
RHINOS

Endangered Species

MALCOLM PENNY



CHRISTOPHER HELM
LONDON

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COLOUR PLATES

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FOREWORD

Malcolm Penny wrote this book in anticipation of my 1988 rhino crusade. The population of black rhinos is down to four or five hundred now; in the sixties we had 20,000. I shall be walking for the rhino again because it is our most endangered animal. The money raised will be donated to the existing rhino sanctuaries to buy fencing materials, boost up security, and pay for holding pens, translocation costs and the establishment of new protective zones. As on my previous walks I shall raise the money from individuals, companies and institutions, through sponsorship programmes.

Conservation cannot be imposed. It must have the understanding and support of the public, and especially those on whose land the animals live. So much of the conservation message has begun to sound sentimental and must seem horribly out of date to a man whose grain (his sole means of staying alive) has just been trampled by a herd of buffalo. We need to come up with practical solutions and systems in line with these realities and the present times: positive aims and positive actions. And surely the start of that is to know, really, what the problems are out there in the bush and among the farmers, out there at the grass roots.

On my walks I want to get people's views about what they feel about wildlife and current conservation measures. Their views will help me understand better what should be done to alleviate the tension created by the interaction between man and animal. My rhino campaign is only a symbol of conservation. If we don't save the rhino now how can we save the rest of the endangered species including the De Brazza monkey, Bongo antelope, Roan antelope and elephant? Like them, the rhino will live or die because of us.

Awareness of the rhino's plight is growing. Malcolm Penny's book will contribute further to our understanding of this animal and its perilous situation.

Michael Werikhe

Noted Kenyan rhino crusader Michael Werikhe has recently undertaken two sponsored walks in East Africa. In 1988 he is planning walks across the United States, and from Rome to London.

1

Introduction

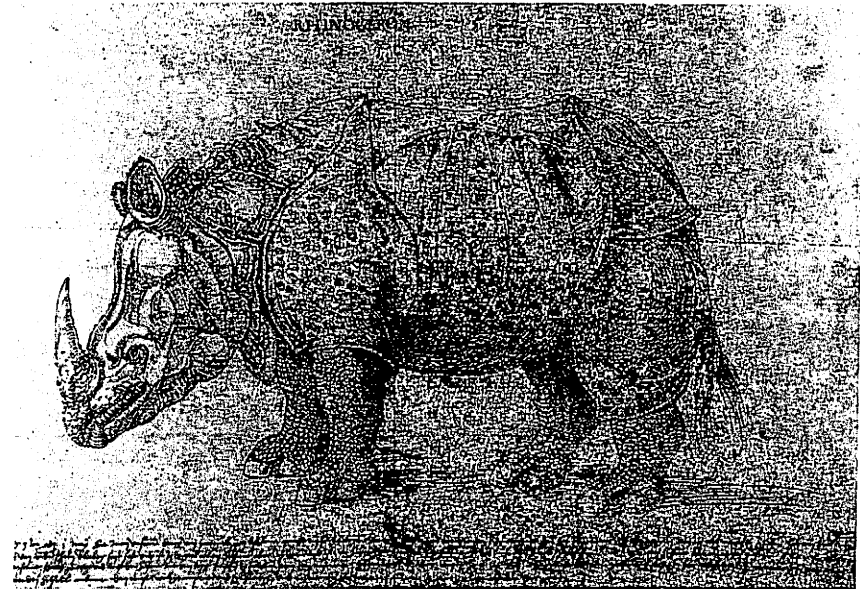


Figure 1: The first and most famous illustration of a rhinoceros, by Albrecht Dürer. It gave rise to long-held misunderstandings about the toughness of its skin

'Nobody loves a rhinoceros much', sang Flanders and Swann on one of my favourite records. Of course, they went on to defend the beast, but their perception was true, as always. The Germans call the Indian rhinoceros *Panzernashorn*, the 'tank rhinoceros'; Dürer thought that it was held together with rivets, like a knight

in armour, and made his famous drawing most explicitly impregnable. Ogden Nash announced that its hide could be penetrated only by platinum bullets; and an unfortunate private in the British Army during the Indian Mutiny was court-martialled for testing that belief a hundred years earlier by shooting the regimental mascot in a spirit of scientific enquiry.

After centuries of misunderstanding, there is a powerful movement today to defend the last of the world's great wild animals — the whales, tigers, bears and elephants — almost as if we have all come to realise, at the last minute before disaster, that unless we do something, now, there will be none left to inspire our descendants. The rhinoceroses have joined that doomed band of animals which has inspired the stubborn devotion of otherwise practical people. For some of these species, it might already be too late.

The fortunes of the black rhinoceros are declining so fast that the population figures given in this book will have fallen by the time you have finished reading it. The other four species, with one exception, are not much better off. The world is not ignoring the plight of the rhinoceroses: there are several schemes to help them. But in all of them, time is the crucial factor.

In the early 1960s, when the genetic code was just being unravelled, our lecturers at the University used to tell us that the best textbook for the foreseeable future would be *Scientific American*, with its month-by-month updates on the progress of research. A quarter of a century later, the genetic code is in every school biology syllabus, and the subjects on which there can be no definitive textbook have shifted to electronics, particle physics — and the state of the world's wildlife. And today, there are numerous official, semi-official and amateur conservation bodies which can keep us up to date.

The journals of the august scientific societies chronicle the research which produces the results, but for the results themselves we would do better to turn, for example, to the quarterly *Traffic Bulletin*, published by the Wildlife Trade Monitoring Unit of the International Union for the Conservation of Nature. Alternatively, the pages of *Oryx*, the journal of the Fauna and Flora Preservation Society, give regular reports from around the world.

A source which is even more up to date is the admirable nature coverage in certain national daily newspapers, such as the *Daily Telegraph* or the *Guardian* in Britain. Both give regular bulletins on the world's threatened populations of animals. Television has played a large part in creating and encouraging a heightened public awareness of the plight of endangered wild animals, but it takes time to get programmes on to the screen. The press has developed and followed this awareness, usually overtaking television with the most recent information.

Why, then, write a book about rhinoceroses, when some at least of the information in it will be out of date by the time it has gone through the presses? There are several reasons, which I shall summarise here, in the hope that they will become more apparent in the course of the book itself.

