

The Black Rhino Sanctuaries of Kenya

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The purpose of this article is to show that the policy adopted by Kenya in 1984 of creating rhino sanctuaries has been a success over the last four years. This is qualified by the fact that the areas showing the largest increases in rhino numbers, Nairobi National Park and Solio Ranch Game Reserve, were stocked in the late 1960s and early 1970s long before the term 'rhino sanctuary' had been coined. As mentioned in a previous *Pachyderm*, the established rhino sanctuaries are now beginning to show the population growth which it was hoped they would promote, in addition to providing security from poaching either by fencing, alarms, armed patrols or a combination of these.¹

Sanctuaries and Rhinos

The total number of black rhinos remaining in Kenya is between 370 and 400 animals. The majority of these animals are located in 11 well protected areas which come under the general heading of rhino sanctuaries. None of these areas has more than 60 rhinos and of the areas concerned, six are ring fenced, three are partly fenced and two are open. Data from these 11 major protected rhino populations are shown in Table I. Two sanctuaries are at an early stage of stocking and development; the completed 93 km² Ol Pejeta Ranch Game Reserve has received only 4 males so far and the Tsavo Ngulia sanctuary, being extended this year to 73 km², has been stocked with six females and one male. Each of these sanctuaries eventually should be stocked with at least 20 rhinos in more balanced sex ratios.

In addition to the total of 285 black rhino in sanctuaries, a WWF-funded census has produced an estimated number of 85-100 rhinos living outside these areas. There still exist significant breeding populations of 20 in the Ngeng Valley and 12 in the Loita Hills. Other animals are widely separated and include rhinos still remaining in areas which have been heavily poached, such as Tsavo National Park outside the Ngulia sanctuary. Many of these 'outlier' rhinos are isolated and non-breeding individuals living in remote and largely unprotected areas. Although several have been captured since 1984, in particular to stock the Lewa Downs and Tsavo Ngulia rhino sanctuaries, the remaining outliers, almost by definition, are very difficult to locate and capture and hence costly to translocate.

Management of Sanctuaries

Apart from protection, the aim of the sanctuaries is to build up the number of rhinos as quickly as possible. In the absence of an adaptive management system which would maintain a defined balance of age structure and sex ratio, a fixed stocking rate approach is appropriate, particularly in the relatively small ring-fenced sanctuaries which range in area from 40 to 142 km² with an average of 55 km².² Initial estimates of the carrying capacities of the rhino sanctuaries have been calculated and are shown in Table 2. For each of the ring-fenced sanctuaries and Nairobi National Park the Ecological Carrying Capacity (ECC) was estimated and three-quarters of this figure was taken as the

Table I
The Black Rhinoceros in Kenya: Population Statistics as at the End of 1988

SANCTUARY: TYPE and Name	Males				Females				Unknown sex				TOTAL
	Adults	Sub- adult	Calves	Sub- total	Adults	Sub- adult	Calves	Sub- total	Adults	Sub- adult	Calves	Sub- total	
	>6yr	4-6yr	<4yr	♂	>6yr	4-6yr	<4yr	♀	>6yr	4-6yr	<4yr	?	
RING-FENCED													
Nakuru NP	8	3	0	11	5	2	0	7	0	0	2	2	20
Ngulia RS	1	0	0	1	5	1	0	6	0	0	2	2	9
Solio GR*	16	2	8	26	19	5	6	30	0	0	2	2	58
Lewa Downs RS*	1	1	1	3	5	1	4	10	0	0	0	0	13
Ol Jogi GR*	1	3	1	5	3	1	0	4	0	0	1	1	10
Ol Pejeta GR*	2	2	0	4	0	0	0	0	0	0	0	0	4
	29	11	10	50	37	10	10	57	0	0	7	7	114
PART-FENCED													
Nairobi NP	15	9	3	27	18	6	5	29	0	0	1	1	57
Aberdare NP ^S	7	1	2	10	9	3	31	5	7	?	?	12	37
Laikipia R*	19	3	1	23	10	4	1	15	3	0	2	5	43
	41	13	6	60	39	13	9	59	3	0	3	18	137
UNFENCED													
Masai Mara GR	5	1	3	9	11	1	2	14	1	0	1	2	25
Amoseli NP	4	1	0	5	2	1	0	3	0	0	1	1	9
	9	2	3	14	13	2	2	17	1	0	2	3	34
TOTALS	79	26	19	124	89	25	21	133	4	0	12	28	285

NP = National Park GR = Game Reserve RS = Rhino Sanctuary R = Ranch * = Private Land ^S = Aberdares National Park Salient

number of rhinos the area should normally support, i.e. a management level of 75% of ECC. Rhinos surplus to this number would have to be removed to maintain maximum breeding output and adequate food supply. Calculation of such management levels is at present inappropriate for the Aberdares Salient, Laikipia Ranch, Masai Mara Game Reserve and Amboseli National Park, where, in each case, rhinos exist in a small and relatively secure but open area contained within a much larger potential distribution range. Carrying capacity in these open areas is primarily determined by the limits of the zone of security rather than ecological bounds

Breeding and Possible Problems

Indicators of breeding performance over the last four years are also given in Table II. Known births and deaths show that there have been 3½ times more births than deaths over the period and an approximate 5% annual increase in numbers overall.

The limitations on breeding output in high density rhino populations require much further study: the relationship between the effect of a given density of rhino and other browsers on vegetation and the rate of population increase may be complex. For example, a very marked over-browsing of a favoured species (*Acacia drepanolobium*) by rhinos in a high density of 1-1½ per km² on Solio Ranch Game Reserve, a small 56 km² area, as yet has had little or no deleterious influence on their very

high breeding output. However, rhino populations exceeding the ECC of large areas have clearly suffered detrimental effects. Reduced calving as density increased has been recorded in the Central Complex Reserves in Zululand.³ During the late 1960s, for areas of Tsavo National Park where rhinos were in a very high density of 0.9-1.4 rhino per km², Goddard noted reduced cow-calf ratios and lower percentages of calves compared to the values for animals living in low density areas.⁴

Recruitment rates recorded in the sanctuaries in recent years have varied considerably. An exceptionally high annual birth-rate of 15% from 1980-1986 at Solio Ranch, where virtually every adult female had a calf at foot, compares with a low recruitment of 2½% from 1986-89 at Laikipia Ranch, where there have been twice as many adult males as adult females and poor breeding performance from the latter. Solio Ranch has achieved a 12% net annual rate of increase while Nairobi National Park rhino population has grown at an annual rate of only 3% since stocking ceased in 1968.⁵ Annual rates of recruitment for other parks and reserves and at various dates are shown in Table III.

Under present conditions the total capacity of the Kenya rhino sanctuaries is about 680 rhinos and, at a high 10% rate of recruitment, this figure could be easily bred from the present nucleus of 285 rhinos within the next ten years. By the turn of the century and certainly thereafter, the emphasis must be on restocking the large areas of former rhino distribution that remain in both highland and lowland areas of Kenya such as the

Table II
The Black Rhinoceros in Kenya: Management and Overall Breeding Performance from 1986 to 1989

SANCTUARY: TYPE and Name	Total	Management					Breeding			Births & Deaths				Census Rating ⁷
		Area of Sanctuary km ²	Density of Rhinos km ²	Management Level	Carrying Capacity ⁶	Existing Surplus of Rhinos	Known Sex Ratio Male/Female	% of Adult Cows with Calves	% of Calves in Population	Total Births 1986-89	Total Births in 1989	Total Deaths 1986-89	Total Deaths in 1989	
RING-FENCED														
Nakuru NP	20	142	0.13	71	53	0	1.57	40	10.0	2	0	1	0	1
Ngulia RS	9	73	0.12	73	55	0	0.17	40	22.2	2	2	1	2	1
Solio GR*	58	56	1.04	56	42	16	0.87	84	27.6	17	5	1	0	1
Lewa Downs RS*	13	40	0.33	26	20	0	0.30	100	38.5	4	0	0	0	1
Oi Jogi GR*	10	73	0.14	20	15	0	1.25	67	20.0	3	1	1	1	1
Oi Pejeta GR*	4	93	0.04	93	70	0	-	-	0.0	0	0	0	0	1
	114	1135	0.10	337	253	16	0.88	73	24.7	28	8	4	3	
PART-FENCED														
Nairobi NP	57	117	0.49	60	45	12	0.93	50	15.8	12	2	5	1	1
Aberdare NP ^S	37	70	0.53	50	(50)	0	0.67	56	28.0	5	0	0	0	1
Laikipia R*	43	397	0.11	100	(100)	0	1.53	40	9.3	5	1	2	1	1
	137	584	0.23	210	195	12	1.02	46	13.1	22	3	7	2	
UNFENCED														
Masai Mara GR	25	1690	0.01	80	(80)	0	0.64	55	24.0	7	0	1	0	1
Amboseli NP	9	390	0.02	50	(50)	0	1.67	50	11.1	2	2	1	0	1
	34	2080	0.02	130	130	0	0.82	54	20.6	9	2	2	0	
TOTALS	285	3410	0.08	679	580	28	0.93	58	18.2	59	13	13	5	

NP = National Park GR = Game Reserve RS = Rhino Sanctuary R = Ranch * = Private Land ^S = Aberdares National Park Salient

Table III
Annual Recruitment Rates of Black Rhinoceros Populations

Area	Recruitment rate %	Authority
Olduvai Gorge	7.2	Goddard ⁸
Ngorongoro Crater	7.0	Goddard ⁸
Tsavo National Park	10.9	Goddard ⁹
	8.2	Western and Sindiyo ¹⁰
		(from Goddard ⁹ data)
Amboseli National Park	6.8	Western and Sindiyo ¹⁰
Kruger National Park	9.0	Hall-Martin ¹¹
Hluhluwe Game Reserve	5.3	Hitchins and Anderson ¹²
Umfolozzi Game Reserve	11.0	Hitchins and Anderson ¹²
Addo Elephant National Park	9.6	Hall-Martin ¹³
Ndumu Game Reserve	8.9	Conway and Goodman ¹⁴
Solio Ranch Game Reserve	15.0	Brett ¹⁵

Aberdares and Tsavo National Parks. Ngulia sanctuary provides an example of a possible management approach. It is located deep inside Tsavo and has a fence designed purely to contain rhino for breeding while anti-poaching patrols maintain a zone of security extending far beyond the sanctuary area: surplus rhinos can simply be released to restock the surrounds and breed with the 'wild' population.

