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THE STATUS OF THE SQUARE-LIPPED RHINOCEROS, *CERATOTHERIUM SIMUM SIMUM* (BURCHELL), IN ZULULAND

JOHN VINCENT
Natal Parks Board

INTRODUCTION

The southern race of *Ceratotherium simum* was originally widely distributed over the greater part of southern Africa. This distribution has been well documented in the past, and has been adequately summarised by recent authors, viz. Sidney (1965) and Huntley (1967).

By 1900 the race had been exterminated virtually everywhere except for an unknown number which remained in the area of the Umfolozi Game Reserve. This presumably small population was rigorously protected from the inception of Umfolozi in 1897, and it is the progeny thereof that form the subject of this paper. The aim of this paper is to trace the numerical status of the species to date and to provide some preliminary comments on the population dynamics.

THE AREA

When originally proclaimed in 1897, Umfolozi Game Reserve embraced only an area between the Black and White Umfolozi Rivers from their confluence westward for some 14 miles. Essentially this situation prevailed until 1962 when various additions were proclaimed. These included the major portions of what had been State Land known as the western and southern buffer zones respectively, and a small portion of land north of the Black Umfolozi River.

Since that time the eastern, southern and western boundaries have fenced by a rhino-proof cable and barbed wire fence, whilst the adjacent areas to the west and south have now been settled by Bantu. These two factors have had a profound effect upon the rhinoceros population for it has been contained within only a remnant of its former range; Player and Feely (1960) point out that the main direction of seasonal straying is southwards and, to a lesser extent, westwards. The only exit from Umfolozi Game Reserve at present is across the Black Umfolozi River into the adjacent State Land known as the Corridor, whence they may move further north towards Hluhluwe Game Reserve, or into adjacent Bantu Reserve. It is also probable that some animals leave the game reserve via the dry bed of the White Umfolozi River in the south western corner. A barrier is erected each year but summer floods wash it away, leaving a gap, often for some months.

Up until the present time (January, 1969), there has been no barrier to movement east and west out of the Corridor and then south through native reserve, and there is good evidence that such

movement actually has been taking place. However a start has now been made on a rhino-proof fence on the eastern border of the Corridor and another has been proposed for the western border. These fences will have the effect of containing the rhinoceros population even farther.

In summary then, prior to 1963 there was free movement of White Rhino over a wide area south and west of the game reserve but since then the movement has been largely stopped by the boundary fence. Nevertheless, because of the continued but reduced movement "round the ends" of the fence, it is necessary for the purposes of this study, to consider the entire population occupying the area shown in Figure 1. This covers some 294,000 acres (460 square miles).

Player and Feely (*op. cit.*) describe briefly the habitat requirements of the species and various limiting factors. A change would appear to have taken place since then however, in that Hluhluwe Game Reserve has now been extensively occupied by the species, including even the comparatively broken terrain in the northern parts. A recent ground count (December, 1968) revealed a total of some 170 animals north of the main road through the Corridor from Mtubatuba to Hlabisa (see Figure 1); 50 of these were counted in the northern section of Hluhluwe Game Reserve. (P. Hitchins, pers. comm.). This occupation is probably a result of two factors: (a) the build-up of population pressure in Umfolozi Game Reserve, and (b) the barrier to dispersal southwards.

NUMERICAL STATUS

Numerous attempts have been made to assess the numbers of Square-lipped Rhinoceros. Player and Feely (1960) have summarised the results of estimates and censuses up to 1959, since which time a further six aerial counts have been carried out.

The method employed in the three most recent counts is that described briefly as follows:

The aircraft used is a Cessna 172 which seats four people and is high-winged. Besides the pilot the occupants are a recorder and two observers, one on each side. The procedure is to divide the whole area into conveniently-sized sections, preferably bounded by natural boundaries such as rivers but where necessary, recourse has to be made to roads as boundaries. Each of these sections is not so large that it takes more than 2½ to 3 hours to complete. An initial course is selected and, flying at about 70 m.p.h. at an average altitude above ground level of approximately 600 ft., parallel courses are flown in opposite directions on this compass bearing and its reciprocal. The interval between successive courses is about 1,200 yards, so that each observer covers a strip about 600 yards wide. The advantage of this technique is that if the observers know their country they are less likely to double-count or miss animals, for on the return run their counting strip is adjacent to that just covered.

