Growth of female black rhinos at Dvur Kralove Zoo prior to 31 December 2009

Age	Weight span	Mean weight	Comments
Day 1 to 4	24-37 kg	30 kg	n = 4
Month 1	47 kg	47 kg	
Month 2	68.5 kg	68.5 kg	
Month 3	91 kg	91 kg	
Month 4	117 kg	117 kg	
Month 5	147 kg	147 kg	
Month 5.5	184 kg	184 kg	
Month 6	180-220 kg	200 kg	n = 2
Month 7	214 kg	214 kg	

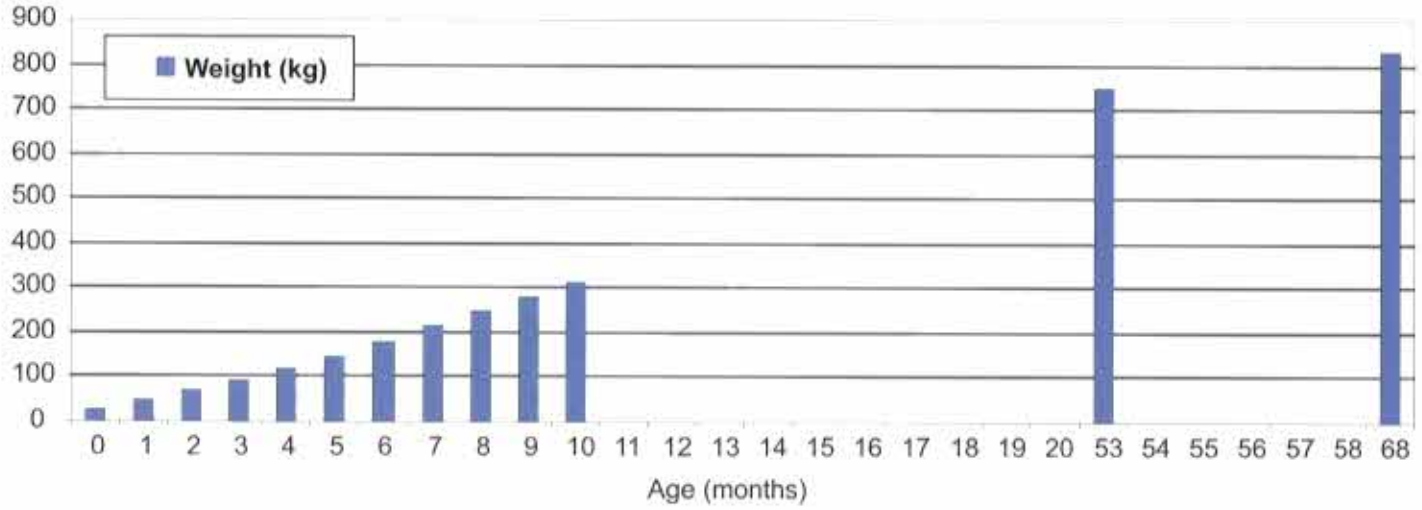
Age	Weight span	Mean weight	Comments
Month 8	249 kg	249 kg	
Month 9	280.5 kg	280.5 kg	
Month 9.5	298 kg	298 kg	
1 year and 1.5 months	510 kg	510 kg	
1 year and 5 months	592 kg	592 kg	
1 year and 6 months	510 kg	510 kg	
2 years and 2 months	765 kg	765 kg	
2 years and 4 months	720 kg	720 kg	
2 years and 5 months	843 kg	843 kg	
2 years and 7.5 months	865 kg	865 kg	
2 years and 9 months	889 kg	889 kg	
2 years and 10 months	895 kg	895 kg	
2 years and 11 months	725-954 kg	863 kg	n = 3
3 years	897 kg	897 kg	
3 years and 1 month	925-991 kg	958 kg	n = 2
3 years and 2 months	931 kg	931 kg	
3 years and 3 months	966-1,022 kg	997.7 kg	n = 3
3 years and 7.5 months	1,042 kg	1,042 kg	
3 years and 8.5 months	930-1,055 kg	992.5 kg	n = 2
3 years and 10 months	1,064 kg	1,064 kg	
3 years and 11 months	1,099 kg	1,099 kg	
4 years and 2.5 months	975 kg	975 kg	
4 years and 4 months	750-992 kg	871 kg	n = 2
4 years and 5 months	990 kg	990 kg	
Adult	**560-1,292 kg**	**951.5 kg**	**13 females; n = 100**

The following table (VONDRA *et al*. 1994, HOLECKOVA, 1995) as well as the graph show the growth of female Jaga DK 14, which was bottle-fed, thus regularly weighed up to near 10 months of age. The female above was measured at the age of 15.5 months together with Etna DK 13 of the same age. The table documents that these female did not differ in size, although one of them was reared solely by mother (Etna), while the other was largely bottle-fed (see hand-rearing chapter on page 132). The female growth chart has been compiled from data of six animals - Jaga DK 14, Jiddah DK 17, Musso DK 20, Deborah DK 27, Maisha DK 28 and Etosha DK 30. The last chart regarding growth summarises the weight data of female Jiddah DK 17, in which the following additional data has been obtained: birth weight (37 kg), weight at the age of 0.5 and 1.5 year and also extensive information at the age of 14-15 years. The chart records the variation in weight in adulthood.

Growth of the black rhino female Jaga DK 14 at Dvur Kralove Zoo

Age	Weight (kg)	Age	Weight (kg)	Age	Weight (kg)
Day 4	26.2	5 months	117	8 months	214
Day 33	47	Day 132	131	Day 225	224
2 months	68.5	6 months	147	9 months	249
Day 70	75.8	Day 163	162.5	Day 255	261
4 months	91	7 months	180	Day 275	280.5
Day 101	100.5	Day 192	192	Day 291	298

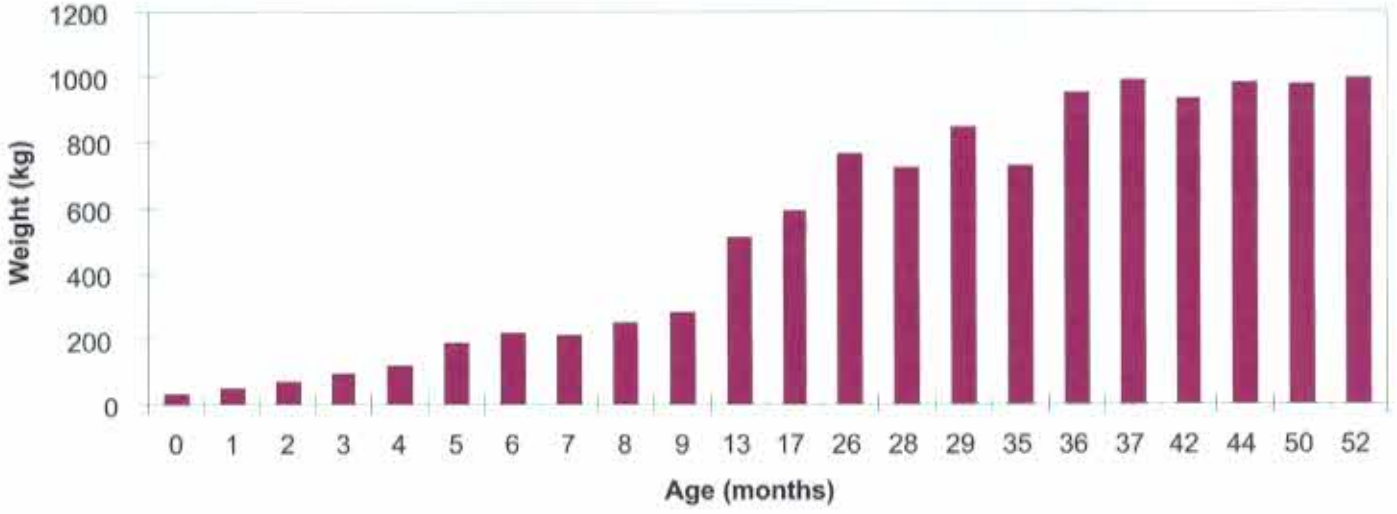
Growth of the black rhino female Jaga



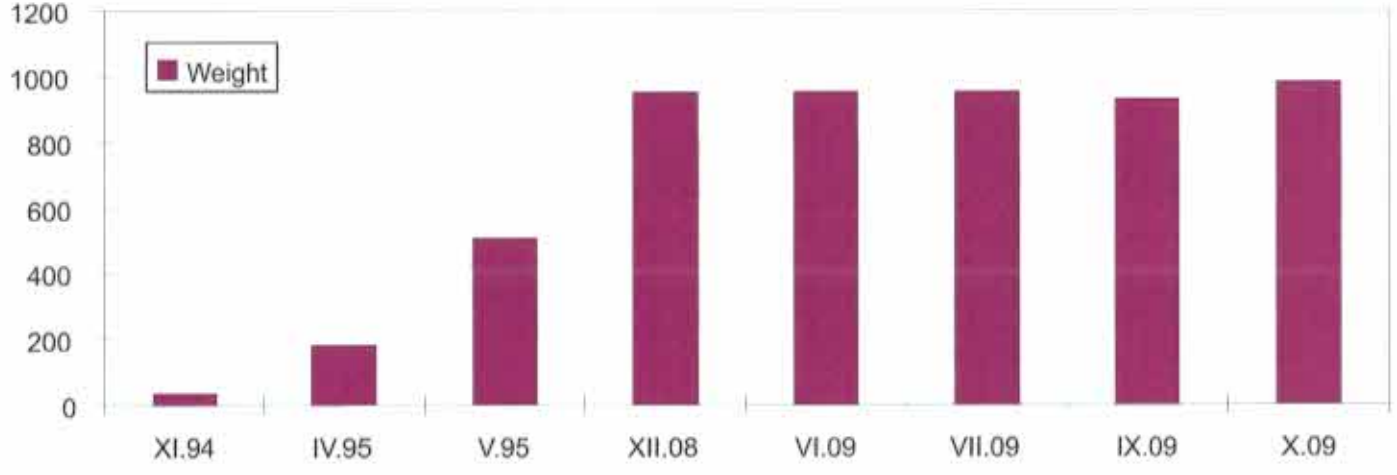
Comparison of sizes of young black rhino females at the age of 15.5 months