Managing a Metapopulation

Apart from the necessities of continuing to protect rhinos within sanctuaries and ensuring the integrity and security of future dispersal areas, other long-term management guidelines have already been recommended for maintaining demographic stability and genetic variability in rhino populations. These recommendations include ensuring that 15-20 unrelated breeding animals are gathered together to found a new population, that the habitat is capable of carrying at least 200 rhinos, and that one or two unrelated adults are moved into each population



A 3rd generation three year-old female black rhino born in Solio Ranch Game Reserve

every generation or 6 to 15 years. The latter will involve the movement of animals between the Kenya sanctuaries as well as the capture and translocation of outliers.

However, there are a number of practical difficulties involved with moving rhinos between populations and some are enumerated below: the list should not be considered exhaustive:

1. In an area with a high rhino density there is often aggression between introduced rhinos and residents. When confined in small, ring-fenced sanctuaries, dominant males may be very aggressive and this behaviour is not confined only to males.¹⁶ In Nakuru National Park a sub-adult female introduced from Solio Ranch in 1987 was so repeatedly attacked by an unknown rhino assailant that she had to be translocated. High levels of aggression, predominantly between adult males, has been recorded in artificially high density populations such as that in Addo Elephant National Park where there were 2 to 5 rhinos per km².¹⁷

2. The degree of success in breeding to be expected of rhinos brought into an area is unknown; particularly for males introduced to confined areas where mating is exclusive to one or a few dominant males.

3. The suitability of a particular rhino for immobilization varies and often relates to age and sex: females may be heavily pregnant or have small calves at foot. The home range of the animal is also a factor in deciding whether to capture: areas close to rivers or swamps make successful darting problematic.

4. The availability of animals of the required sex is limited: females are in great demand for improving breeding in all rhino areas.

5. There will be differences in habitat between donor and

recipient areas: the browse species available, diseases such as trypanosomiasis, minerals, heat, disturbance, etc. all can influence the success of a translocation.¹⁸

6. There are many difficulties with the 'rescue'-type capture of outlier rhinos. The remoteness and inaccessibility of the animals and the typically unsuitable terrain make capture operations very expensive, if they are feasible at all.

7. There is risk of mortality during immobilization and translocation. Capture related death rates have been close to 5% in Kenya since 1984.

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8. After release, the rhino may wander or stray into unprotected areas.

9. Owners of sanctuaries on private land have personal preferences and often form an attachment to particular animals.

The first three of these difficulties might be overcome by appropriate 'predictive' management, for example by moving young animals between sanctuaries in the hope they will eventually breed, or introducing rhinos only into low density populations. Young animals, particularly sub-adults, are the 'easiest' animals for translocation in any case. 'Swops' of breeding males between small sanctuaries where single males dominate and breed may also be feasible, but have not been attempted yet in Kenya. When stocking rhino sanctuaries, choosing unoccupied ranges as release points for new inhabitants may also relieve subsequent conflict. Solio Ranch Game Reserve was stocked with 23 rhinos over a ten year period, with animals released in many locations; only one sub-adult male was subsequently killed in fighting.

It has become clear that in the short term, demographic problems of age and sex bias in small populations can quickly limit their breeding performance. The pronounced preponderance of males in the indigenous Laikipia Ranch population has severely limited the number of calves born in recent years and, as part of a 'swop' of breeding males with Ol Jogi, the removal of the dominant male from Lewa Downs has resulted in there being no matings in this sanctuary for at least two years through lack of a capable successor.

Information and Research

With the largely anecdotal nature of many of the important past events in different rhino sanctuaries, it could be rewarding if the AERSG would serve as a focus for such limited information as is available since it strongly influences management decisions. The data would provide a basis for decision rules in management and, in addition, criteria for the selection of sanctuary areas. Given limited funds, sound assessment of the genetic value of translocations, which each cost approximately US\$ 10,000 in Kenya in 1989, will become increasingly important as will a dispassionate appraisal of the effectiveness, in breeding terms, of

rescuing outliers as opposed to moving others between sanctuaries.

Detailed population viability analyses (PVA) are required to enable interactive management of the small sanctuary rhino populations in Kenya, and to make the best use of inviable or 'doomed' outliers when they can be captured. Data now exist, and monitoring is sufficient in many of the sanctuaries for such PVAs to be made. Collection of material for genetic analyses of these populations and outliers could allow the genetic value of these animals to be assessed and, perhaps, future levels of inbreeding to be determined.

Further study of rhino in well-monitored areas can provide facts relating to the proportion of males breeding, their turnover, generation times, mortality curves, and other characteristics and structures. In turn, this will enable for each sanctuary a better estimation of the effective population size, N_e , a measure of the competence with which each population of N rhinos can propagate its reserves of genetic variation to the next generation, and how this is influenced by sex ratio, age structure, habitat and confinement. From available information for Kenyan sanctuaries, N_e/N ratios are in the range 0.2-0.4, with seven of the populations having ratios of about 0.4, and lower ratios of 0.2 and 0.3 in Lewa Downs and Ol Jogi where single dominant males monopolise breeding.

Conclusion

Crucial to the success of the existing rhino sanctuaries is continued security and this will largely depend on the maintenance of fencing, anti-poaching surveillance and monitoring. The sanctuaries can only be considered a complete success when surpluses of rhino bred there have restocked the former areas of distribution such as Tsavo. Despite such errors as the abortive Meru National Park sanctuary, the achievements to date are encouraging. In spite of occasional poaching of animals outside sanctuaries, the total number of black rhinos in Kenya is slowly increasing. The expenditure of the largest part of conservation funds for black rhino on small sanctuaries is beginning to show success in terms of breeding output, results which would not have been realized if the limited amount of money had been spread more thinly.¹⁹

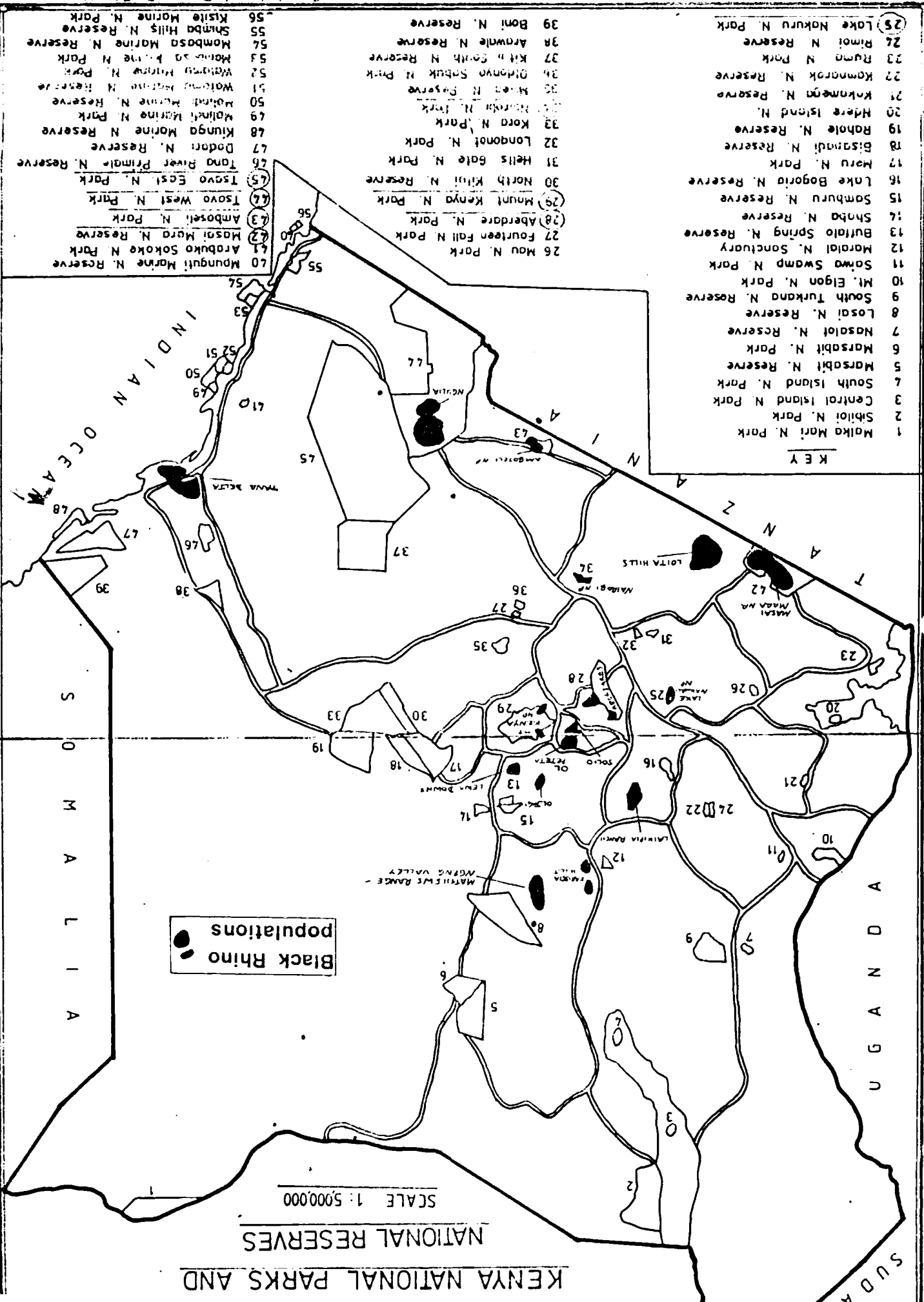
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KENYA NATIONAL PARKS AND NATIONAL RESERVES