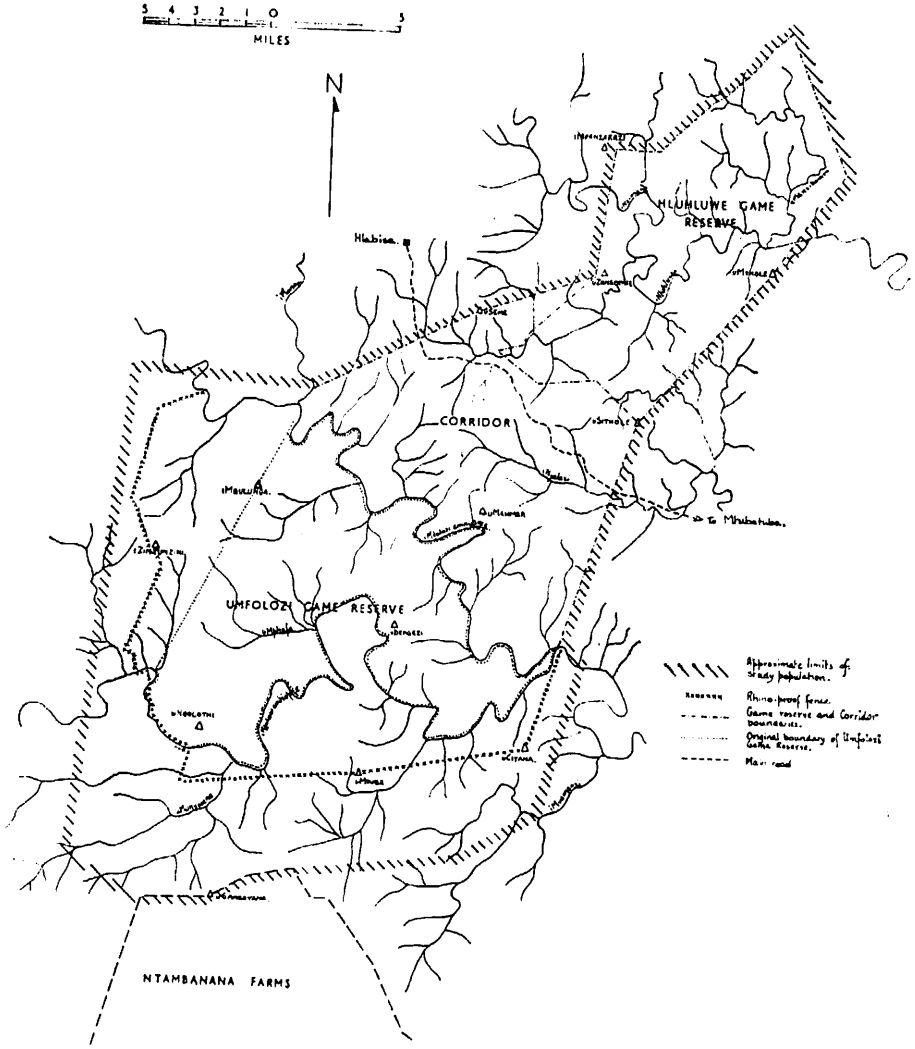

Figure 1

The observers are able to focus all their attention on counting for they have only to shout the information with regard to numbers seen to the recorder who then enters it on a small scale map in the appropriate area. In this way too, a good idea may be obtained of the distribution.

An inherent error, and one which is constant from count to count is that caused by the "blind spot" beneath the aircraft. It is calculated on the basis of the above, that this error amounts to 7.5 per cent of the total area, so that it must be assumed that only 92.5 per cent of the animals are counted. This error is however not considered for the purposes of this paper.

Prior to this method of counting being evolved it is not possible to assess the accuracy of the counts, and for this reason only the counts for 1965, 1967 and 1968 have been considered. These are summarised in Table 1, with totals of previous aerial counts for comparison.