Body size	Jaga	Etna
Wither height	114 cm	112 cm
Body length excl. tail	291 cm	284 cm
Chest perimeter	202 cm	215 cm

Growth of black rhino females (n = 5) at Dvur Kralove Zoo prior to 31 December 2009



Growth and weight of Jiddah



Weight gain

Regular weighing of young rhinos successfully produced a number of data concerning weight increments during growth as contained in the tables on next page, which implies that the daily gains in both males and females are about 1 kg per day up to the age of 1 to 2 years; then the growth is getting slower with increments of about three quarters of a kilo per day and in the fourth year this declines to about half a kg per day. Growth is terminated between 4 and 5 years of age.

Weight gain in growing males at Dvur Kralove Zoo prior to 31 December 2009

Date	Age	Weight	Weight gain	Daily weight gain
Jos - M *21 May 1989 Dvur Kralove				
12 May 1989	Day 1	28 kg		
19 Nov 1990	1 year and 6 months	535 kg	+ 507 kg in 556 days	+ 0.91 kg/day
Davu - M *19 February 2006 Krefeld				
20 Feb 2006	Day 2	32 kg		
19 Feb 2007	1 year	350 kg	+ 318 kg in 365 days	0.87 kg/day
5 Nov 2008	2 years and 8.5 months	787 kg	+ 437 kg in 625 days	0.70 kg/day
10 Jun 2009	3 years and 4 months	927 kg	+ 140 kg in 190 days	0.73 kg/day
2 Dec 2009	3 years and 10 months	1,017 kg	+ 90 kg in 175 days	0.51 kg/day
Jamie - M * 2 January 2006 Dvur Kralove				
Birth weight	Estimation	45 kg		
27 Nov 2008	2 years and 11 months	1,066 kg	+ 1,021 kg in 1,059 days	0.96 kg/day
3 Apr 2009	3 years and 3 months	1,155 kg	+ 89 kg in 127 days	0.70 kg/day
Jasper - M * 13 September 1991 Dvur Kralove				
Birth weight	Estimation	35 kg		
6 Oct 1993	2 years and 1 month	720 kg	+ 685 kg in 753 days	0.91 kg/day
Jacob - M *23 June 1991 Dvur Kralove				
Birth weight	Estimation	35 kg		
23 May 1994	2 years and 11 months	890 kg	+ 855 kg in 1064 days	0.80 kg/day
Jabu - M * 1 February 2007 Dvur Kralove				
Birth weight	40 kg (estimated)			
30 Nov 2008	1 year and 10 months	690 kg	+ 650 kg in 667 days	0.97 kg/day
19 May 2009	2 years and 3.5 months	826 kg	+ 136 kg in 170 days	0.8 kg/day
Dzanty - M * 24 November 2007 Dvur Kralove				
Birth weight	Estimation	40 kg		
4 Dec 2008	1 year	481 kg	+ 441 kg in 375 days	1.18 kg/day
8 May 2009	1 year and 5.5 months	668 kg	+ 187 kg in 155 days	1.21 kg/day
24 Nov 2009	2 years	819 kg	+ 151 kg in 200 days	0.76 kg/day

Weight gain in growing females at Dvur Kralove Zoo prior to 31 December 2009

Date	Age	Weight	Weight gain	Daily weight gain
Jaga - F *14 December 1992 Dvur Kralove				
18 Dec 1992	Day 4	26.2 kg		
14 Mar 1993	3 months	91 kg	+ 65 kg in 85 days	0.76 kg/day
15 Jun 1993	6 months	180 kg	+ 89 kg in 93 days	0.96 kg/day
1 Oct 1993	9.5 months	298 kg	+ 118 kg in 108 days	1.09 kg/day
1 Oct 1993	Day 291 from birth	298 kg	+ 272 kg in 287 days	0.95 kg/day as of day four of age
21 Apr 1997	4 years and 4 months	750 kg	+ 452 kg in 1297 days	0.35 kg/day
26 Jul 1998	5 years and 7 months	830 kg	+ 80 kg in 461 days	0.17 kg/day
Sara - F * 24 February 1992 Dvur Kralove				
Birth weight	Estimation	30 kg		
5 Apr 1993	1 year and 1.5 months	510 kg	+ 480 kg in 405 days	1.19 kg/day
14 Jun 1994	2 years and 4 months	720 kg	+ 210 kg in 435 days	0.48 kg/day
Jiddah - F * 15 November 1994 Dvur Kralove				
15 Nov 1994	Day 1	37 kg		
30 Apr 1995	5.5 months	184 kg	+ 147 kg in 166 days	0.89 kg/day
14 May 1996	1 year and 6 months	510 kg	+ 326 kg in 379 days	0.86 kg/day
Deborah * 11 September 2004 Dvur Kralove				
Birth weight	Estimation	35 kg		
29 May 2008	3 years and 8.5 months	930 kg	+ 895 kg in 1,355 days	0.66 kg/day
10 Apr 2009	4 years and 6 months	992 kg	+ 62 kg in 316 days	0.20 kg/day
Maisha - F * 21 December 2005 Dvur Kralove				
Birth weight	Estimation	35 kg		
28 Jun 2006	6 months and 1 week	220 kg	+ 185 kg in 189 days	0.98 kg/day
12 May 2007	1 year and 5 months	592 kg	+ 372 kg in 318 days	1.17 kg/day
28 Nov 2008	2 years and 11 months	954 kg	+ 362 kg in 565 days	0.64 kg/day
21 Nov 2009	3 years and 11 months	1,099 kg	+ 145 kg in 358 days	0.40 kg/day
Etosha - F * 4 September 2006 Dvur Kralove				
Birth weight	Estimation	35 kg		
5 Nov 2008	2 years and 2 months	765 kg	+ 760 kg in 792 days	0.96 kg/day
10 Jun 2009	2 years and 9 months	889 kg	+ 124 kg in 217 days	0.57 kg/day
5 Dec 2009	3 years and 3 months	966 kg	+ 77 kg in 178 days	0.43 kg/day

HAND REARING

Artificial rearing was successfully carried out only once in the black rhino, in the years 1992-1993 (VAHALA *et al.* 1995, VONDRA *et al.* 1994). This involved female Jaga whose birth weight was only about 26 kg; this calf was the first young of the already 22-year-old female Jarca. The reason for the hand rearing was the fact that the calf was so weak that it could not stand while his mother produced little milk.

Because rearing problems had been expected, milk was collected from lactating females, in particular Sali and later on Elvira, and then frozen. The females were milked during the rearing period by keepers, who this way managed to gain and maintain in the frozen state about 3.5 litres of rhino milk. In cooperation with Hrebcin Slatinany (stud farm) where they keep the Kladruby white horse, about 8 l of frozen equine colostrum and milk had been prepared for the rearing.

After the birth, which took place smoothly, the keepers tried to help the calf to drink. Because these efforts were unsuccessful, the little Jaga was fed using a syringe 6 hours after birth with 20 ml of colostrum, which the keepers had obtained from Jaga's mother Jarca. This helped Jaga obtain the necessary immunity from her mother. However, as the calf was still unable to get up, it was fed from the bottle for calves for the first time three hours later (VONDRA *et al.* 1994). Jaga was drinking without problems and as mother Jarca was very quiet, the calf was hand-reared, separated from the mother only for drinking. Jarca was licking the calf, and at the same time, keepers were trying to put Jaga to her mother's udder throughout the first week of rhino's life, but milk was produced only from the left teat (VONDRA *et al.* 1994). Since another female - Elvira - gave birth at the same house only 6 days before Jarca and had enough milk, this female was milked by the keepers daily and small Jaga could be fed in part by rhino maternal milk up to day 50 of her age. At the same time, the keepers were trying to retain the lactation in Jarca and this female was milked periodically as well. During the rearing time, at least 25 l of milk from Jaga's mother Jarca and 70 litres of Elvira's milk could be obtained this way and administered to Jaga. Because the stock of the frozen milk was not any large, Jaga was given additional feeding consisting of the milk replacement based on the dried cow milk. The exact composition of the milk is shown in the following table.

Composition of milk for artificial rearing of the black rhinoceros at Dvur Kralove Zoo

Component	Quantity
Laktina	50 g
Glukopur	40 g
Germ oil	4 ml
Boiled water for bringing volume	To make up 1 litre
Calcium chloratum - once per day as of the day 5	1 coffee spoon
Combinal AD2 - once per day as of the day 5	1 ml
Combinal E - three times per week as of the day 5	0.2 ml

Because Jaga lived with her mother who produced the milk, she began to suck from the mother as well (VONDRA *et al.* 1994), first at the age of 20 days (3 Jan 1993), followed by daily drinking, which however probably made no more than 1-2 litres per day. From the month 4, Jaga was drinking only briefly; within the month 5, Jarca stopped lactating definitely, which was confirmed by the keepers on 23 May (VONDRA *et al.* 1994).