First, four out of the five species of rhinoceroses in the world are in real danger of becoming extinct before the end of this century. The single exception is the white rhinoceros in South Africa. That species reached its nadir in the 1930s, but it is now recovering from its lowest ebb after heroic and determined management, and is secure for the foreseeable future. The Javan and Sumatran rhinoceroses are

virtually extinct, though the remainder are being protected in tiny remnants of their habitat. The Indian one-horned rhinoceros is making a last stand in very limited areas of southern Nepal and northern India. The African black rhinoceros has suddenly come under a sustained attack, financed from outside its home countries, which threatens to extinguish it in all of Africa north of the Limpopo River, though the front line of the fierce fight to save it lies at present at the Zambesi River.

Second, the reasons for the apparently unstoppable plunder of rhinoceros populations, particularly that of the black rhinoceros, are not always clearly understood. It is not, as we read so often in the newspapers, simply a matter of supplying a number of elderly Chinese with their daily aphrodisiac, nor of supplying a few Arabs with some fancy knives. If it were, I doubt whether the death toll among poachers would be so high. Forty-three invading poachers from Zambia were shot in the first three months of 1987, crossing the Zambesi to hunt black rhinoceroses in northern Zimbabwe. The medical uses of rhinoceros horn are many, and very deeply embedded in the culture of the Chinese and Japanese peoples. Similarly, there is much more to a *jambia* dagger than a fancy knife to stick into one's belt: if there were not, the men of the Yemeni Republic would not be willing to pay as much as \$30,000 for one.

Misunderstanding the trade in rhinoceros horn, whether for medical uses or for ornamental dagger-handles, can lead to a serious underestimation of its importance to certain groups of people, the Chinese in particular. Although they are otherwise law-abiding and humane, they will not be deprived of their traditional remedial medicines without a long and difficult period of persuasion. If the rhinoceroses are to survive into the next century, some way will have to be found of controlling the medicinal trade in horns, hooves and skin, to stem its destructive effect on rhinoceros populations. Force, whether physical or political, will be of no avail.

Third, there are many organisations around the world which are successfully collecting money for charities whose aim is to save rhinoceroses. Many, if not most, of their benefactors are people who have never seen a wild rhinoceros in their lives. The charities often seem to be extracting the money with arguments and emotional pleas which create a false impression in their hearers. This is not to accuse the collection agencies themselves of dishonesty — far from it — but merely to remark that the quality of seed is immaterial if it falls on stony ground, or into a lake of misunderstanding.

The fourth and perhaps the most powerful reason arises from a recent conversation in London.

A devoted fund-raiser for wildlife projects all over the world was discussing the success of his efforts to raise money to save the black rhinoceros. Thousands of pounds have been collected already, at an early stage of the project. When I asked him what the money was to be spent on, he told me that they were going to buy radio sets, so that game rangers could keep more closely in touch with each other, and electric fences and rifles with which they could defend the animals in their charge. He seemed very surprised when I suggested to him that what he and his colleagues were really doing was buying arms to be used in a bush war.

It is a sad fact that most rural Africans are rather fond of poachers: poachers give

them money and food in exchange for small services such as showing them where the rhinoceroses are to be found. They rather dislike rhinoceroses, which are a nuisance and can be dangerous: and they positively hate game rangers, who prevent their dealing with either poachers or rhinoceroses in the way which they would prefer. In the event of an out-and-out fight over who will have control over the lands from which the rhinoceroses are presently being poached, there is little doubt that the local farmers and smallholders will take the side of the poachers. When they need weapons, they will be supplied --- from the poachers' substantial armoury. My good friend is providing the finance which will arm the rangers in their attempt to take the upper hand by force, and he is just as surely compelling the rural Africans to accept the offered Kalashnikovs next time they meet the poachers.

This book would not be complete without a summary of the facts about each species of rhinoceros, as far as they are known. In the case of the Javan and Sumatran rhinoceroses that is not very far, but such information as there is is here. However, the main purposes of the book are to describe and explain the trade in parts of dead rhinoceroses, and why it is so important to those who engage in it; to explain some recent theories about conservation; and to try to prevent my friend and his supporters from financing a bush war.

I hope very much that not all of my readers are converted, yet. I should like to think that there is someone reading this page who is asking why the black rhinoceros, or any other, should be saved. I reply that there are several reasons, three of which I give here:

- 1 Allowing any species to become extinct from preventable causes is a symptom of disregard for the natural environment which can only end in disaster for the human race.
- 2 The survival of any ecosystem depends on all its members, large or small, beautiful or ugly, valuable or worthless to humanity.
- 3 Rhinoceroses are, as I shall hope to show, interesting, awe-inspiring, peaceable — in short, nice animals and well worth saving.

2

The Evolution of Rhinoceroses

Imagine meeting an animal 20 ft (6 m) tall at the shoulder and 23 ft (7 m) long, with a head nearly 6½ ft (2 m) long at the end of a powerful, horse-like neck. Its feet, if you took the time to glance down at them, would have had three toes each, and the fact that the animal was herbivorous would have been small comfort in the wide open spaces of the Mongolian plains. Its defensive armoury consisted not of horns, but of two sharp tusks, formed from the incisors of its lower jaw. *Indricotherium*, the name given by palaeontologists to this huge hornless browsing rhinoceros, became extinct about ten million years ago. It represented the peak of rhinoceros evolution, at a time when the group as a whole was very successful both in the Old World and the New.

In evolutionary terms, rhinoceroses are the surviving members of one branch of a very ancient line of animals, the ungulates, which were the first mammals to develop hooves. Their ancestors included the paenungulates, or 'nearly-hooved' animals, and the protungulates, or 'first hooved' animals, both long extinct.

Rhinoceroses belong to the group known as the perissodactyls, or 'odd-toed ungulates', which includes horses and tapirs. The group originated in the Eocene Period, about 50 million years ago. In the following 40 million years, leading up to the Pliocene and Pleistocene Periods, the perissodactyls were themselves replaced to a large extent by the modern artiodactyls, the 'even-toed ungulates', including deer, gazelles and antelopes, as well as pigs, camels and hippopotamuses. The artiodactyls also arose in the Eocene Period, but they evolved along a different course before finally gaining the advantage over the perissodactyls. They became fast movers, with keen senses and well-developed brains, and efficient grinding and cropping teeth. Most important of all, many of them became ruminants, with stomachs which enabled them to digest cellulose by fermenting it with the aid of bacteria.

The slow-moving, slow-witted and somewhat dyspeptic perissodactyls represent an ancient line most of whose members are coming to the end of their evolutionary career. The exception is their relatives the horses, some of which are still very successful, even the wild species which lack the intervention of humans in their breeding and feeding.