TABLE I

Showing the distribution and numbers of White Rhino in the Hluhluwe-Corridor-Umfolozi complex since 1959.

Area	1959	1960	1962	1964[2]	1965	1967	1968
Hluhluwe Game Reserve	?	40[1]	31	?	40[3]	55	89
Corridor	106	55	133	61	117	149	175
Between rivers South of White Umfolozi — Umfolozi Game Reserve	331	409	476	300	560	577	530
Between rivers South of White Umfolozi — Umfolozi Game Reserve	130	141	93	169	100	148	187
Bantu Reserves			154		95	71	394
Totals	567	645	877	530	912	1000	1020

NOTES

1. This figure was an estimate.
2. The 1964 count was carried out under very adverse conditions and can under no circumstances be considered reliable.
3. This figure of 40 was estimated from observations.
4. It is considered that this figure should be somewhat higher (probably between 60 and 70), but continued molestation by the local natives has led the animals to lead very much more secretive lives; they take to dense bush during the daylight hours, and are difficult to spot from the air.

For the sake of convenience, animals counted inside the present reserve boundaries in earlier counts are taken as having been in the game reserve.

REMOVAL

Since 1961 a programme of translocation of the White Rhinoceros has been carried out as described in previous papers e.g. Player (1967), Rochat and Steele (1968), Anon. (1968). The animals concerned have all been removed from the Umfolozi population, initially from within the game reserve, but latterly from adjoining Bantu Reserve. Thus it is pertinent to include the number of removed animals in the present discussion, particularly since perusal of Table I might create an erroneous impression regarding the actual rate of increase of the population. The numbers of animals removed, either by translocation or due to their having succumbed during immobilisation, are shown in Table II. For the purposes of this tabulation, the count for 1964 has been omitted.

TABLE II

Showing the numbers of animals removed from the population as a result of immobilisation in the intervals between successive censuses.

Interval	*Males*	*Females*	*Total*
1960-1962	29	31	60
1962-1965	120	108	228
1965-1967	98	107	205
1967-1968	62	48	110
Total	309	294	603

MORTALITY

As with any population of wild animals the exact rate of mortality is very difficult to assess for it is highly unlikely that all dead animals will be located. However, a record of deaths has been kept and this is summarised in Table III according to the date on which the animal was found.

TABLE III

Showing recorded deaths of rhinos in the intervals between successive censuses

Interval	*Males*		*Females*		*Sex unknown*		*Total*
	Ad.	*Juv.*	*Ad.*	*Juv.*	*Ad.*	*Juv.*	
1962-1965	19	5	8	3	4	5	43
1965-1967	23	—	13	1	13	4	55
1967-1968	6	1	6	—	2	—	15
Total	48	6	27	4	19	9	113

These figures provide only a minimum estimate of the losses by death from natural causes. It should be mentioned that a severe drought at the end of 1964 had a serious effect on the rhino population during the 1965 winter.

AGE STRUCTURE

From the air it is possible to recognise three age categories of rhino, namely new-born (up to about 3 months), juvenile, and adult. However, because of the subjectivity involved in estimating the age of small calves no attempt will be made to separate the first category mentioned: new-born calves are lumped with the juvenile age category.

Dr. U de V. Pienaar (pers. comm.) states that a definite calving interval has been obtained from a female kept in a large enclosure in the Kruger National Park. This interval was within a few days of $2\frac{1}{2}$ years. He also mentions that a second female was expected to calve very shortly (December, 1968), and this would provide an interval of about $2\frac{3}{4}$ years. A third record obtained from the only female in the northern district of the Park indicates a calving interval of between $2\frac{1}{2}$ and 3 years. One further record of the interval between successive calves comes from the Loskop Dam Nature Reserve where a female was observed to calve $4\frac{1}{2}$ years after having produced the first calf to be born in the Transvaal since the extinction of the species there in the last century.