Hand rearing was carried out without any problems except for one brief diarrhoeic disease (26-27 February 1993), which was successfully handled using antibiotics (Chlamoxyl, Duon, Penicilin) and Carbosorb tablets. The physical development and use of prophylactic and medical preparations (VONDRA *et al.* 1994) is summarised in the following table. Jaga went out into the enclosure with her mother for the first time at the age of 3 months (VONDRA *et al.* 1994).

Treatment, prophylaxis and physical development of the black rhino Jaga at Dvur Kralove Zoo

Age (days)	Observations and actions	Comments
1	Showing attacks to the keeper by its immature horn	Natural action against the unknown
2	1st urination - 39 hrs after birth, 1st meconium - 40 hrs after birth	Meconium following massage of the rectum
3	Axetocal, Erevit, Selevit, juvenile arthritis serum	Prevention
7	Tetanus serum	Prevention
14	Juvenile arthritis serum; already regular defecation (once per day)	Prevention; throws faeces on a dung pile and poking them as her mother does
14-18	Duon, Ferridextran	Diarrhoea treatment
16	Tetanus serum	Prevention
31	Axetocal, Erevit	Prevention
42	Juvenile arthritis vaccine	Prevention
48	First evidence of grain feed intake (remnants after her mother)	31 Jan 1993
56	Juvenile arthritis vaccine	Prevention
60	Began take hay as a supplemental feed	12 Feb 1993
65	Began take carrots (unsliced)	17 Feb 1993
75-78	Chlamoxyl, Duon, Penicilin	Diarrhoea treatment - 5 days
86	Tetanus vaccine	Prevention
94	Outdoors with the mother for the first time	18 Mar 1993 at14°C
107	Tetanus vaccine	Prevention
129	Leptospirosis vaccine	Prevention
150	Leptospirosis vaccine	Prevention
453	Weaned and separated from the mother; united with Etna	10 Mar 1994

Undoubtedly, such feeding was the foundation for successful artificial rearing. What's more, Jaga lived with her mother all the time, separated only for feeding. The very positive relationship between the keepers and Jarca played a vital role. In its 45 days of age, Jaga would drink 12 litres of milk per day, increasing her weight with 1 kg per day. The following preparations were added to the milk: Calcimag and Glyphostan from the day 58 over the period of 2 months and Vubimag and Farmaferr from the day 97 up to weaning in the month 15.

Jaga was fully weaned in the month 15 of her age - on day 453 (10 March 1994), fed with 3.5 litres of milk for the last time, and separated from the mother. At the same time, she was united with the daughter of Elvira, which was female Etna, only 6 days old. The original intention to continue on Jaga's bottle-feeding was cancelled because Etna also wanted her bottle of milk (VONDRA *et al.* 1994). At the time of weaning, both females were about the same size, which is suggested by their physical dimensions obtained on 1 April 1994 (more details are available in the table - VONDRA *et al.* 1994).

Jaga was weighed from day 4 up to 291, when her weight was already 298 kg. The following chart shows the growth of Jaga and is supplemented by the data obtained in her adulthood at Port Lympne Zoo, England (ARKS).

At the end of her second month, Jaga kept growing 750 g per day; in month 3 to 5 it was 0.9 kilograms per day, and later until the end of weighing (after 9 months of age) it was nearly 1 kg per day (VONDRA *et al.* 1994).

As part of prevention, Jaga was administered with the following: juvenile arthritis serum (day 3 and 14), tetanus serum (day 7 and 16), juvenile arthritis vaccine (day 42 and 56), tetanus vaccine (day 86 and 107) and leptospirosis vaccine (day 129 and 150).

The second Jarca's young - male Jonas - was born very weak. Jonas weighed only 23 kg and unfortunately was even unable to stand, unlike Jaga. Despite all efforts we failed to keep him alive and the male died when 8 days old, weighing 25 kg.

Zdenek Vondra bottle-feeding Jaga DK 14 (zc)

The composition of maternal milk in the black rhinoceros (VAHALA 1995, GOLTENBOTH *et al.* 1995):

	Details not specified	Jarca, lactation day 57	Elvira, lactation day 65	Lactation month 19	Lactation day 30-330	Replacement milk in DK
Dry matter		9.3%	10.18%	8.1%	8.8%	8.73%
Fat	3.2%	1.3%	2%		0.2%	0.3%
Lactose	4.7%	8.29%	6.83%	6.06%	6.6%	8.43%
Protein	3.3%	0.986%	1.033%	1.54%	1.4%	1.452%
Ashes		0.451%	0.493%	0.34%	0.3%	0.625%
Ca		0.53%	0.49%	0.06%		0.36%
pH		6.3	6.0			6.4

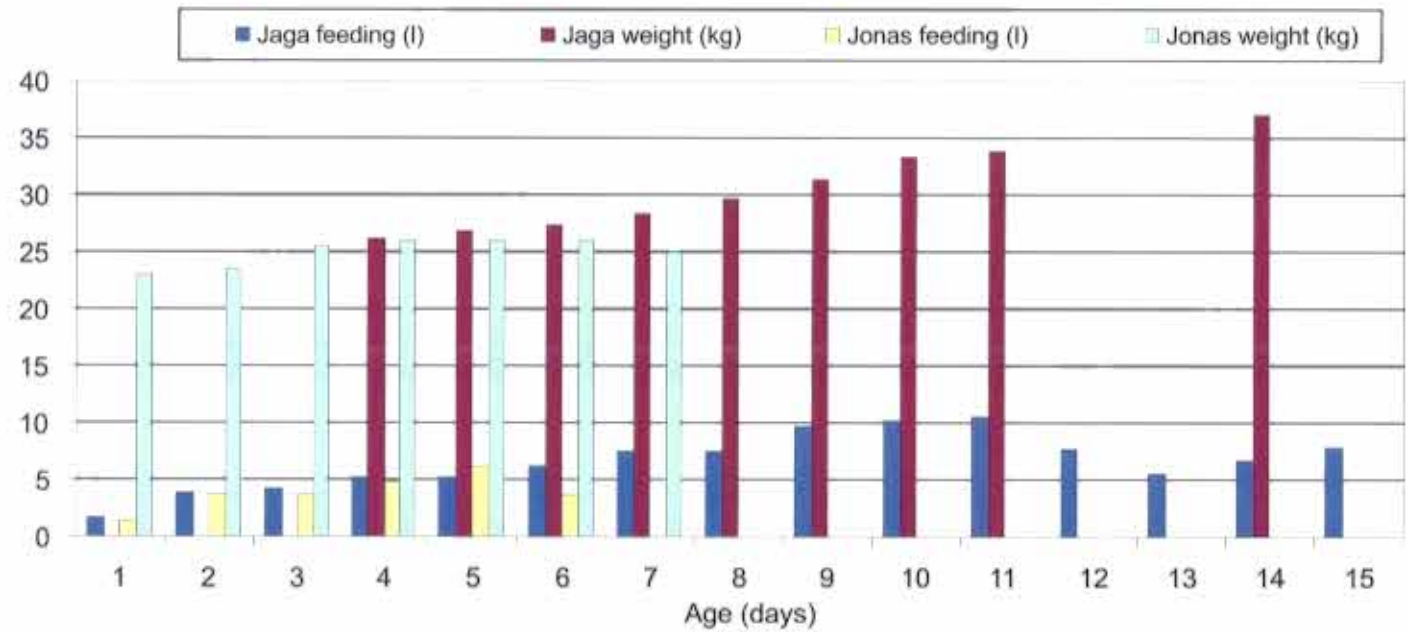
Diet composition of the black rhino Jaga until 60 days old

Milk/Day	1.	2.	3.	4.	5.	10.	15.	20.	25.	30.	35.	40.	45.	50.	55.	60.
Rhino milk Elvira	730	1,690	410	1,350	1,720	3,370	1,800	780	1,710	1,640	650	1,600	1,710	1,400	-	-
Rhino milk Jarca	20	345	690	520	860	1,050	540	200	610	580	600	100	200	350	70	-
Rhino milk Sali	450	80	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Horse colostrum	530	1,690	2,900	1,875	875	-	-	-	-	-	-	-	-	-	-	-
Replacement milk	-	-	120	1,505	1,750	5,700	5,510	7,020	7,280	8,080	7,650	10,030	10,140	11,210	13,700	13,800
Total (ml)	1,730	3,805	4,120	5,250	5,205	10,120	7,850	8,000	9,600	10,300	8,900	11,730	12,050	12,960	13,770	13,800

Information on bottle-feeding of the black rhino Jaga (VAHALA *et al.* 1995, VONDRA *et al.* 1994)

Age	Feeding interval/time	Night break	Dose per feeding	Number of feedings	Drunken quantity per day
Day 1	60-90 min	2.5 hrs - before the dawn	As required by Jaga	Since 9 am 8	1.73 l
Day 2-9	1.5 hrs	4 hrs (12 pm - 4 am)	270-370 ml	11	3.8-9.75 l
Day 10	2 hrs	4 hrs (12 pm - 4 am)	1,400 ml	9	10-11 l
Day 30 to 60	2.5 hrs	6 hrs (12 pm - 6 am)	1,400-2,000 ml	7	10-14 l
Month 2 to 6	3.5 hrs	8 hrs (10 pm - 6 am)	3,000 ml	5	15 l
Month 6 to 10	3.5 hrs	-	3,000-3,500 ml	4	12-14 l
Month 11	8 am, 2 pm, 7 pm	-		3	10 l
Month 13 to 14	9 am, 3 pm	-	3,500 ml	2	7 l
Month 15	12 am		3,500 ml	1	3.5 l

Feeding and growth of bottle-fed black rhinos Jaga and Jonas



Changes in the composition of maternal milk during lactation

In 2006, following the first birth given by a very quiet female Musso (21 December 2005), we managed to obtain milk samples for analysis, taken regularly every week over the period of 3.5 months (from 16 January to 26 April 2006). The laboratory analysis of the samples was carried by EKO-LAB Zamberk; the data obtained are summarised in the table.