SCALE 1:5000000

Black Rhino populations



- KEY
- 1 Moika Mari N. Park
 - 2 Shilo N. Park
 - 3 Central Island N. Park
 - 4 South Island N. Park
 - 5 Marsabit N. Reserve
 - 6 Marsabit N. Park
 - 7 Nasol N. Reserve
 - 8 Losai N. Reserve
 - 9 South Turkana N. Reserve
 - 10 Mt. Elgon N. Park
 - 11 Sawa Swamp N. Park
 - 12 Morati N. Sanctuary
 - 13 Buffalo Spring N. Reserve
 - 14 Shaba N. Reserve
 - 15 Samburu N. Reserve
 - 16 Lake Bogoria N. Reserve
 - 17 Haru N. Park
 - 18 Bisani N. Reserve
 - 19 Rahaie N. Reserve
 - 20 Hara Island N.
 - 21 Kakamega N. Reserve
 - 22 Kamarak N. Reserve
 - 23 Ruha N. Park
 - 24 Rimoi N. Reserve
 - 25 Lake Nakuru N. Park

- 26 Mau N. Park
- 27 Fourteen Fall N. Park
- 28 Aberdare N. Park
- 29 Mount Kenya N. Park
- 30 North Kiuli N. Reserve
- 31 Hellis Gate N. Park
- 32 Londonot N. Park
- 33 Kora N. Park
- 34 Nairobi N. Park
- 35 Meru N. Reserve
- 36 Olmouya Sabuk N. Park
- 37 Kitale South N. Reserve
- 38 Arundie N. Reserve
- 39 Boni N. Reserve
- 40 Mpunguti Marine N. Reserve
- 41 Arabuko Sokoke N. Park
- 42 Masai Mara N. Reserve
- 43 Amboseli N. Park
- 44 Tsavo West N. Park
- 45 Tsavo East N. Park
- 46 Tana River Primale N. Reserve
- 47 Dodori N. Reserve
- 48 Kiunga Marine N. Reserve
- 49 Moini Marine N. Park
- 50 Moini Marine N. Reserve
- 51 Watamu Marine N. Reserve
- 52 Watamu Marine N. Park
- 53 Mombasa Marine N. Park
- 54 Mombasa Marine N. Reserve
- 55 Shimba Hills N. Reserve
- 56 Kisite Marine N. Park

[Compiled and Drawn By F.N. Muchiri]

Rhino Area: Type & Name	Males			Females			Unknown Sex			Management			Breeding			1986-90			Trans-90								
	AD	SA	CF	AD	SA	CF	AD	SA	CF	A	D	CC	ML	S	SR	XC	%C	+	-	+	-	In	Out	CR			
RING-FENCED:																											
Nakuru NP	11	2	1	14	8	2	2	12	2	2	28	142	0.20	71	53	1.17	63	17.8	6	4	4	1	4	1	1		
Ngu'li RS	1	1	1	3	4	3	4	7	1	1	11	73	0.15	73	55	0.43	14	9.0	3	2	1	1	1	1	1		
Sot'lo R GR	14	4	6	24	21	2	4	27	5	5	56	56	1.00	56	42	0.89	71	26.8	23	6	6	1	1	1	1		
Lewa Downs R	2	2	2	4	5	2	3	10	1	1	14	40	0.35	26	20	0.28	43	21.4	4	1	1	2	1	1	1		
O1 Jogi R GR	2	2	1	5	3	1	1	5	1	1	11	73	0.15	20	15	1.00	100	27.2	4	1	1	1	1	1	1		
O1 Pejeta R GR	2	2	4	4	1	3	4	8	93	0.09	93	70	1.00	0	0.0							5	1	1			
Total	32	13	9	54	42	13	10	65	0	0	9	128	0.27	339	255	14	0.83	67	21.9	40	10	12	2	6	12	6	
PART-FENCED:																											
Mait'obi NP	18	4	7	29	18	9	4	31	1	1	61	117	0.52	60	45	0.94	67	19.7	18	2	6	5	1	1	1		
Aberdare NP	8	1	1	10	10	3	2	15	12	3	15	40	0.57	50	(50)	0.67	56	28.0	8	3	3	2	2	2	1		
Laiikipia R	18	5	23	10	4	1	15	3	1	2	6	44	397	0.11	100(100)	1.53	30	6.8	6	1	1	1	1	1	1		
Total	44	10	8	62	38	16	7	61	15	1	6	22	145	584	0.25	210	195	16	1.02	55	14.5	32	3	10	0	0	5
UNFENCED:																											
Masai Mara NR	4	4	4	12	9	1	2	12			24	1680	0.01	50	(50)	1.00	67	37.5	11	2	4	2	1	1	1		
Amboseli NP	2	1	3	2	1	1	4			7	390	0.02	50	(50)	0.75	50	14.3	3	3	1	1	1	1	1			
Total	6	5	4	15	11	2	3	16	0	0	0	31	2080	0.01	100	100	0.94	47	22.6	14	5	5	3	0	0	0	
TOTALS	82	28	21	131	91	31	20	142	15	1	15	31	304	3141	0.10	649	550	30	0.92	62	18.4	86	18	27	5	12	11

Table 1 - Population Statistics for the black rhino in Kenya sanctuaries (at the end of 1990), and overall breeding performance from 1986 to 1990

Key: AD=Adults (>6 y.o.)
SA=Subadults (4-6 y.o.)
CF=Calves (<4 y.o.)
ST=Subtotal (Sex)
TOT=Population total
A=Area of rhino reserve (sq km)
D=Density of rhino (per sq km)
CC=Carrying Capacity (Brett (1989) estimate)
ML=Management Level
S=Existing Surplus of Rhino (number of rhino exceeding ML (TOT-ML), available for translocation)
SR=Known Sex Ratio (No. Males/No. Females)
XC=Percentage of Adult Female (Cow) Rhinos with Calves
+ = Total No. of Births for stated period
- = Total No. of Deaths for stated period
Trans-90=Total No. of translocations In and Out of sanctuary in 1990
CR=Census Rating (Du Toit 1989)
NP=National Park
NR=National Reserve
GR=Game Reserve
R=Private Ranch

Rhino Area: Type & Name	----Males-----			----Females----			--Unknown Sex--			TOT			
	AD	SA	CF	ST	AD	SA	CF	ST	AD		SA	CF	ST
RING-FENCED:													
Lake Nakuru NP	11	2	1	14	8	2	2	12					28
Ngulia RS	1	1	1	3	4	3		7					11
Sollio R GR	14	4	6	24	21	2	4	27					56
Lewa Downs R RS	2	2	1	4	5	2	3	10					14
Oi Jogit R GR	2	2	1	5	3	1	1	5					11
Oi Pejeta R GR	2	2	2	4	1	3		4					8
Total	32	13	9	54	42	13	10	65	0	0	9	9	128
PART-FENCED:													
Nairobi NP	18	4	7	29	18	9	4	31					61
Aberdare NP	8	1	1	10	10	3	2	15	12				40
Laikipia R	18	5	1	23	10	4	1	15	3	1	2	6	44
Total	44	10	8	62	38	16	7	61	15	1	6	22	145
UNFENCED:													
Masai Mara NR	4	4	4	12	9	1	2	12					24
AmboSELL NP	2	1	1	3	2	1	1	4					7
Total	6	5	4	15	11	2	3	16	0	0	0	0	31
TOTALS	82	28	21	131	91	31	20	142	15	1	15	31	304
OTHER AREAS (OUTLIERS):													
Tsavo West NP													15
Tsavo East NP													1
Mt Kenya NP													10
Aberdare NP North													4
Loita Hills													12
Ngong Valley													20
Karissia Hills/Barsaloi													6
Tana River-Garsen-Lamu													12
Jilori-Chacama													1
Tharaka-Kiagu Hill													1
Ndotos-Losai													1
Chyulu Hills North													1
Orghans													5
Total													88
KENYA MINIMUM TOTAL													392

Key: AD=Adults (>6 y.o.)
SA=Subadults (4-6 y.o.)
CF=Calves (<4 y.o.)
ST=Subtotal (Sex)
TOT=Population total

Population Statistics for black rhinos in Kenya (at the end of 1990)

KENYA RHINO PROJECT
POPULATION STATISTICS
SEPTEMBER 1991.

RHINO AREA	MAD	MSA	MCF	MST	FAD	FSA	FCF	FST	UAD	USA	UCF	UST	TOTAL
** RING FENCE													
NAKURU PARK	11	2	1	14	8	2	2	12	0	0	3	3	29
NGULIA SANCTUARY	2	0	1	3	3	3	0	6	0	0	2	2	11
SOLIO RANCH	14	4	6	24	21	2	4	27	0	0	6	6	57
LEWA DOWNS	2	2	0	4	5	2	4	11	0	0	0	0	15
OL JOGI RANCH	2	2	1	5	3	1	1	5	0	0	1	1	11
OL PEJETA RANCH	2	2	0	4	1	3	0	4	0	0	0	0	8
** Subtotal **	33	12	9	54	41	13	11	65	0	0	12	12	131
** PART FENCE													
NAIROBI PARK	19	6	8	33	18	5	4	27	0	0	1	1	61
ABERDARE PARK	8	1	1	10	10	3	2	15	12	0	3	15	40
LAIKIPIA RANCH	18	5	0	23	10	4	1	15	3	1	2	6	45
** Subtotal **	45	12	9	66	38	12	7	57	15	1	6	22	146
** UNFENCED													
MASAI MARA	4	4	4	12	9	1	2	12	0	0	0	0	24
AMBOSELI PARK	2	1	0	3	2	1	1	4	0	0	0	0	7
** Subtotal **	6	5	4	15	11	2	3	16	0	0	0	0	31
*** Total ***	84	29	22	135	90	27	21	138	15	1	18	34	308

NB.