These details are mentioned because they are relevant to the present discussion on age structure. Both Player and Feely (1960) and Foster (1960) refer to a lasting relationship between mother and calf, but nearly all females seen with small calves during the recent aerial censuses were on their own. It would seem then that the older calf leaves its mother when a new calf is born, although it may rejoin her at a later stage. In this context it is interesting to note that 132 (72.5 per cent) of the 182 observations of juvenile animals made during the 1968 count were of a single animal with its mother only, whilst the bulk of the remainder (13.2 per cent) were of a single juvenile with two "adults" – possibly either the older calf that had rejoined its mother or a bull.

Because of this it is a relatively simple matter to assign an animal to the juvenile age category: any calf still accompanying its mother is assigned as such. From the evidence quoted above it can reasonably be assumed that the likely calving interval is about three years, so that the term "juvenile" refers to animals up to three years of age. This system of ageing has been consistently used for the past three censuses, and the figures obtained for juvenile animals are summarised in Table IV.

TABLE IV

Numbers and percentages of juvenile animals observed during rhino censuses.

Year	*Adult and Immature*	*Juvenile*	*Total*	*% Juvenile*
1965	704	168	872[1]	19.3%
1967	770	230	1,000	23.0%
1968	807	213	1,020	20.9%
Mean				21.1%

Note 1: This figure does not include the 40 animals estimated to have been in Hluhluwe Game Reserve.

SEX RATIO

A number of studies have been made on this subject, but only two are known to involve a sufficiently large sample. One is from unpublished data in the Natal Parks Board files and involves 409 animals of which 213 were males and 188 females, whilst 8 were unsexed. The second involves a sample of 226 animals of which 116 were males and 110 females. (Dr. M. Keep, pers. comm.). Neither of these samples show a sex ratio significantly different from unity ($\chi^2=1.557$, d.f.1, in the first and $\chi^2=0.164$, d.f.1, in the second).

It is concluded then that the sex ratio of this population of Square-lipped Rhinoceros is unity.

DISCUSSION

1. Numerical status

Quite clearly the population has exhibited a steady upward trend, although since the count in 1962 the trend is not readily apparent. This, as already mentioned, is due to the number of animals which were removed from the population, having the effect of levelling it off. (See Fig. 2.).

2. Productivity

Because of the difficulties of ageing the rhinos with any certainty after about three years, it is necessary to compute the number of non-breeding animals in the population in order to obtain more complete data on age structure. This is done fairly simply on the basis of the reasonable assumption that sexual maturity is reached at or about the age of 5 (*vide* Huntley, 1967, who cites two references to an age of puberty of 4 to 5 years: Kirby (1920) and Lang (1920). The gestation period of one animal in the Kruger National Park has

been established as a little less than 16 months – 476 days (Pienaar, pers. comm.). This gestation period would seem to be confirmed by another animal which gave birth to a calf in the Krugersdorp Game Reserve, Transvaal, 482 days after mating was observed. (Anon (1968)).

If sexual maturity is reached at the age of about 5 years, females would thus be expected to produce the first calves between the ages of 6 and 7 years.

From the data provided in Table IV regarding the proportion of juvenile animals in the population, it is calculated that there were 8 juveniles in Hluhluwe Game Reserve in 1965 (20 per cent of 40 animals). These 8 animals may be added to the figure for the remainder of the study area to yield a total of 176 juveniles.

Thus it can be concluded that 176 (17.3 per cent) of the animals counted in 1968 would be between 3 and 6 years of age and would thus not have produced their first calf. Together with the 213 juveniles counted in 1968, this gives a total of 389 animals below breeding age, and 631 adults. Accepting a sex ratio of unity, there are therefore 315 females of breeding age. If these animals breed every third year on the average one-third of the females can be expected to calve each year. On this assumption 105 calves would have been born between the 1967 and 1968 censuses – a rate of increase of 10.5 per cent.

This figure compares quite favourably with the observed rate of increase between 1967 and 1968 when 110 animals were removed alive from the population and 20 more were counted in 1968 than in 1967. The total increment of 130 animals gives a rate of increase of 13 per cent.