Changes in the composition of maternal milk in female Musso, Dvur Kralove Zoo, in 2006

Sampling date	Lactation day	Dry matter (%)	Ash (%)	Fat (v/v)	Lactose (%)	Milk protein (%)
16 Jan	26	10.46	0.24	2.0	5.86	1.76
23 Jan	33	9.36	0.21	0.40	7.17	1.54
30 Jan	40	8.86	0.16	0.50	6.80	1.80
January (mean)		**9.56**	**0.20**	**0.97**	**6.61**	**1.70**
6 Feb	47	8.55	0.15	0.30	6.75	1.78
13 Feb	54	9.19	0.01	0.50	7.25	1.30
20 Feb	61	8.71	0.11	0.50	7.17	1.36
27 Feb	68	8.77	0.03	0.50	7.48	1.51
February (mean)		**8.81**	**0.08**	**0.45**	**7.16**	**1.49**
8 Mar	77	8.85	0,01	1.00	5.99	1.37
13 Mar	82	8.72	0.06	0.80	5.83	1.29
20 Mar	89	8.39	0.12	0.50	5.83	1.14
29 Mar	98	8.69	0.13	0.40	6.07	1.30
March (mean)		**8.66**	**0.08**	**0.68**	**5.93**	**1.28**
5 Apr	105	9.17	0.13	0.70	5.96	1.51
10 Apr	110	8.68	0.10	0.40	6.28	1.46
20 Apr	120	8.60	0.09	0.70	6.44	1.13
26 Apr	126	7.94	0.15	0.60	6.40	1.05
April (mean)		**8.60**	**0.12**	**0.60**	**6.27**	**1.29**

Maximum longevity

At Dvur Kralove Zoo, female Jimmi, a wild-caught rhino from Kenya, achieved the highest age, i.e. more than 39 years. Males Isis (born more than 32 years ago in the U.S.) and Jimm (born over 29 years ago in Dvur Kralove) are still alive. Information about the oldest animals is summarised in the table. The highest age recorded in black rhinos in captivity from 1956 to 1990 was 45 years in one of females and 36 in one of males (KLOS and FRESE 1991). At Detroit Zoo, the U.S., wild-caught male Rudy was euthanised in 2001 at the age of 49 years (FRADRICH and OCHS 2001). JONES (1993) gives the highest recorded age at the eastern black rhinoceros in captivity: 45 years and 10 months (the animal died in 1980). According to the International Studbook (GOLTENBOTH and OCHS 1997), the oldest males that lived in 1996 were 44-46 years, while in females the oldest age category was 40-42 years.

Maximum longevity in black rhinos at Dvur Kralove Zoo prior to 31 December 2008

No.	Name	Sex	Date and place of birth	Date of death	Age
7/7/DK/0	Jimmi	F	February 1970, Kenya	21 Aug 2009	39 years and 6 months
16/14/DK/0	Isis	M	7 Nov 1977 Cincinnati, US	Alive	32 years and 2 months
17/0/DK/3	Jimm DK 3	M	18 Mar 1979 Dvur Kralove	Alive	30 years and 9.5 months
15/0/DK/2	Sali DK 2	F	5 Jul 1978 Dvur Kralove	25 Feb 2006	27 years, 7 months and 22 days
10/10/DK/0	Jarca	F	February 1970 Kenya	8 Sep 1990	26 years and 6 months
19/0/DK/5	Jessi DK 5	F	8 Dec 1984 Dvur Kralove	Alive	25 years and 1 month
29/15/DK/0	Cody	M	20 May 1975 Sydney, Australia	19 May 1999	23 years, 11 months and 29 days
14/0/DK/1	Elvira DK 1	F	2 Oct 1977 Dvur Kralove	25 Feb 1996	18 years, 4 months and 23 days
30/16/DK/0	Mabu	M	23 Jan 1979 Magdeburg, Germany	11 Apr 1994	17 years, 8 months and 26 days

Jimmi, 39 years and 3 months old on 16 May 2009 (dh)

Nutrition and feeding

In terms of zoo husbandry, the black rhinoceros is a food specialist that feeds particularly on leaves of various shrubs and herbs, and occasionally grass. Therefore, determining a correct diet is the most critical and also most difficult in breeding this species. Moreover, there are considerable animal-specific differences in size and the correct estimate of the individual weight without the use of scales is very difficult.

Feeding black rhinoceroses has evolved considerably at Dvur Kralove Zoo through a number of changes during the breeding history. Following the young rhino imports from the wild up to their adolescence, there were in fact no difficulties in rhino management. The basic components of feeding over the years are summed up in the following tables. Water was available to animals in every type of diet.

1971 diet		1972 diet	1973 diet	1974-1976 diet
Young	Sub-adults			
Mush; twice per day	Maize	Hay - ad libitum	Hay - ad libitum	Hay - ad libitum (Except summers since 1975)
Pellets (inc alfalfa pellets)	Pellets - 1 kg/animals (incl. alfalfa pellets)	Summers: Grass; sometimes alfalfa and clover	Summers: Grass Winters: Carrots	Summers: Grass
Milk	Milk - 3 l/animal	Alfalfa pellets Pellets	Alfalfa pellets VD-P2 pellets	Pellets
Glukopur	Oats	Milk	Dried milk	Dried milk
Alfalfa hay - ad libitum		Sugar-beet pomace, 3 times per week	Oats	Sugar-beet pomace
Winters: Carrots, 2-4 times per week Sugar-beet pomace, 2-4 times per week		Carrots, once per week	Bread	
Summers: Browse, 2-4 times per week		Pre-germinated cereals, once per week	VITASA, salt	Winters: Daily - apples, pears, carrots
		From time to time: Mash, VITASA, glucose, beet, salt	Browse	Browse Winters: Sometimes browse and fresh-frozen twigs

From July 1975, the summer diet was simplified to concentrated feedstuffs, browse and green fodder. From July 1976, the summer ration was again simplified to concentrated feedstuffs, green feed and browse. In January 1977, the basic diet composed of hay, concentrated feedstuffs, browse and preserved twigs, sometimes accompanied by carrots, apples and beets. In summer, grass was fed alongside seasonal fruits and vegetables, like cucumbers, Savoy cabbage, tomatoes, cabbage, cauliflower, apples, pears and plums).

The oversimplification of the ration could probably have an effect on worsening health in adolescent black rhinos. In terms of management, the rhinos lived in their own house, and the space conditions could be considered better than ever before. The more surprising was the unexpected death of the first breeding female Elsa in April 1978, who then nursed her six-month calf.

In the second half of 1978, after the death of another female (Zina), the diet of all animals was completely changed, and the then served concentrated feed was replaced with other types of feedstuffs, which had proved following the arrival of the black rhinos in the early 1970s.

After the death of Ken in November 1979, there was another change in diet, now consisting of hay, oats, vegetables, browse, clay with sea salt and Plastin, ground maize, VITASA and browse twice a week.

The following table documents the difference in the diet of the lactating female Elsa (died on 7 April 1978) and Jimmi, who survived almost 40 years.

Comparison of the diet of two female black rhinoceroses at Dvur Kralove Zoo

Elsa + Elvira DK 1 (born 1977)	Jimmi + Jimm DK 3 (born 1979)
Concentrated feedstuffs	Concentrated feedstuffs 15 l/day
Dried milk - only 3 Oct to 22 Nov 1977 and from 20 Dec to January 1978	Dried milk - 1.5 l/day
Fruits - plums, pears, apples, bananas	Fruits and vegetables - 20 l/day
Vegetables - cabbage, Savoy cabbage, celery, peppers, cauliflower, carrots, root parsley	Rice mash - 3 l/day
Green fodder in summer; hay only in winter	Hay - ad libitum
D.C.F. - from time to time	Yeast
Glukopur - from time to time	Salt
As of 22/12/1978: vitamin treatment as follows: B-komplex 1 spoon/day Celaskon - 1 spoon/day Ferronat 10 tablets/day	Farmaferr 10 tablets/day

In the late 1970s and early 1980s, with regard to several deaths of adult black rhinos, a number of dietary components were experimentally tested and diet composition evaluated, resulting in a formulation of pellets developed by the Dvur Kralove Zoo research institute, called ZOO A and ZOO B pellets (SPALA 1986). The modification of the diet in the 1980s are summarised in the following table.

