THE WHITE RHINOCEROS POPULATION OF THE WILLEM PRETORIUS GAME RESERVE

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ABSTRACT

The objective of this scientific report is to study the development of the population of **White Rhinoceros** (*Ceratotherium simum*) in the **Willem Pretorius Game Reserve (WPGR)** between 1962 and 1997.

In order to carry out properly my observations regarding the behaviour of the reserve's white rhinoceros, I mostly followed the existing **data-gathering system** created by the Senior rangers (**Appendix I**), as well as utilizing extensively my **video camera** for the recording and later interpretation of the behaviour details. At the same time I carried out constant detailed discussions with the reserve's Conservator **Wilton Raats** and the Senior Ranger in charge of monitoring the white rhino, **Alan Kietzman**. I also used my compact **35 mm camera** with which I took all photographs contained in this report; and as my main field observation guides, I used the books of R.N.Owen-Smith **"Megaherbivores"** and Richard Estes' **"The Behaviour Guide to African Mammals"**.

Within my limited time, assisted by the above methods, I learnt the **history** of the white rhino in **WPGR**, the **demographics** of the current population and the main patterns of white rhino **behaviour**.

The successful development of the **white rhinoceros** at the **WPGR** in the Free State which is a different habitat from the original Zululand's Umfolozi/Hluhluwe Game Reserves, proves that it is definitely possible for this species to adapt and survive outside its former range.

INTRODUCTION

General Information

All rhinoceroses belong to the Order Perissodactyla (odd-toed ungulates) and the Family Rhinocerotidae. There are two populations of White Rhinoceros in Africa: the northern race (*Ceratotherium s. cottoni*) and the southern race (*Ceratotherium s. simum*). Animals of the northern race are differentiated from those of the southern race by the flatter dorsal profile of their skulls, by their somewhat smaller teeth, by their higher-legged/less long in the body, and lack of body hair. The few animals left of the northern race are currently found only in Zaire and Sudan **(Cave 1962; Heller 1913)**. Originally the range of the southern White Rhinoceros included South Africa, Moçambique, Zimbabwe, Angola, Botswana and Namibia. As a result of the onslaught of the animal by man, only a few were left in South Africa's Umfolozi-Hluhluwe Game Reserves by the turn of the century. Today these game sanctuaries contain the largest population of white rhino in the world. They have also been reintroduced into other reserves, parks and private game ranches in most of its former range in southern Africa, including the WPGR and others in the Free State.

Fig. 1 - Southern white rhinos in the Willem Pretorius Game Reserve.

Status and History

The northern White Rhinoceros is in immediate danger of extinction and CITES classifies it as an Appendix I species. However the southern White Rhinoceros has been classified as Appendix II which means it is not currently threatened with extinction but could become so unless trade is strictly regulated.

According to **Balfour (1991)** the success story of the white rhino in southern Africa culminated in its removal in 1965 from the Category A protection list of the IUCN "threatened with extinction" and declared "no longer endangered", the only animal to achieve this distinction. It was primarily through the efforts of bodies such as the Natal/Zululand Game Protection Association and later the Wildlife Society of Southern Africa, as well as several concerned individuals, that the slaughter was stopped before all wild game in Zululand was completely exterminated.

Originally there were only an estimated 40 adult rhinos remaining in the Umfolozi Game Reserve, representing the last remnant of the subspecies in southern Africa. But as the years went by the white rhino population steadily increased in numbers, from the 30-40 recorded at the turn of the century to some 200 counted in 1929. The first accurate aerial census of 437 was recorded in the Umfolozi Game Reserve by Ian Player in 1953.

By 1960 they had multiplied to such an extent (numbering 705) that capture and relocation to other areas where they had occurred previously was considered necessary. Notwithstanding that considerable takeoff, an aerial count in the Umfolozi Game Reserve in August 1970 showed a population of 1,764 white rhino **(Balfour, 1991)**.

Throughout the first decade of the Operation Rhino in Umfolozi Game Reserve more than 1,000 white rhinoceros were caught and sent to game reserves, parks and zoos. Today's world population are all descendants of the original Umfolozi population representing one of the greatest success stories in conservation **(Balfour, 1991).**

According to Peter Hartley, a section ranger at Umfolozi, the current population of white rhino at the Umfolozi-Hluhluwe Game Reserve is over 2,000.

On the latest CITES meeting in Zimbabwe (June 1997) there were no changes in their status despite the proposal from South Africa to remove the restrictions placed on the Southern African White Rhinoceros at the previous Conference of Parties. Much concern, however, was raised about the trade in white rhino products. Despite the fact that the populations in South Africa are productive and growing to such an extent that rhinos have to be removed annually to prevent overpopulation and habitat degradation, the concerns of the opposing parties were that a legal trade could result in an increased poaching effort on other populations **(Rhino & Elephant Foundation, 1996).**

Table 1. White Rhino Numbers in South Africa 1987 - 1996 (Rhino & Elephant Foundation).

REGION	1987	n	1994	n	1996	n	% INCREASE 87-96
CAPE	17	4	33	4	48	8	
FREE STATE	25	3	28	5	51	9	
NATAL	109	13	137	13	159	17	
TVL	423	57	720	83	985	110	
SUBTOT. PRIVATE	574	77	918	105	1243	144	116 . 55
GKNP	222	4	281	0	234	0	5 . 41
SUB TOTAL	796	81	1199	105	1477	144	85 . 55
STATE	3307	20	5113	36	5832	36	76 . 35
OTHER	39	9	64	12	64	12	64 . 10
COUNTRY TOTAL	4142	110	6376	153	7373	192	78 . 01

n = number of populations
GKNP = Private properties now incorporated in the Kruger National Park

The WPGR has been fortunate in the past by avoiding the rhino-poaching onslaught **(Kietzmann, pers. comm.).** The eight white rhinos originally brought to Willem Pretorius Game Reserve from Umfolozi Game Reserve in 1962/65, developed into 18 healthy animals by 1972. Their population growth since then has made it possible to redistribute them to other reserves and also made available to the public.

Dimensions and Identification

According to **Estes (1991)** the white rhino is generally regarded as the biggest living land mammal after the elephant but outweighed by the hippo - weights vary between 2,000 to 2,300 kg for adult males and about 1,600 kg average for adult females. Males can attain shoulder heights up to 1.8 m, while female adults up to 1.77 m. The horns grow from skin consisting of keratin and are unattached to the skull. The front horn is longer than the back horn; normally, the front horn of the females is longer and thinner, whereas the male's horn is shorter and thicker. The head is big and weighty with small low-set eyes in relation to body size. There is a large pronounced hump on the back of the neck. The legs are short in relation to the rest of the body. The skin is thick and its tone varies between plain gray to dark brown depending on the environment **(Raats, pers. comm.)**.

Fig. 2 - Lateral photo of a male white rhino showing its profile (WPGR).

Ecology

The white rhino is widely distributed in open grasslands, particularly short-grassed areas with trees and bushes for shade and cover, including a reliable supply of water. According to **Estes (1991)** the white rhino is the largest pure grazer that ever lived and uses its wide and square mouth to efficiently graze in dense swards of short-green grass.

Their high-crowned molars and pre-molars with fine surfaces are adapted for their grazing habits. They often drink twice daily but can go between two and four days without drinking if the water source is distant, and they enjoy wallowing in mud puddles in order to get rid of their parasites **(Estes, 1991)**.

Social Organization & Behaviour

According to **Balfour (1991)** bulls are territorial and usually solitary. Cows are comparatively sociable and frequently found in groups of between three and twelve, and occasionally up to 18. During my study field trips, I usually found them aggregated in pairs - a female with a brand new calf or a subadult calf - or larger groupings of up to 10 members, which I only saw once. These larger groupings usually included two or three adult females with their recent offsprings and/or the previous subadult calves or/and some other non-related subadults.

According to **Estes (1991)** adult females live in overlapping home ranges which encompass six to seven territories. Territorial bulls occupy clearly defined territories which they defend fiercely against intruding dominant bulls; subordinate bulls are tolerated as long as they remain submissive. During the period of my studies on WPGR, there was only one dominant bull, four young adult males, ten adult cows and three subadults. White rhinoceros make use of communal dung heaps (middens) and these have territorial significance when used by the territorial bulls **(Owen-Smith, 1988)**.

Reproduction

Females calve for the first time at 6-7 years, after a 16-month gestation - estrus cycles occur at monthly intervals. According to **Estes (1991)** bulls make hic-throbbing sounds when approaching cows and are usually driven backward by mock attacks; when the urine reveals a female is approaching estrus the territorial bull begins a courtship lasting between five to twenty days during which he shows remarkable restraint by keeping the distance set by the cow, usually between 5-30 m. Eventually the female will allow him to come closer and ultimately mount her; copulation usually lasts for approximately 15-28 minutes **(Owen-Smith, 1988).**

Parent/Calf Behaviour

According to **Estes (1991)** cows seek seclusion in dense cover before and for several weeks after calving. Within a month she resumes her normal routine and range, always closely accompanied by the offspring which moves in front but responds immediately to the cow's changes of direction. The calf suckles for 2-3 minutes or until satisfied; it begins grazing when approximately two months old, and weaning occurs at one year old **(Owen-Smith, 1988).** The calf usually remains with its mother until she is ready to calf again at which time she chases the older calf off **(Kietzmann, pers. comm.).**

Antipredator Behaviour

The number one enemy of the white rhinoceros is Man, nurturing his greed for trophy hunting and utilization of the horn for medicine and adornment. Otherwise there are very few reports of predation on the white rhino, except calves which are sometimes taken by hyenas or lions. According to **Estes (1991)** during flight the calf gallops ahead and the mother follows close behind thus insuring that the young are well protected at all times.

STUDY AREA : WILLEM PRETORIUS GAME RESERVE (WPGR)

Fig. 3 - Western entrance to the Willem Pretorius Game Reserve.

General

Willem Pretorius Game Reserve is the oldest nature reserve in the Free State covering an area of 12,081 ha. It is situated in the central Free State between 28° 16' and 28° 21' south and 27° 07' and 27° 23' west. The altitude varies between 1375m and 1510m above sea level. It is named after the M.E.C. Willem Pretorius whom in the 60's campaigned to establish the reserve.