It is of interest in this context to note that a model population constructed on the basis of a 3-year calving interval, first calf at 7 years, and a longevity of 40 years yielded an average annual increase of 10 per cent. It should be pointed out that this model was commenced with one new-born male and one new-born female and did not take into account infant mortality about which little is known. After 75 years, this theoretical population consisted of 1,063 animals of which 259 (24.4 per cent) were less than 3 years old and 196 (18.4 per cent) were between 3 and 6 years old. In addition there would have been an increment of 115 calves. These figures compare favourably with those calculated from observations.

It might also be of interest at this point to draw some comparisons with the annual rates of increase of other large mammals with roughly similar life histories. The hippopotamus first calves at the age of something over three years and thereafter breeds every third year. Construction of a life table for this species showed that the expected annual increase is 16.6 per cent (Pienaar, 1966).

The elephant on the other hand, first calves at the age of about twelve years and thereafter breeds every fourth year. Pienaar, *et al* (1966) show that the potential annual rate of increase is between 7 per cent and 8 per cent, although this may not actually be realised.

The square-lipped rhinoceros therefore falls between these two species, with a rate of increase of about 10 per cent per annum. This might be expected from a comparison of the life history parameters quoted above with those thought to apply to the rhinoceros.

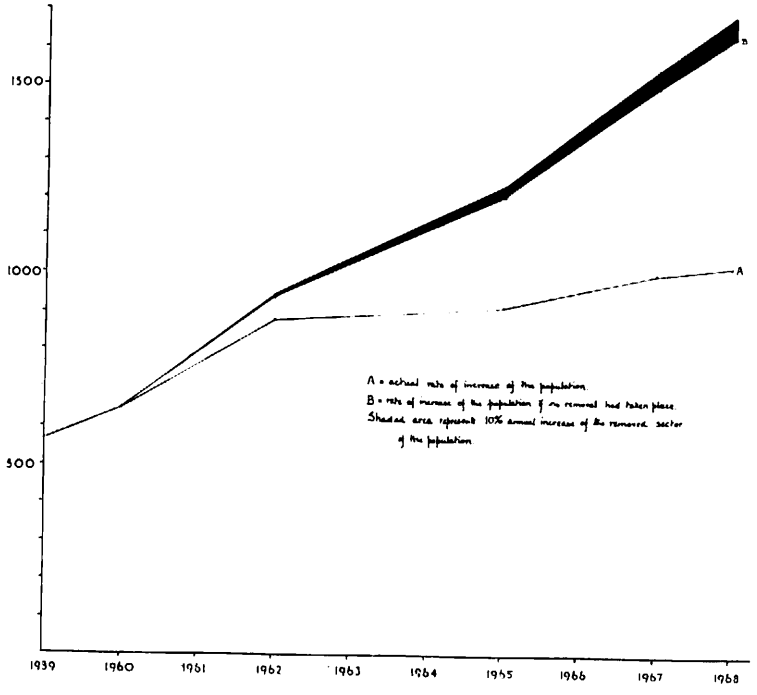

Figure 2

OTHER POPULATIONS IN ZULULAND

1. Mkuzi Game Reserve

In the period 1961-1965 a total of ten animals were translocated from the study area to Mkuzi Game Reserve. Of these there are eight remaining – 6 males and 2 females. At least one of the females has given birth to a calf, but it is not known whether there is now a second one.

2. Ndumu Game Reserve

Between 1961 and 1963 a total of 18 white rhino were moved to Ndumu. Fourteen of these have survived, the others having died accidental deaths, and these consist of 8 males and 6 females. At least six calves have been born there, but it is possible that more have been.

3. Private game ranches

A total of 13 animals – 6 males and 7 females – have been sent to two game ranches in Zululand since 1967.

SUMMARY

1. The present distribution of the southern race of *Ceratotherium simum* in Zululand is briefly described, the main population being centred on Umfolozi Game Reserve.

2. Recent counts of this species are provided, with pertinent comments. In July, 1968 there were over 1,000 animals in the population.

3. Some preliminary data on population dynamics are given, and a tentative estimate of the present rate of increase of the population is put at about 10 per cent per annum.

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