Comparative overview of black rhino diets at Dvur Kralove Zoo in the 1980s

1980 diet	1982 diet	1986 diet
Hay - ad libitum	Hay - ad libitum	Hay - ad libitum
MKP pellets	Oats - 6 l/animal/day	Summers - grass (green fodder)
Rice mash	Crushed oats - 2.3 l/animal/day	ZOO A pellets - 1.3 measur. cup ZOO B - 1.4 measur. cup
Apples, sometime lemons, fruit pomace	Alfalfa pellets - 1.6 l/animal/day	Oats - 4.9 measur. cups
Celery, root parsley, kohlrabi, giant kohlrabi, sometimes carrots, onions, leeks, cauliflower, peppers, tomatoes, cucumbers, potatoes, cabbage, Savoy cabbage, red beets	Vitasa - 3 spoons/animal/day Farmaferr - 3 spoons/animal/day	VITASA - 10 spoons Farmaferr - 2 spoons
From time to time: ground or crushed barley, alfalfa pellets, oats, Solamyl, bran, Hippovit, bread, brewer's yeast	Apples, cabbage, onions, red beet, celery Carrots in winter Summers - green fodder	Browse
Temporarily: Plastin, marine salt, clay, Glukopur, Farmaferr	Browse	Nursing females: dried milk
Browse	Nursing females: dried milk	

An integral part of the black rhino diet is browse, which since 2002 has been served inside the enclosure in upright position, i.e. the branches are mounted in brackets embedded in the ground to simulate the real bush. At the same time, such feeding is a part of rhino enrichment (TOMASOVA 2004).

Fundamental reassessment of diets took place in 1999, when the condition of Isis was so poor that the male's death was expected. Because the rhino was only 18 years old and thin-bodied, his ration was recalculated and found to have a deficit of about 14% nitrogen substances (PTACKOVA - pers. comm.) against the male's weight. Subsequent inspection revealed that males and females without calves were the most lightweight, which could be because offspring and pregnant and nursing females were provided with added milk powder and other feeding improvements. Because a good condition was known to be that of the rhinos based in Port Lympne, London and Berlin, those zoos were contacted and diets compared. The diet was subsequently modified, and the condition of females without calves and males improved. The diet has since included bananas, potatoes, etc. Isis got better, but Elvira, less than 19-year-old female, died. Because at that time it was already discussed that very similar symptoms as those of haemolytic anaemia, which our animals suffered particularly in the past, can be assigned to the excess of iron, which used to be served to suppress haemolytic anaemia), samples of Elvira's organs were sent for testing whether they contained iron or not. As it turned out, Elvira had haemosiderosis of all organs (iron-containing medications began to be administered in the late 1970s), and therefore all supplements containing iron were excluded from the diet. In 2002 and 2003, four animals were treated with potassium humate, which was intended to help flushing iron from the body based on colloidal minerals. These involved males Isis and Jimm, and females Jimmi and Eimi. The treatment consisted in administering 1 tablespoon of the solution in bread 3 times a day for 3 weeks, one-week break and another three weeks of administration. Male Isis completely recovered and became a father again in 2007. Unfortunately, female Eimi died unexpectedly of bacterial infection in 2004, while examination of organs showed continuing haemosiderosis. Eimi's death was sudden and surprising, because the female had a very good physical condition, weighing more than a tonne. The remaining three animals became the oldest ones in the breeding history. Unfortunately, organ haemosiderosis turned out to be the cause of death of Sauron, a relatively young male (less than 13 years) in 2007, and therefore we proceeded to the potassium humate treatment on the remaining rhinos, who had been using Ferrone in the past (i.e. until 2001). Determining whether iron had been flushed from organs or not is difficult in live animals. As a result of age, female Jimmi was euthanised in August 2009, where organ examination revealed that haemosiderosis did persist. Thus, the positive impact of colloidal minerals cannot be clearly demonstrated, although some toxins and iron might have been flushed to some extent (VAHALA pers. comm.).

The change in the pelleted feed in recent years was also of great importance - at first, black rhinos were fed with two types of pellets according to the formula developed directly at Dvur Kralove Zoo (SPALA 1986) and called ZOO A, B and C, which were supplemented with Mazuri pellet feeds over a short period. Currently, rhinos obtain ungulate pellets called ZOO A (manufacturer: De Heus, Bucovice, CR) and rhino pellets called KWANU (manufacturer: FeedNatur Brno, CR) in line with nutritional requirements of the Dvur Kralove Zoo Nutrition Department (PTACKOVA pers. comm.). Nutritional composition of the pellets is presented in the following table.

Nutritional values of pelleted feeds in black rhino feeding at Dvur Kralove Zoo (PTACKOVA 2009)

Pellets/contents	ZOO A	KWANU
Nitrogen substances (N)	155.32 g/kg	130 g/kg
Fat	51.28 g/kg	28 g/kg
Fibre	136.43 g/kg	140 g/kg
Vitamin A	41,221 IU/kg	8,500 IU/kg
Vitamin E	120.10 IU/kg	2,000 IU/kg
Calcium (Ca)	16.95 g/kg	12 g/kg
Sodium (Na)	1.53 g/kg	1.7 g/kg
Phosphorus (P)	12.26 g/kg	8 g/kg

The basis of feeding black rhinos now is quality grass hay including alfalfa hay, supplemented by meadow grass and fresh alfalfa in summer. The basic ration is shown in the following table. In the winter, carrots are fed instead of grass. From spring to autumn, browse is made available from willow, fruit trees, etc. In winter, wheat germs are fed. In summer, Inulin is administered (10 g/animal/day). In nursing females and growing calves, limestone (45 g/animal/day) and skimmed milk powder (0.6 kg/animal/day) is added into the diet.

Base diet of the black rhinoceros at Dvur Kralove Zoo in 2009 (PTACKOVA 2009)

	Hay Grass	Pellets ZOO A	Pellets KWANU	Oats crushed	Ground barley	Bread	Apples	Bananas	Vegetables	Inulin
Male	Ad libitum	2 kg	2 kg	0.3 kg	0.15 kg	1 kg	3 kg	2 kg	5 kg	0.05 kg
Female	Ad libitum	1.3-1.7 kg	1.3 kg	0.3 kg	0.15 kg	1 kg	2 kg	1-2 kg	4 kg	0.05 kg

The diet includes the following supplements: torula 0.1 kg/animal/day, olive oil 0.02 l/kg/animal/day, feeding salt 3 g/kg/animal/day (i.e. 1 teaspoon/week), C - Compositum 10 g/animal/day, and vitamins A, B and E once per month.

Health issues

Throughout the years, internal and external parasites were not an issue in rhinos, except for the period immediately after the arrival from the wild (STEHLIK 1979). There were rare cases of slight tapeworm invasion throughout the years, with the *Anoplocephala* genus responsible (VAHALA pers. comm.). The fundamental problem in the black rhino is that they tend to suffer haemolytic anaemia in captivity. Following the deaths in connection with the disease above in the late 1970s, iron-containing preparations were included in the diet, as animals were showing low blood levels of red blood cells and haemoglobin both throughout and after the period of disorder. As red blood cells disintegrate, iron is flushed into the body and stored in organs in the form of haemosiderine. When dead animals were eventually examined, haemosiderosis confirmed in all organs and excess of iron in the diet found to even intensify storage of surplus iron in tissues - thus increasing haemosiderosis in organs, the zoo ceased to include iron in the diet; indeed, efforts followed to flush iron from the organs using colloidal minerals. When the condition of the animals was worsening, this was usually manifest as a bleeding tail tip and peeling skin. Exposing animals to the UV lamps installed inside the house for about 1 hour per day especially in winter has had a positive effect on the skin. Female Sali DK 2 suffered bloody mucosal erosions in the mouth a number of years, which was treated using a range of ways, with applied high doses of vitamin C eventually proving to be the most effective. In one of the cases, surgery of a purulent molar abscess was performed (Jimm DK 3). The factors having an impact on the deterioration in the condition of animals included diet, especially if animals' weight was not well monitored, but rather only estimated. In one case (Isis), the imbalance of the diet was established because the male suffered around 1999 from worsening condition, skin problems including the tip of the tail, and following a change in feeding and repeated administration of colloidal minerals his condition returned to normal and the accompanying health problems disappeared. Because black rhinos tend to be significantly nervous animals, a preventive calming by Diazepam is practiced, especially at a time before transport or transfer and capture.

The following table lists the causes of deaths as recorded in the post mortem reports (VAHALA 2009). The causes of deaths include age, repeated haemolytic anaemia, pneumonia including fungal pneumonia and kidney failure. A negative role in the deterioration of even relatively young animals might probably be played by haemosiderosis of organs and possibly in some cases, the imbalance of the diet as well. Two cases of mortality occurred in connection with anaesthetising rhinos using Immobilon: male King suffered intestinal volvulus, which occurred following a transfer of the narcotised animal; the second case was heart failure in female Satara once the animal entered the state of narcosis (VAHALA pers. comm.).

According to the International Studbook data for the years 1956-1990, deaths were recorded throughout the year with a maximum in January and December (KLOS and FRESE 1991).