Although all five surviving species of rhinoceros look rather similar, and are descended from a remote single common ancestor, they are the modern ends of two evolutionary lines which diverged about 30 million years ago, in the middle of the Oligocene. One line led to the one-horned rhinoceroses, represented today by the rather primitive, forest-dwelling Javan rhinoceros and the more advanced grazing Indian species. The other line gave rise to the two-horned species, one branch of it by way of the woolly rhinoceros, which survived into the Stone Age — the Sumatran rhinoceros is its only surviving direct descendant. About ten million years ago, a branch of the two-horned group found its way into Africa, where it set off along the evolutionary road which led to today's black and white rhinoceroses. They evolved to feed without cutting teeth, and therefore lost the incisors which form the tusks of the other species. Their horns became their main defensive weapons, being longer and sharper than those of their Asian relatives.

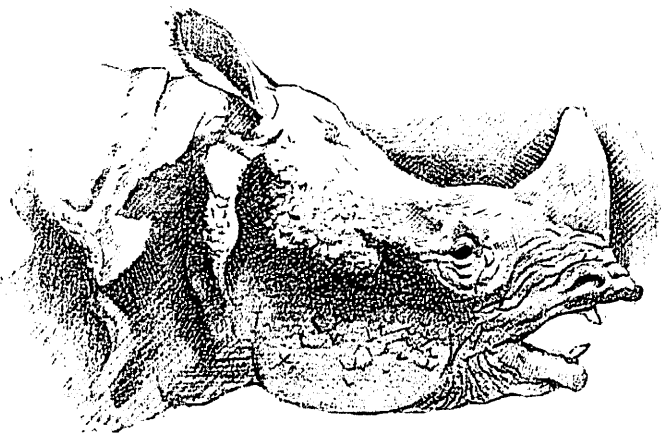


Figure 2: The Indian rhinoceros, like all the Asian species, retains its incisors, and occasionally uses them as weapons

The surviving species are a tiny remnant of the vast and varied range of animals which lived during the heyday of the rhinoceroses. The fossil record is surprisingly full. The extinct species took a number of different forms, many of them quite unlike modern rhinoceroses. Forty or 50 million years ago, in the Eocene, their relationship to horses was much clearer, in the long-limbed species of the families Hyrachidae and Hydracodontidae, whose fossils are found in North America. These 'running rhinoceroses' already had three toes on each foot, an arrangement also found in the horses of the period. There is evidence that the Hyrachidae were technically the very first rhinoceroses; but their descendants explored many evolutionary blind alleys before they arrived at the forms which we know today.

Also in North America, as well as in Eurasia, there were tubby, hippopotamus-like creatures, the Aymnodonts, or 'defensive-toothed' rhinoceroses, which were partly aquatic, and more like the modern animal in appearance. The oldest

rhinoceroses which we would recognise as such, the Caenopenes and the Aceratheres, appeared about 30 million years ago in the Oligocene in North America and Europe. They were distinctly rhinoceros-shaped, but their fossil skeletons show no sign of horns. They have a complete dentition, not the specialised grinding equipment which was to develop later, with little or no distinction between molar and premolar teeth. Just before they died out, in the Pliocene, they had begun to develop small horns, but their principal weapons of defence still seem to have been the lower incisors, which had developed into considerable tusks. The name Aceratheres means 'hornless animals'.

Their close relatives, the Paraceratheres, produced some of the biggest rhinoceroses, which were also the largest terrestrial mammals ever to have lived. They occurred in Eurasia during the first three ages of the Tertiary, the Eocene to the Miocene, usually dated between 60 and 10 million years ago. The biggest of the group, which we met at the beginning of this chapter, was *Indricotherium asiaticum*. Its fossil remains, found in Kazakhstan in central Russia, were dated at 35 million years old. A very similar animal, found in the Gobi Desert in the early 1920s, was *Paraceratherium*, which had no horns but formidable tusks. Its low-crowned molars reveal it to have been a browser, with a reach not much less than that of a modern giraffe.

The great Indian rhinoceros, *Rhinoceros unicornis*, and the Javan rhinoceros, *Rhinoceros sondaicus*, are descended from the line which included the Caenopenes, themselves descended from the long-legged running rhinoceroses of the Eocene. The Javan is the older species: it can be found in its present form in fossil deposits more than a million years old.

Asiatic two-horned rhinoceroses appeared in the Miocene, 15 million years ago. One of their descendants was the woolly rhinoceros, *Coelodonta antiquitatis*, which was first discovered in 1799 in the permafrost of Siberia, complete with skin and fur. Drawings of this species occur in the cave paintings of the early Stone Age, but it was extinct by the end of the last Ice Age, 15,000 years ago. Although frozen specimens have been found with willow leaves and fragments of coniferous twigs between their teeth, it seems to have been principally a grass-eating species. Its dentition was very similar to that of the modern white rhinoceros, with no front teeth and high-crowned molars suitable for grinding the tough, siliceous grasses of the Steppes. However, this merely shows that the two species evolved to eat similar diets, and says nothing about their true relationship to each other. It is an example of 'convergent evolution'.

Forest rhinoceroses survived into the Ice Ages as well, including one species with a close resemblance to the modern Sumatran rhinoceros, *Dicerorhinus sumatrensis*, with front teeth and low-crowned molars suitable for eating forest vegetation rather than grass. In fact, the Sumatran rhinoceros has been said to be a survivor, almost unmodified, from the Tertiary Period. It is certainly the most primitive form of the family alive today.