MAD Male Adult
MSA Male sub-adult
MCF Male calf
MST Male subtotal
FAD Female adult
FSA Female subtotal
FCF Female calf
FST Female subtotal
UAD Un-identified adult
USA Un-identified sub-adult
UCF Un-identified calf
UST Un-identified subtotal

	1990	IN	OUT	BIRTHS	DEATHS	1991
SANCTUARIES/PROTECTED:						
NAIROBI NP	61	0	1	3	1	62
SOLIO GR	56	0	0	3	0	59
ABERDARES NP	40	0	0	2	0	42
LAIKIPIA R	44	0	7	1	0	38
LAKE NAKURU NP	28	0	0	2	1	29
MASAI MARA NR	24	1	0	1	0	26
LEWA DOWNS RS	14	1	1	1	4	11
NGULIA RS	11	1	0	0	0	12
OL JOGI GR	11	0	0	1	1	11
OL PEJETA GR	8	1	1	1	1	8
AMBOSELI NP	7	0	2	0	2	3
TOTAL	304	4	12	15	10	304
OTHER PROTECTED:						
TSAVO WEST	15	0	0	1	0	16
LOITA HILLS	12	0	0	0	0	12
NGENG VALLEY	15	0	0	0	0	15
MT KENYA NP	10	0	0	0	0	10
ABERDARES N	4	0	0	0	0	4
ORPHANS	5	1	0	0	0	6
TOTAL	61	1	0	1	0	63
OUTLIERS:						
TANA RIVER	12	0	0	0	0	12
KARISSIAS	6	0	0	0	0	6
LOUNIEK	0	5	0	0	0	5
KENO	0	4	0	0	0	4
RUMURUTI FOR	0	2	0	0	0	2
MOYALE	2	0	0	0	0	2
KIAGU	1	0	0	0	1	0
JILORI-CHACAMA	1	0	0	0	0	1
CHYULUS N	1	0	0	0	0	1
TOTAL	23	11	0	0	0	33
KENYA TOTAL	388	16	12	16	11	401

SOLIO RANCH GAME RESERVE BLACK RHINO LIST
24-10-91

NAME	ID	SEX	AGE	MOTHER	ID	FATHER	NAME	ID	SEX	AGE	MOTHER	ID	FATHER	ID
F3	4501	F	20				F21 CALF 2	4533	M	3	F21	4552		0
F3 CALF 2	4502	M			4523	4501.MB7	F22	4554	F	8	F127	4509		0
F4	4503	F	7	F5?	0		F23	4555	F	20		0		0
F4 CALF 2	4504	F	15		0		F24	4556	F	15		0		0
F1 LAMURIA	4505	F	2	F4	0	4504.MB?	F24 CALF 1	4557	F	1	F24	4556	M11?	4533
F1 CALF 4	4506	F	20		0		M18	4558	M	15		0		0
F2 RUDI	4507	M	3	LAMURIA F1	4523	4506.MB	STROPPIE	4601	F	20		0		0
F12 LAMURIA	4508	M	22		0		HOSHIM	4600	M	17		0		0
F2 CALF 3	4509	F	20		0		BONZO	4900	M	0	F1 LAMURIA	4506		0
F6	4510	M	3	LAMURIA 2 F12	0		455	4901	F	12		0		0
F7 RIDGEBACK	4511	F	9	LAMURIA 2 F12	0		452	4902	M	12		0		0
F6 CALF 1	4512	F	15		0		451	4903	F	20		0		0
M4 BORAN BULL	4513	M	25	F6	4514	4512.M4?	453	4904	F	20		0		0
F7 RIDGEBACK	4514	M	20		0		MIA F20 CALF	4905	M	1	453	4904		0
F7 CALF 3	4515	F	20		0		F22 CALF 1	4559	F	5	F20	4543		0
M5 RED TANK	4516	M	15	3 RIDGEBACK F7	0	4515	F1 CALF 5	4560	?	1	F22	4554		0
F5 CALF 4	4517	M	20		0		F20 CALF 2	4561	F	1	F1 LAMURIA	4506	M8	4523
M6 3 HORNS	4518	M	20		0		F4 CALF 3	4562	?	0	F20	4543		0
F9 OLD NARIBO	4519	F	20		0		F7 CALF 4	4563	?	0	F7	4504	M8	4523
M7	4520	F	3	F5	4523	4519.M8	F14 CALF 4	4564	?	0	F14	4515		0
M8	4521	M	15		0			4565	?	0	F14	4533		4533
M9 LONG LEGS	4522	M	20		0									
M10	4523	M	20		0									
F2 LAMURIA 3	4524	M	8		0	4530								
F2 CALF 2	4525	M	15		0									
F11 CALF 2	4526	M	15		0									
M14 SOBAT	4527	M	20		0									
F14	4528	F	20		0									
F14 CALF 3	4529	M	2	F2 LAMURIA 3	4528									
M13	4530	F	30		0	4530								
F15	4531	F	15		0									
F16	4532	M	15		0									
F16 CALF 1	4533	M	15		0									
M12	4534	M	15		0									
M17	4535	M	15		0									
F20	4536	F	6	F7	4549	4538.M15?								
F10	4537	F	15		0									
F10 CALF 1	4538	F	3	F16	4549	4538.M15?								
F18	4539	M	15	F7	0	4515								
M3	4540	M	15		0									
F18 CALF	4541	M	15		0									
M15 MARIO	4542	F	6	F7	0	4515								
F19	4543	F	20		0									
F19 CALF 2	4544	F	15		0	4544								
F21	4545	F	2	F10	0									
	4546	F	15	F18	0	4546								
	4547	F	15	F18	0	4546								
	4548	M	15		0									
	4549	M	25		0									
	4550	F	20		0									
	4551	?	3	F19	4517	4550.M16								
	4552	F	20		0									

SOLIO RANCH RHINO POPULATION BREAKDOWN

	MALES	FEMALES	UNKNOWN SEX	TOTAL
ADULTS	13	19	0	32
SUBADULTS	2	4	2	8
CALVES	9	4	6	19
TOTAL	24	27	8	59

NAIROBI NP BLACK RHINO LIST
28-10-91

NAIROBI NP BLACK RHINO LIST
28-10-91

NAME	ID	SEX	AGE	MOTHER	ID	FATHER	ID	NAME	ID	SEX	AGE	MOTHER	ID	FATHER	ID	
NAIROBI	1	M	27		0		0	MOSES	61	M		2	HERIN	20	KOSKEI/DURUKO	0
MUSAM	2	F	29		0		0	GICHUKI	62	M		3	FATUMA	8	NAIROBI	1
LILLIAN	4	F	8	MIRIAM	2	NAIROBI	1	MEASI	63	M		2	CATHERINE	45	MURRAM	43
MARK	5	M	9		0		0	MOSONGO	64	M		3	KHALI	10	KIMELEL	29
MATTHEW	7	M	10	SUSIE	6		0	ANN	65	F		2	SARAH	39	KINUTHIA	49
FRUYA	8	F	18		0		0	DAIDAI	66	F		2	MIRIAM	2	NAIROBI	1
KHALI	10	F	31		0		0	SISO	67	M		1	LILLIAN	4	NAIROBI	1
CAMPIE	11	M	5	KHALI	10		0	MAX	68	M		0	MOSHI	27	NAIROBI	1
STELLA	12	F	33		0		0	ADAM	69	M		0	HOOKIE	36		0
KADOGO	13	F	5	STELLA	13		0	FLORENCE'S CALF	70	F		0	FLORENCE	59		0
CONSERVATION	14	M	11		0		0	STELLA'S CALF	71	M		2	STELLA	12	KIMELEL	29
MAOYEI	15	M	11		0		0									
CHIRO	16	F	9		0		0									
CARISTOPHER	17	M	4	CHIRO	16		0									
NICHU	18	M	12		0		0									
REARD	19	M	12		0		0									
HERIN	20	F	13		0		0									
KYELA	21	M	5	HERIN	20		0									
TUTUS	22	M	13		0		0									
DUROKO	23	M	13		0		0									
KINYANJUI	24	M	14		0		0									
JEE	25	F	14		0		0									
KOSKEI	26	M	20		0		0									
MOSHI	27	F	15		0		0									
BEHEWA	28	F	3	MOSHI	27	NAIROBI	1									
KIMELEL	29	M	21		0		0									
KING	30	M	15	DAPHNE	31		0									
DAPHNE	31	F	22		0		0									
SVEDA	32	F	3	DAPHNE	31		0									
ORMANYI	33	F	23		0		0									
WAIRINU	34	F	5	ORMANYI	33	RICHARD/TIM	0									
BILL	35	M	6		0		0									
HOOKIE	36	F	16		0		0									
MUKOROFI	37	M	16		0		49									
SARAH	39	F	17		0		0									
LYNDA	40	F	3	SARAH	39		0									
HYRAX	41	M	17		0		0									
MURRAM	43	M	35		0		0									
ERIC	44	M	24		0		0									
CATHERINE	45	F	25		0		0									
CAROL	46	F	5	KATHERINE	45		0									
NANCY	47	F	18		0		0									
NDUNGI	48	M	2	NANCY	47		0									
KINUTHIA	49	M	26		0		0									
TIM	50	M	19		0		0									
JEREMY	54	M	3	MAIN GATE	53		0									
WANGARE	55	F	27		0		0									
WANJIKU	56	F	27		0		0									
YEMBE	57	M	18		29		0									
MUGAIRA	58	M	18		0		0									
FLORENCE	59	F	19		0		0									
BONAS	60	M	18		0		0									

