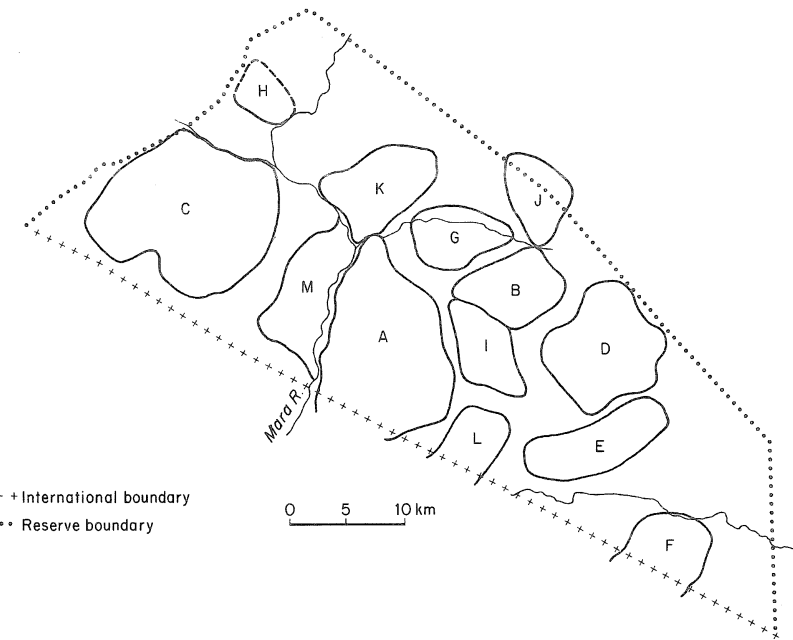


Like many other mammals, male rhinos scent the boundaries of their home range with urine. Bushes, tufts of grass, stumps or stones are sprayed with a scattering of urine drops which dry out into white flecks. These landmarks are generally temporary but Ritchie (1963) and others have reported that a hard deposit similar to the "dassiepeiss" of hyraxes may form on rocks that are used for many years, possibly by generations of rhinos. This habit is mainly an adult male's prerogative and the penis is well adapted to direct a horizontal squirt between the hindlegs. Females make a finer spray while they are in oestrus or during encounters with other rhinos in the presence of their young, but it appears to be at random (Schenkel and Schenkel, 1969). These authors report that in the early mornings some bulls may make a more or less circular tour sniffing and urine squirting. Rhinos also use well established dung deposits, some individuals wiping their hindlegs through the dung immediately afterwards. Single deposits are common on roads and paths but these may represent no more than the reaction of animals encountering a strange element in their surrounding. The cumulative dung middens, however, tend to be added to by rhinos of either sex that come across them. Mukinya (1973) found a relationship between the degree to which a pile was shared (and hence its size) and the frequency with which a path or area was used by other rhinos. The social nature of dunging behaviour is betrayed by young rhinos that soon follow the mother's example. Sheldrick, who reared a young rhinoceros, could make it defaecate by scraping the earth with his boots.

As with many scent-oriented animals, an important function of these deposits may be connected with reassurance within the home range, by extension of the "self" and may favour the regulation of social and sexual contacts by allowing animals in the same area some choice in contacting or avoiding one another. Both these functions are well illustrated by Goddard's experiments in Ngorongoro while he was trying to learn more about the significance of scent trails. He dragged bags of rhinoceros dung behind a vehicle, laying out complicated trails for distances up to two miles. Most rhinos were able to follow every twist and turn of the bag, 60% of them followed their own dung trail and most of them chose to defaecate on it and an even larger proportion, 70%, followed the dung of animals with which they shared the home range. However, only 20% of them defaecated over it. The least response (30%) was for the dung of distant rhinos.

Goddard (1967a) was unable to find any consistent pattern in the deposits of dung, which are apparently random in distribution. Urine on the other hand, may be the main way of marking out the area used by an individual. Rhinos, particularly adult males and particularly in dense habitat, are essentially solitary but Goddard (1967a), noting their tolerance of well known neighbours, described the rhinos resident within a restricted locality as a community. Joubert and Eloff (1971) have used the word "clan" and they regarded a watering point as the focus for all social activity. In such circumstances rhinos are often tolerant of one another. In a study of the ecology and behaviour of 108 black rhinos in the 750 sq km of the Masai-Mara game reserve, Mukinya (1973) was able to delineate thirteen areas of variable size, within which resident rhinos associated with each other but were never seen

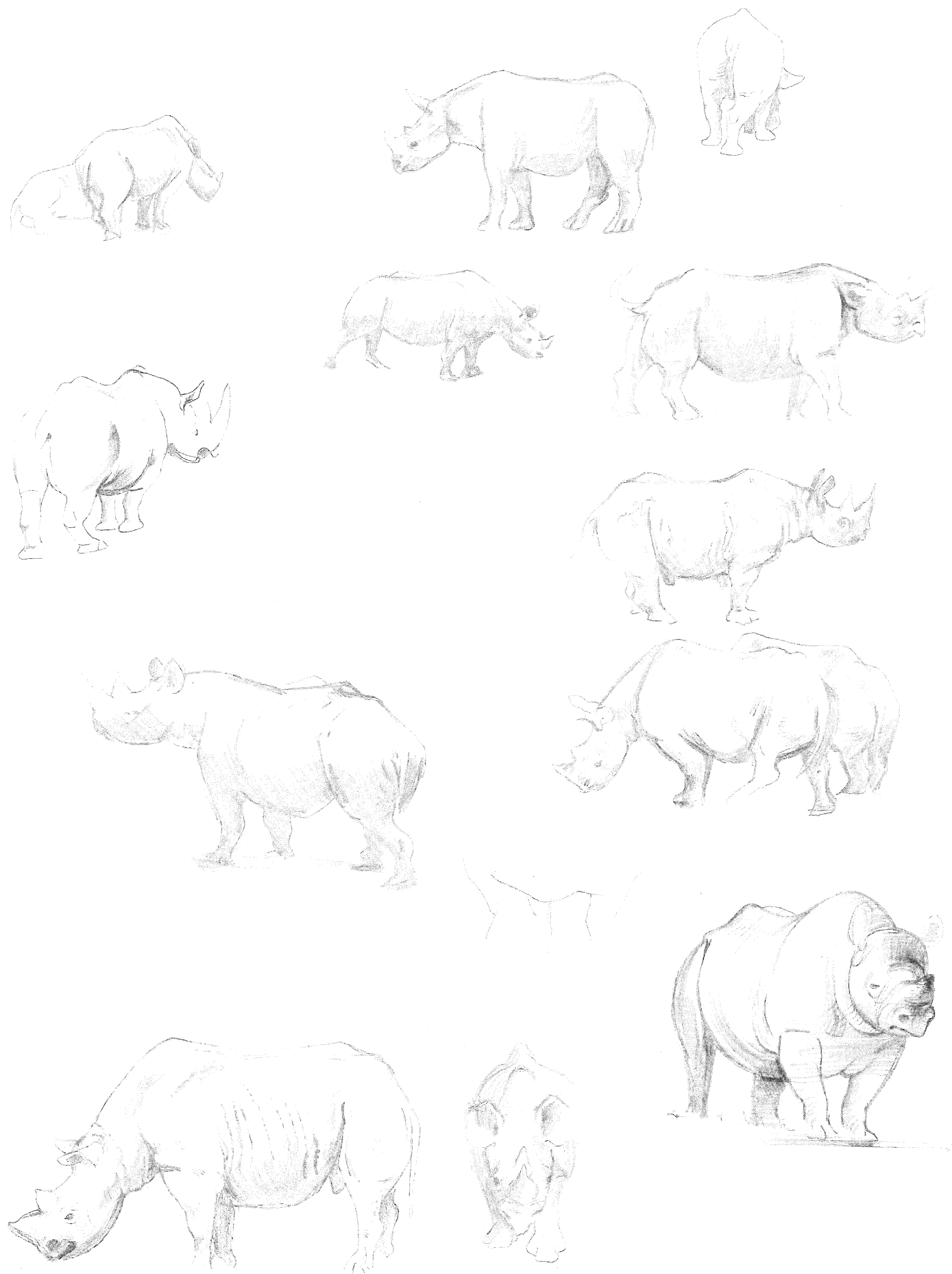


Rhinoceros distribution or "clan" areas in Masai Mara Game Reserve, from Mukinya (1973).

with individuals from another area. As many as thirteen have been seen together in a wallow in Ngorongoro but such aggregations are very temporary and soon disperse into singles and groups of two or three. Female rhinos are hardly ever alone. Most of their life is spent with their current offspring, sometimes in company of an earlier daughter. If without any young, females form attachments with neighbouring females. When the long-sustained bond between a mother and her offspring is broken by the birth of a new calf, the subadult rhinoceros is quick to seek out a new attachment irrespective of its sex. At this stage subadult rhinos range over a larger area. Occasionally a rhinoceros disturbed by a vehicle gives the impression of actively seeking contact with a large moving object. This was noticeable when a solitary subadult animal that had recently lost its mother tried to follow my Land-Rover.