The two African species, the black rhinoceros, *Diceros bicornis* and the white or square-lipped rhinoceros, *Ceratotherium simum*, are a separate branch of the family which split from the Asiatic two-horned rhinoceroses around the end of the Miocene, 10 million years ago. The black is thought to be the more primitive species, a browser from which the grazing white rhinoceros separated between four

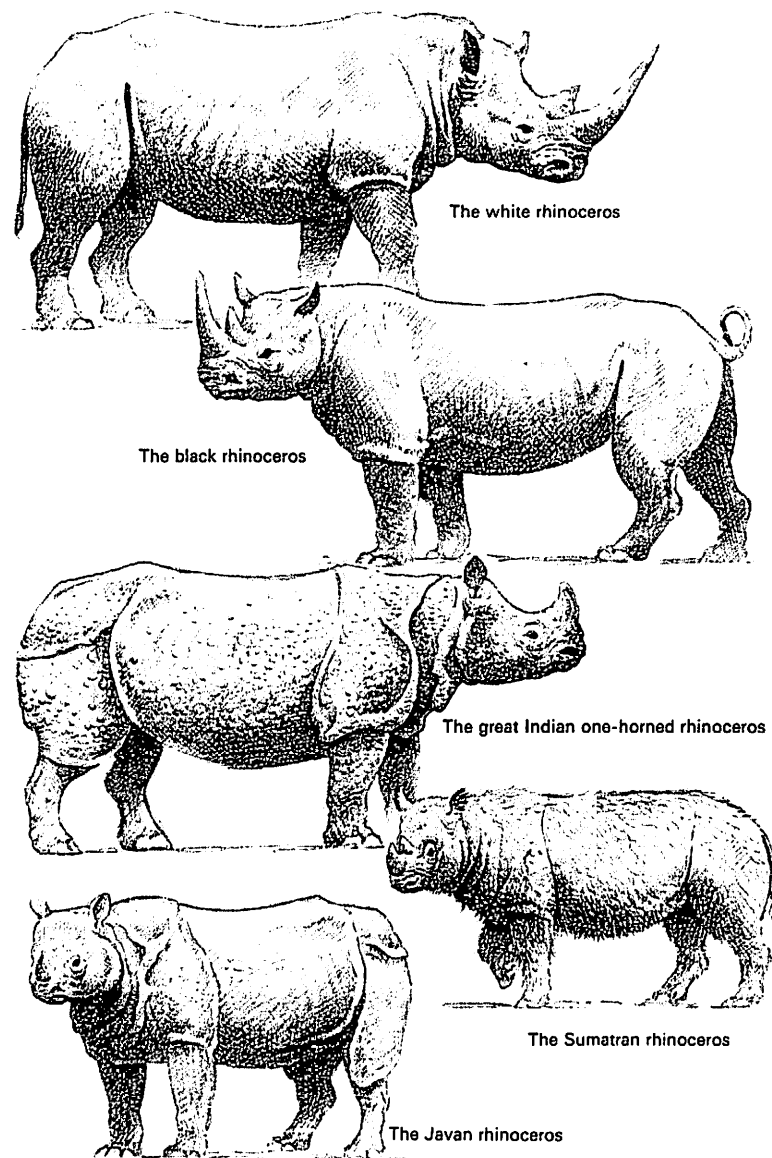


Figure 3: The five surviving species of rhinoceros

and five million years ago. The two species are still closely enough related for some taxonomists to doubt whether they should be separated into two genera.

The Last of Their Line

Rhinoceroses are an example of a major animal group which is long past the peak of its evolutionary development. Their heyday was 40 million years ago, when massive animals like *Indricotherium* and *Paraceratherium* roamed the plains of Mongolia, and lithe runners and sub-aquatic wallowers occupied niches away from the woodlands where the giant browsers lived.

Opinions differ about the reason for the decline of these huge animals: they must have been ponderous in motion, their weight poised over their front limbs, counter-balanced by their massive heads. Because of their size, they are unlikely to have been the victim of any contemporary predator. One suggestion is that a major change took place in the vegetation of their principal range, which at one time was the forest zone stretching across Eurasia from the British Isles to India. They had low-crowned molars, suggesting that they were browsers not grazers; if the woodlands had given way to steppe or savannah, where grass was the principal or only food available, they would have been at a severe disadvantage. The Sumatran rhinoceros might be considered to be the only true descendant of the old browsing rhinoceroses, the others having evolved to eat grass, or perished.

The slow movement and generally placid demeanour of rhinoceroses must have made them very easy to hunt. Cave paintings at Font-de-Gaume and other sites in France indicate that Stone Age man was familiar with the woolly rhinoceros, and almost certainly hunted it. At the end of the last century, hunters in Sumatra used sharpened stakes in pits dug in the rhinoceroses' habitual trails as a means of killing their local species. African tribesmen, before the advent of guns, used similar weapons and presumably similar hunting methods. They would have been capable of killing rhinoceroses from an early time. However, when white explorers and hunters first penetrated the interior of southern Africa, in the second half of the nineteenth century, both species of rhinoceros were plentiful, with no sign that they had been under any particular hunting pressure from the local people. Frederick Courtney Selous, the first of the great white hunters, whose first major expedition was in 1873, blamed European hunters for the decline of both species during the following 20 years.

Although it is tempting to place the blame for the decline of the surviving rhinoceros species entirely on the hunting activities of humans, there are other factors which ought to be borne in mind. The preparation of land in East Africa for agricultural settlement after the Second World War caused the death of very large numbers. Bernhard Grzimek, the great German naturalist, mentions in his *Animal Life Encyclopaedia*, the British hunter, John A. Hunter, who killed 300 rhinoceroses in 1947 and 500 in the following year, in the course of government-sponsored clearance work for African farming settlements. In India, in Assam especially, the clearing of land for tea plantations was a principal cause of the decline of the Indian species. Even without the direct killing, the clearance of woodland and scrub would have been similar in its effect to the hypothetical change in vegetation which might have accounted for the decline of the large browsing species of the Oligocene.

Clearing for rubber plantations had the same effect on the Sumatran rhinoceros in Malaysia. Many animals were shot, but the removal of their feeding grounds and breeding territories was surely as serious a blow to their populations.

The Swiss zoologist, Ernst Lang, sums up the position of the modern rhinoceroses thus:

Compared to this multitude of forms in the Tertiary and glacial rhinoceros, the surviving four genera seem rather stunted in spite of their size. They all live in remote habitats, seemingly because they have not been able to compete any longer with the other ungulates, especially the ruminants. Above all, however, human influence has basically changed wide areas of Asia and Africa, thus making them uninhabitable for rhinoceros.

Adult rhinoceroses have very few predators, though there are recorded cases of lions and even a crocodile killing them. Grzimek relates a most unusual account of a rhinoceros being torn to pieces by a hippopotamus, which surfaced as the rhinoceros was about to drink from a pool. However, it is unlikely that predation was the cause of the extinction of any of the earlier species. It is true now, though, that the presence of spotted hyaenas has a serious effect on the recruitment rate, or population growth rate, of the slow-breeding black rhinoceros.

Humanity cannot prevent the eventual extinction of the rhinoceroses. It is inevitable in geological time, and is in fact going on around us now, as it has been for many million years. The perissodactyls are an outmoded group, incapable of competing on equal terms with the artiodactyls, for all that they are safer from predation. What we can do is to ensure that we reduce the pressure on them from our own species, so that they can become extinct, not in the geological second represented by our brief appearance as a destructive force, but in the natural course of events, many thousands of years from now.