NAIROBI NP BLACK RHINO POPULATION BREAKDOWN

	MALES	FEMALES	UNKNOWN SEX	TOTAL
ADULTS	21	17	0	38
SUBADULTS	2	5	0	7
CALVES	9	7	2	18
TOTAL	32	29	2	63

LAKE NAKURU NP BLACK RHINO POPULATION LIST
28-10-91

NAME	ID	SEX	AGE	MOTHER	ID	FATHER	ID
AMBONI	501	M	15	JUNO	2506		0
KISERIAN	502	M	20		0		0
TATU	503	M	10		0		0
RIDSEBACK	504	M	8	F9 OLD NARIBO	4522		0
NERIT	505	M	13		0		0
MWIKALI	506	F	19		0		0
JEBUNGEI	508	F	10		0		0
MAJOR MWANGI	509	M	9		0		0
MANGARI	510	F	10		0		0
NDUKU	511	F	11		0		0
NYAHURURU	512	M	7		0		0
RODNEY	513	M	15		0		0
SINDANO	514	M	12		0		0
MAMA WINNIE	515	F	12		0		0
MANGARI	516	F	11		0		0
MACHIRA	517	M	11		0		0
MWENDE	518	F	30		0		0
KISEE	519	M	20		0		0
KAGIRI	521	M	3	MWIKALI	506	MARIO M15	4549
NG'ANG'A	525	M	4		0		0
CALF	526	F	2	JEBUNGEI	508		0
WINNIE MANDELA	527	F	0	MAMA WINNIE	515		0
JANBI	3	F	4	MIRIAM	2	NAIROBI	1
S:HOHO	9	M	4	FATUMA	8	NAIROBI	1
SUZIE	6	F	8		0		0
JUDY	52	F	6		0		0
0516 CALF 1	528	F	2	WANGARI 1	516		0
CALF	529	F	1	SUZIE	510		0
KYELA	530	F	0		6	NAIROBI	1
MBURUGU	531	M	0	MWIKALI	506		0
			0		0		0

	MALES	FEMALES	UNKNOWN SEX	TOTAL
ADULTS	10	8	0	18
SUBADULTS	3	2	0	5
CALVES	1	3	2	6
TOTAL	14	13	2	29

MASAI MARA NATIONAL RESERVE BLACK RHINO LIST
28-10-91

NAME	ID	SEX	AGE	MOTHER	ID	FATHER	ID
MARY	1501	F	20		0		0
MAMA KAYAI	1502	F	20		0		0
SUSAN	1504	P	15		0		0
NUMBER SIXTEEN	1505	F	15		0		0
MTOTO WA FATUMA	1506	F	15	FATUMA	0	KIPANGA	0
WANJIRU	1507	F	10	MARY	1501	AMUKATWENDE	1517
GATHONI	1508	F	8	MARY	1501	UMEME	1514
KAYAI	1509	F	10	MAMA KAYAI	1502	AMUKATWENDE	1515
CHEBRECH	1510	P	8	MAMA KAYAI	1502	UMEME	1514
HELICOPTER	1511	F	6	NUMBER SIXTEEN	1505	UMEME	1515
NAISHURU	1512	F	3	HALIMA	1503	KIOKO	1516
CHEPKOSKEI	1513	F	3	MAMA KAYAI	1502	AMUKATWENDE	1514
AMUKATWENDE	1514	M	20		0		0
UMEME	1515	M	20		0		0
KIOKO	1516	M	15		0		0
KIPANGA	1517	M	15		0		0
KEN	1518	M	15	SUSAN	1504	AMUKATWENDE	1514
PERRET	1519	M	5	MAMA KAYAI	1502	UMEME	1515
PAUL	1520	M	5	MARY	1501	UMEME	1515
CHARLIE	1521	F	3	MARY	1501	UMEME	1515
CALF	1523	F	2	NUMBER SIXTEEN	1511	UMEME	1515
KARANJA	1524	M	20		0		0
CALF	1526	F	1	KAYAI	1509		0
CALF	1528	M	1	WANJIRU	1507		0
CALF	1529	M	1	MTOTO WA FATUMA	1506		0
CALF	1530	M	0	SUSAN	1504		0

MASAI MARA RHINO POPULATION BREAKDOWN

	MALES	FEMALES	UNKNOWN SEX	TOTAL
ADULTS	5	9	0	14
SUBADULTS	4	1	0	5
CALVES	4	3	0	7
TOTAL	13	13	0	26

OL JOGI GAME RESERVE BLACK RHINO LIST
28-10-91

NAME	ID	SEX	AGE	MOTHER	ID	FATHER	ID
OL JOGI	3501	M	20		0		0
MAMA SAFI	3502	F	20		0		0
MAMA KALI	3503	F	20		0		0
JAMES	3505	M	8	MAMA KALI	3503	OL JOGI	3501
MALAIKA	3506	F	7	MAMA SAFI	3502	OL JOGI	3501
EPON	3507	M	6	MAMA KALI	3503	OL JOGI	3501
AMORU	3508	M	4	MAMA KALI	3503	OL JOGI	3501
EKILE	3509	M	4	MAMA SAFI	3502	OL JOGI	3501
LENANA	3510	M	2	MAMA KALI	3503	OL JOGI	3501
NO NAME	3511	F	1	MAMA SAFI	3502	OL JOGI	3501
SHATOOSH	3512	F	8	SOLIO COW	0	SOLIO BULL	0

LEWA DOWNS RANCH - NGARE SERGOI SANCTUARY RHINO LIST
28-10-91

NAME	ID	SEX	AGE	MOTHER	ID	FATHER	ID
SHABA	2503	F	15		0		0
STUMPY	2504	F	25		0		0
SOLIA	2505	F	18		0		0
JUNO	2506	F	30		0		0
MWINGO	507	F	7	SOLIO COW	0	SOLIO BULL	0
SAMIA	2508	F	6	SOLIA	2505	SOLIO BULL	0
JUNIPER	2509	F	3	JUNO	2506	NGOTHO BULL	2501
KELELE	2510	M	10	RONGAI	2502	MWEIGA BULL	0
JILALE	2513	F	3	RONGAI	2502	NGOTHO	2501
ZARIA	2514	F	3	SOLIA	2505	NGOTHO	2501
CALF	2516	F	0	SOLIA	2505	KELELE	2510

OL JOGI BLACK RHINO POPULATION BREAKDOWN

	MALES	FEMALES	UNKNOWN SEX	TOTAL
ADULTS	2	3	0	5
SUBADULTS	3	1	0	4
CALVES	1	1	0	2
TOTAL	6	5	0	11

LEWA DOWNS RANCH RHINO POPULATION BREAKDOWN

	MALES	FEMALES	UNKNOWN SEX	TOTAL
ADULTS	1	5	0	6
SUBADULTS	0	2	0	2
CALVES	0	3	0	3
TOTAL	1	10	0	11

NGULIA RHINO SANCTUARY BLACK RHINO LIST
28-10-91

NAME	ID	SEX	AGE	MOTHER	ID	FATHER	ID
KIBWEZI 1	5001	F	25		0		0
KIBWEZI 2	5002	F	20		0		0
KIBWEZI 3	5003	F	15		0		0
TAITA 1	5004	F	20		0		0
TAITA 2	5005	F	15		0		0
NGULIA	5007	M	15		0		0
CALF 1	5008	M	5		0		0
CALF 2	5009		4		0		0
CALF 3	5010		3		0		0
CHRIS GACAHU	42	M	8		0		0
MISS MAKTAU	5011	F	15		0		0
SIMON	51	M	10	MAIN GATE	53		0

NGULIA RHINO SANCTUARY - BLACK RHINO POPULATION BREAKDOWN

	MALES	FEMALES	UNKNOWN SEX	TOTAL
ADULTS	3	6	0	9
SUBADULTS	1	0	1	2
CALVES	0	0	1	1
TOTAL	4	6	2	12

LAIKIPIA RANCH
BLACK RHINO POPULATION BREAKDOWN

28-10-91

	MALES	FEMALES	UNKNOWN SEX	TOTAL
ADULTS	18	10	1	29
SUBADULTS	2	23	2	7
CALVES	0	1	1	2
TOTAL	20	14	4	38

ABERDARE NATIONAL PARK
BLACK RHINO POPULATION BREAKDOWN

SAMPLE OF 33 RHINOS IDENTIFIED AT THE ARK LODGE

	MALES	FEMALES	UNKNOWN SEX	TOTAL
ADULTS	8	12	0	20
SUBADULTS	2	3	0	5
CALVES	3	5	0	8
TOTAL	13	20	0	33

Rhino Area: Type & Name	---Males---			---Females---			---Unknown Sex---			---Management---			---Breeding---			1986-90		1990		Trans-90 In Out CR							
	AD	SA	CF	AD	SA	CF	AD	SA	CF	A	D	CC	ML	S	SR	XCC	XC	+	-		+	-					
RING-FENCED:																											
Lake Nakuru NP	11	2	1	14	8	2	2	12	2	2	28	142	0.20	71	53	1.17	63	17.8	6	4	4	1					
Ngulia RS	1	1	1	3	4	3	2	7	1	1	11	73	0.15	73	55	0.43	14	9.0	3	2	1	1					
Solito R GR	14	4	6	24	21	2	4	27	5	5	56	56	1.00	56	42	0.89	71	26.8	23	6	6	1					
Lewa Downs R RS	2	2	2	4	5	2	3	10	1	1	14	40	0.35	26	20	0.28	43	21.4	4	1	1	2					
Oj Jogi R GR	2	2	1	5	3	1	1	5	1	1	11	73	0.15	20	15	1.00	100	27.2	4	1	1	1					
Oj Pejeta R GR	2	2	2	4	1	3	4	4	8	8	93	93	0.09	93	70	1.00	0	0.0			5	1					
Total	32	13	9	54	42	13	10	65	0	9	128	477	0.27	339	255	14	0.83	67	21.9	40	10	12	2	12	6		
PART-FENCED:																											
Nairobi NP	18	4	7	29	18	9	4	31	1	1	61	117	0.52	60	45	0.94	67	19.7	18	2	6	5	1				
Aberdare NP	6	1	1	10	10	3	2	15	12	3	15	40	70	0.57	50	(50)	0.67	56	28.0	8	3	3	2				
Laikipia R	18	5	23	10	4	1	15	3	1	2	6	397	0.11	100	(100)	1.53	30	6.8	6	1	1	1					
Total	44	10	8	62	38	16	7	61	15	1	6	22	145	584	0.25	210	195	16	1.02	55	14.5	32	3	10	0	5	
UNFENCED:																											
Nasai Mara NR	4	4	4	12	9	1	2	12			24	1690	0.01	50	(50)	1.00	67	37.5	11	2	4	2					
Amboseli NP	2	1	1	3	2	1	1	4			7	380	0.02	50	(50)	0.75	50	14.3	3	3	1	1					
Total	6	5	4	15	11	2	3	16	0	0	31	2080	0.01	100	100	0.94	47	22.6	14	5	5	3	0	0	0	0	
TOTALS	82	28	21	131	91	31	20	142	15	1	15	31	304	3141	0.10	649	550	30	0.92	62	18.4	86	18	27	5	12	11