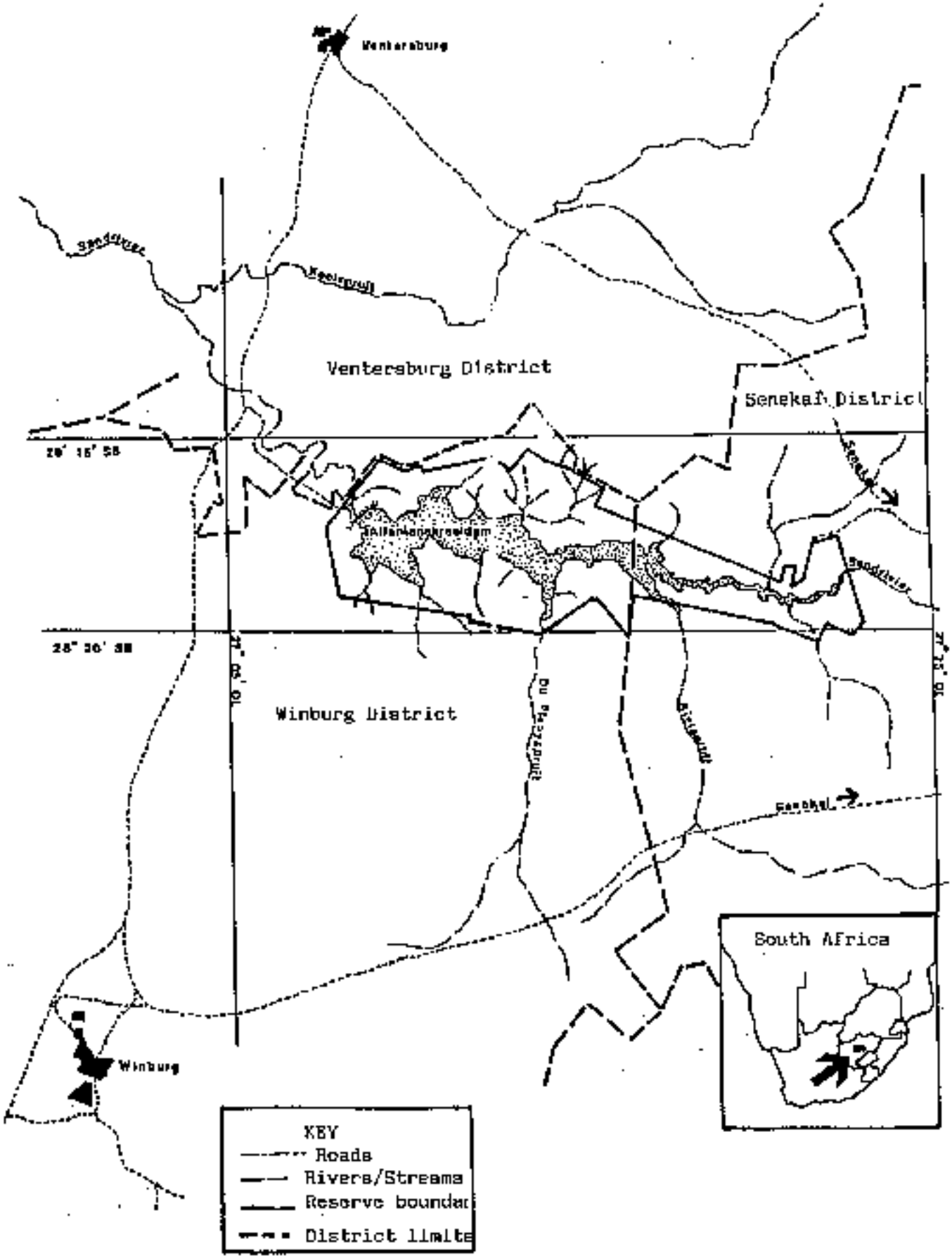

Fig. 4 - Location of the Willem Pretorius Game Reserve

Like most of the Free State provincial reserves, the Willem Pretorius Game Reserve is proclaimed around a dam - the Allemanskraal Dam, which was built as part of an irrigation scheme. It is fed by the Sand River and when full, it covers an area of 2,500 ha.

Fig. 5 - View of the Allemanskraal Dam and surrounding plains.

The dam separates the reserve into a northern and southern section, providing contrasting habitats as follows :

- The southern side comprises of an undulating landscape which supports large herds of plains game such as springbok, blesbok and black wildebeest. According to **Kietzmann (pers.comm.)** no white rhino has been observed in this side of the dam for over three years, except on the eastern side by the Sand River.

- In contrast, the northern side of the reserve is more diverse consisting of hills covered by wild olive and karee trees and densely vegetated ravines. These alternate with open grasslands and patches of sweet thorn trees. Having a greater diversity of habitats available, more different animals are likely to be encountered.

Fig. 6 - Rhinos grazing on the hills of the northern side of the reserve.

Geology and Soils

According to **Muller (1986)** Willem Pretorius Game Reserve is situated on the Beaufort series of the Karoo System. The soils in the reserve are predominantly heavy clay soils of dolerite origin, but lighter sand soils with characteristically unique vegetation have been identified on the reserve. There are, however, important local variations with significant differences in plant communities. Dolerite outcrops are present in the northern part of the reserve, as are isolated sandstone banks. Karoo elements are present where earlier ploughing (before 1962) and overgrazing have weakened the natural ecosystem.

Climate

A long term rainfall average of 575 mm is experienced annually at WPGR, and it is mainly in the form of summer showers and thunderstorms, usually between the months of October and March. However, during the severe 1991-92 drought, the total rainfall between September 1991 and September 1992 was only 307.5 mm. Between October 1992 to March 1993, 377.4 mm was recorded, although this total amount of precipitation was still less than the long term average, the soil penetrating rains spread over these months facilitated vegetation growth, run-off water formed an insignificant part of the precipitation **(Kietzmann, pers. comm.)**.

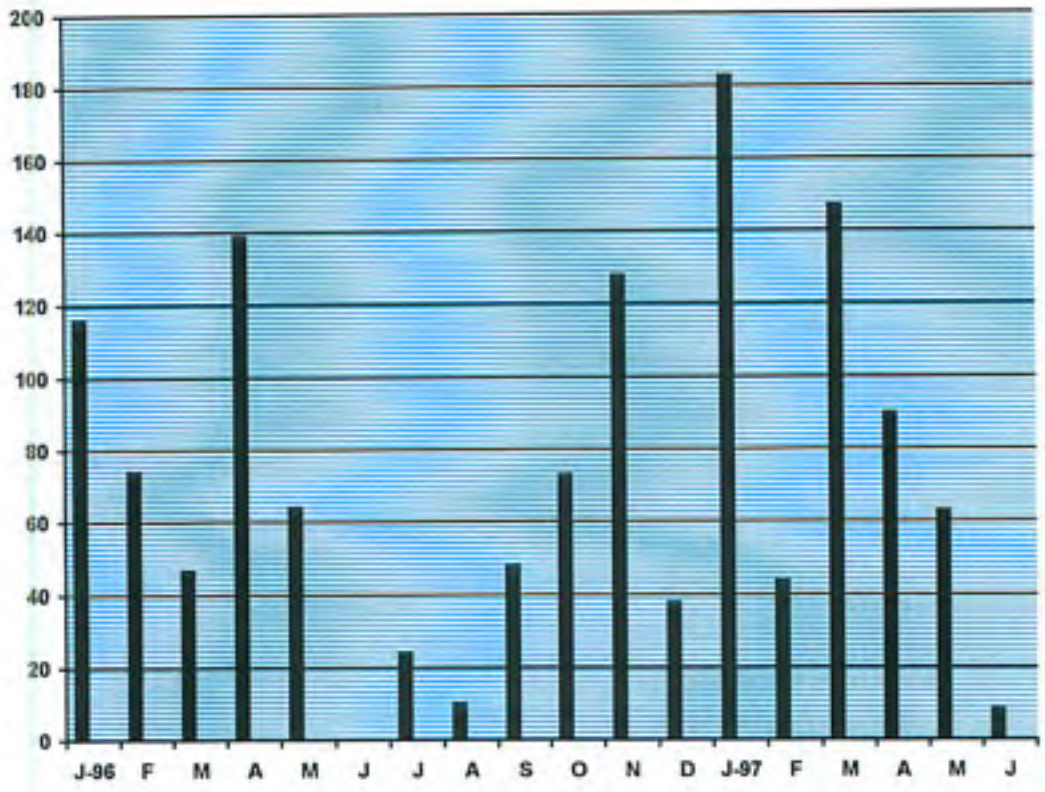

Fig. 7 - Rainfall (mm) graph of WPGR - January 1996/June 1997 (J. Erasmus).

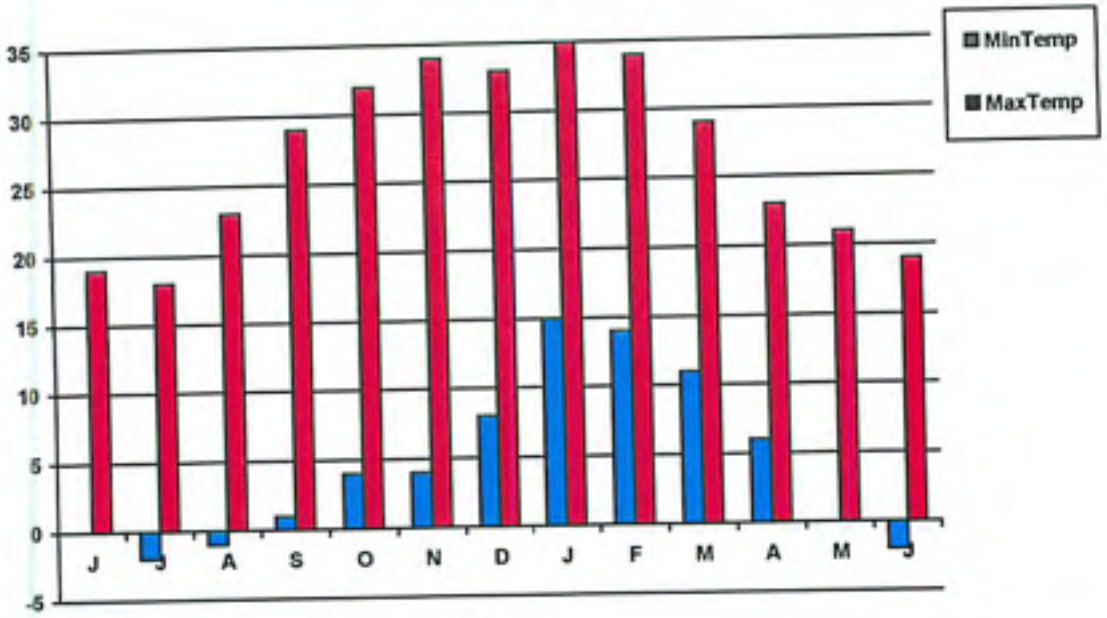

Fig. 8 - Minimum and maximum temperatures recorded at WPGR - June 96/June 97 (J.Erasmus).

Vegetation

According to **Acocks (1988)** the *Cymbopogon-Themeda* grassveld vegetation type receives approximately 400-600mm of rain annually. This vegetation type runs down the middle of the Free State in an irregular belt and is supported in the Willem Pretorius Game Reserve.

Trees seen in the ravines and along the steep slopes are white stinkwood, wild currant, karee, buffalo thorn, blue bush, bush guam and highveld cabbage tree. Red grass (*Themeda triandra*) and turpentine grass (*Cymbopogon plurinodis*) are the dominant grass species while weeping love grass, wire grass, finger grass and three-awn grasses are also abundant.

The reserve lies in the mixed grassland of the highveld which is predominantly grasslands with trees and shrubs against the hillsides and in the ravines. Sweet thorn (*Acacia karroo*) trees as illustrated in the photo below, grow predominantly on the clay soils of the flats and along water courses **(Muller, 1986)**.

Fig. 9 - Young sweet thorn tree blooming in the Willem Pretorius Game Reserve.

Kietzmann (1992) created a map illustrating the six different habitat types identified on the Willem Pretorius Game Reserve (Appendix II).

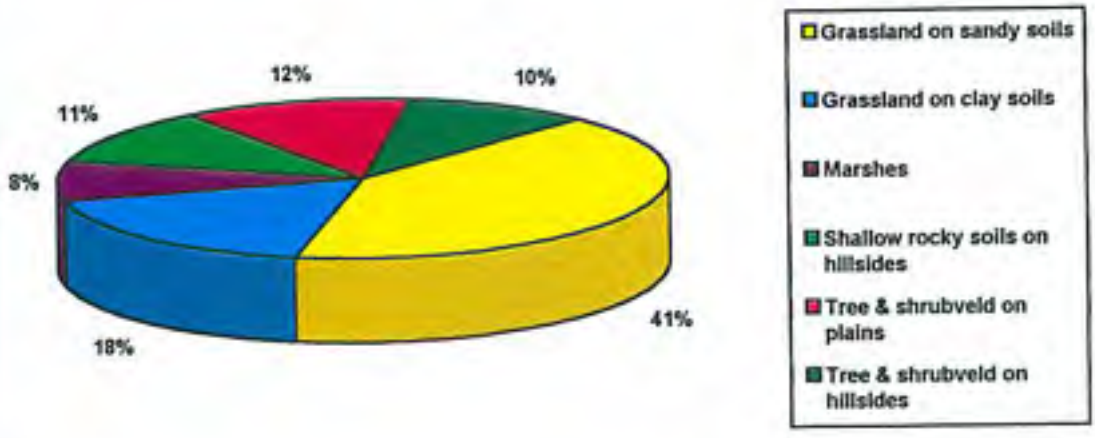

Fig. 10 - Graph illustrating the percentage of each habitat in the Willem Pretorius Game Reserve.

According to **Muller (1986)** the part of the reserve south of the dam and river comprises predominantly of plants covered by grass while the shrub and tree communities are again mainly confined to the northern side. The tree and shrub communities occupy 22% of the reserve surface area.

The tree and shrubveld of the hillsides cover approximately 46% of the hillside area. Seventy seven percent of WPGR is represented by the various grassland communities while the open plains represents 66% of the reserve. The hillside communities are restricted to the northern side of the Allemanskraal Dam and Sand River and cover approximately 21% of the reserve.

Fig. 11 - View of the Sand river on the eastern side of the Reserve.