3

The Life of a Rhinoceros

The life of a rhinoceros is dominated by the fact that it is an ungulate. The ungulates are all herbivores, that is to say primary consumers. Their somewhat thankless ecological role is to act as a channel for energy passing from plants to carnivores: they are the primary food source of most large predators. In the past, rhinoceroses were probably also prey animals — food for such as the now extinct sabre-tooth tiger — today, although they are rarely taken as prey, rhinoceroses still retain other characteristics of the ungulates. Ungulates are usually shy, retiring animals. Their weapons are defensive rather than offensive, and they are alert to sights, scents and sounds which indicate the approach of danger. Their principal reaction to a threat is to run rather than to stand and fight.

In all of these respects, rhinoceroses are typical ungulates. They are also typical perissodactyls. Because they are large and sturdy, they do not need to be able to run as fast as their relatives the horses: instead, they have developed a thick skin which can withstand an attack should it be unavoidable.

Rhinoceroses are not gregarious. Their size and their digestive apparatus affect their feeding behaviour, so that it is inefficient for them to feed in sociable herds. Their digestion is slow, so that their food intake must be bulky and reliable. The cellulose in their diet is broken down by bacterial action, not in the stomach, as in artiodactyls, but in the caecum, an arrangement which enables them to tolerate large quantities of fibre. Their food requirements are such that an individual needs a home range where it can feed alone, moving slowly around a limited area from which others are excluded, or in which they are tolerated but not welcomed. There is no direct correlation between the amount of food available and the animal's size, but big rhinoceroses may be able to win access to more food than their smaller neighbours, dominating them and thus enlarging their own territories by ritualised conflicts in which the heavier animal will always be the winner.

Rhinoceroses need regular access to water. Most of them have to drink daily, though during droughts the two African species can manage three or four days without water. Rhinoceroses cannot sweat, so they also need water or mud as a means of keeping cool by wallowing. A large body tends to overheat, and having a

small surface area relative to its volume it needs some assistance in cooling down: mud is an excellent way of accelerating heat loss, taking over an hour to dry, and absorbing heat from the body in the process. Rhinoceroses have developed behaviour which takes full advantage of this, and also of the therapeutic properties of mud for maintaining the skin in a healthy condition. A thick coating of mud probably serves also to reduce the attentions of biting flies and to protect the rhinoceros from other parasites. Ticks and lice tend to fall off with the mud when it dries. Access to water may well be the crucial factor determining how many rhinoceroses can live in a particular area.

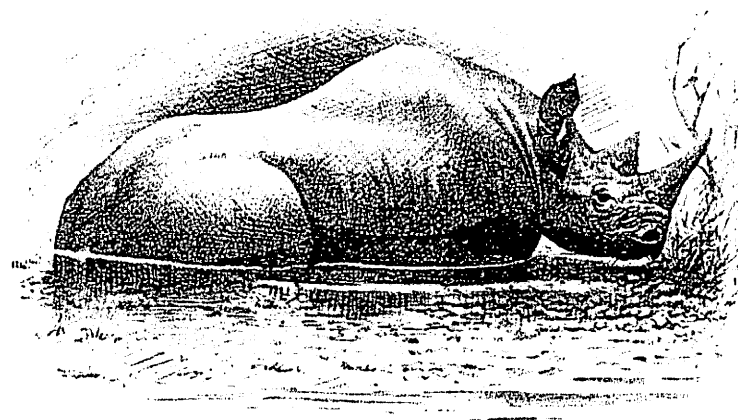


Figure 4: Wallowing is an important part of the daily routine, for keeping cool, protection against parasites, and keeping the skin supple

Senses

The sense of smell of a rhinoceros is very acute: the volume of its nasal passages is actually greater than that of its brain. Scent is important as a means of detecting danger at a distance, to give the rhinoceros time to prepare its escape: but such sensitivity has other uses. Rhinoceroses have evolved a pattern of behaviour in which scent is the principal means of signalling to others of their kind. Urine and dung are obviously important in this system of communication, but so too are flakes of skin, which may be left on trees which are used as regular rubbing posts, or on bushes as the rhinoceros brushes past. Dried mud which falls from the skin between wallows probably serves the same purpose, carrying the scent of its erstwhile wearer. The territory of a dominant male rhinoceros is labelled all over with invisible scent-markers of this kind. Round the boundaries are dung-heaps and urine-sprayed bushes whose significance we will consider later.

Their hearing, too, is acute, with large swivelling ears to locate the direction of suspicious sounds: another typical adaptation of an animal which, contrary to appearances, is descended from a long line of prey animals.

The vision of rhinoceroses, however, is not very good, though they are not half-blind, as people used to think. They are short-sighted, apparently able to perceive movement but not detail beyond a range of about 100 ft (30 m). This may be a reflection of their evolutionary history as forest dwellers: the only species which is ever likely to be confronted with a wide vista in its natural habitat is the white rhinoceros of the open African plains, which is usually considered to be very advanced in evolutionary terms.

There has been some discussion about whether rhinoceroses have binocular or stereoscopic, 3-D vision. A common adaptation of prey animals is to sacrifice stereoscopy for a wide-angle view. Accounts by early hunters, such as Selous, often contain descriptions of a rhinoceros looking at its pursuers first with one eye and then the other, like some huge bird, suggesting that it does not have binocular vision. However, such accounts may well have been mistaken: as Jonathan Kingdon, the East African zoologist, has pointed out, a common display between two challenging males is 'head-flagging'. When two rival males meet, whilst they are still some way apart, they turn their heads from side to side — possibly to demonstrate the size of their horns. This might be a symbolic, long-distance version of the horn-wrestling which occurs when the animals are within reach of each other. He gives sketches in which both eyes are clearly visible from the front when the animal's head is in its normal feeding position, suggesting that in spite of the obstruction presented by its large nose, surmounted by a horn, a rhinoceros does have binocular vision, at least over a limited field. The hunters were probably being challenged by a gesture in rhinoceroses rather than merely being inspected.

The stiff-legged, strutting walk which is seen in some displays would also be of little use if the rhinoceros were really half-blind. This, together with the head-flagging display, suggests that at close enough range rhinoceroses can see perfectly well.