Key: AD=Adults (>6 y.o.)
SA=Subadults (4-6 y.o.)
CF=Calves (<4 y.o.)
ST=Subtotal (Sex)
TOT=Population total
A=Area of rhino reserve (sq km)
D=Density of rhino (per sq km)
CC=Carrying Capacity (Brett (1989) estimate)
ML=Management Level
S=Existing Surplus of Rhino (number of rhino exceeding ML (TOT-ML), available for translocation)

SR=Known Sex Ratio (No.Males/No.Females)
XC=Percentage of Adult Female (Cow) Rhinos with Calves
+ = Total No. of Births in population
- = Total No. of Deaths for stated period
CR=Census Rating (Du Toit 1989)
NP=National Park
NR=National Reserve
S=Game Reserve
R=Private Ranch

Population Statistics for the black rhino in Kenya sanctuaries (at the end of 1990), and overall breeding performance from 1986 to 1990

Rhino Area: Type & Name	----Males----				----Females----				--Unknown Sex--				TOT
	AD	SA	CF	ST	AD	SA	CF	ST	AD	SA	CF	ST	
RING-FENCED:													
Lake Nakuru NP	11	2	1	14	8	2	2	12			2	2	28
Ngulia RS	1	1	1	3	4	3		7			1	1	11
Solio R GR	14	4	6	24	21	2	4	27			5	5	56
Lewa Downs R RS	2	2		4	5	2	3	10					14
O1 Jogi R GR	2	2	1	5	3	1	1	5			1	1	11
O1 Pejeta R GR	2	2		4	1	3		4					8
Total	32	13	9	54	42	13	10	85	0	0	9	9	128
PART-FENCED:													
Nairobi NP	18	4	7	29	18	9	4	31			1	1	61
Aberdare NP	8	1	1	10	10	3	2	15	12		3	15	40
Laikipia R	18	5		23	10	4	1	15	3	1	2	6	44
Total	44	10	8	62	38	16	7	61	15	1	6	22	145
UNFENCED:													
Masai Mara NR	4	4	4	12	9	1	2	12					24
Amboseli NP	2	1		3	2	1	1	4					7
Total	6	5	4	15	11	2	3	16	0	0	0	0	31
TOTALS	82	28	21	131	91	31	20	142	15	1	15	31	304
OTHER AREAS (OUTLIERS):													
Tsavo West NP													15
Tsavo East NP													1
Mt Kenya NP													10
Aberdares NP North													4
Loita Hills													12
Ngong Valley													20
Karissia Hills/Barsalof													6
Tana River-Garsen-Lamu													12
Jilori-Chacama													1
Tharaka-Kiagu Hill													1
Ndotos-Lodai													1
Chyulu Hills North													1
Orphans													5
Total													88
KENYA MINIMUM TOTAL													392
Key:													
AD=Adults (>6 y.o.)													
SA=Subadults (4-6 y.o.)													
CF=Calves (<4 y.o.)													
ST=Subtotal (Sex)													
TOT=Population total													

Population Statistics for black rhinos in Kenya (at the end of 1990)

Rhino Area: Type & Name	Males			Females			Unknown Sex			TOT	Management			Breeding			1986-90		1990		Trans-90								
	AD	SA	CF	ST	AD	SA	CF	ST	AD	SA	CF	ST	TOT	A	D	CC	ML	S	SR	%C	%C	+	-	+	-	In	Out	CR	
RING-FENCED:																													
Nakuru NP	11	2	1	14	8	2	2	12	2	2	2	2	28	142	0.20	71	53	1.17	63	17.8	6	4	4	4	1	1	1	1	
Nguja RS	1	1	1	3	4	3	2	7	1	1	1	1	11	73	0.15	73	55	0.43	14	9.0	3	2	1	1	1	1	1		
Sotio R GR	14	4	6	24	21	2	4	27	5	5	5	5	56	56	1.00	56	42	14	0.89	71	28.8	23	6	6	1	1	1		
Lewa Downs R RS	2	2	1	4	5	2	3	10	14	40	0.35	26	20	40	0.35	26	20	0.28	43	21.4	4	1	1	1	2	6	1	1	
O1 Jogi R GR	2	2	1	5	3	1	1	5	1	1	1	1	11	73	0.15	20	15	1.00	100	27.2	4	1	1	1	1	1	1	1	
O1 Pejete R GR	2	2	4	4	1	3	3	4	8	93	0.09	93	70	93	0.09	93	70	1.00	0	0.0	0	0	0	0	5	5	1	1	
Total	32	13	9	54	42	13	10	65	0	0	9	9	128	477	0.27	339	255	14	0.83	67	21.9	40	10	12	2	12	6	6	
PART-FENCED:																													
Naitobi NP	18	4	7	29	18	9	4	31	1	1	1	1	61	117	0.52	80	45	16	0.94	67	19.7	18	2	6	5	1	1	1	
Aberdare NP	8	1	1	10	10	3	2	15	12	3	15	40	40	70	0.57	50	(50)	0.67	56	28.0	8	8	3	3	3	5	2	2	
Latikipia R	18	5	1	23	10	4	1	15	3	1	2	6	44	397	0.11	100(100)		1.53	30	6.8	6	1	1	1	1	1	2	2	
Total	44	10	8	62	38	16	7	61	15	1	6	22	145	584	0.25	210	195	16	1.02	55	14.5	32	3	10	0	0	5	5	
UNFENCED:																													
Masai Mara NR	4	4	4	12	9	1	2	12	24	1690	0.01	50	(50)	1.00	67	37.5	11	2	4	2	4	2	4	2	4	2	1	1	
Amoseli NP	2	1	1	3	2	1	1	4	7	390	0.02	50	(50)	0.75	50	14.3	3	3	1	1	1	1	1	1	1	1	1	1	
Total	6	5	4	15	11	2	3	16	0	0	0	0	31	2080	0.01	100	100	0.94	47	22.6	14	5	5	3	0	0	0	0	
TOTALS	82	28	21	131	91	31	20	142	15	1	15	31	304	3141	0.10	649	550	30	0.92	62	18.4	86	18	27	5	12	11	11	

Table 1 - Population Statistics for the black rhino in Kenya sanctuaries (at the end of 1990), and overall breeding performance from 1986 to 1990

Key: AD=Adults (3-6 y.o.)
SA=Subadults (4-6 y.o.)
CF=Calves (4 y.o.)
ST=Subtotal (Sex)
TOT=Population total
A=Area of rhino reserve (sq km)
D=Density of rhino (per sq km)
CC=Carrying Capacity (Brett (1989) estimate)
ML=Management Level
S=Existing Surplus of Rhino (number of rhino exceeding ML (TOT-ML), available for translocation)
SR=Known Sex Ratio (No. Males/No. Females)
%CC=Percentage of Adult Female (Cow) Rhinos with Calves
%CR=Percentage of Calves in Population
+ = Total No. of Births for stated period
- = Total No. of Deaths for stated period
CR= Census Rating (Du Toit 1989)
NP=National Park
NR=National Reserve
GR=Game Reserve
R=Private Ranch

Rhino Area: Type & Name	----Males-----				----Females---				--Unknown Sex--				TOT
	AD	SA	CF	ST	AD	SA	CF	ST	AD	SA	CF	ST	
RING-FENCED:													
Lake Nakuru NP	11	2	1	14	8	2	2	12			2	2	28
Ngulia RS	1	1	1	3	4	3		7			1	1	11
Solio R GR	14	4	6	24	21	2	4	27			5	5	56
Lewa Downs R RS	2	2		4	5	2	3	10					14
O1 Jogi R GR	2	2	1	5	3	1	1	5			.1	1	11
O1 Pejeta R GR	2	2		4	1	3		4					8
Total	32	13	9	54	42	13	10	65	0	0	9	9	128
PART-FENCED:													
Nairobi NP	18	4	7	29	18	9	4	31			1	1	61
Aberdare NP	8	1	1	10	10	3	2	15	12		3	15	40
Laikipia R	18	5		23	10	4	1	15	3	1	2	6	44
Total	44	10	8	62	38	16	7	61	15	1	6	22	145
UNFENCED:													
Masai Mara NR	4	4	4	12	9	1	2	12					24
Amboseli NP	2	1		3	2	1	1	4					7
Total	6	5	4	15	11	2	3	16	0	0	0	0	31
TOTALS	82	28	21	131	91	31	20	142	15	1	15	31	304

OTHER AREAS (OUTLIERS):

Tsavo West NP	15
Tsavo East NP	1
Mt Kenya NP	10
Aberdares NP North	4
Loita Hills	12
Ngeng Valley	20
Karissia Hills/Barsaloi	6
Tana River-Garsen-Lamu	12
Jilori-Chacama	1
Tharaka-Kiagu Hill	1
Ndotos-Losai	1
Chyulu Hills North	1
Orphans	5
Total	88

KENYA MINIMUM TOTAL 392

Key: AD=Adults (>6 y.o.)
SA=Subadults (4-6 y.o.)
CF=Calves (<4 y.o.)
ST=Subtotal (Sex)
TOT=Population total

Population Statistics for black rhinos in Kenya (at the end of 1990)

KENYA RHINO PROJECT
POPULATION STATISTICS
SEPTEMBER 1991.