Only when they are fully adult do males become solitary and even then they may associate with other neighbours for variable lengths of time.

In Ngorongoro, Goddard (1967a) thought adults of both sexes had similar-sized ranges and estimated an average of about 15.5 (2.6—44) sq km in open grassland, a third of which was regularly shared with other rhinoceros. In the more barren Olduvai gorge, the average was about 25 (3.6—90) sq km and males appeared to have slightly smaller home ranges. Comparing a well-thicketed area with more open savanna in South Africa, Hitchins (1969) found similar orders of magnitude with many more animals living within



smaller ranges in thickets. After marking all the resident rhinoceroses, Goddard was able to affirm that conflicts between males in the crater usually concerned strangers wandering into an established range and that strange females were not treated as violently as males. Nursing females were found to have larger ranges than single females or single males by Mukinya (1973). He recorded an incident in which one animal snarled and screamed at another which simply stared, after which both animals ran off in opposite directions. It was perhaps in cases where the invader was dominant that Goddard saw resident animals scream and snarl at a silent stranger. In one instance the intruding bull from another area displaced a resident male, which in turn moved into a neighbour's range, illustrating what might happen when the status quo is upset by ecological or other disturbances. A chain of displacements might have been a factor in the situation reported by the warden of East Tsavo shortly before the 1960—61 drought, when all the rhinos seen in that area were covered in fresh wounds and a number died as a result of fighting.

Fighting over females has been reported but it is also known for several bulls to court a female without conflict and Schenkel and Schenkel (1969) considered that there is not very much direct competition for oestrous females. Males do not associate closely with females except while they are in oestrus.

Watching the Tsavo rhinos during a period of drought, Schenkel and Schenkel (1969) thought that the females were generally intolerant of one another. However, in certain circumstances they seem capable of giving one another some degree of mutual protection. Ellis (1958) saw four rhinos come out of a forest together and cross a plain. "Three of these fully-grown rhinos were moving in a strange manner, pressed shoulder to shoulder, with the fourth one following behind. On closer inspection it was seen that the three front ones were cows, and that the centre one, very heavy in calf, was being helped along by her companions. One of the attendant cows actually rubbed the pregnant animal's flank with the side of her head and horn. Rangers reported the birth of a calf three days later." Perhaps pregnancy elicited maternal or protective responses in the other females but, unusual though it is, this observation serves to show that apparently altruistic social behaviour is not unknown in black rhinos.

Births are about two to four years apart and Klingel and Klingel (1966) estimated that about 28% of the Ngorongoro females bred each year. Births have been recorded at all times of the year but mating peaks have been suggested for September—November and also for March—April in Kenya. The gestation period is about fifteen months, 446—478 days.

Courtship has sometimes been described as being phlegmatic and without display but it is not unusual for the female to attack the male and he is often very slow and circumspect in his initial approach and movements. More than one male has been seen to try and court a cow, pairs form and break up very easily and Cowie watched a male copulate with two females in succession. Goddard, however, saw one pair associate for four months after mating. Males make a distinctive display towards females, which Schenkel and Schenkel (1969) have interpreted as symbolic aggression against a rival; it consists of sideways swipes with lowered horns directed at the ground or at a

bush, short forward and backward rushes on stiff legs accompanied by the shuffling and scraping of the hindlegs that normally accompanies foot-scenting together with urine-squirting. Schenkel and Schenkel have also described a young female becoming very excited as she repeatedly approached and fled from a big male only to return again and repeat her approaches. Another observer in a car also interrupted a courtship in which the female appeared to take an active role. The precipitate flight of the male had passed unnoticed by the female, which continued for about fifteen minutes to display towards the motionless car. After a retreat brought no response, she stopped and pranced; then she took a tuft of grass in her mouth and tossed it into the air. After approaching closer with a stilted walk she suddenly caught the scent of the car and charged into the vehicle's bumper.

Circling the female, the bull may prod her belly with his horn, curl back his lip in a spectacular *flehmen* gesture and lay his head on her back before attempting to mount her, standing in an upright posture and keeping up with her steps. Copulation may last over half an hour and may be repeated intermittently over a few days.

The birth of a wild rhinoceros was witnessed by Park Scouts Edy and Malinda in Manyara National Park. They had been descending one of the game trails along the rift wall when they found a female rhinoceros lying down in their path:

"thinking the animal was probably dead, they first threw some stones in her direction, with no result. They approached closer and found the surrounding ground was covered with liquid. Within a few minutes the rhino got up and with little effort the calf was seen to appear. Within approximately ten minutes, the calf was dropped. The mother then turned round and started removing the birth sac with her mouth and ten minutes later the baby was on its feet, twitching its ears." (T.P.R., 1961).

Mothers are extremely intolerant of any disturbance for some days after a birth and it is probably at this stage or just before the birth that the former calf is driven off. The new calf is about 40 kg at birth and sucks within three hours. Twin calves are unknown but it is possible that adoptions take place. Thereafter the calf sucks briefly but frequently. Schenkel and Schenkel noticed that mothers with recently born young avoided wallowing even though the wallows are preferred areas for suckling. The young bleat for their mothers and continue sucking when they are so enormous it is necessary for them to lie down to get their heads under the mothers' bellies. They keep very close indeed to the mother and respond to every detail of her behaviour. Normally the calf follows but in an alarm the mother attempts to interpose herself between the baby and the cause of alarm and she tends to swing broadside on to the source of the disturbance, which hides the calf more effectively. Both animals tend to get their backsides together and as the calf gets older this behaviour turns into a very characteristic radial formation with which any group of subadult or adult rhinoceroses first responds to an alarm.

Very young calves can be quite frolicsome and will rush around tossing vegetation. Frame (1971) watched three calves taking turns at picking up and mouthing a stick without biting or chewing it.

Although it becomes independent at about two-and-a-half years a rhinoceros is not fully grown until about seven. However, it is sexually mature between five and six. Ages of about forty years have been reached by zoo animals and the animals are probably fertile to the end.

Goddard (1970a) estimated an annual mortality of about 16% in the first two years of life, dropping to 9.8% between the ages of five and twenty-five. Recruitment in Ngorongoro is about 7% but it would be difficult to find a truly undisturbed rhinoceros population today and all the results of population dynamics must be calculated in the light of very local conditions.

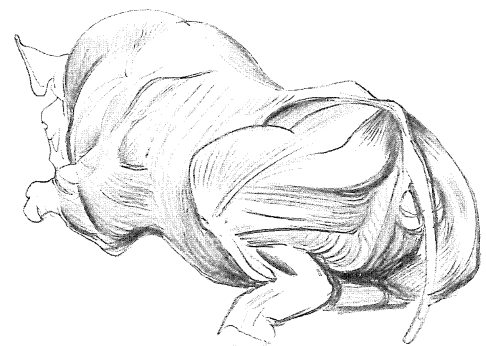
In their preferred thickets rhinoceros are impossible to count accurately over large areas but Goddard (1969a) used density strata samples to estimate 6,000—9,000 animals in the Tsavo National Park. This is the largest single concentration of the species in existence today (Glover and Sheldrick, 1964). At the time of this estimate the area also supported about 36,000 elephants. While the elephants had increased over a period of some twenty years, Sheldrick considered that the rhinoceros population had fallen by half over the same period. It would be extremely interesting to learn more about the interaction of these two species and see how elephants might influence the numbers of rhinos and this should be one of the priorities for wildlife research in the region.