A Ponderous Tread

From their build, rhinoceroses look as though they should move slowly and ponderously. Their pillar-like legs and huge head seem to be designed for standing still, rather than moving at all. The form of their body is very similar to that of their distant, heavyweight, and extinct, ancestors. The vertebrae have long spines for the attachment of muscles which support the back and the weight of the head. The head itself acts as a counter-balance, so that the whole body pivots over the front legs. The main pelvic bones, the ilia, are nearly vertical and the rhinoceros has more ribs than other perissodactyls: these are both adaptations for carrying great body weight.

The basic number of toes in mammals is five. Modern rhinoceroses have three on each foot, in contrast to the swift-running artiodactyls, which have two. The middle digit takes the weight of the animal, rather than the axis passing between the second and third, as in the artiodactyls. It is this which sets the perissodactyls, the tapirs, horses and rhinoceroses, apart from the artiodactyls, the even-toed ungulates. Even when they had four toes on the fore feet, the extinct rhinoceroses took their weight on the third digit: hence 'odd-toed'. The three toes produce the typical 'ace of clubs' footprint, showing that rhinoceroses support their weight on a

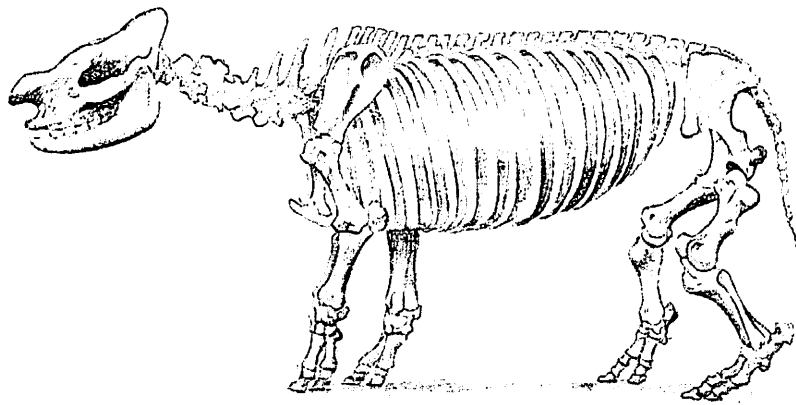


Figure 5: The skeleton of a black rhinoceros is typical of all species, having large attachments for the muscles which support the head, and numerous ribs

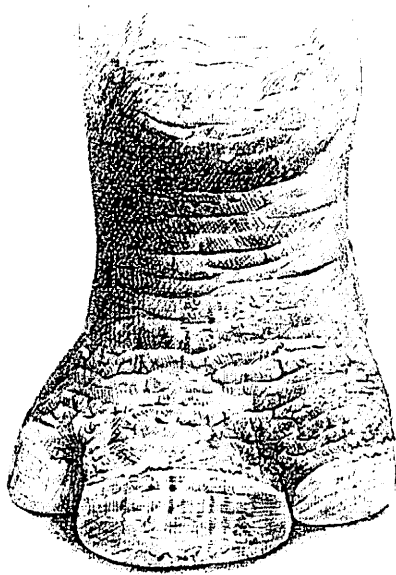


Figure 6: Black rhinoceros forefoot. The toes are reduced to three in all species, the middle digit taking the weight of the animal

relatively large area, most of it on the front legs. The thrust when the animal moves comes mainly from the hind legs.

As many have remarked, this weighty and clumsy-looking creature is capable of moving quite swiftly when the need arises. Kingdon has stated that the black rhinoceros can charge at up to 31 miles (50 km) per hour, and that it is very manoeuvrable. Selous, extracts from whose diary will appear in more detail later, had great respect for the speed and stamina of rhinoceroses. One female, into which he had fired two bullets, trotted off 'as fast as an eland . . . it is very little use following either elephants or rhinoceroses, however desperately they may have been wounded, unless, indeed, one of their legs has been injured'. He found many times that they 'walk on and on until they drop', and was amazed that these 'unwieldy-looking beasts run at a pace that, with their short legs and heavy bodies, one would not believe them capable of'.

Teeth and Feeding

The feeding mechanism of perissodactyls such as the rhinoceroses is generally less specialised than that of artiodactyls. Originally, they all had incisors, which they used for cropping grass and leaves. These teeth had a hollow on the outside surface, which meant that as they were worn away they remained sharp. Both African species have now lost their front teeth, though the Asian species retain them. The canines, if they are present at all, are usually much reduced; but the primitive Sumatran rhinoceros has well-developed lower canines, which it can use as tusks for fighting rather than for food-gathering.

The grinding teeth of the early perissodactyls were at first low-crowned, suitable for eating leaves but not siliceous grasses. Later, horses and some rhinoceroses developed high-crowned molars which enabled them to eat grass. Modern rhinoceroses are therefore able to make use of a fairly broad diet: a feature which may well be the main reason for their survival.

Animals which are too specialised in their feeding preferences die out when there are changes to the food available to them. Such a change may be the result of an alteration in climate, or an increase in some other species with which the specialists are unable to compete. One of the signs which enable palaeontologists to state for certain when the true rhinoceroses appeared in the fossil record is the elaboration of the grinding teeth: a true rhinoceros has no recognisable premolars, but instead a long row of fully-developed molars, sometimes referred to as 'molarised premolars'.

The specialist feeders among the profusion of ancient rhinoceroses were the first to succumb to the changes in vegetation, which whittled the surviving species down to the present five. Although the Javan and Sumatran rhinoceroses are both almost entirely browsers, occasionally even breaking down small trees to get at the leaves in their crowns, both will also take fruit, as does the African black rhinoceros. The Indian one-horned rhinoceros is a grazer, but it can make use of its prehensile lip to gather tall grass in bunches. When it is eating shorter grass, it is able to tuck the lip out of the way. The black rhinoceros in Africa is usually said to be exclusively a browsing animal, but it too is capable of eating smaller plants, such as clover, when the situation demands.

Horns and Fighting

The horns of rhinoceroses appeared late in their evolutionary history, though those of the white rhinoceros can reach an enormous size. The structure of the horn gives rise to a good deal of misunderstanding. It is not a horn in the conventional sense, having no bony central core. Instead, it consists of an aggregation of hollow keratin fibres, similar to hair, but lacking the outer cuticle. Each fibre is 0.01–0.02 in (0.3–0.5 mm) in diameter, and they are bonded together with a minimal amount of horn between the filaments. This makes the horn fray rather easily when it is worn, especially in the Indian and Javan rhinoceroses, whose horns are not sharply pointed like those of the African species.