RHINO AREA	MAD	MSA	MCF	MST	FAD	FSA	FCF	FST	UAD	USA	UCF	UST	TOTAL
** RING FENCE													
NAKURU PARK	11	2	1	14	8	2	2	12	0	0	3	3	29
NGULIA SANCTUARY	2	0	1	3	3	3	0	6	0	0	2	2	11
SOLIO RANCH	14	4	6	24	21	2	4	27	0	0	6	6	57
LEWA DOWNS	2	2	0	4	5	2	4	11	0	0	0	0	15
OL JOGI RANCH	2	2	1	5	3	1	1	5	0	0	1	1	11
OL PEJETA RANCH	2	2	0	4	1	3	0	4	0	0	0	0	8
** Subtotal **	33	12	9	54	41	13	11	65	0	0	12	12	131
** PART FENCE													
NAIROBI PARK	19	6	8	33	18	5	4	27	0	0	1	1	61
ABERDARE PARK	8	1	1	10	10	3	2	15	12	0	3	15	40
LAIKIPIA RANCH	18	5	0	23	10	4	1	15	3	1	2	6	45
** Subtotal **	45	12	9	66	38	12	7	57	15	1	6	22	146
** UNFENCED													
MASAI MARA	4	4	4	12	9	1	2	12	0	0	0	0	24
AMBOSELI PARK	2	1	0	3	2	1	1	4	0	0	0	0	7
** Subtotal **	6	5	4	15	11	2	3	16	0	0	0	0	31
*** Total ***	84	29	22	135	90	27	21	138	15	1	18	34	308

NB.

MAD Male Adult
MSA Male sub-adult
MCF Male calf
MST Male subtotal
FAD Female adult
FSA Female subtotal
FCF Female calf
FST Female subtotal
UAD Un-identified adult
USA Un-identified sub-adult
UCF Un-identified calf
UST Un-identified subtotal

	1990	IN	OUT	BIRTHS	DEATHS	1991
SANCTUARIES/PROTECTED:						
NAIROBI NP	61	0	1	3	1	62
SOLIO GR	56	0	0	3	0	59
ABERDARES NP	40	0	0	2	0	42
LAIKIPIA R	44	0	7	1	0	38
LAKE NAKURU NP	28	0	0	2	1	29
MASAI MARA NR	24	1	0	1	0	26
LEWA DOWNS RS	14	1	1	1	4	11
NGULIA RS	11	1	0	0	0	12
OL JOGI GR	11	0	0	1	1	11
OL PEJETA GR	8	1	1	1	1	8
AMBOSELI NP	7	0	2	0	2	3
TOTAL	304	4	12	15	10	304
OTHER PROTECTED:						
TSAVO WEST	15	0	0	1	0	16
LOITA HILLS	12	0	0	0	0	12
NGENG VALLEY	15	0	0	0	0	15
MT KENYA NP	10	0	0	0	0	10
ABERDARES N	4	0	0	0	0	4
ORPHANS	5	1	0	0	0	6
TOTAL	61	1	0	1	0	63
OUTLIERS:						
TANA RIVER	12	0	0	0	0	12
KARISSIAS	6	0	0	0	0	6
LOUNIEK	0	5	0	0	0	5
KENO	0	4	0	0	0	4
RUMURUTI FOR	0	2	0	0	0	2
MOYALE	2	0	0	0	0	2
KIAGU	1	0	0	0	1	0
JILORI-CHACAMA	1	0	0	0	0	1
CHYULUS N	1	0	0	0	0	1
TOTAL	23	11	0	0	0	33
KENYA TOTAL	388	16	12	16	11	401

SOLIO RANCH GAME RESERVE BLACK RHINO LIST
24-10-91

NAME	ID	SEX	AGE	MOTHER	ID	FATHER	ID
F3 CALF 2	4501	F	20		0		0
F3	4502	M	3	F3	0	4501 MB?	4523
F8	4503	F	7	F5?	0		0
F4	4504	F	15	F4	0		0
F4 CALF 2	4505	F	2	F4	0		0
F1 LAMURIA	4506	F	20		0		0
F1 CALF 4	4507	M	3	LAMURIA F1	4523		4523
M2 RUDI	4508	M	22		0		0
F12 LAMURIA	4509	F	20		0		0
F12 CALF 3	4510	M	3	LAMURIA 2 F12	4509		0
F13	4511	F	9	LAMURIA 2 F12	4509		0
F6	4512	F	15		0		0
F6 CALF 1	4513	M	3	F6	4512 M4?		4514
M4 BORAN BULL	4514	M	25		0		0
F7 RIDGEBACK	4515	F	20		0		0
F7 CALF 3	4516	M	3	RIDGEBACK F7	4515		0
M16	4517	M	15		0		0
M5 RED TANK	4518	M	20		0		0
F5 CALF 4	4519	F	20		0		0
M6 J HORNS	4520	F	3	F5	4519 MB		4523
M6 J HORNS	4521	M	15		0		0
F9 OLD NARIBO	4522	F	35		0		0
M8	4523	M	20		0		0
M7	4524	M	20		0		0
M9 LONG LEGS	4525	M	0	F11?	4530		0
M10	4526	M	8		0		0
M10	4527	M	15		0		0
F2 LAMURIA 3	4528	F	20		0		0
F2 CALF 2	4529	M	2	F2 LAMURIA 3	4528		0
F11 CALF 2	4530	F	30		0		0
M14 SOBAT	4531	F	4	F11	4530		0
M11	4532	M	15		0		0
F14	4533	M	15		0		0
F14 CALF 3	4534	F	3	F14	4534		0
M13	4535	M	6		0		0
F15	4536	F	6		0		0
F16	4537	F	15		0		0
F16 CALF 1	4538	F	3	F16	4538 M15?		4549
M12	4539	M	15	F7	4515		0
M1	4540	M	15		0		0
M17	4541	M	15		0		0
F20	4542	F	6	F7	4515		0
F20	4543	F	20		0		0
F10	4544	F	15		0		0
F10 CALF 1	4545	F	2	F10	4544		0
F18	4546	F	15		0		0
F18 CALF	4547	F	15	F18	4546		0
M3	4548	M	15		0		0
M15 MARIO	4549	M	25		0		0
F19	4550	F	20		0		0
F19 CALF 2	4551	F	3	F19	4550 M16		4517
F21	4552	F	20		0		0

SOLIO RANCH GAME RESERVE BLACK RHINO LIST
24-10-91

NAME	ID	SEX	AGE	MOTHER	ID	FATHER	ID
F21 CALF 2	4553	M	3	F21	4553 M		4552
F22	4554	F	8	F12?	4554 F		4509
F23	4555	F	20		0		0
F24	4556	F	15		0		0
F24 CALF 1	4557	F	1	F24	4557 F		4533
M18	4558	M	15		0		0
STROPPIE	4601	F	20		0		0
HOSHIM	4600	M	17		0		0
BONZO	4900	M	0	F1 LAMURIA	4506		4506
455	4901	F	12		0		0
451	4902	M	12		0		0
453	4903	F	20		0		0
453 CALF 1	4904	F	20		0		0
M14 F20 CALF	4905	M	1	F20	4905 M		4904
F22 CALF 1	4559	F	5	F20	4559 F		4543
F1 CALF 5	4560	F	1	F22	4560 F		4554
F20 CALF 2	4561	F	1	F1 LAMURIA	4561 F		4506 MB
F4 CALF 3	4562	F	0	F20	4562 F		4543
F7 CALF 4	4563	F	0	F4	4563 F		4504 MB
F14 CALF 4	4564	F	0	F7	4564 F		4515
	4565	F	0	F14	4565 F		4534 M11 ?

SOLIO RANCH RHINO POPULATION BREAKDOWN

	MALES	FEMALES	UNKNOWN SEX	TOTAL
ADULTS	13	9	0	32
SUBADULTS	2	4	2	8
CALVES	9	4	6	19
TOTAL	24	27	8	59

NAIROBI NP BLACK RHINO LIST
28-10-91

NAME	ID	SEX	AGE	MOTHER	ID	FATHER	ID
NAIROBI	1	M	27		0		0
MIRIAM	2	F	29		0		0
LILIAN	4	F	8	MIRIAM	2	NAIROBI	1
MARK	5	M	9		0		0
MATTHEW	7	M	10	SUSIE	6		0
FATUMA	8	F	18		0		0
KHALI	10	F	31		0		0
CAMPBIE	11	M	5	KHALI	10		0
STELLA	12	F	33		0		0
KADOGO	13	F	5	STELLA	13		0
OBSERVATION	14	M	11		0		0
MUKOYATI	15	M	11		0		0
CHIRO	16	F	9		0		0
CHRISTOPHER	17	M	4	CHIRO	16		0
NGICHU	18	M	12		0		0
RICHARD	19	M	12		0		0
HERIN	20	F	13		0		0
KYELA	21	M	5	HERIN	20		0
TITUS	22	M	13		0		0
DUROKO	23	M	13		0		0
KINYANJUI	24	M	14		0		0
JEE	25	F	14		0		0
KOSKEI	26	M	20		0		0
MOSHI	27	F	15		0		0
BEHEWA	28	F	3	MOSHI	27	NAIROBI	1
KIMELEL	29	M	21		0		0
KING	30	M	15	DAPHNE	31		0
DAPHNE	31	F	22		0		0
SVEDA	32	F	3	DAPHNE	31		0
ORMANYI	33	F	23		0		0
WAIRIMU	34	F	5	ORMANYI	33	RICHARD/TIM	0
BILL	35	M	6		0		0
HOOKIE	36	F	16		0		0
MUKOROFI	37	M	16		0	KINUTHIA	49
SARAH	39	F	17		0		0
LYNDA	40	F	3	SARAH	39		0
HYRAX	41	M	17		0		0
MURRAM	43	M	35		0		0
ERIC	44	M	24		0		0
CATHERINE	45	F	25		0		0
CAROL	46	F	5	KATHERINE	45		0
NANCY	47	F	18		0		0
NDUNGI	48	M	2	NANCY	47		0
KINUTHIA	49	M	26		0		0
TIM	50	M	19		0		0
JEREMY	54	M	3	MAIN GATE	53		0
WANGARE	55	F	27		0		0
WANJIKU	56	F	3	WANGARE	55	KIMELEL	29
KISENBE	57	M	18		0		0
MORAIRA	58	M	18		0		0
FLORENCE	59	F	19		0		0
BOMAS	60	M	18		0		0