Fauna

A large diversity of animals occur in the reserve, including several species of reptiles such as the puff adder and leopard tortoise. Several interesting species of butterflies and scorpions are also found on the reserve, as well as the common resident spider golden orb-web spider Nephila, which one often finds in the webs located between branches of the sweet thorn trees.

The Allemanskraal Dam is populated with carp, yellow-fish and catfish. Some of the catfish on WPGR can attain a mass of ± 25 kg **(WPGR Quarterly Reports)**.

According to the reserve's records, over 250 species of birds have been spotted including spurwinged and Egyptian geese, African spoonbill stork, sacred ibis, hamerkop, goliath heron, giant kingfisher, ostrich, secretary bird, helmeted guineafowl, Orange river francolin, black korhaan, Namaqua dove, doublebanded courser, spotted dikkop, pale chanting goshawk and steppe buzzard. According to **Raats (pers. comm.)** fish and martial eagles have been breeding on the reserve for a few years. The martial eagles had to move their nest from its recent location in order to avoid the baboon troop living in the area.

Most of the larger highveld mammal species which inhabited the reserve in earlier times, have been reintroduced except for the mountain reedbuck, steenbok and duiker which have always occurred here. All other species had to be introduced from other parks and reserves **(Kietzmann, pers. comm.)**.

Fig. 12 - Giraffe browsing in the Willem Pretorius Game Reserve.

The reserve has one of the largest black wildebeest populations in existence, and in conjunction with a few conservation-minded farmers were instrumental in saving this species from extinction. WPGR still accommodates the nucleus breeding herd from which other areas are restocked.

One of the largest herds of disease-free African buffalo (*Syncerus caffer*) in South Africa occur on the WPGR; their "disease free" status makes them extremely sought after, and prices of ± R 80,000 have been recently paid **(Nel, pers. comm.)**.

According to **Raats (pers. comm.)** the reserve is not large enough and the fencing not adequate to support large predators, and consequently the numbers of the game have to be regulated to prevent over stocking.

The largest predators on the reserve are caracal and black-backed jackal. Their numbers are also checked in order to assist the neighbouring stock farmers **(Raats, pers. comm.)**. The surplus game is either captured annually and sold live to the public, culled or made available to trophy hunters at the auction.

Table 2. List of other existing mammals in the WPGR, after game counting/aerial census April 97.

SPECIES	TOTALS
Black Wildebeest	420
Blesbok	320
Buffalo	75
Common Reedbuck	40
Eland	100
Giraffe	15
Impala	110
Kudu	80
Mountain Reedbuck	120
Oryx	70
Red Hartebeest	110
Springbok	1300
Zebra	60

MATERIALS, APPARATUS AND METHODOLOGY

In March 1997, I was accepted as a student/trainee in the WPGR by the Reserve Manager Wilton Raats and consequently by the Free State Department of Environmental Affairs & Tourism. He accompanied me most of the day on my first field trip in order to lay the basic rules of tracking megaherbivores in the bush, and also to get to know my past experience with wildlife. Because I am a Mozambican and spent most of my teenage years exploring the savanna, it was easier for me to understand his "bush" language.

He recommended that I use either a vehicle or walk, depending on the situation, trying at all times not to put pressure on the animals in order to observe them at close range with no danger of getting hurt. He also told me that I was not allowed to carry a rifle and that it was not possible to assist me with a tracker or ranger for my field trips. However I should feel free to come anytime to the office and use any existing data on rhino or consult the staff for any further information regarding my observations.

I was also given monitoring data sheets for keeping track of the white rhino and other species, in order to assist the rangers with monitoring of the population structure of game on the reserve (Appendix I). Basically I felt like one of the reserve's crew, authorized to drive through all "no-visitors" vehicle tracks and walk anywhere; therefore, I was requested to sign an indemnity form in case of accident while carrying out my field studies on the WPGR.

Regarding visual and sound recording equipment, I mainly used a Sony TR-750 Hi8 video camcorder. After a field trip, I usually edited the best video footage (VCR standard) of the rhinos, studied the details of their behaviour, referring and comparing to the information in the field guide books. On my next trip I would take that video footage, accompanied with the relevant filled data sheets, back to the senior rangers in order to clear up any questions regarding identification, sex, behaviour, etc.

I also used a compact-automatic 35 mm photo camera. These photos were used for rhino identification (sex, number, age, etc) and for documentation of any other particular ecological aspect of the reserve, such as the ones in this report.

All existing documentation of the WPGR was available for my use; from the few past monitoring records to the latest, more extensive demographic study done in 1996 .

In order to prepare a reasonably documented scientific paper within a limited time frame, the main objectives while studying the development of the white rhino population on WPGR (1962-1997), were to learn the following:

- The history of the white rhino population on the reserve.
- The age structure, sex ratios and physical condition of the current white rhino population.
- The main patterns of behaviour such as social organization, territoriality, reproduction and habitat utilization through direct observation of the white rhino on the reserve.

History of the White Rhinoceros Population on Willem Pretorius Game Reserve

The past records of the history of the white rhino were obtained from the reserve's quarterly reports. Before 1994, very little data of this white rhino population was available, mainly due to previous poor record keeping. Consequently the need for monitoring was realized and initiated during July/August 1994 and June 1995.

According to the records between 1962 and 1965, four bulls and four cows were originally introduced into the reserve; they all came from the Umfolozi Game Reserve, donated by the Natal Parks Board. In June 1969 one of the bulls died and in 1971 another adult bull was brought in from Umfolozi, also a donation from the NPB. By March 1972 the numbers of the introduced rhino had increased to 18 showing 10 recruitments.

Since 1976 a total of 17 live white rhino have been removed from the reserve for redistribution. Six were transferred to Tussen-die-Riviere Nature Reserve in 1977, with a 50% mortality; five were transferred to Gariep Dam Nature Reserve in 1982; two were sold to a private buyer in 1989; one adult cow was transferred to Koppies Dam Nature Reserve in 1995; one subadult male was translocated to Ficksburg in April 1997 (as part of an exchange program with a private owner, but unfortunately died two months later apparently from the severe cold weather during that time); two subadults (bull and cow) were transferred to Northern Province in June 1997, as an exchange for sable antelope and klipspringer **(Raats, pers. comm.)**.

According to the original records, five rhino were removed through hunting, including a trophy bull shot in 1986 by a Portuguese hunter which, according to **Raats (1997)** was the last rhino to be hunted on WPGR.

Further mortalities have been recorded on the reserve which were apparently caused by drowning when trying to cross the river, getting stuck in the mud, bulls fighting (presumably territorial disputes), etc. Not all dates for these events are available, neither are the sexes or ages nor particular causes of death **(WPGR Quarterly Reports)**.

In the three years proceeding December 1986, no significant recruitment was noted due to the alpha bull's death by hunting, thus leaving no other dominant bull on the reserve to substitute the loss. Consequently it took time for the younger bulls to establish their territories.

A new, relativey young bull was brought to the reserve in 1994 as a replacement for the alpha bull that died in the mud while crossing the Sand River in April 1994 **(Raats, pers. comm.)**. This bull (marked #20) came originally from Umfolozi Game Reserve, then to Qwa Qwa National Park before being translocated again to WPGR. He was in very poor condition upon arrival apparently from not having adapted to the mountainous climate of the Drakensberg. Therefore, it took him a considerable amount of time to build up his condition again. Currently, this adult male is the sole dominant bull and has been reproducing quite well with a total of six new recruitments.

Table 3. White Rhino History (WPGR Quarterly Reports).

Periods	Introductions	Births	Removals	Mortalities	Totals
1962 / 1965	8	0	0	0	8
1966 / 1969	0	0	0	1	7
1970 / 1973	1	10	0	0	18
1974 / 1977	0	6	6	0	18
1978 / 1981	0	13	0	5	26
1982 / 1985	0	9	5	6	24
1986 / 1989	0	4	2	3	* (?) 15
1990 / 1993	0	4	0	0	19
1994 / 1997	2	7	3	3	22

By 1987 the Reserve's records indicated a considerable difference in the rhino population between the amount supposedly on the Reserve and numbers obtained from a game census in the same year, consequently the population records had to be adjusted to the true size (Kietzman, 1997).

While the animal was down, the following activities were also performed in order to compile its identity :

- each rhino has been marked according to a numbering system whereby slots were cut into the ears (Appendix I). This rhino was #25 and had been previously marked.
- recording of the sex of the animal. This rhino was a male.
- the age structure is characterized into juvenile, subadult and adult. This rhino was a subadult.
- the physical condition of each animal is determined visually, using only two ratings: good and poor. This rhino was in good condition.
- morphological measurements were taken such as the ear length, horn lengths and basal circumference, head length, total body length, etc (figures not available).

Once the translocation preparations were ready, the veterinarian injected a pre-determined dose of Nalorphine to awake the animal and enable him to walk with the assistance of ropes held by the entire crew (Fig. 14).

Fig. 14 - Free State Game Capture team in action - WPGR (April, 1997).

Between March and November 1997, I had the opportunity to see most of the white rhinos on the reserve - at each encounter I tried to identify the animal's number according to their ear notches, using binoculars or digital zoom whenever necessary. The list below contains all the original rhinos which were present when I started my research work in March 97, and it also includes the latest born calf on the reserve in November 1997.

Table 4. White Rhino Population demographics on WPGR (Kietzmann, 1996/1997).

RHINO #	AGE / SEX	CONDITION / REMARKS
6	Adult female	Good condition. Marked in 1994. Not calved yet. Believed to have been covered by alpha bull #20 in 1997.
7	Adult female	Good condition. Marked in 1994. She had a female calf in March 97.
8	Young adult female	Good condition. Marked in 94 and had a male calf in Aug 97.
9	Adult female	Good condition. Marked in 1994. She has a subadult male calf #10. Believed to have been covered by alpha bull #20 in 1997.
10	Young adult male	Good condition. Marked in 1994 and is # 9's calf. Subordinate male. Whereabouts unknown since May 1997.
11	Adult female	Good condition. Marked in 1994. Believed to have been covered by alpha bull # 20 in 1997.
13	Adult female	Good condition. Marked in 1994 and she had a male calf (# 28). She had another calf September 1994 (not marked yet). She had a new male calf in November 1997.
14	Young adult female	Good condition. Marked in 1994. Not calved yet.
16	Adult female	Good condition. Marked in 1994. She had a subadult male # 17 at the time and calved again in September 1994 (not marked yet). She had another female calf Nov 1996 (not marked yet).
17	Subadult male	Good condition. Marked in 1994. #16's calf, was moved from the Reserve in June 1997.
20	Adult male	Good condition. Marked in 1994. He came from Umfolozi to Qwa Qwa N R and then to W P G R in September 1994. Currently the alpha bull with six recruitments already.
21	Adult female	Good condition. Marked in 1995 and had calf # 25. She had a female calf in September 1997 (not marked yet).
25	Subadult male	Good condition. Marked in 1995. # 21's calf , was removed from the WPGR in April 1997 as part of an exchange program.
26	Adult female	Good condition. Marked in 1995. She had calf # 27. She had a male calf in July 97 (not marked yet).
27	Subadult female	Good Condition. Marked in 1995. Removed from WPGR in June 1997.
28	Young adult male	Good condition. Marked in 1995. # 13's calf. Subordinate male.
33	Adult male	Introduced on WPGR last year as part of an exchange program, but he has not been seen since early 1997.

Observing the Behaviour of the White Rhino Population on WPGR

I spent a total of 23 days - approximately 220 hours - in field observation on WPGR, between March and November 1997 - for details of these recordings, see Appendix III and included video footage. During these field trips I tried to observe and understand the main patterns of behaviour of the white rhino - following the course's recommendations and both field guides of Owen-Smith and Richard Estes, I concentrated on the following aspects :

A. Social Structures and Interactions

According to **Estes (1991)** females and subadults are rarely solitary. During most of my field trips I had the opportunity to confirm this association and usually found them in pairs formed by an adult female with an older calf or a cow with her most recent offspring and the older subadult calf.

I also found them in groupings of five to eight animals, consisting of several cows with their offsprings and one or more subadult not directly related to any of the cows. **Estes (1991)** confirms this type of association saying that, when a mother calves again she usually rejects the older offspring which consequently seeks companionship preferably with another animal of the same age, but may attach itself temporarily to another cow with calf - also often a calfless cow may tolerate one or more juvenile substitutes and two cows may join forces, thus forming stable herds of several animals. I had the opportunity of finding a group of 10 animals grazing together on the grasslands. According to **Estes (1991)** large groups of up to a dozen animals represent temporary aggregations. These larger groups are coincidental and caused by either resting or feeding in the same area **(Kietzmann, pers. comm.)**.