Both African species sharpen their horns regularly, by stropping them on trees or on rocks. Wood sharpens the horn more effectively: rocks eventually wear it away to a blunt stub. Each horn is mounted on a roughened knob on the skull. If the horn is accidentally knocked off, it will grow again, especially in younger animals. The African and Sumatran species have two horns in tandem, while the Indian and the Javan have only one.

The use of the horn in fighting leads to some interesting conclusions about the development of ritualised conflict among heavily-armed animals. It has long been observed that gannets and colonially-nesting cormorants, for example, both fish-eating birds with long sharp bills, have elaborate threat behaviour which enables them to avoid actual violence while still settling disputes between individuals. The effect at the breeding ground is to space out the nests so that they are two bill-lengths apart: neither animal can reach the other to harm it, but both are able to maintain their social position.

The same is true of other animals which have weapons capable of inflicting severe wounds, so that both loser and winner of any fight might be physically damaged or even killed. White rhinoceroses have the most formidable horns of all and, as might be expected, they have the most ritualised confrontation behaviour. Two males at the boundary of their territories appear to stand nose to nose without any particular movement or aggression, before backing off to wipe their horns on the ground, after which they part. Male black rhinoceroses are not usually territorial, but they cross horns with females from time to time during courtship.

The difference between the white rhinoceros and the black in this respect has been traced to the difference in their diet, as it affects the amount of space which each species needs in order to find enough food. Grazing white rhinoceroses may build up quite large densities in their feeding areas, as many as five per 0.4 sq miles (1 sq km). This means that each occupies a relatively small territory, with the result that they meet often, and boundary disputes are common. Thus there is more need for some form of ritualised confrontation which stops short of actual conflict and does not threaten the combatants with injury. Their apparent inactivity during their 'staring matches' is in fact a subtle and precise contest in which each animal gauges the weight and strength of the other. It might be likened to arm-wrestling as a test of strength between human males. The horn-wiping which follows may be interpreted as a symbolic attack, in which only the preliminary lowering of the fearsome weapon remains. Sometimes the loser in a contest may make a similar gesture before retreating, as a form of redirected aggression.

Black rhinoceroses, which feed in woodland, do not meet each other so often. As



Figure 7: Horn-wrestling is a ritualised form of conflict, which permits a trial of strength without the risk of injury to either party

a browsing animal, the black rhinoceros needs a much larger range than the white to provide it with enough food: densities in the wild, even in well-stocked areas, rarely exceed one per 0.4 sq miles (1 sq km). The boundaries of territories can overlap, because they are not so frequently visited by the owner. Instead of fighting, or developing ritualised conflicts which simulate fighting, the black rhinoceros places more reliance on sign-posting his boundaries with urine.

The Indian rhinoceros has a different approach from that of both the black and the white: neighbouring males fight only rarely, but any intruder from outside is attacked with great ferocity. It feeds among the tall grasses which grow on drying flood plains beside rivers. The exact location of its feeding grounds is not predictable, as the water-level changes from season to season. Being a grazing animal, the Indian rhinoceros can build up densities on the feeding grounds as high as those of the white rhinoceros, but because it needs to be able to feed when and where the grass is growing best, it is more efficient for it not to be too dedicated to the idea of holding territory at all. Furthermore, the temptation to assert itself may be less because it seldom actually sees any rivals: in elephant grass 10 ft (3 m) tall, in which the visibility is almost nil, the Indian rhinoceros may be close to a potential adversary without the sight of it triggering an attack.

Although all five species of rhinoceros have some degree of ritualised conflict, there are records of tremendous fights between males, resulting in serious wounds to both combatants. African rhinoceroses fight by jabbing upwards with their horns, while the Asian species slash open-mouthed to attack with their incisors, or the canines in the case of the Javan rhinoceros.

In discussing the ritualisation of conflict, Kingdon has made the interesting point that animals which limit fighting by keeping out of each other's way, rather than by developing rituals which enable them to live closer together without actually coming to blows, may be missing an opportunity of exploiting their habitats more fully, since they are wasting space. This is a poor evolutionary strategy: there are therefore few examples of animals whose social behaviour is so explicitly violent and unrestrained. (Kingdon quotes the chevrotain — a primitive ungulate with large teeth, claws where the others have toenail-style hooves, and a fiercely combative nature.) In evolutionary terms, the black rhinoceros would

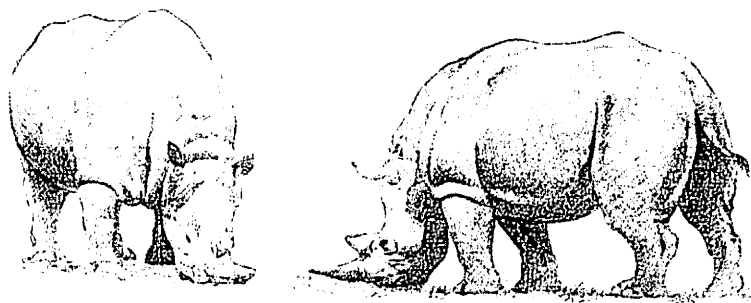


Figure 8: The gesture of wiping the horn may well symbolise the preliminary to an attack which is never carried out

benefit from developing a more strongly territorial social system, especially when food is in short supply. At Tsavo in East Africa, and in other overcrowded locations, more competition for the available food would have saved a large number of animals from starvation, even though it meant the death of a few less dominant individuals.

Chemical Markers

In male rhinoceroses the retracted penis is directed backwards; they can use it for spraying urine behind them on to bushes or on to the ground. Urine-spraying is an expression of dominance during and after conflicts, and a means of marking territorial boundaries at other times. The urine is produced in a fine spray, almost like an aerosol, scenting the air for some distance around, and lingering on the ground for days afterwards. Among white rhinoceroses, urine-spraying is the privilege of dominant males inside their own territories. Subordinate males, or senior bulls passing through the territories of others on their way to and from water, do not spray. The dominant male will recommence spraying only when he is once

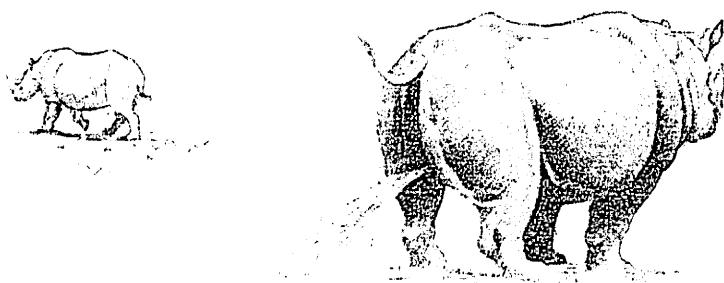


Figure 9: Urine-spraying is the prerogative of dominant males, usually to mark the boundaries of a territory

more on his own ground. The details of urinary etiquette vary from species to species.