Where rhinos are numerous, their young and very occasionally adults may fall prey to lions, and hyaenas have also been known to kill young rhinos. Elephants, hippopotamuses and crocodiles have all been recorded killing rhinos but these are almost as isolated as the instances of rhinos attacking other animals. When resistance has been lowered by lack of food or water, disease may hasten death, but there is no evidence of rhinos suffering from widespread epidemics.

A large number of tick species and other parasites have been recorded from rhinos (see Zumpt, 1964) and the "rhino sores" found behind the shoulder are associated with a worm, *Stephanofilaria dinniki* (Schultz and Kluge, 1960), which is carried by flies and ticks. Two species of flies, *Rhinomusca* and *Lyperosica*, develop in rhinoceros's dung and, after hatching, fly on to the first rhino visiting the dung midden.

Because the rhinoceros's favourite habitats are generally well-watered and reasonably fertile, settlement of rhino habitats is continuous. When food or cotton crops are damaged, or herdsmen are chased there are demands for control or extermination. Very large numbers of rhinoceros have been killed on the assumption that any form of human enterprise and the presence of rhinos are incompatible. One hunter, a former Scottish gamekeeper, claimed to have killed 1,600 rhinos in Kenya, most of them shot officially in order to make way for government settlement schemes. It is impossible to know how many rhinos have been killed illegally for their very highly priced horns, but a fairly detailed reconstruction of the species' overall decline in East Africa has been possible (see maps).

The varied disposition of rhinos is in the opinion of Ritchie (1963) related to genetic selection over many generations of exposure to hunters or to the greater tolerance of pastoralists. Given the long period of learning, it is more likely that the killing off of rhinos that expose themselves to attack has favoured those that have acquired a learnt tradition of caution and/or

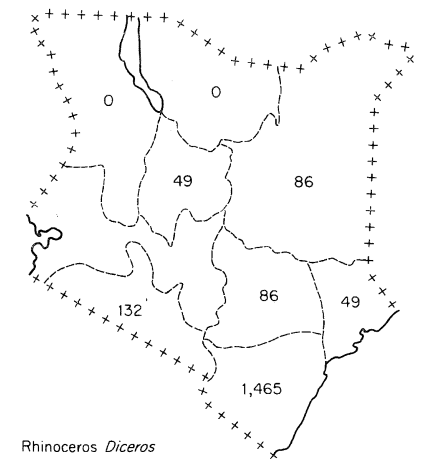




truculence. The traditional attitude of Masai pastoralists towards rhinos resembled that of European country folk towards dangerous domestic bulls, avoiding provocation and giving due respect to their size and armament, and it is no coincidence that the largest populations of rhinoceros still left outside national parks are in Masailand (see map).

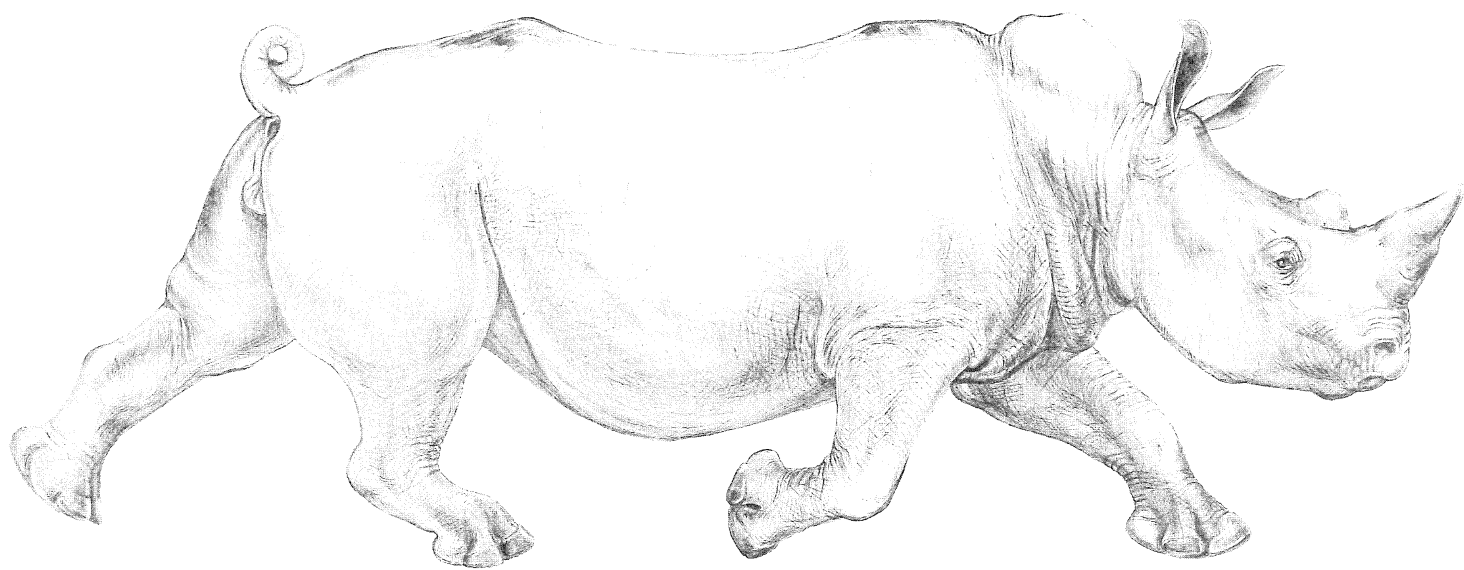
Although they are effective converters of very coarse, prickly vegetation into animal protein, they are not very suitable for regular exploitation as meat, among other reasons they grow and breed so slowly.

It is important that the species be conserved wherever possible and the details of its ecological niche be investigated further; for fossils have shown that black rhinos have been an important part of the African scene for several million years.



Rhinoceros *Diceros*

Preliminary estimate of *Diceros* numbers in Kenya rangelands in 1977. From Ministry of Tourism and Wildlife, Kenya Rangeland Ecological Monitoring Unit. Aerial survey report No. 3.



**White rhinoceros,  
Grass rhinoceros  
(*Ceratotherium  
simum*)**

**Family**  
**Order**

Rhinocerotidae  
Perissodactyla

**Local names**

Kifaru ya majani (Kiswahili), Ijiji (Madi),  
Ubiryia (Lugbara).

**Measurements  
head and body**

3.6—4.2 m

**height**

1.5—1.85 m

**tail**

48 cm

**weight**

2,300—3,600 kg

**horn**

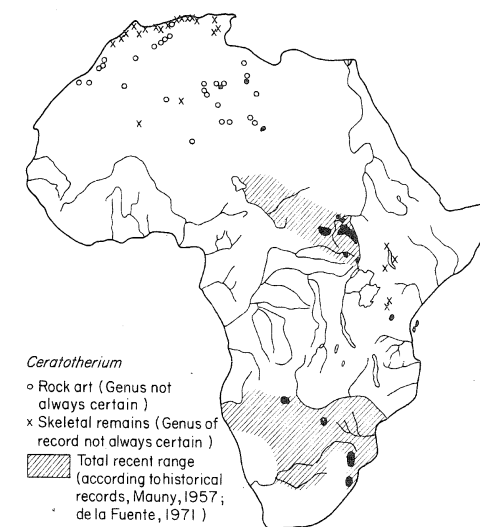
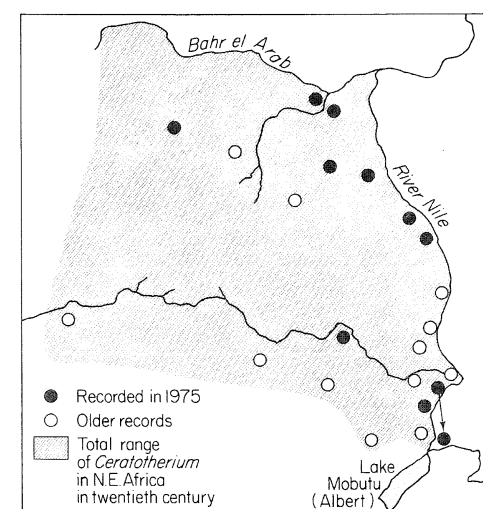
95—101 cm (Northern population)