NAIROBI NP BLACK RHINO LIST
28-10-91

NAME	ID	SEX	AGE	MOTHER	ID	FATHER	ID
MOSES	61	M	2	HERIN	20	KOSKEI/DURUKO	0
GICHUKI	62	M	3	FATUMA	8	NAIROBI	1
MBAASI	63	M	2	CATHERINE	45	MURRAM	43
MOSONGO	64	M	3	KHALI	10	KIMELEL	29
ANN	65	F	2	SARAH	39	KINUTHIA	49
DAIDAI	66	F	2	MIRIAM	2	NAIROBI	1
SISO	67	M	1	LILIAN	4	NAIROBI	1
MAX	68	M	0	MOSHI	27	NAIROBI	1
ADAM	69	M	0	HOOKIE	36		0
FLORENCE'S CALF	70	F	0	FLORENCE	59		0
STELLA'S CALF	71	M	2	STELLA	12	KIMELEL	29

NAIROBI NP BLACK RHINO POPULATION BREAKDOWN

	MALES	FEMALES	UNKNOWN SEX	TOTAL
ADULTS	21	17	0	38
SUBADULTS	2	5	0	7
CALVES	9	7	2	18
TOTAL	32	29	2	63

LAKE NAKURU NP BLACK RHINO POPULATION LIST
28-10-91

NAME	ID	SEX	AGE	MOTHER	ID	FATHER	ID
AMBONI	501	M	15	JUNO	2506		0
KISERIAN	502	M	20		0		0
TATU	503	M	10		0		0
RIDGEBACK	504	M	8	F9 OLD NARIBO	4522		0
NERIT	505	M	13		0		0
MWIKALI	506	F	19		0		0
JEBUNGEI	508	F	10		0		0
MAJOR MWANGI	509	M	9		0		0
WANGARI	510	F	10		0		0
NDUKU	511	F	11		0		0
NYAHURURU	512	M	7		0		0
RODNEY	513	M	15		0		0
SINDANO	514	M	12		0		0
MAMA WINNIE	515	F	12		0		0
WANGARI	516	F	11		0		0
WACHERA	517	M	11		0		0
MWENDE	518	F	30		0		0
KISEE	519	M	20		0		0
KAGIRI	521	M	3	MWIKALI	506	MARIO M15	4549
NG'ANG'A	525	M	4		0		0
CALF	526	?	2	JEBUNGEI	508		0
WINNIE MANDELA	527	F	0	MAMA WINNIE	515		0
JAMBI	3	F	4	MIRIAM	2	NAIROBI	1
S:HOHO	9	M	4	FATUMA	8	NAIROBI	1
SUZIE	6	F	8		0		0
JUDY	52	F	6		0		0
0516 CALF 1	528	?	2		516		0
CALF	529	F	1	WANGARI 1	510		0
KYELA	530	F	0	SUZIE	6	NAIROBI	1
MBURUGU	531	M	0	MWIKALI	506		0
	0		0		0		0

MASAI MARA NATIONAL RESERVE BLACK RHINO LIST
28-10-91

NAME	ID	SEX	AGE	MOTHER	ID	FATHER	ID
MARY	1501	F	20		0		0
MAMA KAYAI	1502	F	20		0		0
SUSAN	1504	F	15		0		0
NUMBER SIXTEEN	1505	F	15		0		0
MTOTO WA FATUMA	1506	F	15	FATUMA	0	KIPANGA	1517
WANJIRU	1507	F	10	MARY	1501	AMUKATWENDE	1514
GATHONI	1508	F	8	MARY	1501	UMEME	1515
KAYAI	1509	F	10	MAMA KAYAI	1502	AMUKATWENDE	1514
CHEBRECH	1510	F	8	MAMA KAYAI	1502	UMEME	1515
HELICOPTER	1511	F	6	NUMBER SIXTEEN	1505	UMEME	1515
NAISHURU	1512	F	3	HALIMA	1503	KIOKO	1516
CHEPKOSKEI	1513	F	3	MAMA KAYAI	1502	AMUKATWENDE	1514
AMUKATWENDE	1514	M	20		0		0
UMEME	1515	M	20		0		0
KIOKO	1516	M	15		0		0
KIPANGA	1517	M	15		0		0
KEN	1518	M	5	SUSAN	1504	AMUKATWENDE	1514
PERTET	1519	M	5	MAMA KAYAI	1502	UMEME	1515
PAUL	1520	M	5	MARY	1501	UMEME	1515
CHARLIE	1521	M	3	MARY	1501	UMEME	1515
CALF	1523	F	2	NUMBER SIXTEEN	1511	UMEME	1515
KARANJA	1524	M	20		0		0
CALF	1526	F	1	KAYAI	1509		0
CALF	1528	M	1	WANJIRU	1507		0
CALF	1529	M	1	MTOTO WA FATUMA	1506		0
CALF	1530	M	0	SUSAN	1504		0

MASAI MARA RHINO POPULATION BREAKDOWN

	MALES	FEMALES	UNKNOWN SEX	TOTAL
ADULTS	10	8	0	18
SUBADULTS	3	2	0	5
CALVES	1	3	2	6
TOTAL	14	13	2	29

	MALES	FEMALES	UNKNOWN SEX	TOTAL
ADULTS	5	9	0	14
SUBADULTS	4	1	0	5
CALVES	4	3	0	7
TOTAL	13	13	0	26

OL JOGI GAME RESERVE BLACK RHINO LIST
28-10-91

NAME	ID	SEX	AGE	MOTHER	ID	FATHER	ID
OL JOGI	3501	M	20		0		0
MAMA SAFI	3502	F	20		0		0
MAMA KALI	3503	F	20		0		0
JAMES	3505	M	8	MAMA KALI	3503	OL JOGI	3501
MALAIKA	3506	F	7	MAMA SAFI	3502	OL JOGI	3501
EPON	3507	M	6	MAMA KALI	3503	OL JOGI	3501
AMORU	3508	M	4	MAMA KALI	3503	OL JOGI	3501
EKILE	3509	M	4	MAMA SAFI	3502	OL JOGI	3501
LENANA	3510	M	2	MAMA KALI	3503	OL JOGI	3501
NO NAME	3511	F	1	MAMA SAFI	3502	OL JOGI	3501
SHATOOSH	3512	F	8	SOLIO COW	0	SOLIO BULL	0

LEWA DOWNS RANCH - NGARE SERGOI SANCTUARY RHINO LIST
28-10-91

NAME	ID	SEX	AGE	MOTHER	ID	FATHER	ID
SHABA	2503	F	15		0		0
STUMPY	2504	F	25		0		0
SOLIA	2505	F	18		0		0
JUNO	2506	F	30		0		0
MAWINGO	507	F	7	SOLIO COW	0	SOLIO BULL	0
SAMIA	2508	F	6	SOLIA	2505	SOLIO BULL	0
JUNIPER	2509	F	3	JUNO	2506	NGOTHO	2501
KELELE	2510	M	10	RONGAI	2502	MWEIGA BULL	0
JILALE	2513	F	3	RONGAI	2502	NGOTHO	2501
ZARIA	2514	F	3	SOLIA	2505	NGOTHO	2501
CALF	2516	F	0	SOLIA	2505	KELELE	2510

OL JOGI BLACK RHINO POPULATION BREAKDOWN

	MALES	FEMALES	UNKNOWN SEX	TOTAL
ADULTS	2	3	0	5
SUBADULTS	3	1	0	4
CALVES	1	1	0	2
TOTAL	6	5	0	11

LEWA DOWNS RANCH RHINO POPULATION BREAKDOWN

	MALES	FEMALES	UNKNOWN SEX	TOTAL
ADULTS	1	5	0	6
SUBADULTS	0	2	0	2
CALVES	0	3	0	3
TOTAL	1	10	0	11

NGULIA RHINO SANCTUARY BLACK RHINO LIST
28-10-91

NAME	ID	SEX	AGE	MOTHER	ID	FATHER	ID
KIBWEZI 1	5001	F	25		0		0
KIBWEZI 2	5002	F	20		0		0
KIBWEZI 3	5003	F	15		0		0
TAITA 1	5004	F	20		0		0
TAITA 2	5005	F	15		0		0
NGULIA	5007	M	15		0		0
CALF 1	5008	M	5		0		0
CALF 2	5009		4		0		0
CALF 3	5010		3		0		0
CHRIS GACAHU	42	M	8		0		0
MISS MAKTAU	5011	F	15		0		0
SIMON	51	M	10	MAIN GATE	53		0

NGULIA RHINO SANCTUARY - BLACK RHINO POPULATION BREAKDOWN

	MALES	FEMALES	UNKNOWN SEX	TOTAL
ADULTS	3	6	0	9
SUBADULTS	1	0	1	2
CALVES	0	0	1	1
TOTAL	4	6	2	12

LAIKIPIA RANCH
BLACK RHINO POPULATION BREAKDOWN

28-10-91

	MALES	FEMALES	UNKNOWN SEX	TOTAL
ADULTS	18	10	1	29
SUBADULTS	2	23	2	7
CALVES	0	1	1	2
TOTAL	20	14	4	38

ABERDARE NATIONAL PARK
BLACK RHINO POPULATION BREAKDOWN

SAMPLE OF 33 RHINOS IDENTIFIED AT THE ARK LODGE

	MALES	FEMALES	UNKNOWN SEX	TOTAL
ADULTS	8	12	0	20
SUBADULTS	2	3	0	5
CALVES	3	5	0	8
TOTAL	13	20	0	33