Causes of deaths in the black rhinoceros at Dvur Kralove Zoo prior to 31 December 2009

No	Name	Sex	Died	Age	Cause of death
6/6/DK/0	Elsa	F	7 Apr 1978	7 years	Haemolytic anaemia
4/4/DK/0	King	M	22 Apr 1978	7 years	Died following immobilization - intestinal volvulus
9/9/DK/0	Tuty	F	24 May 1978	7 years	Haemolytic anaemia
5/5/DK/0	Zina	F	26 Jun 1978	8 years	Haemolytic anaemia
2/2/DK/0	Ken	M	8 Nov 1979	9 years and 9 months	Haemolytic anaemia, mediocalcinosis, haemosiderosis of all organs
13/13/DK/0	Satara	F	24 Apr 1981	7 years	Died during immobilization - heart failure, haemosiderosis of all organs
31/0/DK/15	—	F	11 Apr 1994	0	Premature birth - stillborn on day 427 of pregnancy, 24 kg
35/0/DK/18	Jonas	M	12 Dec 1995	8 days	Pneumonia - in hand rearing
14/0/DK/1	Elvira	F	25 Feb 1996	18 years and 5 months	Pneumonia - pulmonary mycosis - Aspergillus, aortic mediocalcinosis, haemosiderosis of all organs
10/10/DK/0	Jarca	F	8 Sep 1996	26 years and 6 months	Mycotic pneumonia, mediocalcinosis, haemosiderosis of all organs
30/30/DK/0	Mabu	M	19 Oct 1996	17 years and 9 months	Pneumonia, mediocalcinosis, haemosiderosis of all organs
29/29/DK/0	Cody	M	19 May 1999	24 years	Pneumonia, nephritis, enteritis
43/0/DK/25	—	F	24 Aug 2002	0	Stillborn, complicated birth
23/0/DK/9	Eimi	F	14 May 2004	13 years and 9 months	Bacterial infection, haemosiderosis of organs
33/4/DK/0	Sali	F	25 Feb 2006	27 years and 8 months	General exhaustion, aortic mediocalcinosis, haemosiderosis of all organs
37/0/DK/20	Musso	F	14 Jul 2007	9 years and 11 months	Mycotic pneumonia, colic, haemosiderosis of all organs
50/0/DK/32	—	M	22 Sep 2007	0	Abortion
32/0/DK/16	Sauron	M	24 Sep 2007	12 years and 11 months	Purulent pneumonia, mediocalcinosis, organ dystrophy, haemosiderosis of all organs
7/7/DK/0	Jimmi	F	21 Aug 2009	39 years	Euthanised for age, unable to stand up
33/0/DK/17	Jiddah	F	25 Dec 2009	15 years	Euthanised while in agony - kidney failure

Exports of black rhinoceroses

Throughout the breeding history, 23 (13.10) black rhinos have been exported from the zoo, where 6 (3.3) individuals were wild caught and the remaining 17 (10.7) were born at Dvur Kralove Zoo; this included 3 (2.1) individuals shipped to the USA, 17 (9.8) distributed around Europe and 3 (2.1) reintroduced to the country of origin - Tanzania. More details are included in the following table.

Overview of black rhino exports from Dvur Kralove Zoo prior to 31 December 2009 (M - male, F - female)

No	Sex	Name	Stdbk #	Departure	Born	Arrival	Comments
1	M	Lord	169	22 Jun 1972 Jacksonville, USA	January 1970, Kenya	22 Aug 1971 Kenya, wild-caught	Died 1999; number of descendants: 1.3
2	F	Lenka	176	22 Jun 1972 Jacksonville, USA	1970 Kenya	22 Aug 1971 Kenya, wild-caught	Died in 1982 without offspring
3	M	Addo	216	20 Apr 1976 Lesna, CR	1971 Kenya	2 Jul 1974 Kenya, wild-caught	Died in 1978 without offspring
4	F	Satara	218	20 Apr 1976 Lesna, CR	1973 Kenya	2 Jul 1974 Kenya, wild-caught	Died in 1981 without offspring
5	M	Murray	171	29 Oct 1980 Wroclaw, Poland	February 1970, Kenya	22 Aug 1971 Kenya, wild-caught	Died in 2009, number of descendants: 1.0
6	F	Sabi	217	23 Apr 1983 Zurich, Switzerland	1972 Kenya	26 Jun 1974 Kenya, wild-caught	Died in 2008; number of descendants: 2.1
7	M	Sado	388	18 Oct 1989 Atlanta, USA	26 Aug 1986 Dvur Kralove	Reared in DK	Lives in Atlanta Zoo (local name: Boma)
8	M	Jos	391	19 Nov 1990 London, UK	21 May 1989 Dvur Kralove	Reared in DK	Died 2004; number of descendants: 0.1
9	F	Sany	417	4 Sep 1991 Hannover, Germany	1 Oct 1989 Dvur Kralove	Reared in DK	Number of descendants until 2005: 1.2
10	M	Eli	386	1 Oct 1992 Magdeburg, Ger.	15 May 1984 Dvur Kralove	Reared in DK	Died 1995; number of descendants: 1.1
11	M	Jasper	450	6 Oct 1993 Leipzig, Germany	13 Sep 1991 Dvur Kralove	Reared in DK	Exchanged with Berlin for female Nane on 1 Oct 1993 Number of descendants until 2004: 1.4
12	F	Nane	437	23 May 1994 Krefeld, Germany	4 Apr 1991 Berlin, Germany	Never arrived, the exchange was carried out through contracts	Obtained based on an exchange with Berlin Zoo; never arrived in Dvur Kralove, the mother of Davu (Stdbk # 970)
13	M	Jacob	438	24 May 1994 Krefeld, Germany	23 Jun 1991 Dvur Kralove	Reared in DK	Until 2005 without offspring
14	F	Sara	481	14 Jun 1994 Leipzig, Germany	24 Feb 1992 Dvur Kralove	Reared in DK	Died 2001; number of descendants: 1.1

No	Sex	Name	Stdbk #	Departure	Born	Arrival	Comments
15	F	Etna	455	16 Nov 1995 Port Lympne, UK	8 Dec 1992 Dvur Kralove	Reared in DK	Number of descendants after 2005: 1.1
16	F	Jaga	456	11 Nov 1999 Port Lympne, UK	14 Dec 1992 Dvur Kralove	Reared in DK	Number of descendants until 2005: 1.0
17	F	Salome	762	26 Nov 2001 Port Lympne, UK	25 Jan 2000 Dvur Kralove	Reared in DK	Had one calf in 2009
18	M	Jeremy	857	11 Apr 2005 Chester, GB	25 Jan 2000 Dvur Kralove	Reared in DK	In 2005 moved to France, in 2009 to Zurich
19	F	Ema Elsa	898	11 Apr 2005 Chester, GB	2 Nov 2002 Dvur Kralove	Reared in DK	Loan, exchanged for her first daughter in 2009 (Bashira)
20	M	Jimmi	283	21 Aug 2007 Zurich, Switzerland	18 Mar 1979 Dvur Kralove	Reared in DK	Moved back to Dvur Kralove on 16 May 2008
21	F	Deborah	924	27 May 2009 Mkomazi NP, Tanzania	11 Sep 2004 Dvur Kralove	Reared in DK	Arrival in Mkomazi NP on 29 May 2009
22	M	Jamie	976	27 May 2009 Mkomazi NP, Tanzania	2 Jan 2006 Dvur Kralove	Reared in DK	Arrival in Mkomazi NP on 29 May 2009
23	M	Jabu	986	27 May 2009 Mkomazi NP, Tanzania	1 Feb 2007 Dvur Kralove	Reared in DK	Arrival in Mkomazi NP on 29 May 2009
In total, 23 (13.10) individuals were exported, of which 3 (2.1) were returned to the wild in Africa.							

Summary

Breeding black rhinos began by capturing juvenile animals in Kenya in 1971, when first ten (4.6) animals were imported from Tsavo National Park, from which a pair was supplied to Florida (USA) a year after. In 1974, additional trio (1.2) was imported from Kenya; in the same year, 4 (2.2) animals left to Wroclaw (Poland), Zurich (Switzerland) and Lesna Zoo in Moravia (CZ). In the beginnings, the animals were managed without any problems, staying together, which was the reason why the father of the first calf born in 1977 was unknown because the mother had been mated by two males kept within the same herd. More two calves were born in 1978 and 1979, respectively. From 1978 to 1981, 5 (2.3) rhinos died, including both adult males. This interrupted the series of successful breeding for 5 years, as the new male, which was obtained from the U.S. in 1983 had yet to reach adulthood. Since 1984, there were already regular births; a total number of rhinos born for the entire period of holding was 35 (13.22) animals, of which three (2.1) were born dead and 31 (11.20) calves were successfully reared. In May 2009, a trio (2.1) of juveniles was reintroduced to Mkomazi National Park, Tanzania, which is a part of the Tsavo Ecosystem. Summary data for each year are shown in the following table.