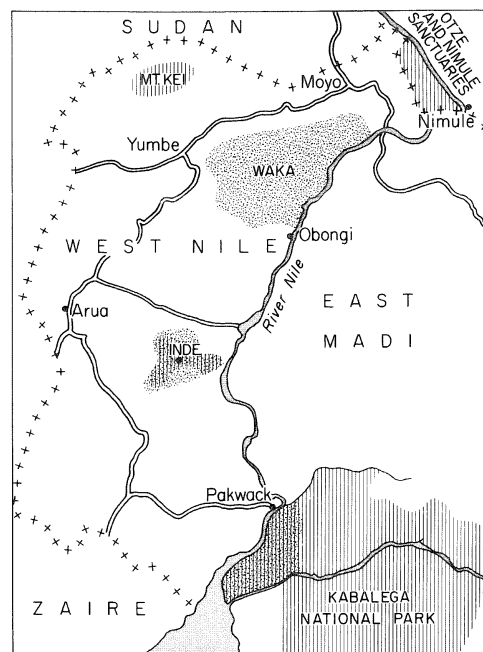
95—200 cm (Southern population)

## White rhinoceros, Grass rhinoceros (*Ceratotherium simum*)

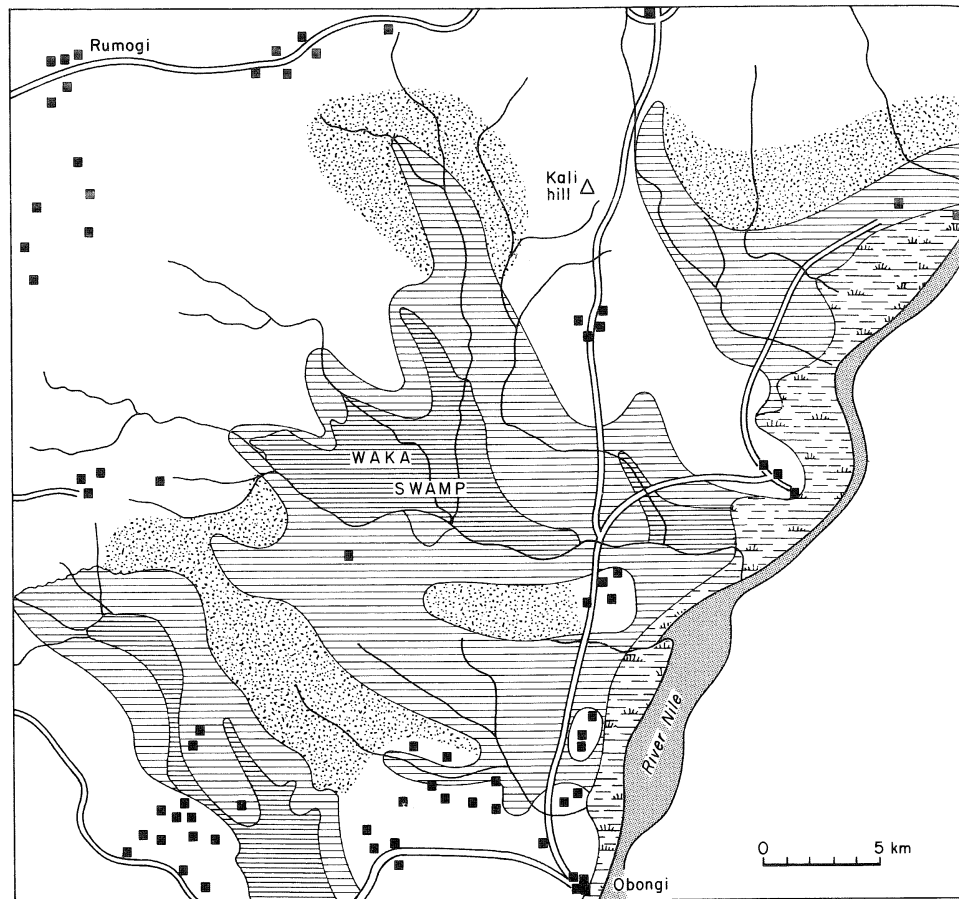
The survival of this huge grass-eating animal, second only to the elephant in size, in two widely separated pockets, one by the Nile and the other in Zululand, has been the subject of much discussion. The two populations have been regarded as racially distinct mainly on the basis of the relative concavity of the skull forepart. Cave paintings from as far afield as the Sahara, the Kalahari and Tanzania show that this species had a very much wider range within very recent times, although it was already greatly reduced before Europeans started exploring the continent.

The common black rhino was known to Linnaeus in 1758, whereas the white rhino was not described until 1817 from South Africa and 1907 from Uganda. What made this animal so scarce and why has it survived in these two areas? Like all rhinoceroses it needs water (for example, many died in Zululand during a drought in 1932). Also, the grass rhino eats a lot of food; the sheer quantity needed by each rhino might be difficult to obtain during droughts, both because the vegetation has died or been burnt off and because smaller ungulates with bigger ranges, faster or more efficient cropping methods and greater numbers might converge on water supplies and compete for reduced resources. Thus areas subject to erratic rainfall have perhaps always been avoided by this species. As grazers forest, dense woodland and thickets would also have been closed to them. Recolonization of lost ground is delayed by the slow breeding and static habits of these rhinoceroses but, even allowing for this and considerable fluctuations of climate, large areas of Africa, between the two extremes of forest and semi-arid country, should have been available to grass rhinos for they do not demand very special grass species or extraordinary ecological conditions. They are almost immune to wild predators and it is perhaps this invulnerability that has encouraged a

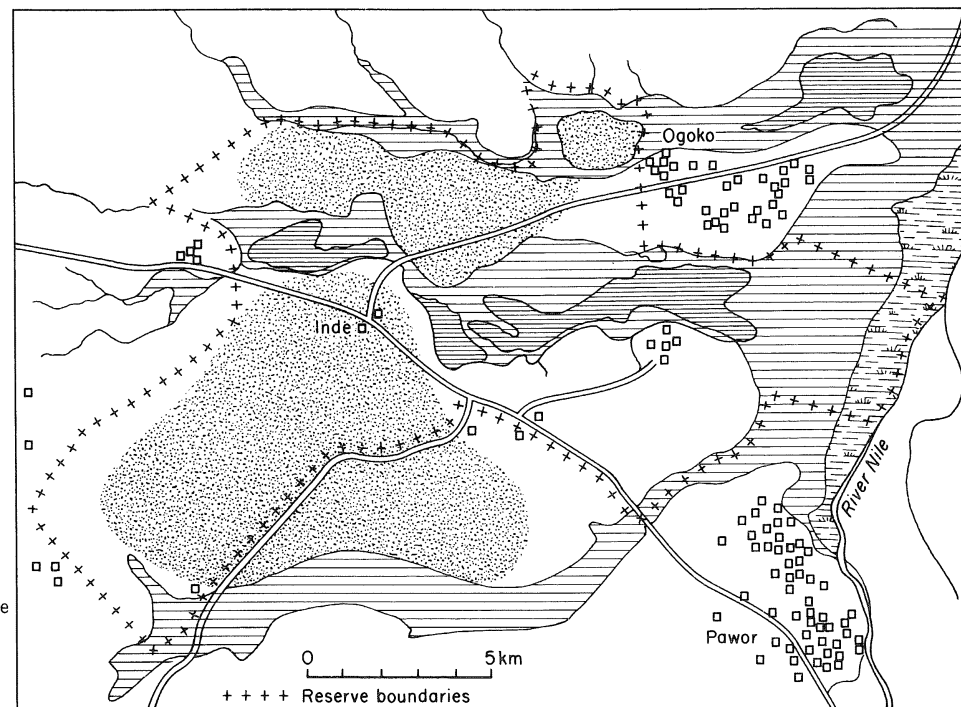




Above: Gazetted white rhino-sanctuaries and National Parks in North-west Uganda and present range of *Ceratotherium*. Introduced into Kabalega National Park. Eliminated in Mt Kei and Otze sanctuaries. (Also exterminated in Nimule National Park, Sudan.)



Right: Ungazetted refuge for *Ceratotherium* in area of Waka seasonal swamp.