Only on two occasions did I find the dominant male bull on his own for the entire day. Adult bulls are basically solitary and except to check the female's urine, they associate only with those in estrus **(Estes, 1991)**. However, throughout the year I often found the alpha bull usually accompanied by the same two adult females #9 and #11, and according to **Kietzmann (pers. comm.)** this unusual association has been taking place for awhile.

B. Territoriality, Reproduction and Antipredator Behaviour

According to **Owen-Smith (1988)** the patterns of social organisation reflect the cooperative and competitive interactions occurring among animals within local populations relating to survival and reproduction; dominance is particularly a feature of adult males which are competitors for reproductive opportunities.

On the WPGR there is currently only one dominant male - #20 - this bull is now approximately 12 years old. For the past three years he has resumed his mating activities (six recruitments), after a considerable period of adaptation and physical re-establishment, as he was in relatively bad condition upon arrival from Qwa Qwa N.P. in 1994.

Fig. 15 - "Qwa Qwa" the alpha bull of WPGR.

There are currently only two other young adult males - #28 and #10 - during my observations they have always showed subdued behaviour when the dominant bull is present, and there is consequently no competition for the dominant bull regarding territorial dominance. When I first started my research work there were two other subadult males - #17 and #25 which I had the opportunity to observe often before they were relocated to private game reserves as part of a game exchange program.

According to **Owen-Smith (1988)** white rhino bulls occupy nonoverlapping home ranges which are appropriately termed territories, and defined by his dung middens on which he always defecates and scatters. Currently the dominant male's territory covers the entire reserve, as he has been spotted one day in the far southeastern point of the reserve accompanied by an adult cow and, a few days later spotted grazing in the other extreme end of the reserve, approximately 35 kilometers away.

Once I observed the alpha bull #20 following the usual adult cows #9 and #11 for the whole afternoon, and wherever they moved, he followed them close, always keeping a certain distance. Later on, while he was following these same cows, he kept spraying urine over existing middens. On this same afternoon, the female #11 confronted him with a lot of noise and coming close to his face. He retreated momentarily but a few minutes later he was following them close and spraying the middens again.

According to **Estes (1991)** bulls make hic-throbbing sounds when approaching cows, only to be driven backward by mock attacks; when the urine test reveals a cow is approaching estrus, the bull begins a courtship lasting from 5 to 20 days, during which he shows remarkable restraint. Unfortunately copulation never took place in my presence.

The gestation period of the white rhino in WPGR and elsewhere in the main South African game reserves has been recorded to be approximately 16 months. This is based on the interval between the last occurrence of estrus, as revealed by an accompanying bull, and the birth date of the subsequent calf, from its estimated age when first seen **(Owen-Smith, 1988).**

According to **Estes (1991)** cows seek seclusion in dense cover before and several weeks after calving. I observed the adult female #16 and her brand new calf, keeping away from the rest of the rhino population for a long period of time.

Also in July, I found the adult female #26 hiding on her own in the dense bush of a ravine. I walked quite close to her in order to investigate and noticed her enlarged teats. I kept motionless for a long time trying to observe if she had a new calf but could not see one in the dense bush. She stayed in the same location all afternoon. I mentioned this incident to reserve staff before leaving. They closely followed her behaviour during the next few days and later informed me about the birth of a new calf.

Fig. 16 - Calf recently born on the reserve, suckling from its mother.

Animals may respond to the threat posed by potential predators by fleeing, attacking or standing defensively; alarm displays may be given to draw the attention of companions to the threat, or to signal to the predator that it has been detected **(Owen-Smith, 1988).**

During my walks while tracking white rhinos on WPGR, I sometimes caused them to become nervous; consequently shuffling around agitated. This happened though I was quite far away - approximately 100 m. They usually adopted a rump-to-rump formation, standing nervously, facing my direction or they would start running away from me. However, a couple of times the male subadults #17 and #25 charged me suddenly, but stopped after a few meters.

According to **Owen-Smith (1988)**, at distances of up to 800 m white rhinos respond to human scent by standing peering about uneasily, while at closer ranges their immediate response is to run off, especially in case of a cow and offspring.

Fig. 17 - White rhino calf running ahead of its mother, WPGR.

During one instance while tracking/filming the adult female #16 and her five month old calf, I allowed myself to get too close to them - approximately 20 m. I was so involved with filming such close-up footage that when I took my eyes away from the camera's view-finder, I actually realized how close we were to each other. The calf had been nervous for awhile (as it had probably noticed my scent) and several times had started running around the mother (probably to get her attention); but after she looked around and failed to smell my scent, she would resume grazing. At that point I was very scared not knowing what to do, either to remain immobile or run away. As the cow kept approaching, the calf inevitably spotted me and started running in circles and consequently the cow saw me as well and ran towards my direction making loud noises. At that stage I took off at full speed through bushes up the hill and fortunately escaped unhurt (I have included this close up footage in the attached video).

Wilton Raats, the Reserve Manager, advised me early on that while tracking rhino or buffalo by foot, I should always make myself visible to the animals so that in case of a stampede, they would not run over me by mistake. Concerning the above described closeup situation with the cow and calf, he told me that I should have started talking (softly) to the cow before she got too close to me, in order to let her know my presence. And in case of the direct charge, I should have shouted loudly to the animal before backing off.

Whenever I found white rhino in Umfolozi-Hluhluwe and Mkuzi Game Reserves, they were usually accompanied by red-billed oxpeckers (*Buphagus erythrorhynchus)*. These birds assist the herbivores in getting rid of their parasites (ticks and flies), and also act as a warning device by giving loud calls whenever danger approaches, such as a predator or hunter. However on Willem Pretorius Game Reserve there are no oxpeckers, and the cattle egret (*Bubulcus ibis*) provides this service to the white rhino and other herbivores (Fig. 17 is an example of this interaction).

C. Food, Water and Other Habitat Use

According to several sources the name White Rhino does not originate from the color but rather from the Afrikaans word "Weit" or "Wyd" which means wide-mouth. The white or square-lipped rhino is strictly a grazer feeding on grasses. During the rainy season they graze on short grasslands; in dry season they move to medium-tall grasslands. Their favourite grass is *Themeda triandra*, one of the dominant grass species on WPGR.

Fig. 18 - White rhino grazing in *Themeda* grassland during the dry season (WPGR).

I usually found the rhino grazing in areas against the hill slopes (ravines) protected from the winter winds, far from the main visitor roads. By grazing on the same areas, the short and nutritious grasses develop better thus creating areas of habitat **(Kietzmann, pers. comm.)**. These few, beautiful interior meadows are covered with rhino middens (a definite sign of their regular presence) and mainly located in the northwest section of the reserve.

According to **Skinner & Smithers (1990)** the size of the area covered by white rhino depends on the habitat conditions; in areas with good grazing and water the home range of an individual cow may be as small as 6-8 km. With deteriorating food supplies, this may increase to 10-15 km and, if there is no water available, be increased to 20 km. Regarding white rhino, they have identified the following four basic habitat requirements:

- areas of short grass
- the availability of water for drinking and in which to wallow
- adequate bush cover
- a relatively flat terrain

On the WPGR white rhino usually drink from the streams in the ravines between the hills, from rain pools where they also perform mud-wallowing, from the existing man-made water holes or, in the dry season, they have to make a longer journey to the dam. White rhinos drink daily, or even twice daily; lying in water is common over midday while mud-wallowing occurs most frequently in the early afternoon **(Owen-Smith, 1988).**

Fig. 19 - Man-made waterhole on the north west side of the reserve.

D. Sleeping, Shelter and Periods of Activity

I found that the white rhino's main active periods throughout the months of my studies - March to November 1997 - were the early hours of the morning and the late hours of the afternoon. During midday I usually found them resting or sleeping. During the hot months, they usually congregated under the shade of the sweet thorn (*Acacia karroo*). In colder and windy weather, I found them closer to the hill slopes where taller trees grow. According to **Owen-Smith (1988)** the main active periods are the early part of the morning, and the late afternoon, extending into the evening.

From my observations regarding the shelter requirements, I found them usually along the hill slopes grazing peacefully on the short grass meadows. Rarely did I see them away from these areas and when I did, they were often "in transit" to their preferable habitats or on the way to the water points of the reserve.

I once observed the dominant bull # 20 sleeping under these same thorn acacias accompanied by his favorite female companions #11 and #9; he remained on the same spot for approximately two hours. One early afternoon I tracked down a group of seven rhinos and I observed them for over three hours, during which they laid down resting under the acacias.

Fig. 20 - A group of rhinos hiding from windy weather in the hill slopes, WPGR.

RESULTS

According to the reserve's records regarding the history of the white rhino, the following figures have been recorded since its inception in 1962:

- a total of 11 white rhinos have been introduced to the reserve.
- a total of 16 rhinos have been removed from the reserve, either by hunting or by live translocation.
- a total of 53 natalities have taken place on the reserve.
- a total of 18 mortalities have taken place on the reserve.

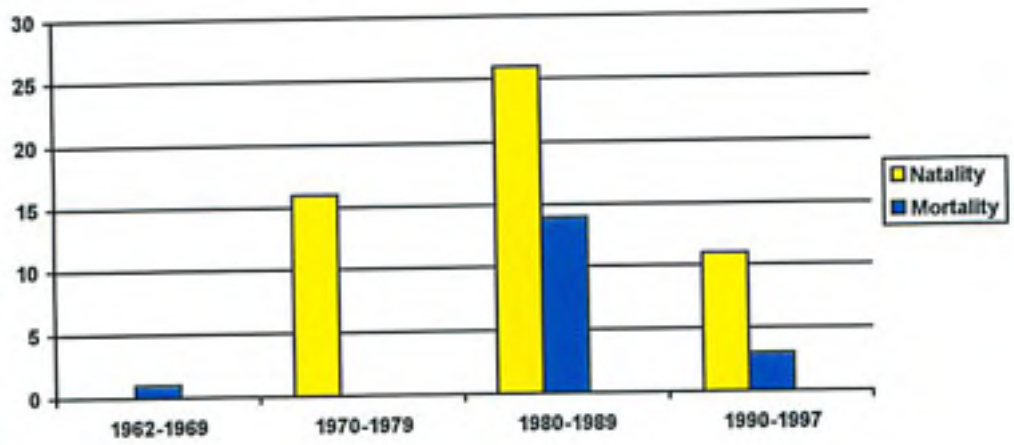

Fig. 21 - History of natality/mortality of the white rhino population on WPGR.

Currently there is a total of 21 white rhinos on the reserve. Ten are adult females, one is the alpha male, two are subordinate males, two are subadults and six are juveniles.

The other adult male (#33) which was introduced to the reserve in 1996, has not been seen since January 1997 **(Kietzmann, 1997)**, and therefore has not been included in the ratios below.

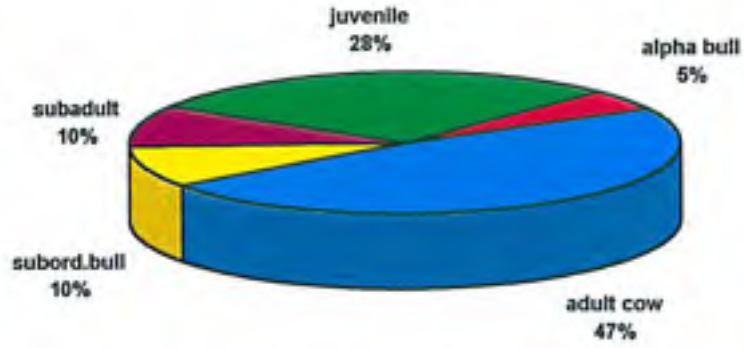

Fig. 22 - Sex and age ratios of the current white rhino population of WPGR.