A group of black rhinos, 24 August 1983 (lh)

Numbers of black rhinos at Dvur Kralove Zoo in the years 1971-2009 (1.0 - male, 0.1 - female)

YEAR	Status as per 1 Jan	Arrival	Departure	Born	Died	Status as per 1 Dec
1971	0	4.6		-		10 (4.6)
1972	10 (4.6)		1.1	-		8 (3.5)
1973	8 (3.5)			-		8 (3.5)
1974	8 (3.5)	1.2	1.0	-		10 (3.7)
1975	10 (3.7)			-		10 (3.7)
1976	10 (3.7)		1.1	-		8 (2.6)
1977	8 (2.6)			0.1		9 (2.7)
1978	9 (2.7)	1.0		0.1	1.3	7 (2.5)
1979	7 (2.5)	0.1		1.0	1.0	8 (2.6)
1980	8 (2.6)	1.0		-		9 (3.6)
1981	9 (3.6)			-	0.1	8 (3.5)
1982	8 (3.5)			-		8 (3.5)
1983	8 (3.5)		1.1	-		6 (2.4)
1984	6 (2.4)			1.1		8 (3.5)
1985	8 (3.5)			-		8 (3.5)
1986	8 (3.5)			1.0		9 (4.5)
1987	9 (4.5)			-		9 (4.5)
1988	9 (4.5)			-		9 (4.5)
1989	9 (4.5)		1.0	1.1		10 (4.6)
1990	10 (4.6)		1.0	0.1		10 (3.7)
1991	10 (3.7)		0.1	2.0		11 (5.6)
1992	11 (5.6)	2.0	1.0	0.3		15 (6.9)
1993	15 (6.9)		1.0	-		14 (5.9)
1994	14 (5.9)		1.1	1.2	0.1	14 (5.9)
1995	14 (5.9)		0.1	1.0	1.0	13 (5.8)
1996	13 (5.8)			0.1	1.2	11 (4.7)
1997	11 (4.7)			0.2		13 (4.9)
1998	13 (4.9)			0.1		14 (4.10)
1999	14 (4.10)		0.1	-	1.0	12 (3.9)

YEAR	Status as per 1 Jan	Arrival	Departure	Born	Died	Status as per 1 Dec
2000	12 (3.9)			1.1		14 (4.10)
2001	14 (4.10)	1.0	0.1	-		14 (5.9)
2002	14 (5.9)			0.2	0.1	15 (5.10)
2003	15 (5.10)			-		15 (5.10)
2004	15 (5.10)			0.1	0.1	15 (5.10)
2005	15 (5.10)		1.1	0.1		14 (4.10)
2006	14 (4.10)			1.1	0.1	15 (5.10)
2007	15 (5.10)		1.0	3.0	2.1	14 (5.9)
2008	14 (5.9)	3.0				17 (8.9)
2009	17 (8.9)		2.1	0.2	0.2	14 (6.8)
Total	-	22 (13.9)	23 (13.10)	35 (13.22)	20 (7.13)	-

BASIC GUIDELINES FOR REARING THE BLACK RHINOCEROS

Based on almost 40 years of experience, principles of breeding and management in Dvur Kralove creating optimal conditions for natural reproduction of black rhinos can be generalized as follows:

1. **Nutrition is critical, so it is desirable to weigh the animals regularly** and respond promptly to the drops in animal weight. In particular, it is necessary to increase timely the ration of nursing females, or cut the nursing period to about 12 months. The diet must be varied and carefully determined to avoid worsening the condition of the mother.
2. **Another problem is nervousness,** which may be however often very individual. Therefore, it is necessary not to expose animals to unnecessary stress and exploit medicinal sedation. An important factor is the quality of keepers who are working intensively with the animals. Timely getting used to changes in young animals is of great importance.
3. **Weaning calves at the age of 12 months or earlier does not have an adverse impact on the development and social behaviour in the black rhino, including the subsequent breeding potential.** If calves are weaned earlier, which results in more intense care by the keeper, they seem to be slightly better adapted to the pitfalls of captive breeding than those weaned later. The least stressful weaning procedure is that when the young or the mother is moved away to another house and the calf is immediately associated with another young rhino, including those of other rhino species. At the same time, associating the calf with an individual about a year or more older or grouping with 2-3 other young animals is not a problem.
4. **The first pairing is an animal-specific process.** It is suitable when an inexperienced female is introduced to an experienced male or sub-adults are left to grow up together, which is again a very individual matter, as sometimes over-aggressiveness of a young male may be an issue. Therefore, introducing inexperienced males to experienced females and grouping males with a pair or trio of friendly females has worked well. Keeper's overseeing to make sure the male aggression does not lead to the "betrayal" of the female is important. Introducing should substantially take place in the enclosure, within a sufficient area and under supervision.
5. **Monitoring the cycle and pregnancy in females using faeces testing is fundamental,** allowing earlier separation of females from males and thus prevent aggressive behaviour, leaving pregnant females at rest. Males can mostly walk outdoors with females every day, even if the female is pregnant; the female will usually become aggressive to the male after several months of gestation, through which the uniting is cancelled. Occasionally, a male being connected with a female outside her oestrus period may be unpredictably aggressive and therefore requires an individual approach - such males should be associated with females only during oestrus. If animals are tolerant to each other, leaving them together in the enclosure allows extending the length of stay outdoors, which is desirable in the period of the year with a favourable climate.

6. **When the female is about to give birth, timely isolation into a separate box is necessary,** where a temporary barrier between the fence openings above the ground is required to prevent the calf to escape from the box. **Monitoring the process of birth and the behaviour of the female after birth using CCTV with a recording feature is ideal;** this will allow evaluating the behaviour of mother and calf, as well as monitoring nursing. For a better stability of the calf when trying to stand up after birth, sprinkling little sand around the box is advisable, which depends on the slipperiness of the wet floor.
7. **Health problems include haemolytic anaemia or black urination; however, the latter may have a different cause.** The treatment should not involve iron-containing preparations, which cause haemosiderosis of organs.
8. **Timely introduction of young females who grow adult around the year 4 to 5 to a male, who is ideally experienced and calm, is important.** It is therefore desirable to have at least 2 males, ideally in each of the houses.
9. **Adult males living in the same house must be located as far from each other as possible and use different enclosures;** nonetheless, the presence of two males may positively influence the regular reproduction.
10. **Rhinos should walk outdoors daily,** in the summer they should ideally have a permanent access out and in, while in winter they can be generally released out even in frosts of -5° to -8°C for a short period, but care should be taken to avoid frostbites of ears. Rhinos like wallowing in the snow; however, staying outdoors may not be too long.
11. **Mud baths should be available to rhinos in summer months;** showering is also useful, but that should not be carried out in the cold months. It is particularly important in winter that humidity inside the house is not high; therefore, neither washing the boxes nor showering the animals is desirable.
12. **In winter, skin problems are manifest, which can be improved through periodic exposure to UV lamps.** Any problem with skin may indicate other health problems, as well as imbalances in the diet.
13. **In hand rearing, the young should be left with the mother and separated only for feeding.** Feeding calves by a horse colostrum after birth and then by maternal horse and rhino milks the first weeks has worked well. In case of hand rearing, making a stock of frozen horse and rhino milk is useful. Leaving the calf grow in the company of the mother even if hand-reared may restore lactation and subsequent nursing.
14. **For some males, especially older and inexperienced or those who have not mated for a long time, a problem with inserting the penis may appear;** if that is the case, the female should be fed near the fencing so that an experienced keeper may assist the male with inserting the penis, which is then normally not needed in future mating attempts.

Jane Lee DK 22 (right) and Mweru, 11 August 2008 (dh)

The overview contains basic historical information about the individual black rhinos that were in possession of or owned by Dvur Kralove Zoo.

History of black rhino keeping at Dvur Kralove Zoo prior to 31 December 2009 (M - male, F - female)

No Name	Sex	ISB/ESB # ARKS #	Born	Arrival in DK Parents	Departure from DK	Died	Comments
1/1/DK/0 **Lord**	M	169 058001	January 1979 Kenya	22 Aug 1971 Kenya, wild-caught	22 Jun 1972 Jacksonville, USA	22 Apr 1978 San Antonio	
2/2/DK/0 **Ken**	M	170 058002	January 1979 Kenya	22 Aug 1971 Kenya, wild-caught		8 Nov 1979 Dvur Kralove	1st breeding male
3/3/DK/0 **Murray**	M	171 058004	February 1970, Kenya	22 Aug 1971 Kenya, wild-caught 2 Oct 1980, Wroclaw, Poland	29 Oct 1974, Wroclaw, Poland 23 Apr 1983, Zurich, Switzerland	2009, Tallinn, Estonia	Loaned from Poland, Lived in Tallinn Zoo since 12 Sep 1988
4/4/DK/0 **King**	M	172 058003	1970 Kenya	22 Aug 1971 Kenya, wild-caught		22 Apr 1978 Dvur Kralove	2nd breeding male
5/5/DK/0 **Zina**	F	173 058005	1969 Kenya	22 Aug 1971 Kenya, wild-caught		26 Jun 1978 Dvur Kralove	
6/6/DK/0 **Elsa**	F	174 058006	1970 Kenya	22 Aug 1971 Kenya, wild-caught		7 Apr 1978 Dvur Kralove	1st breeding female
7/7/DK/0 **Jimmi**	F	175 058008	February 1970, Kenya	22 Aug 1971 Kenya, wild-caught		21 Aug 2009 Dvur Kralove	3rd breeding female
8/8/DK/0 **Lenka (Bonnie)**	F	176 058007	1970 Kenya	22 Aug 1971 Kenya, wild-caught	22 Jun 1972 Jacksonville, USA	17 Apr 1982 Columbus, USA	
9/9/DK/0 **Tuty**	F	177 058010	1970 Kenya	22 Aug 1971 Kenya, wild-caught		24 May 1978 Dvur Kralove	
10/10/DK/0 **Jarca**	F	178 058009	February 1970, Kenya	22 Aug 1971 Kenya, wild-caught		8 Sep 1996 Dvur Kralove	7th breeding female
11/11/DK/0 **Addo**	M	216 058013	1971 Kenya	2 Jul 1974 Kenya, wild-caught	20 Apr 1976 Lesna, CR	31 Jan 78 Lesna, CR	
12/12/DK/0 **Sabi**	F	217 058011	1972 Kenya	26 Jun 1974 Kenya, wild-caught	23 Apr 1983, Zurich, Switzerland	13 Apr 2008 Zurich, Switzerland	2nd breeding female
13/13/DK/0 **Satara**	F	218 058013	1973 Kenya	2 Jul 1974 Kenya, wild-caught 14 Jul 1979 Lesna	20 Apr 1976 Lesna, CR	24 Apr 1981 Dvur Kralove	Loaned from Lesna in 1979
14/0/DK/1 **Elvira DK 1**	F	244 058014	2 Oct 1977 Dvur Kralove	Reared in DK Elsa/Ken?King?		25 Feb 1996 Dvur Kralove	4th breeding female