Ajai's White Rhino Reserve, Inde, Uganda

- Seasonally flooded *Hyparrhenia* grassland with scattered *Combretum* and *Acacia*
- Seasonally flooded *Echinochloa* grassland
- Papyrus swamp
- Dry *Combretum* wooded *Hyparrhenia* grassland, scattered *Acacia*
- Wet season concentration areas on better drained soils (sometimes on abandoned fields) grasses are *Chloris*, *Eragrostis*, *Digitaria*, *Loudelia*, *Cynodon*
- Settlements

fatal tameness. In 1927 Pitman visited West Madi and described walking within 3 m of them. In no single instance did an animal show any aggression towards him, although the rhinos were aware of his presence and were watching him with interest. In such circumstances an animal is exceptionally easy to kill, even with the most primitive of weapons and there is no doubt whatever that hunting has been entirely responsible for their decline and continues to endanger present-day populations. Furthermore, if we turn the coin, it is possible that their survival both in Zululand and West Nile was assisted by the traditional attitudes of the local people. In the former area, the flesh is regarded as dangerously inedible and in Uganda a formerly sparse human population tended to avoid the malarial rhino habitats. In 1924 Game Warden Salmon was told that the rhinos were scarcely ever molested in West Nile prior to the demand for their horns.

Because their habitats are so restricted today it is difficult to be certain that these are representative or even include optimum ecological conditions for the species. Their present refuge on the seasonally waterlogged margins of the Nile is possibly less favourable than their former haunts on the higher ground around Moyo, Kei and Inde Hill. Brooks (1959) noted limited seasonal movements in West Madi, the rhinoceroses moving further inland and on to the hills during the dry months of January and February. At this time the dominant tall grass species of this area, *Hyparrhenia*, *Themeda* and *Setaria* are short tufted after the fires and are, therefore, suited to close grazing and are also at their most palatable stage. Once the rains have started, the rhinoceroses avoid the tall grasses and Brooks found them concentrated in July (the wet season) on short grass meadows. *Digitaria*, *Cynodon dactylon*, *Heteropogon contortus* and *Chloris gayana* are grazed at this time. Other species recorded are *Brachiaria brizantha*, *Urochloa* spp., *Eriochloa*, *Panicum* and young *Phragmites*. The cropping of short grass is not entirely unselective and Foster (1967) noted that they were not eating the widespread *Sporobolus festinus* during December and June.

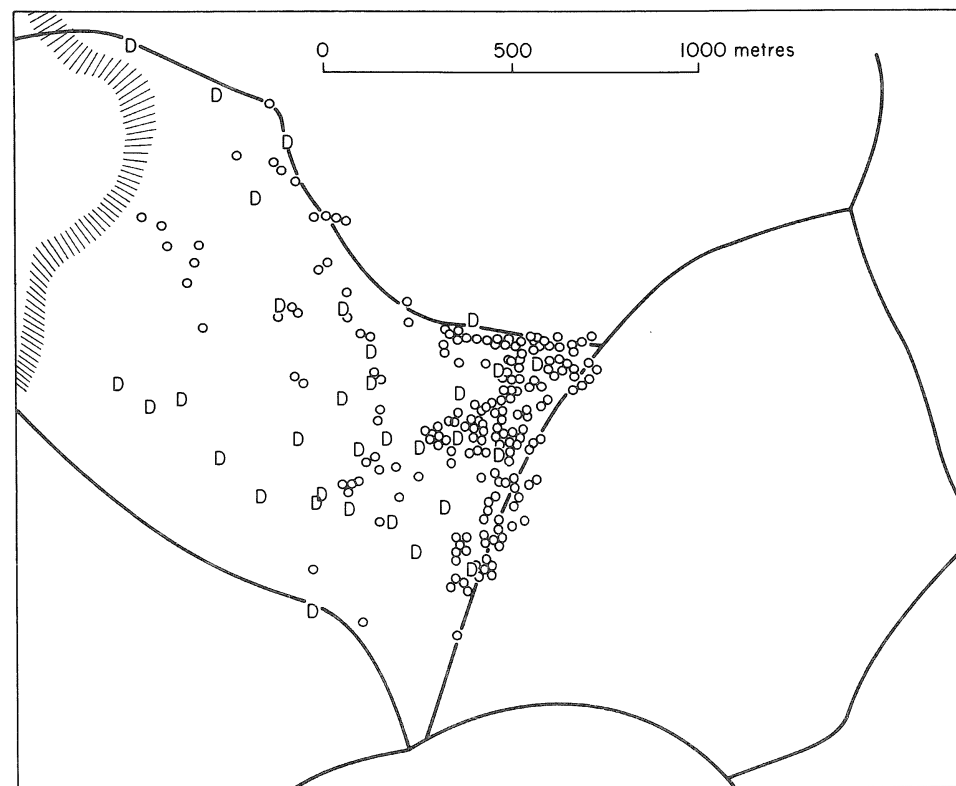
Although they prefer grass shorter than 10 cm they will crop grass up to one metre high in the absence of anything shorter. In addition to grass they may occasionally eat small shrubs and, in Zululand, Foster (1961) noted them commonly feeding on dwarf *Euphorbia*, *Stapelia* and a creeper, *Sarcostemma viminalis*.

Grazing is generally sustained for a few hours and alternates with resting spells. This may continue throughout the day and night in cool weather, but the midday rest becomes progressively longer as the dry season advances. Several observers have noted a tendency for these rhinos to congregate on exposed ridges during the middle of the day, even neglecting to use available shade and it is possible that biting flies may influence this behaviour as harassment is worse along watercourses and near thicker vegetation. Foster (1961) suggested that wallowing habits were influenced by the prevalence of flies, but temperature regulation is clearly the most important factor and Owen-Smith (1975) noted that wallowing became more frequent in hot weather. Wallows are most readily formed on hardpan soils and rhinoceroses join warthogs and buffalo in maintaining short grass patches on these pans for much of the year; walking from one meadow to the other along well established paths.

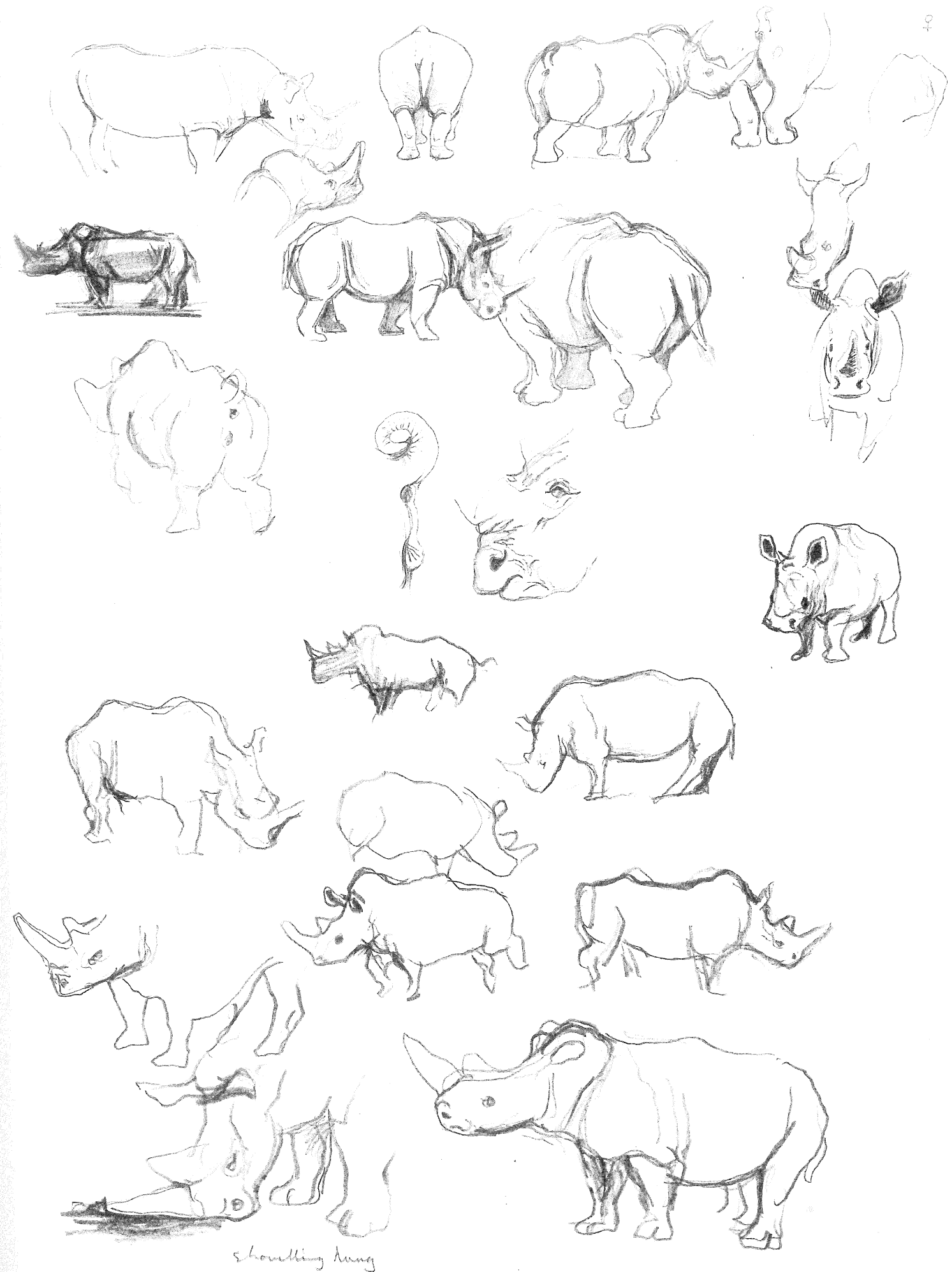
Water is needed every two to four days and very regular drinking habits are attested by well worn paths leading to their drinking stations. In the dry season water may lie 10 km or so from the home range.