Direct results from the observations of the white rhino population carried out on WPGR:

- All rhinos are in good physical condition.
- Often found rhinos in pairs (cow and calf).
- Cows with very young calves were always separate from the rest of the population.
- When threatened by my presence, calves always ran in front of their mothers.
- When threatened by my presence, rhinos would either stand in the defensive rump-to-rump formation or gallop away.
- Often the rhino would feel more threatened by my presence on foot rather than by vehicle.
- I experienced three charges by rhino during my research period, two by subadult males and the other by a cow accompanied by her very young calf. Each time they stopped or turned aside a few meters from me.
- I often encountered rhinos accompanied by cattle egrets which usually alerted them of my presence.
- I only found rhinos alone in two cases: the alpha bull (#20) grazing on its own, and the female adult (#26) hiding in dense bush - she was expecting a new calf.
- Obviously the adult bull #20 is the dominant male of the rhino population (alpha male). His territory covers the home ranges of all other rhino **(Kietzmann, 1997).**

- I observed the young adult males showing subordinate behaviour at all times when they were in the presence of the dominant bull.
- The alpha bull #20 has six recruitments since November 1996.
- During my study period (March - November 1997) , I observed each of the five new calves born on the reserve during this time frame.
- I often observed the dominant male #20 accompanied by the adult females #11 and #9; only once did I observe courtship behaviour.
- Grasslands were utilized by rhino more often than any other type of habitat on WPGR.
- I usually found the rhinos grazing on either short green grass (rainy season) or medium-tall *Themeda* grassland (dry season), during the early hours of the morning and late hours of the afternoon.
- Only twice did I observe rhino by water: once the alpha male drinking from a man-made water hole, the other time a cow with her young calf were laying in a rain water puddle during hot midday.

DISCUSSION

Before 1994, very little data and other relevant records of the white rhino population of the WPGR have been available. This was mainly due to poor record-keeping and consequently, some considerable discrepancies are found in the white rhino history of the reserve. In 1994, the need for monitoring was realized and resulted with the initiation of monitoring the population dynamics, including the marking of the rhinos (ear notching) as a method of identifying individuals regarding sex and age. In order to improve the current, still poor, monitoring system, Alan Kietzmann and Wilton Raats have recently prepared a report to the Department of Environmental Affairs and Tourism (Free State). This paper contains a detailed proposal for the proper monitoring of the white rhino on WPGR, including the following objectives :

- To determine the territories of the adult bulls.
- To determine the home ranges of the females and subordinate bulls.
- To determine habitat utilization of the rhino with respect to carrying capacity and stocking rate.
- To establish population models for management purposes - i.e. predict calving and reproductivity.
- To observe each individual on a frequent basis - a proactive anti-poaching measure.

In order to achieve the above objectives the Nature Conservation personnel (including patrolmen) will have to properly fill in the field observation sheets (Appendix I) everytime they encounter white rhino. The report also proposes full time employment of personnel to protect/monitor the rhino, in order to collect reliable data. These recordings will include day and night activity of the rhinos, and observation in areas away from the usual open and accessible roads. The proposal also includes the proper training of this specialized personnel.

The male to female ratio of the current 21 white rhino on the reserve is skewed with only one adult dominant bull. According to **Kietzmann (1997)** this alpha bull (#20 - Qwa Qwa) was brought to the reserve in September 1994 in order to substitute the dominant bull that drowned in the Sand River in April 1994. Upon his arrival the bull was in very poor condition, so it took some time to build up his condition. As expected, no recruitment of rhino took place on the reserve between September 1994 and November 1996, when his first progeny came to being.

Despite being the sole dominant bull with no real competition so far, he has already sired six offspring between November 1996 and November 1997, which means that he has been able to cover most of the reserve's adult females. Perhaps, by having no other competition on the reserve, he has attained dominance status sooner than expected in a naturally balanced population **(Kietzmann, pers. comm.)**.

The other two young adult bulls currently on the reserve - #10 and #28 - have probably reached sexual maturity at this stage but as per my observations their behaviour was still characteristic of subordinate animals. However, **Kietzmann (pers. comm.)** has observed the young adult male #28 standing his ground to alpha bull Qwa Qwa while trying to mate with the adult cow #6 in November 1997. According to **Owen-Smith (1988)**, males do not achieve sexual maturity until they have attained mature weight and thus become able to compete successfully with older males. This normally takes place at the age of ± 12 years **(Kietzmann, pers. comm.)**.

White rhino occur in small groups with territorial bulls occupying clearly defined territories. In the Umfolozi Game Reserve territories vary in size from 0.75 km^2 to 2.6 km^2 **(Skinner and Smithers, 1990)**.

According to **Owen-Smith (1988)** outside these large conservation areas, the rhino bull's territories are slightly larger, such as in Kyle Game Park in Zimbabwe where the territories varying between 5 - 11 km^2. Territory sizes of the bulls on WPGR are presently unknown, however the alpha bull Qwa Qwa currently covers the entire range of all the rhino.

According to **Kietzmann (1997)**, no significant seasonal movement of the rhino in their home ranges could be detected up to now - the monitoring will have to improve to effectively determine their home ranges and habitat utilization. It has, however, been observed that the rhino no longer use certain sections of the reserve that were utilized previously, before 1995. This could perhaps be ascribed to the fact that there may not be much grazing pressure on their behalf to force them to less favorable areas. Establishing accurately their habitat utilization will assist in determining their carrying capacity and corresponding stocking rates **(Kietzmann, 1997).**

According to **Owen-Smith (1988)**, white rhinos attain local population densities exceeding five animals per km^2 in favorable habitats. Presently on WPGR, the rhino density is 0.27 animals per km^2; the highest density recorded on the reserve was 0.4 rhino per km^2 **(Kietzmann, 1997)** Although the policy stocking rate for rhino on the reserve is presently 21 animals, one could speculate as to whether the equilibrium density of rhino has been approached - in the past, many more rhino had been supported on the same habitat **(Kietzmann, 1997).**

Data for white rhino populations introduced from Umfolozi Game Reserve into other wildlife parks show mean calving intervals varying between 2.7 to 3.5 years. Perinatal mortalities are difficult to detect due to the secretive habits of cows with new-born calves **(Owen-Smith 1988)**. Before 1994 the cows on the WPGR were never positively identified; therefore the calving intervals could never be established with confidence.

Owen-Smith (1988) maintains that the maximum sustained rates of population growth for rhino is 9 %. The average annual natality since 1976 on the reserve is 9.23 %, while the mortalities (excluding removals by either hunting or live translocations) for the same period is calculated to be 1.98 %. Consequently, showing an average population growth of 7.25 % **(WPGR Quarterly Reports)**. For an animal whose historical occurrence in this area is uncertain, this population growth compares favorably to figures quoted by Owen-Smith in 1988.

CONCLUSION

During the late 1800's the white rhino was practically exterminated in all African countries between the Limpopo and Zambezi rivers. By 1907 the white rhino was extinct everywhere else in southern Africa, except a few left in Zululand. In 1916 Frederick Vaughan-Kirby estimated there were between 30 and 40 adult white rhinos in the Umfolozi Game Reserve (**Balfour, 1991**).

In October 1953, Ian Player accompanied by Hendrik van Schoor, carried out the first aerial count of the white rhino in Umfolozi Game Reserve in which they counted 437 white rhino. By September 1957, the white rhino population had increased dramatically and Ian Player realized that in order to ensure the survival of the white rhino, they would have to be captured and translocated to areas within and outside their former range - see Appendixes IV and V.

In 1962, eight white rhinos were introduced to the Willem Pretorius Game Reserve, located in the Free State, from the Umfolozi Game Reserve. Since that time, 53 natalities have occurred on WPGR, in which some were translocated to other reserves and also made available to the public. The current population of 21 rhinos (the largest in the Free State) are in very good condition - one contributing factor is definitely the abundance of red grass (*Themeda triandra*), which is also found in Umfolozi. Although the sex ratio of the current population is skewed, with only one alpha bull for ten adult cows, six natalities have already occurred between November 1996 and November 1997; and more are expected in 1998.

Although the climate and habitat of WPGR are different from Umfolozi, the white rhino has obviously adapted well and is surviving there today. To ensure rhino conservation for the future, monitoring and management of this population will have to improve considerably. For this to happen, the Department of Environmental Affairs and Tourism of the Free State must respond favorably to the proposal presented by the WPGR Conservators.

AKNOWLEDGEMENTS

Special thanks to Wilton Raats, Senior Nature Conservator (Reserve Manager) at Willem Pretorius Game Reserve, who welcomed me as a student and made the application for my permit without any reservations. Also for initiating me into the reserve's bush and using me for monitoring game; for his advice on how to properly track rhino and especially for giving me free reign to walk all over the reserve without any restrictions, thus trusting me as "one of the staff".

Many thanks also to Alan Kietzmann, Senior Nature Conservator, for all his assistance regarding the monitoring and knowledge of the white rhinoceros and the reserve's ecosystem. Also for taking special interest in my studies and making all necessary information available to me, including the evaluation of my project at all stages by watching my video footage and by answering my questions regarding rhinos and other mammals behaviour.

Thanks also to Danie and Jellene Erasmus for their kind assistance at the WPGR office and provision of other necessary logistics.

My gratitude goes also to the Free State Game Capture's team who welcome me as well as part of their "gang", especially Kees Lawrence and Paul "Boma" Davies who took me for a flight over the reserve.

Thanks also to the Rhino & Elephant Foundation, for supplying me with their latest report regarding white rhinos on private land in South Africa.

Special thanks to my friend and bush-companion, Nelda Villines, who accompanied me during all stages of this "Rhino Project"; her editing skills were essential in completing the report.

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APPENDIX I

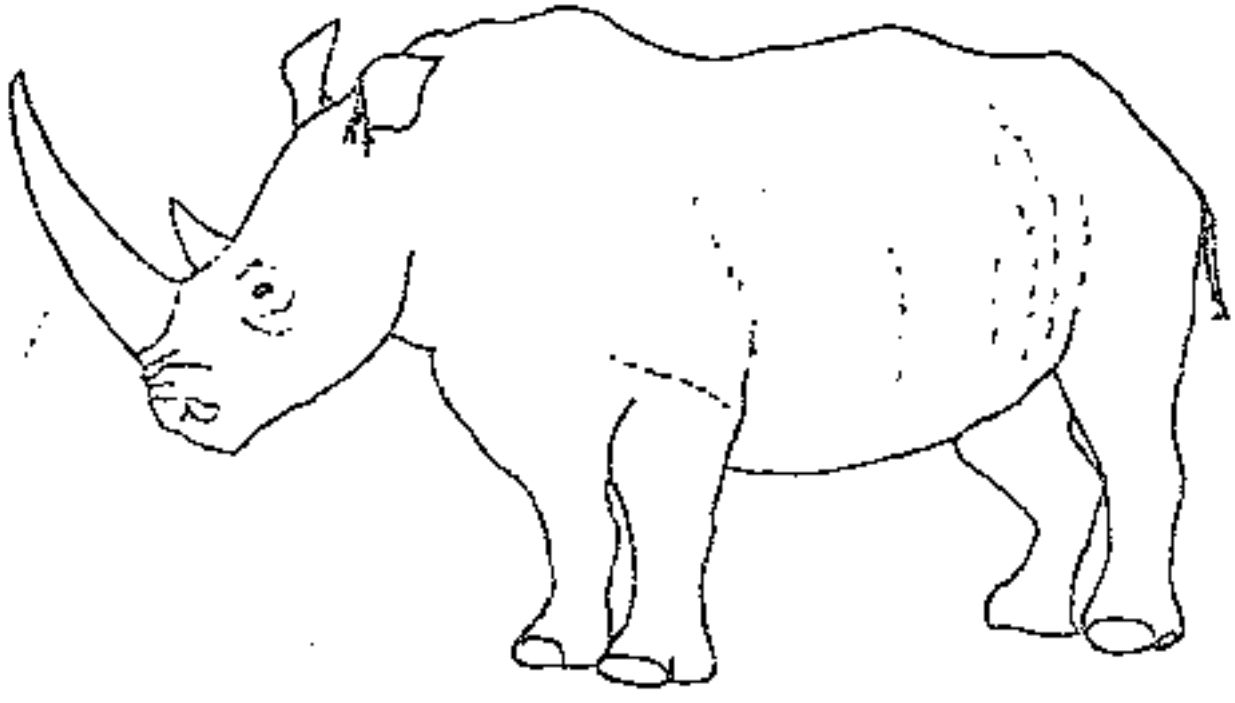
Monitoring of the White Rhino

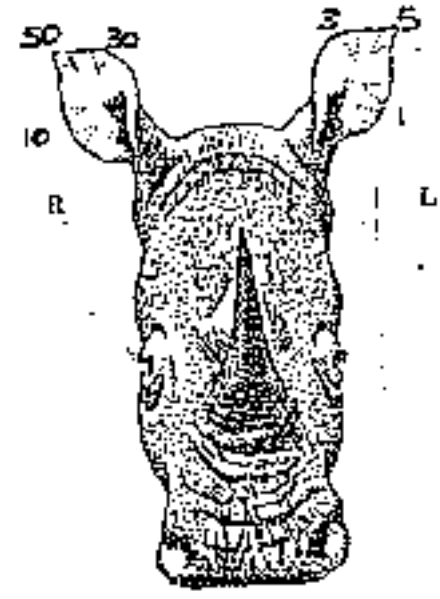
(Data Gathering System)