No Name	Sex	ISB/ESB # ARKS #	Born	Arrival in DK Parents	Departure from DK	Died	Comments
15/0/DK/2 **Sali DK 2**	F	282 058015	5 Jul 1978 Dvur Kralove	Reared in DK Sabi/Ken		25 Feb 2006 Dvur Kralove	
16/14/DK/0 **Isis (Bubba)**	M	268 058016	3 Nov 1977 Cincinnati	17 Nov 1977 Cincinnati, USA			3rd breeding male
17/0/DK/3 **Jimm DK 3**	M	283 058017	18 Mar 1979 Dvur Kralove	Reared in DK Jimmi/King 16 May 08, Zurich, Switzerland	21 Aug 2007 Zurich, Switzerland		5th breeding male, Breeding loan, Returned from loan
18/0/DK/4 **Eli DK 4**	M	386 058018	15 May 1984 Dvur Kralove	Reared in DK Elvira/Isis	1 Oct 1992, Magdeburg, Germany	26 Feb 1995, Magdeburg, Germany	4th breeding male Death - infection
19/0/DK/5 **Jessi DK 5**	F	378 058019	8 Dec 1984 Dvur Kralove	Reared in DK Jimmi/Isis			6th breeding female
20/0/DK/6 **Sado DK 6**	M	388 058020	26 Aug 1986 Dvur Kralove	Reared in DK Sali/Isis	18 Oct 1989 Atlanta, USA		Named Boma in Atlanta
21/0/DK/7 **Jos DK 7**	M	391 058021	21 May 1989 Dvur Kralove	Reared in DK Jimmi/Isis	09 Nov 1990 London, GB		
22/0/DK/8 **Sany DK 8**	F	417 058022	1 Oct 1989 Dvur Kralove	Reared in DK Sali/Isis	4 Sep 1991 Hannover, Ger.		
23/0/DK/9 **Eimi DK 9**	F	431 058023	24 Aug 1990 Dvur Kralove	Reared in DK Elvira/Isis		14 May 2004 Dvur Kralove	
24/0/DK/10 **Jacob DK 10**	M	438 058024	23 Jun 1991 Dvur Kralove	Reared in DK Jessi/Eli	24 May 1994 Krefeld, Ger.		
25/0/DK/11 **Jasper DK11**	M	450 058025	13 Sep 1991 Dvur Kralove	Reared in DK Jimmi/Isis	6 Oct 1993 Leipzig, Ger.		
26/0/DK/12 **Sara DK 12**	F	481 058026	24 Feb 1992 Dvur Kralove	Reared in DK Sali/Jimm	14 Jun 1994 Leipzig, Ger.		
27/0/DK/13 **Etna DK 13**	F	455 058027	8 Dec 1992 Dvur Kralove	Reared in DK Elvira/Jimm	16 Nov 1995 Port Lympne, GB		
28/0/DK/14 **Jaga DK 14**	F	456 058028	14 Dec 1992 Dvur Kralove	Reared in DK Jarca/Jimm	11 Nov 1999 Port Lympne, UK		
29/15/DK/0 **Cody**	M	260 058029	20 May 1975 Sydney, Australia	10 Dec 1992 Berlin Zoo, Germany	-	19 May 1999 Dvur Kralove	
30/16/DK/0 **Mabu**	M	277 058030	23 Jan 1979 Magdeburg, Germany	1 Oct 1992, Magdeburg, Germany	-	19 Oct 1996 Dvur Kralove	

No Name	Sex	ISB/ESB # ARKS #	Born	Arrival in DK Parents	Departure from DK	Died	Comments
31/0/DK/15 **DK 15**	F	539 058031	11 Apr 1994 Dvur Kralove	Reared in DK	-	11 Apr 1994 Dvur Kralove	Stillborn on day 427 of pregnancy
32/0/DK/16 **Sauron DK 16**	M	541 058032	28 Oct 1994 Dvur Kralove	Reared in DK Sali/Cody	-	24 Sep 2007 Dvur Kralove	
33/0/DK/17 **Jiddah DK 17**	F	540 058033	15 Nov 1994 Dvur Kralove	Reared in DK Jessi/Mabu		25 Dec 2009 Dvur Kralove	Euthanised - kidney failure
34/0/DK/0 **Nane**	F	437 058034	4 Apr 1991 Berlin Zoo, Germany	Exchange with Berlin Zoo - loaned to Berlin as of 1 Oct 1993	23 May 1994 Krefeld, Germany		Never arrived in Dvur Kralove; exchanged in 1993 and then sold in 1994
35/0/DK/18 **Jonas DK 18**	M	562 058035	4 Dec 1995 Dvur Kralove	Reared in DK Jarca/Cody	-	12 Dec 1995 Dvur Kralove	Died during an attempt at hand rearing
36/0/DK/19 **Elba DK 19**	F	619 058036	5 Sep 1996 Dvur Kralove	Reared in DK Eimi/Cody			
37/0/DK/20 **Musso DK 20**	F	678 058037	20 Aug 1997 Dvur Kralove	Reared in DK Sali/Jimm		14 Jul 2007 Dvur Kralove	Full name: Ssang Yong Musso
38/0/DK/21 **Jola DK 21**	F	685 058038	25 Oct 1997 Dvur Kralove	Reared in DK Jessi/Mabu		-	
39/0/DK/22 **Jane-Lee DK 22**	F	689 058039	24 Jan 1998 Dvur Kralove	Reared in DK Jimmi/Isis		-	
40/0/DK/23 **Salome DK 23**	F	762 058040	25 Jan 2000 Dvur Kralove	Reared in DK Sali/Jimm	26 Nov 2001 Port Lympne, UK	-	
41/0/DK/24 **Jeremy DK 24**	M	857 058041	21 Dec 2000 Dvur Kralove	Reared in DK Jessi/Jimm	11 Apr 2005 Chester, UK	-	2009 loaned to Zurich
42/17/DK/0 **Mweru**	M	659 058042	12 Sep 1996 Port Lympne, UK	29 Nov 2001 Port Lympne, UK		-	
43/0/DK/25 DK 25	F	897 058043	24 Aug 2002 Dvur Kralove	Reared in DK Eimi/Sauron	-	24 Aug 2002 Dvur Kralove	Stillborn
44/0/DK/26 **Ema Elsa DK 26**	F	898 058044	2 Nov 2002 Dvur Kralove	Reared in DK Elba/Jimm	11 Apr 2005 Chester, GB		Loaned until 2009; to be exchanged for Bashira
45/0/DK/27 **Deborah DK 27**	F	924 058045	11 Sep 2004 Dvur Kralove	Reared in DK Jiddah/Jimm	27 May 2009 Mkomazi NP, Tanzania		Arrival at Mkomazi NP, Tanzania, on 29 May 2009

No Name	Sex	ISB/ESB # ARKS #	Born	Arrival in DK Parents	Departure from DK	Died	Comments
46/0/DK/28 **Maisha DK 28**	F	965 058046	21 Dec 2005 Dvur Kralove	Reared in DK Musso/Isis	-		
47/0/DK/29 **Jamie DK 29**	M	967 058047	2 Jan 2006 Dvur Kralove	Reared in DK Jessi/Sauron	27 May 2009 Mkomazi NP, Tanzania	-	Arrival at Mkomazi NP, Tanzania, on 29 May 2009
48/0/DK/30 **Etosha DK 30**	F	976 058048	4 Sep 2006 Dvur Kralove	Reared in DK Elba/Jimm	-	-	
49/0/DK/31 **Jabu DK 31**	M	986 058049	1 Feb 2007 Dvur Kralove	Reared in DK Jola/Isis	27 May 2009 Mkomazi NP, Tanzania	-	Arrival at Mkomazi NP, Tanzania, on 29 May 2009
50/0/DK/32 **DK 32**	M	987 058050	22 Sep 2007 Dvur Kralove	Reared in DK Jane Lee/Mweru	-	22 sep 2007 Dvur kralove	Premature birth
51/0/DK/33 **Dzanty DK 33**	M	988 058051	24 Nov 2007 Dvur Kralove	Reared in DK Jiddah/Jimm	-	-	
52/18/DK/0 **Davu**	M	970 058052	19 Feb 2006 Krefeld, Germany	3 Apr 2007 Krefeld, Germany	-	-	
53/19/DK/0 **Baringo II**	M	483 058053	3 Dec 1992 Port Lympne, UK	6.6.2008 Port Lympne, UK	-	-	
54/0/DK/34 **Eva DK 34**	F	? 058054	8 Dec 2009 Dvur Kralove	Reared in DK Elba/Baringo II			
55/0/DK/35 **Jasmina DK 35**	F	? 058055	13 Dec 2009 Dvur Kralove	Reared in DK Jessi/Baringo II			
56/0/DK/0 **Bashira**	F	? -	15 May 2009 Chester, UK	Kept in Chester			To be exchanged for Ema Elsa (on loan) once weaned

Explanation for figures: 25/0/DK/11: 25 - Historical (time) serial number of individual at Dvur Kralove Zoo
0 - Historical serial number of import to Dvur Kralove Zoo
DK - Dvur Kralove Zoo symbol
11 - Historical serial number of birth at Dvur Kralove Zoo

Deborah and Jamie in the enclosure inside the bush, area 1,600 m^2; 27 June 2009 (dh)