While the rhino is grazing, the head hangs vertically and only during excitement is the head raised very high, causing a tight constriction at the back of the short neck, which gives this species a highly characteristic neck hump. Even when it is running, the head is not carried very high. Galloping is moderately fast, about 40 km per hour, but cannot be sustained for very long and Foster (1961) described Zulu dogs soon winding them in a chase. While attempting to immobilize rhinos in Zululand, Player (1967) had a horse tossed to the air by a rhinoceros and a captive showed considerable agility in climbing over a gate 2 m high.

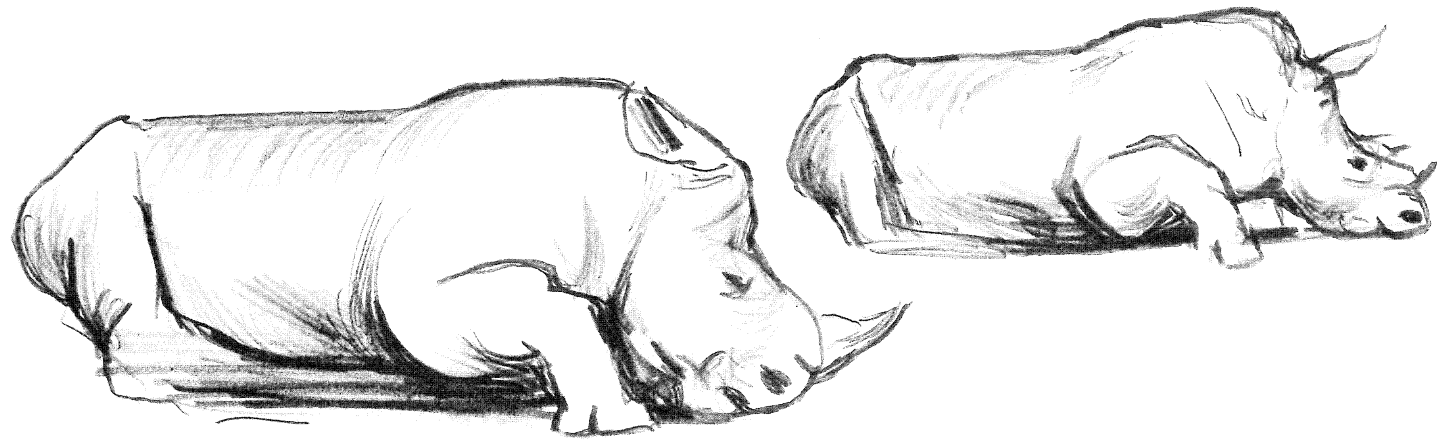
Scent, as with all rhinos, is very important and dung middens are conspicuous throughout country occupied by white rhino. Rhinos tend to add dung to an established deposit but dominant males only use a limited number of deposits which according to Owen-Smith (1975) average about thirty to a territory. Here the bull kicks and scatters the dung pile every time he uses it, whereas other classes do not disturb it. While the dung deposits are scattered throughout the territory, urine sprays are instead essentially boundary markers and Owen-Smith recorded an average of ten sprays per hour. The dominant male also makes scuffing scrape marks along his boundary trails as well as on any other favourite paths but Owen-Smith found the boundary scrapes were more frequent (one every 28 m instead of one every 38 m).



Distribution of urine sprays (O) and dung piles (D) in a grass rhino territory. (After Owen-Smith, 1975.)



Shuffling legs



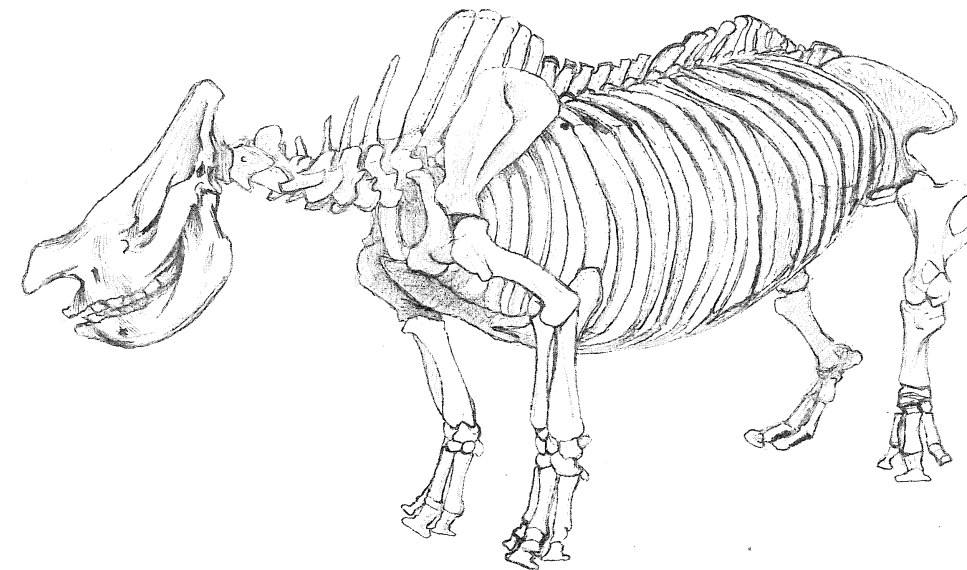
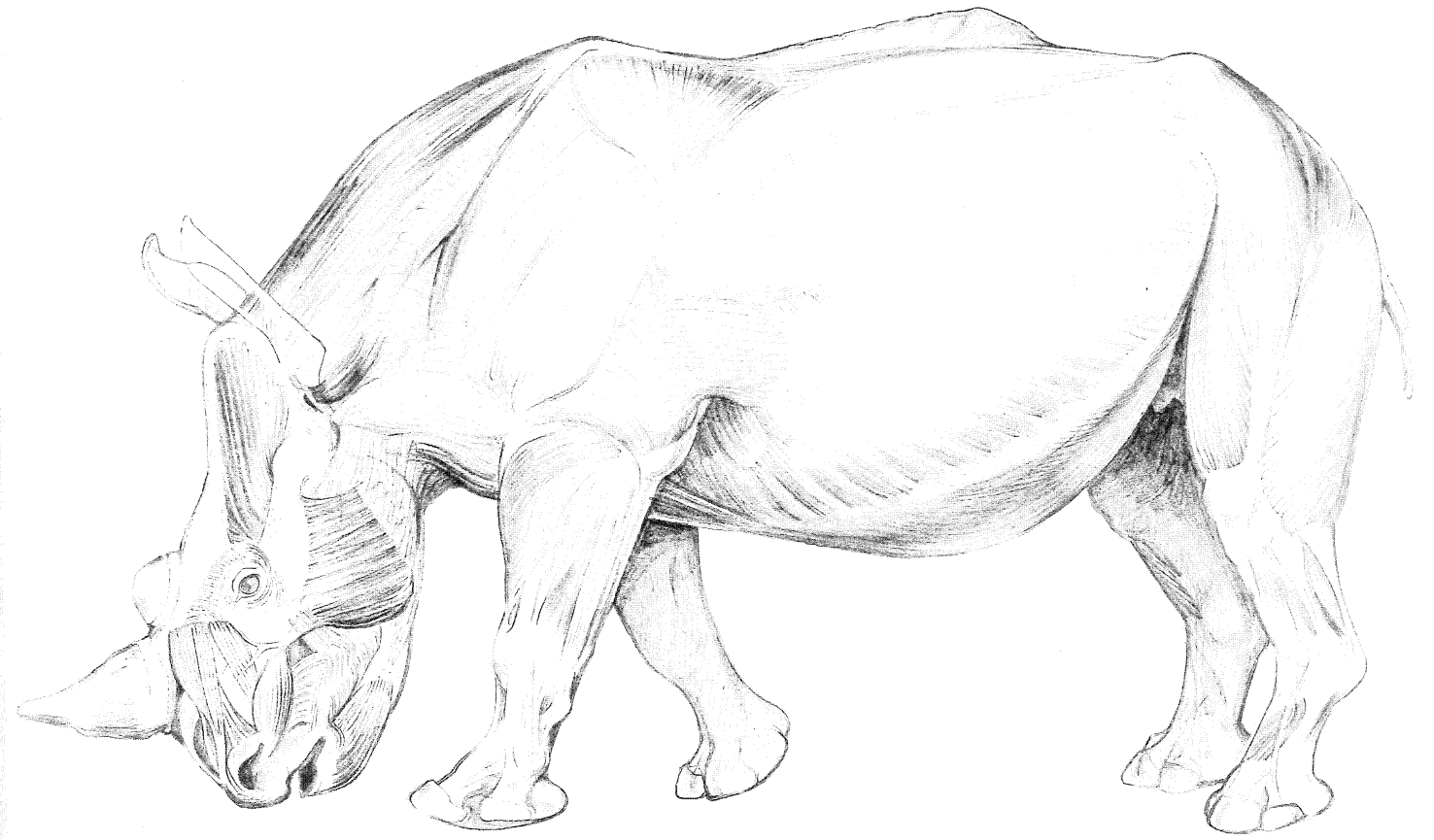
Rubbing posts are also used regularly and I have the stump of an ebony tree, picked up in West Madi, that has been rounded and polished through the regular abrasion of rhino buttocks. They also wallow regularly and occasionally roll in dust.