Prepared by Willem Pretorius Game Reserve

Monitering: Witrenoster

Willem Pretorius Wildtuin





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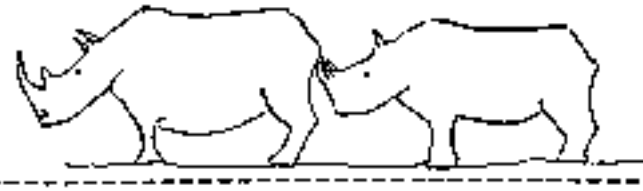

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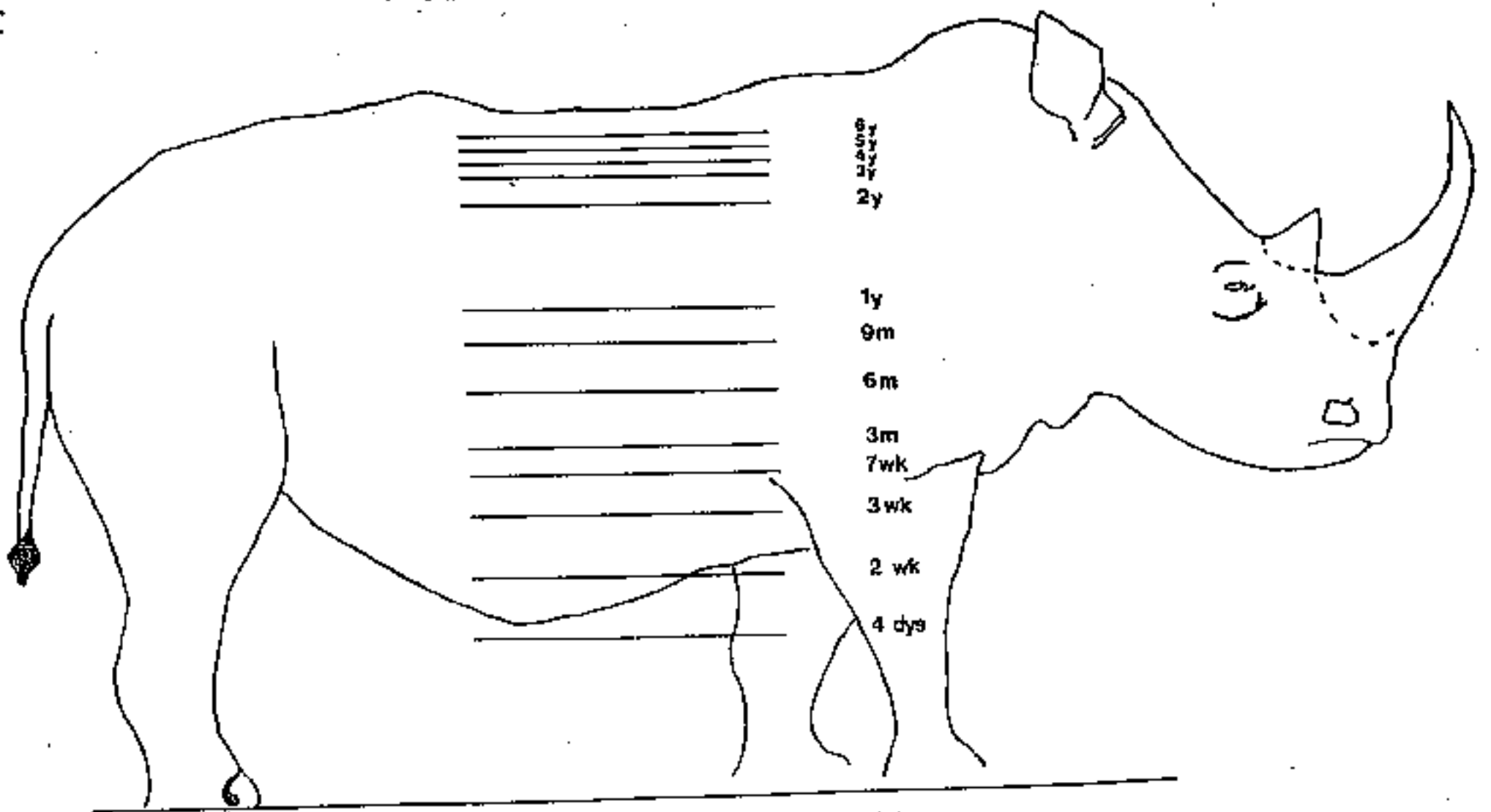

Adult horn:		horn		length ear	
	6 months		$\frac{1}{8}$		
	1 year		$1\frac{1}{8}$		
	2 years				
	3 years		$1\frac{1}{4}$		
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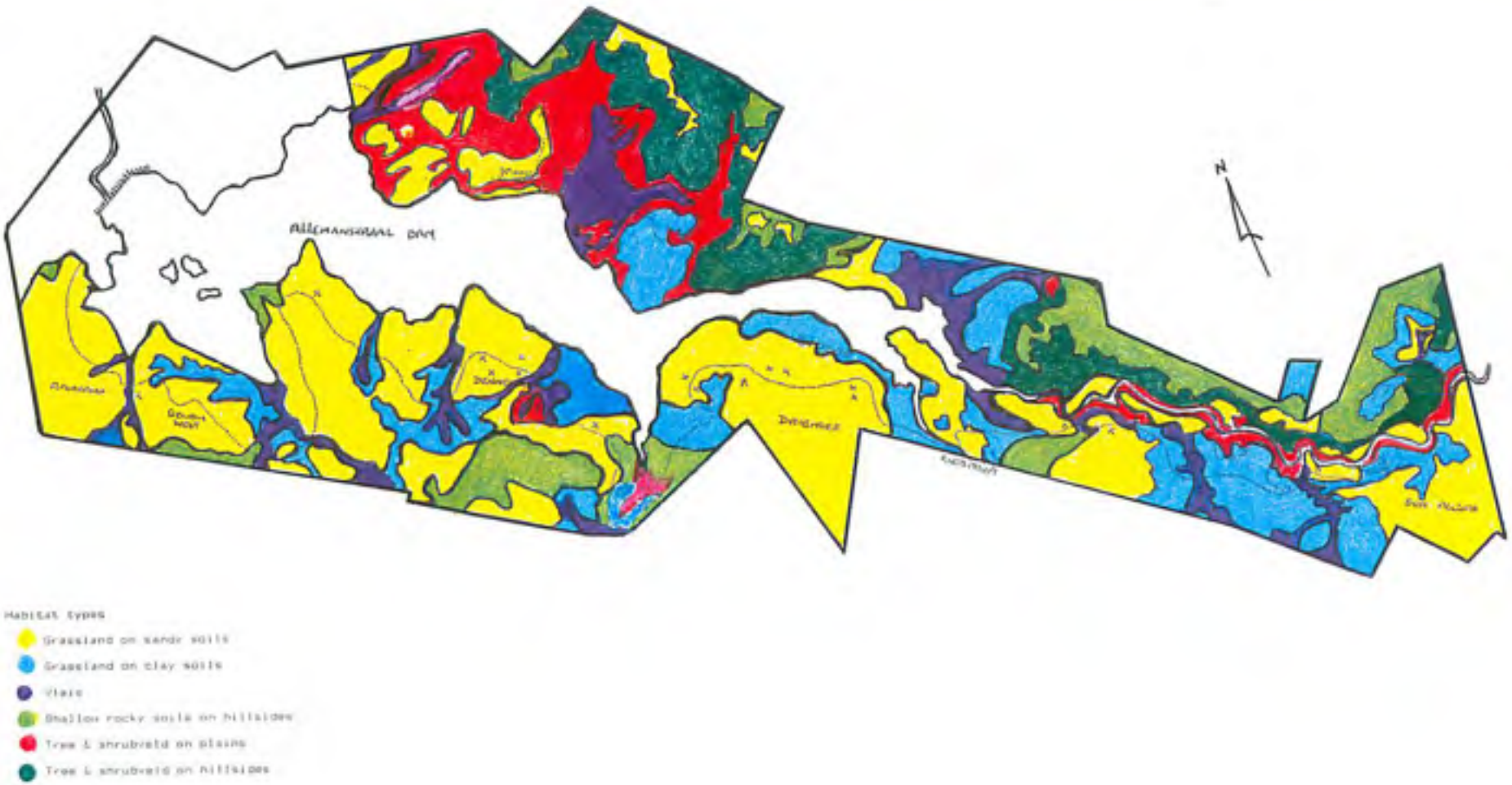
APPENDIX II

Map illustrating the different habitat types

of the Willem Pretorius Game Reserve

Prepared by Alan Kietzmann (WPGR, 1992)


N
Habitat types
Grassland on sandy soils
Grassland on clay soils
Vlei
Shallow rocky soils on hillsides
Tree & shrubveld on plains
Tree & shrubveld on hillsides

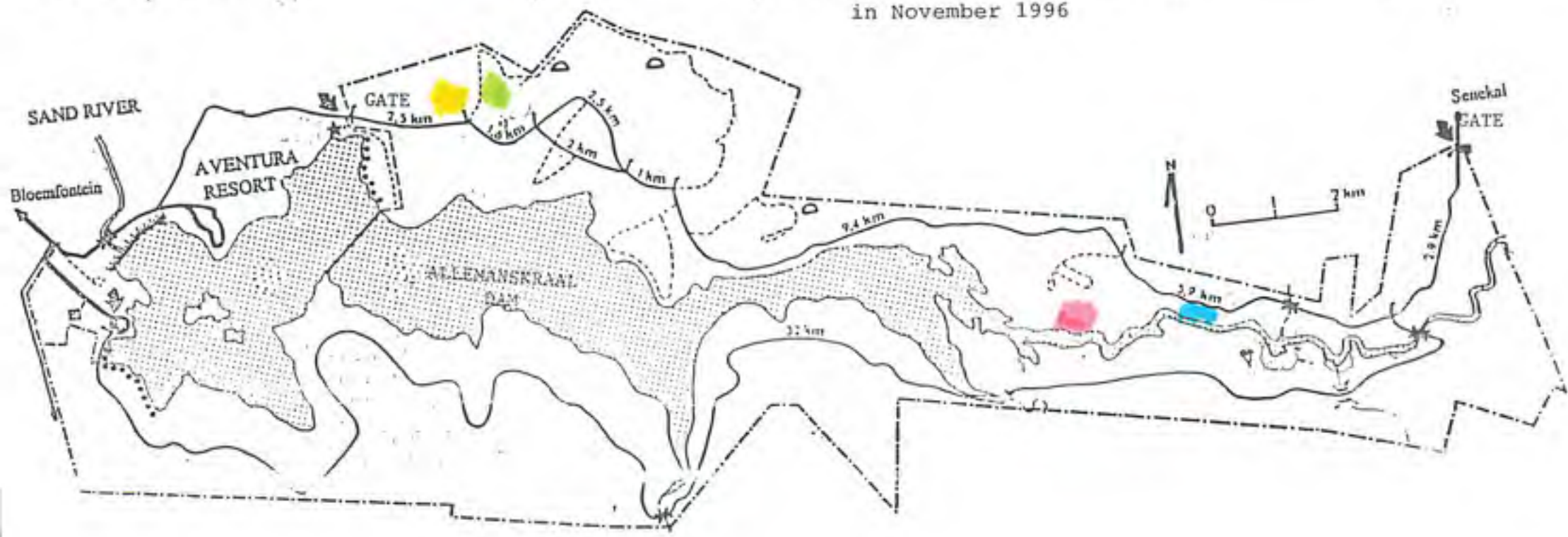
APPENDIX III

Monitoring of the White Rhino on WPGR

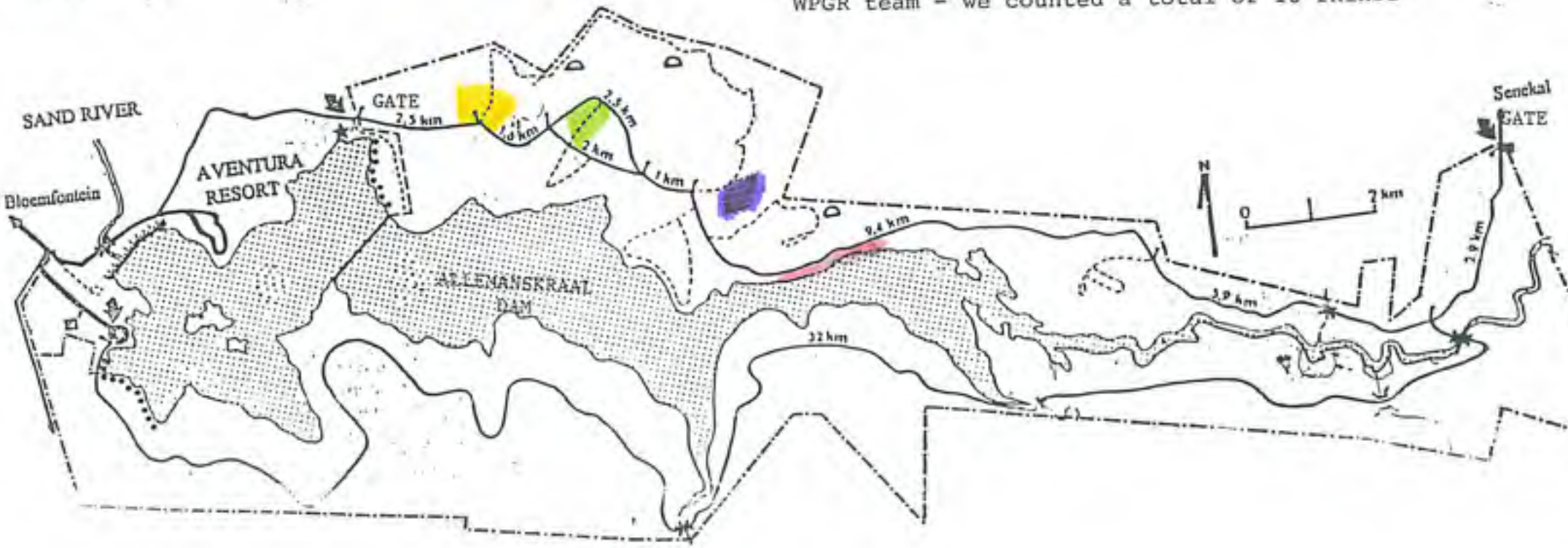
(Data Sheets)

Prepared by F. Bermudes (1997)

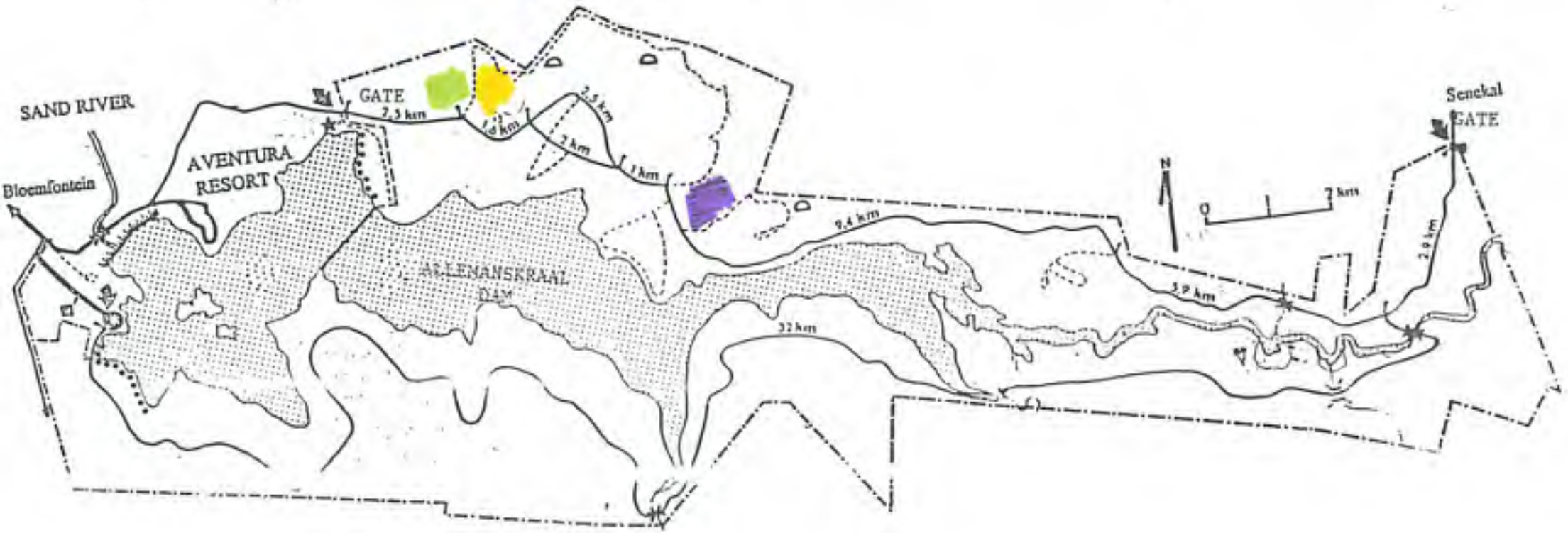
D A T E	LOCATION	SUBADULT FEMALE	SUBADULT MALE	ADULT FEMALE W/UNMARKED CALF	ADULT FEMALE	ADULT MALE
08/03/97	GREEN					# 20
15/03/97	GREEN					# 20
15/03/97	Green			# ? W/subadult calf No ID		
15/03/97	Yellow			# 13 w/unmarked calf		
16/03/97	Yellow		# 28/# 17	# 13 w/unmarked calf	#11 & # 9	# 20
16/03/97	Blue			Could not identify 3 Rhinos		
16/03/97	Blue		# 10			
16/03/97	Pink			# 16 w/unmarked calf born in November 1996		



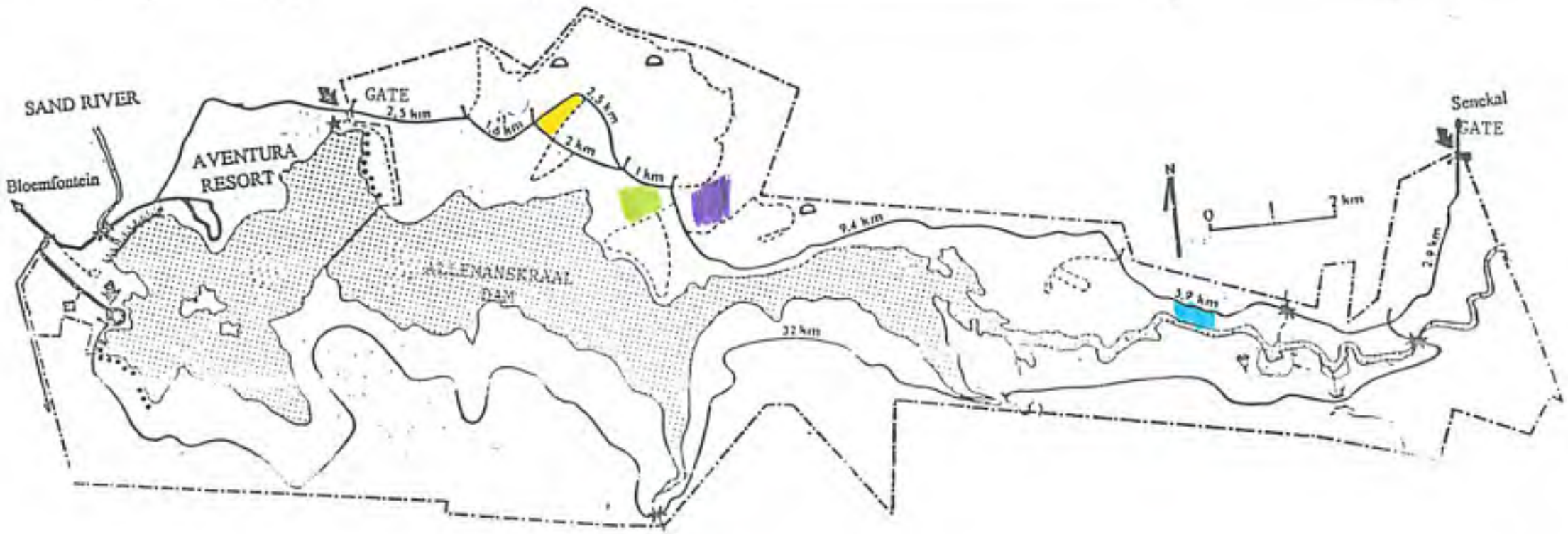
D A T E	LOCATION	SUBADULT FEMALE	SUBADULT MALE	ADULT FEMALE W/UNMARKED CALF	ADULT FEMALE	ADULT MAL
23/03/97	Yellow			# 13 w/unmarked calf (morning)		
23/03/97	Pink			# 16 w/unmarked calf		
23/03/97	Violet		# 17 & # 28		# 11 & # 9	# 20
23/03/97	Violet			# 26 w/unmarked calf		
23/03/97	Yellow			# 13 w/unmarked calf (noon)		
24/03/97	Pink			# 16 w/unmarked calf		
24/03/97	Green					# 20
25 & 26 March 97				Game Counting Operation with WPGR team - we counted a total of 18 rhinos		



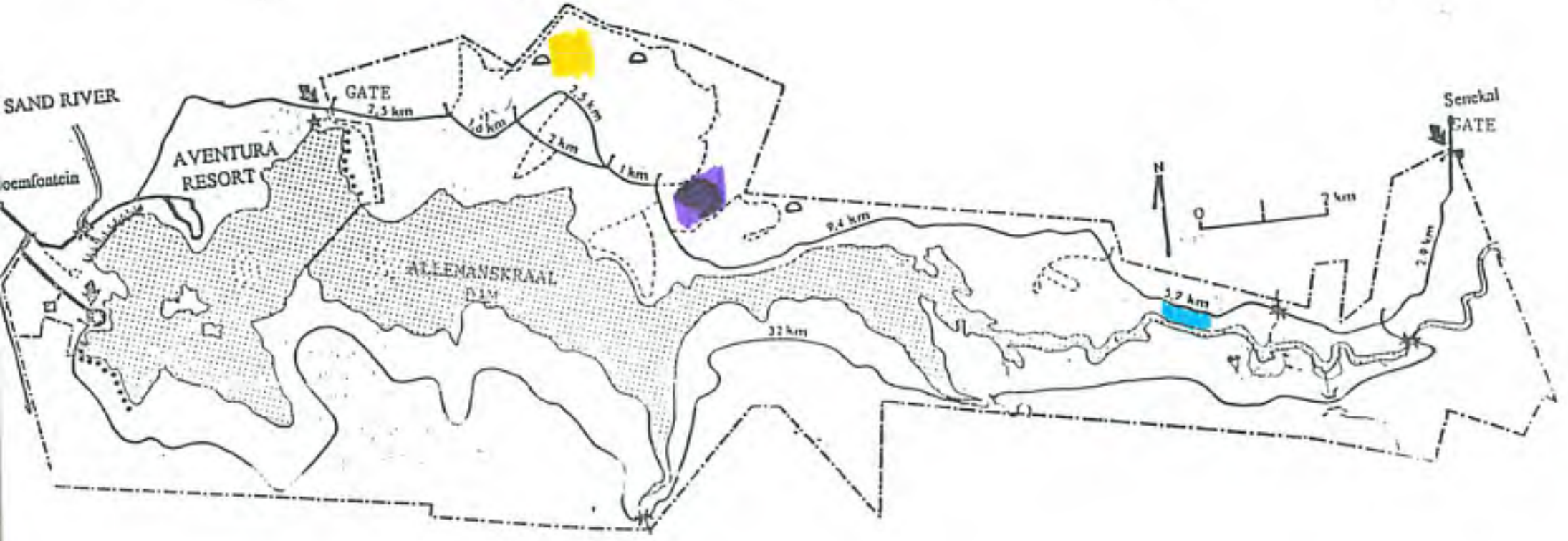
D A T E	LOCATION	SUBADULT FEMALE	SUBADULT MALE	ADULT FEMALE W/UNMARKED CALF	ADULT FEMALE	ADULT MALE
04/04/97	Violet			# 14 w/unmarked calf		
04/04/97	Violet		# 28 & # 17	# 13 w/unmarked calf		
05/04/97	Violet		# 17	# 14 w/unmarked calf		
05/04/97	Violet		# 28 & # 17	# 13 w/unmarked calf		# 20
05/04/97	Yellow		# 25		# 21	
05/04/97	Green		No ID			
06/04/97	Violet			# 13 w/unmarked calf	# 11 & # 9	# 20
08/04/97	Violet		#28,#25 & #17	# 13 & # 14 w/unmarked calves	# 11 & # 9	# 20