Their vocabulary includes a panting contact call which is common in groups, a squeal of distress and a whining want call in juveniles. Threat is implied by a deep bellow or rumbling growl and inferior animals on the run from others utter peculiar chirping cries, which probably signify submission. A loud wail is made by a courting male trying to restrict the movements of a female and Owen-Smith (1975) described the courting call of an approaching male as "hic-throbbing".

Owen-Smith (1975) summarized the interactions of the various classes of rhinos as follows. An alpha male usually approaches any other rhino within his territory but avoids contacts of any sort outside it. Females are sniffed at, subsidiary males are commonly confronted with a brief apposition of horns while intruding males face a more prolonged confrontation if they do not retreat. However fights are rare and it is almost invariably the resident alpha male that moves off first. Females and subadults are remarkably indifferent to one another but playful horn wrestling is common in these classes as well as in calves. All rhinoceroses, except the very young, tend to respond to the approach of an alpha male with snarling threats, which Owen-Smith saw as "separation maintaining displays". In this display the lips are retracted from the open mouth, the head is raised and the ears held back. A loud snarling roar rises to a shriek if the alpha male makes any threatening movement.

Owen-Smith explains the function of snarl displays as follows:

"Subtle visual gestures of submission are likely to pass unnoticed by a rival endowed with such poor vision. Running is energetically highly expensive in so large an animal, and furthermore exposes the fleeing animal to attack from the rear unless it is capable of outdistancing the pursuer (notably only subadults or young adult males respond by fleeing). There is no safe refuge to which a beta male can retreat, on adjoining territories he is likely to be challenged by other alpha males and there is no unclaimed ground. A beta male's best strategy is accordingly to stand his ground ready to deflect attacking moves by the challenger, repeatedly assert non-challenge and wait until the challenger tires and goes away."







In the Zululand Park, where the very numerous rhinos have virtually no space for their expanding population, Owen-Smith (1975) found land divided up into a mosaic of single male territories averaging 1.65 sq km (0.75—2.60) with very narrow overlapping margins. Territorial males patrol their boundaries and reinforce them by challenging any male that contests them. At the time of Owen-Smith's study as many as a third of the adult males were each living under the subordination of one or more territorial bulls, tolerated within the territories for as long as they gave way to the owner. Except for the period of oestrus females and their young wander freely over the male territories. For example, one territory in Zululand was visited by a total of twenty-six different females (Owen-Smith, 1975). However, females also tend to live

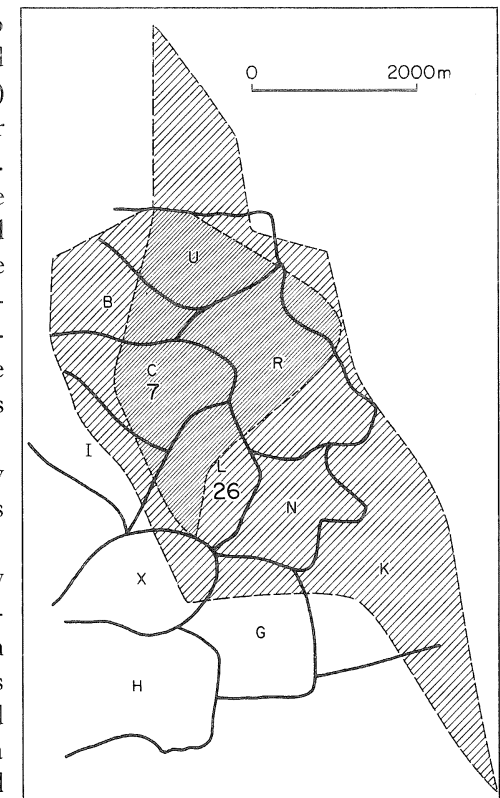
Aggregations of more than two or three animals are commoner in this widely, but others tended to range over an area of only 4—10 sq km. within a limited area of about 10—12 sq km but do not defend land and they share good grazing with other animals. Their normal home range overlaps that of several other cows with their attendant young.

The subadult young are driven off by their mothers at the birth of a new baby, whereupon they tend to pair up with an age-fellow in a similar condition and preferably of the same sex. Alternatively, they may join an unattached female, which occasionally acquires more than one satellite in this way. Many of the adolescent rhinos studied by Owen-Smith wandered species than in the black rhino and they usually centre on wallows, water or a choice area of grazing. Owen-Smith noted that subadult rhinos oriented towards groups rather than to individuals so that cows with immature young are a natural but temporary social focus and may be accompanied by up to six subadults. Of more stable associations lasting a month or more over 40% were with other subadults and 21.5% with a single cow. Only 2.7% of all subadults sighted were solitary; 0.4 cows were solitary, whereas 61.6% of alpha males and 91.8% of other males were on their own. Bonds between mothers and female offspring last longer than with males and Owen-Smith (1975) calculated an average of 10.3 months for the former (with a maximum of 26 months) and 8.1 months for the latter.

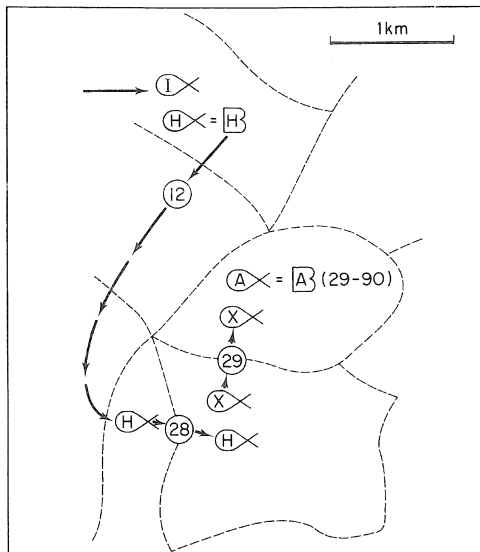
The large grazing ungulates share a general tendency towards greater sociability. Aggregations probably help maintain grass in a condition suited to regular cropping. Rhinos may be favoured by the presence of other grazers as long as grass and water are still adequate for all.

Owen-Smith only recorded conflict among territorial males as a result of trespass. Richards (1972) saw two males fight while female and calf stood nearby. He also recorded a male trying to herd two females and in incidents where a female is present, it is likely that a clash between males will take place on a boundary.

As in the black rhinoceros, preliminary sparring may take the form of sideways swipes with the horn and in this way it is possible for horns to be split. However, Foster (1961) witnessed a remarkable incident that illustrated the ritualized nature of rhinoceroses' contests. "The fight had evidently been going on for some time, as there was an area of roughly 50 feet in diameter where the ground was trampled and the shrubs and trees broken. The two rhinos were battering at each other with their shoulders, like two enormous battering rams and not once while being watched did they use their horns.



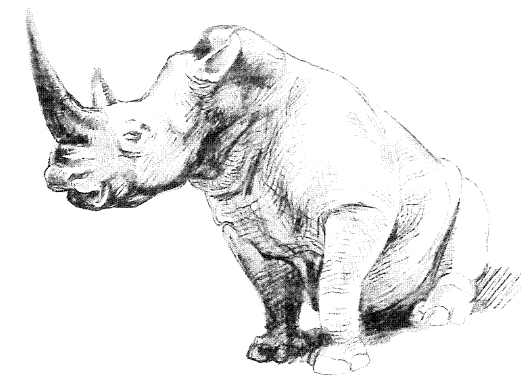
Overall home range and core area of a female grass rhino superimposed upon a mosaic of male territories. The numbers of females recorded visiting two neighbouring territories are indicated; territory L was considered to offer optimum habitat. (After Owen-Smith, 1975.)



Chain displacement of territory holders. Male I displaces H. H becomes subsidiary (beta) male. After 12 weeks H moves to small territory. Sixteen weeks later H displaces X in neighbouring territory whereupon X displaces A as dominant (alpha) male. A remains as beta male for over one year. (After Owen-Smith, 1975.)

Their shoulders were bruised and appeared quite wet." Only in the most serious fighting are direct upwards stabs with the point of the horn employed. This suggests that the originally defensive components of fighting have been isolated from the aggressive one of direct thrusting and ritualized into a less dangerous fencing contest. Defeated bulls are not driven away but they adopt subordinate gestures to the victor; they stop spraying urine and gradually scatter their dung less as they progressively reduce the intensity of their foot wiping. They are also precluded from accompanying females and Owen-Smith (1975) recorded only 8% of all sightings whereas 39% of the alpha or dominant bull sightings were in the company of females. Owen-Smith also noted a chain displacement of territorial males resulting from the ingress of a single bull. The new owner was never observed to rise from the rank of subsidiary male within the same territory but such males can move into a neighbouring territory and displace an alpha male there. They immediately assume all the behaviour of a dominant animal, tending females, confronting other males, spraying boundaries and scattering dung. Boundaries are sometimes altered but are commonly inherited intact by the new tenant. Even more significant is the observance of territorial limits by the subsidiary males which have played no part in the establishment of these boundaries. Presumably the risk of unnecessary challenges are avoided in this way. The displaced bull ceases to spray urine and gradually stops scattering dung. Territories can be taken over after fights in which one or both contestants are wounded or there may be no evidence of a fight at all.

It is possible that outbreaks of fighting that have been observed in West Nile were the product of a similar upset in the territorial system. But the social life of grass rhinos has not yet been studied in East Africa. Although there are occasional fatalities from fighting, the slow breeding and maturation of this species is obviously related to a very low rate of natural mortality. Shortage of water has never been a problem on the banks of the Nile, yet the density of population has never even begun to approach the numbers reached in contemporary Zululand.



Young are born at intervals of two or three years and females in Zululand do not give birth until they are six-and-a-half to seven years old (Owen-Smith, 1975).

A female only elicits interest from the male when she is in oestrus, a condition she advertises by repeated sprayings of urine samples. A female may come into oestrus between six and eight months after giving birth, but Owen-Smith has suggested that a flush of green grass after a dry period may trigger oestrus and encourage the observable mating peaks seen in this species (October—December in South Africa and February—June in West Nile). A birth peak between July and November has been noted in Uganda.

Courtship is prolonged and Owen-Smith saw couples consorting together for 5—20 days. The male is usually cautious but persistent in his approaches to the female, which tends to threaten him at first, as does her calf. A territorial male tries to keep an oestrous female within his territory by heading her off and blocking her way, meanwhile uttering peculiar panting or hic-throbbing calls or actively chasing her back from a boundary with loud wails or squeals. He scrapes, urine-sprays and wipes his horn repeatedly (Owen-Smith, 1975). After 15—20 hours of persistent attendance the male's closer approach is tolerated and he lays his head along her back. Once the female stands still and curls her tail, the male may mount and copulation can last up to half an hour. That the whole affair places considerable demands upon the male was shown at Whipnade Park Zoo when a copulating male had a heart attack and fell so heavily upon the female that she broke her back.

After a gestation of sixteen months the female chases off her previous offspring and gives birth well away from other rhinoceroses. Although the newborn rhino can stand within an hour, the mother remains in a secluded spot for a few days with the rather shaky youngster keeping very close. After

a few weeks they may join up with other rhinos and the young one starts grazing at two months. However, suckling is maintained for over a year, with the young one whining for its drink and taking its fill in two or three minutes.

A curious difference between *Ceratotherium* and *Diceros* is the tendency for calves of the former to take the lead. Even in flight the female appears to follow the direction taken by the young one.

Calves are often alert and curious but never leave their mothers out of reach. While it lasts this relationship is close and enduring but the necessity for a close companion is not lost when the juvenile is rejected. The subsequent rapid link-up of adolescents or unattached females suggests a continuing need by the immature for companionship.

Until recently this species has been rare in zoos but they have proved to be almost ideal zoo animals, easy to feed and maintain in good health. They breed well in captivity and are generally tame and tractable; they can also be controlled by means of tranquillizing drugs.

A female has been recorded still bearing calves at 36 years old (Player and Feely, 1960) and total life expectancy is probably in the region of 40—50 years.

The vicissitudes of the Uganda population have been patchily chronicled in the annual reports of the Uganda Game Department. In 1924 an article was published in the *Bulletin of the Zoological Society of New York* which focused conservationists' attention on the status of the white rhinoceros. Largely as a result of this article, protective legislation and a summary census were attempted. Quantities of horns were on sale at this time and there are official records of some 182 horns from animals killed between 1923 and 1928. In the latter year a marked diminution in numbers and a total estimate of 133 Uganda rhinos was suggested (UGR, 1928). Over the next 20 years casualties were rare and the rhinos were almost unmolested; by about 1950 a healthy population of approximately 500 rhinos were scattered throughout the uncultivated areas of West Nile. At about this time the price of rhino horn rose, so over the next ten years poaching was very heavy and the rhinos were killed out in all their gazetted sanctuaries. By 1963 the sum total of Uganda rhinos was believed to number 71 (Hayes, 1964). Between 1961 and 1964, fifteen rhinos were darted and moved to Murchison Falls National Park and their last stronghold at Inde (Ajai's reserve) was gazetted as a rhino sanctuary. Since then poaching has continued on a reduced scale but a virtually domesticated rhino (nick-named Obongi and pictured in this profile) was killed within the national park.

Throughout this century and probably for several hundred years grass rhinos have lived in proximity with people. In the wake of local shifts or fluctuations in human settlement the rhinos have benefited, like the kob, from the clearings that surround old villages and the swards that form on abandoned fields. No conservation measures for the grass rhino can be successful without the support of the local people of West Nile. Unscrupulous and predominantly foreign middlemen offering to buy horns have been the opponents of the Uganda Game Department (and, in recent years, of a dedicated rhino warden, Dr Ted Williams of Kuluva Hospital). It is not only penalties that have encouraged the people to maintain their traditional

tolerance of these animals. In 1972 there were 120 rhinos in Ajai's Reserve; by early 1978 they had been reduced to 80. About 25 animals are now living in the Kabalega National Park.