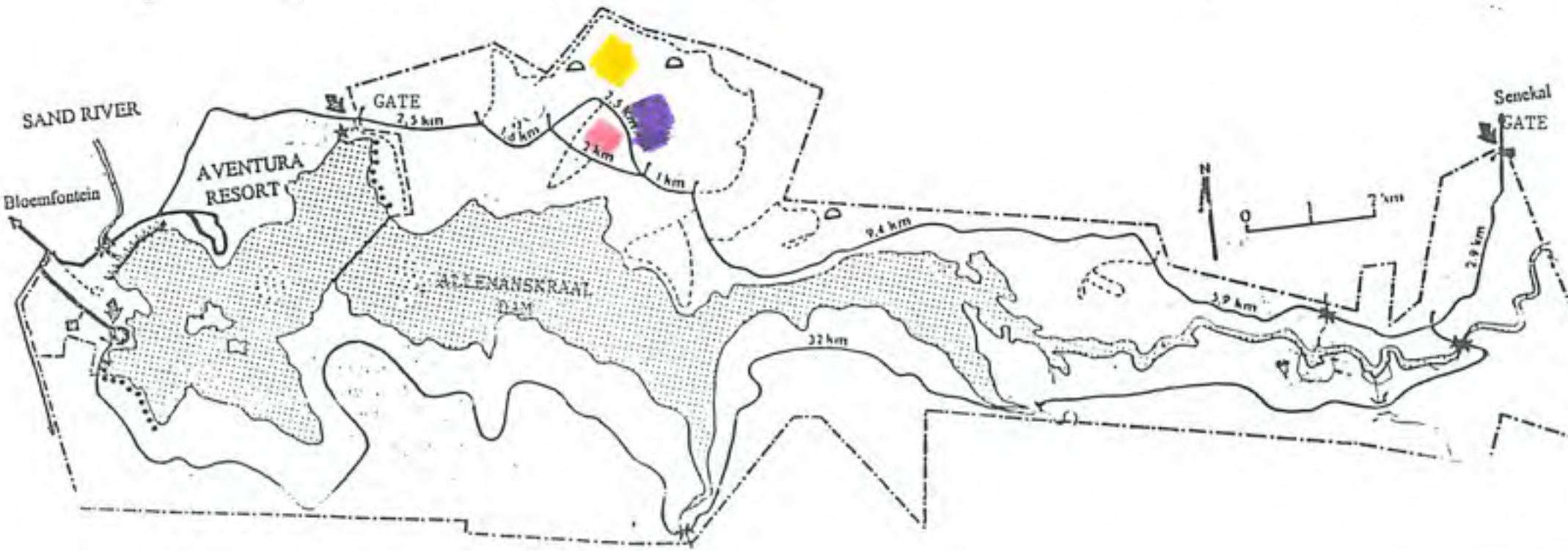
D A T E	LOCATION	SUBADULT FEMALE	SUBADULT MALE	ADULT FEMALE W/UNMARKED CALF	ADULT FEMALE	ADULT MALE
19/04/97	Violet		# 28	# 13 w/unmarked calf		
19/04/97	Violet		# 28	# 13 w/unmarked calf	#11 & # 9	# 20
20/04/97	Blue			No ID two rhinos on river		
24/05/97	Yellow					#20
25/05/97	Violet					#20
26/05/97	Violet				#11 & # 9	#20
26/05/97	Green		#28	# 13 w/unmarked calf		



D A T E	LOCATION	SUBADULT FEMALE	SUBADULT MALE	ADULT FEMALE W/UNMARKED CALF	ADULT FEMALE	ADULT MALE
04/07/97	Violet		#28	# 13 w/unmarked calf		
05/07/97	Violet				#11 & # 9	# 20
06/07/97	Blue			No ID two rhinos		
06/07/97	Yellow			# 26		
23/08/97	Violet					#20



D A T E	LOCATION	SUBADULT FEMALE	SUBADULT MALE	ADULT FEMALE W/UNMARKED CALF	ADULT FEMALE	ADULT MAL
10/10/97	Violet			#13 w/unmarked calf	#11 & #9	#20
11/10/97	Violet			# 8 w/unmarked calf-just born	#11 & #9	#20
12/10/97	Yellow			#26 w/unmarked calf - just born		
12/10/97	Pink			# 13 w/unmarked calf		



APPENDIX IV

MOVEMENT OF WHITE RHINO FROM 1 JANUARY 1961

- UMFOLOZI GAME RESERVE -

Copied from Ian Player's book "The White Rhino Saga" (1973)

Appendix

Movement of White Rhino from 1 January 1961:

COUNTRY	PARK OR RESERVE	MALE	FEMALE	TOTAL
Africa				
Angola (10)*	Quiscama National Park	5	5	10
Swaziland (16)	Mlilwane	3	3	6
	Hlane Game Reserve	2	2	4
	Ephvondvo Game Ranch	3	3	6
Botswana (4)	Chobe Game Reserve	2	2	4
Kenya (6)	Meru Game Reserve	3	3	6
Mozambique (85)	Lourenco Marques Zoo	1	1	2
	Maputo Game Reserve	32	39	71
	Gorongoza National Park	4	8	12
Rhodesia (92)	Kyle Dam Game Reserve	13	14	27
	Matopos National Park	6	7	13
	Mcillwaine National Park	1	2	3
	Victoria Falls National Park	2	2	4
	Wankie Game Reserve	15	20	35
	Henderson Bros. Doddiburn	5	5	10
Zambia (4)	Livingstone Game Park	2	2	4
Transvaal (479)	Hemlock	1	1	2
	Iscor	3	3	6
	Johannesburg Zoo	2	2	4
	Kruger National Park	116	87	203
	Krugersdorp Nature Reserve	2	2	4

* Indicates total number of rhino received.

COUNTRY	PARK OR RESERVE	MALE	FEMALE	TOTAL
Africa (*continued*)				
	Loskop Nature Reserve	7	9	16
	Mala Mala	25	18	43
	Nelspruit	1	1	2
	Manyaleti Game Reserve	3	3	6
	Pietersburg Nature Reserve	3	2	5
	Pretoria Zoo	2	3	5
	Rondalia Game Reserve	2	2	4
	Rob Ferreira Nature Reserve	1	1	2
	Springs Municipality	1	1	2
	Pontdrift	1	1	2
	Rasinia Farm	1	1	2
	Timbavati Nature Reserve	3	5	8
	Vanderbijl Park Nature Reserve	4	3	7
	Waterpoort	1	1	2
	Komatipoort	2	4	6
	Naboomspruit	2	2	4
	Vaalwater	2	3	5
	Roedtan	1	1	2
Cape (6)	Thomas Baines Nature Reserve	1	0	1
	Grahamstown Nature Reserve	1	2	3
	Tygerberg Zoo Park	1	1	2
O.F.S. (12)	Willem Pretorious Game Reserve	4	4	8
	Bloemfontein Zoo	3	1	4
Natal (85)	Hluhluwe Game Reserve	4	2	6
	Mkuzi Game Reserve	6	5	11
	Ndumu Game Reserve	8	10+ 6 calves	24
	Nyala Game Ranch	1	1	2
	Queen Elizabeth Park	6	4	10
	Umfolozi Game Ranch	7	9	16
	Vernon Crookes Game Reserve	3	3	6

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COUNTRY	PARK OR RESERVE	MALE	FEMALE	TOTAL
	Midmar	3	3	6
	Subizi Game Ranch	2	2	4
South West Africa (12)	Ogiwarongo	6	6	12
West Germany (7)	Bremen Zoo	1	1	2
	Hanover	1	0	1
	Leipzig	1	1	2
	Gehenkirchen	1	1	2
East Germany (7)	Berlin	1	1	2
	Dresden	1	1	2
	East Berlin Zoo	0	2	3
Denmark (5)	Copenhagen	2	3	5
Sweden (2)	Kolmarden	1	1	2
Switzerland (4)	Rapperswil	1	1	2
	Zurich	1	1	2
Holland (4)	Rotterdam	1	1	2
	Arnhem Zoo	1	1	2
Japan (4)	Tokyo	1	1	2
	Sindai Zoo	1	1	2
India (3)	Mysore Zoo	1	1	2
	Calcutta Zoo	1	0	1
Cuba (2)	Havana Zoo	1	1	2
Czechoslovakia (10)	Dvur Kralove	3	7	10
Taiwan (4)	Taipei Zoo	2	2	4
Spain (6)	Majorca Zoo	1	1	2
	Barcelona Zoo	1	1	2
	Toledo Zoo	1	1	2
Portugal (2)	Lisbon Zoo	1	1	2
Burma (4)	Rangoon	2	2	4

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COUNTRY	PARK OR RESERVE	MALE	FEMALE	TOTAL
Canada (6)	Calgary	1	1	2
	Edmonton	1	1	2
	Toronto	1	1	2
United Kingdom (31)	Whipsnade	8	14	22
	Woburn Park	3	3	6
	Longleat	3	3	6
	Regents Park	1	1	2
	Chester	1	1	2
	Windsor Park	3	4	7
	Colchester	2	4	6
United States (198)	Bronx, New York	1	1	2
	Catskill, New York	1	1	2
	Chicago	1	1	2
	Detroit	1	1	2
	Fort Worth	3	6	9
	San Diego	7	15	22?
	Albuquerque	1	1	2?
	San Antonio	1	1	2
	Los Angeles	1	1	2
	Louisville	1	1	2
	Memphis	2	2	4
	Milwaukee	1	2	3
	New Orleans	1	1	2
	Oklahoma City	1	1	2
	Omaha, Nebraska	1	1	2
	Phoenix, Arizona	1	1	2
	San Francisco	1	1	2
	Tampa, Florida	1	1	2
	World Animal Park, Dallas	4	4	8
	Gladys Porter Zoo, Brownsville	1	1	2
	Lion County Safari	12	28	40
	International Animal Exchange	6	14	20
	Fresno Zoo	1	1	2
Europe (39)	Destination unknown	16	23	39

Grand total as at end of March 1972: 1109

APPENDIX V

TABLE I: WHITE RHINOS MOVED BY NATAL PARKS BOARD 1988 - 1996

TABLE II: WHITE RHINO ON PRIVATE LAND IN SOUTH AFRICA 1987 & 1996

Copied from "White Rhinos on Private Land in S.Africa", provided by the Rhino & Elephant Foundation (1997)

Table I: White rhinos moved by Natal Parks Board 1986 - February 1996 (excluding 1993).

REGION	Movements out of region	Movements into region	Total gain or loss
Unknown	5	8	3
Natal Private	14	28	14
Natal hunters*	0	53	53
Natal Parks	231	0	-231
N & NW Tvl	5	124	119
Mpumalanga	13	37	24
S Tvl	5	17	12
Cape	5	16	11
Free State	6	2	-4

* These animals are known to have been sold as trophies to professional hunters in Natal.

Table II : White rhino on private land in South Africa 1987 & 1996 (number of populations is given in brackets).

	1987	1996	CHANGE	% CHANGE
East Cape	8 (2)	25 (4)	17 (2)	213 (100)
North Cape	9 (2)	23 (4)	14 (2)	156 (100)
Free State	25 (3)	51 (9)	26 (6)	104 (200)
Natal	109 (13)	159 (17)	50 (4)	46 (31)
Lowveld	127 (16)	255 (35)	128 (19)	101 (119)
North & NW	251 (34)	676 (67)	425 (33)	169 (97)
S Tvl	45 (7)	54 (8)	9 (1)	20 (14)
TOTAL	574 (77)	1243 (144)	669 (67)	117 (87)