Dung is deposited in heaps at a number of selected spots within the territory, the biggest heaps being near the boundary. After defaecation, a dominant white rhinoceros bull kicks the dung with his hind feet, scattering it backwards. A long-established white rhinoceros dunghill or midden has grooves across it showing where the proprietor has repeatedly performed this ritual marking of his territory. The much less strongly territorial black rhinoceros rarely excludes others from his feeding range. Both male and female black rhinoceroses kick their dung after defaecation, and the males spray urine, but the function of their ritual is probably quite different. Some engaging experiments with bags of dung are described in the separate account of the black rhinoceros in Chapter 4.

Courtship and Breeding

The courtship and breeding of each species will also be described separately, so far as the details are available. However, there are some aspects which may be taken as part of the general rhinoceros way of life.

Wild rhinoceroses do not usually breed as fast as their physiology would allow. Single calves are the rule, though twins have very occasionally been seen, and although the interval between calves can in theory be as short as 22 months, most rhinoceroses breed every third or fourth year.

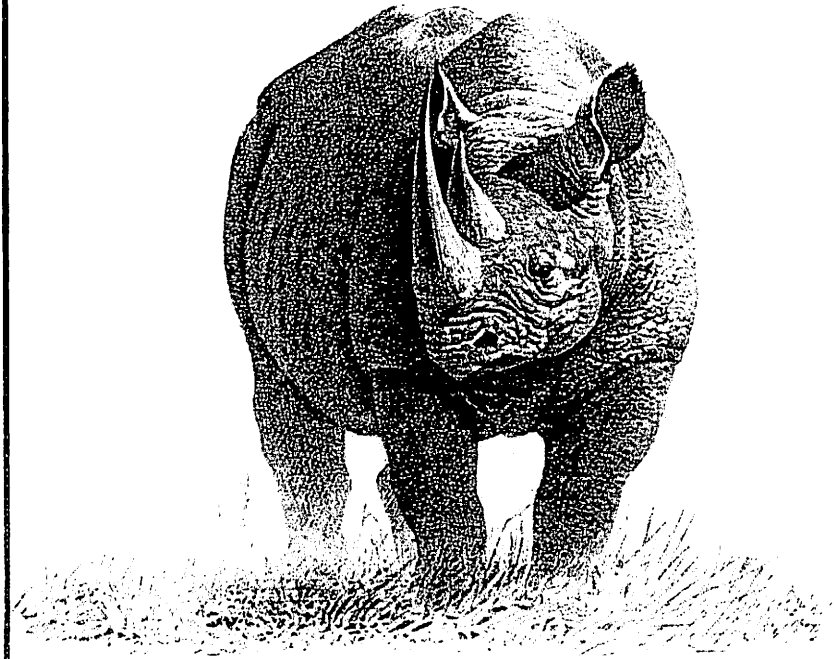
There is an intriguing difference between white and black rhinoceroses once their calves are born: the black rhinoceros calf follows its mother wherever she goes, trailing a few paces behind, while the white rhinoceros calf accompanies its mother just as closely, but almost always travels a few feet ahead of her. Rhinoceros calves remain with their mother after weaning, being dismissed from her company only when the next calf is born. After being turned out to face the world alone, the juveniles may join forces with one or more others of their own age, or attach themselves to a childless female. When they reach adulthood, they become solitary.

Rhinoceroses share some other features in common: they can all be categorised as uncompetitive animals, poorly adapted to resist the pressures which may develop when their habitat comes under pressure from over-population by another species, including (especially) humankind. They breed and grow slowly, making them unsuitable even for controlled exploitation as a resource. They are poor colonists, being conservative in their use of the available terrain: schemes to increase their numbers in selected areas must rely on the translocation of captured animals. However, they are valuable members of the ecosystems where they still survive in sufficient numbers to have any effect: for example, the tracks made through the bush by black rhinoceroses travelling to water are used by large numbers of other animals. Those made by Javan rhinoceroses many years ago are still used by human travellers; some of them have become the route of modern roads.

All rhinoceroses share the same major predator, and all are equally defenceless against and threatened by its attentions. Until the human species stops killing them for medicines and dagger handles, the fate of the world's rhinoceroses is in the balance. The most likely outcome of the present rate of predation by humans is

extinction for all but the white rhinoceros before the end of this century. Paradoxically, perhaps, the greatest hope for the two African species may be that a few of them every year should become trophies on the wall of the den of a number of very wealthy hunters: I shall explore this paradox further towards the end of the book.

4 The Black Rhinoceros



THE BLACK RHINOCEROS

Scientific name: *Diceros bicornis*

Common names: Black rhinoceros, Prehensile-lipped rhinoceros,
Browse rhinoceros

Range and numbers (1984 figures)

Tanzania	3,130
Zimbabwe	1,680
Zambia	1,650
South Africa	640
Kenya	550
Namibia	400
Central African Republic	170
Mozambique	130
Cameroon	110
Sudan	100
Somalia	90
Angola	90
Malawi	20
Rwanda	15
Botswana	10
Ethiopia	10
Chad	5

Total in 17 countries 8,800

Source: Western and Vigne (1985), Oryx 19,
215-20.

Length of head and body	10 ft-12 ft 6 in	(3.0-3.8 m)
Height at shoulder	4 ft 6 in-6 ft	(1.4-1.8 m)
Weight	2,195-3,000 lb	(996-1,362 kg)
Length of front horn	1 ft 8 in-4 ft 4 in	(50-135 cm)

Distribution and Status

The black rhinoceros is no more black than the white rhinoceros is white. When it was described, by Linnaeus in 1758, it was called the two-horned rhinoceros, the only other known species being the Indian one-horned. It seems to have absorbed its misleading common name by contrast with the misnamed white rhinoceros when that species was discovered. The name 'white' is a corruption of the Afrikaans *weit*, which describes the *wide* mouth of the species. Kingdon used the names 'browse rhinoceros' and 'grass rhinoceros' for black and white respectively: these names are far more descriptive than 'black' and 'white', and easier on the tongue than such heavy-handed titles as 'prehensile-lipped' and 'square-lipped' for the

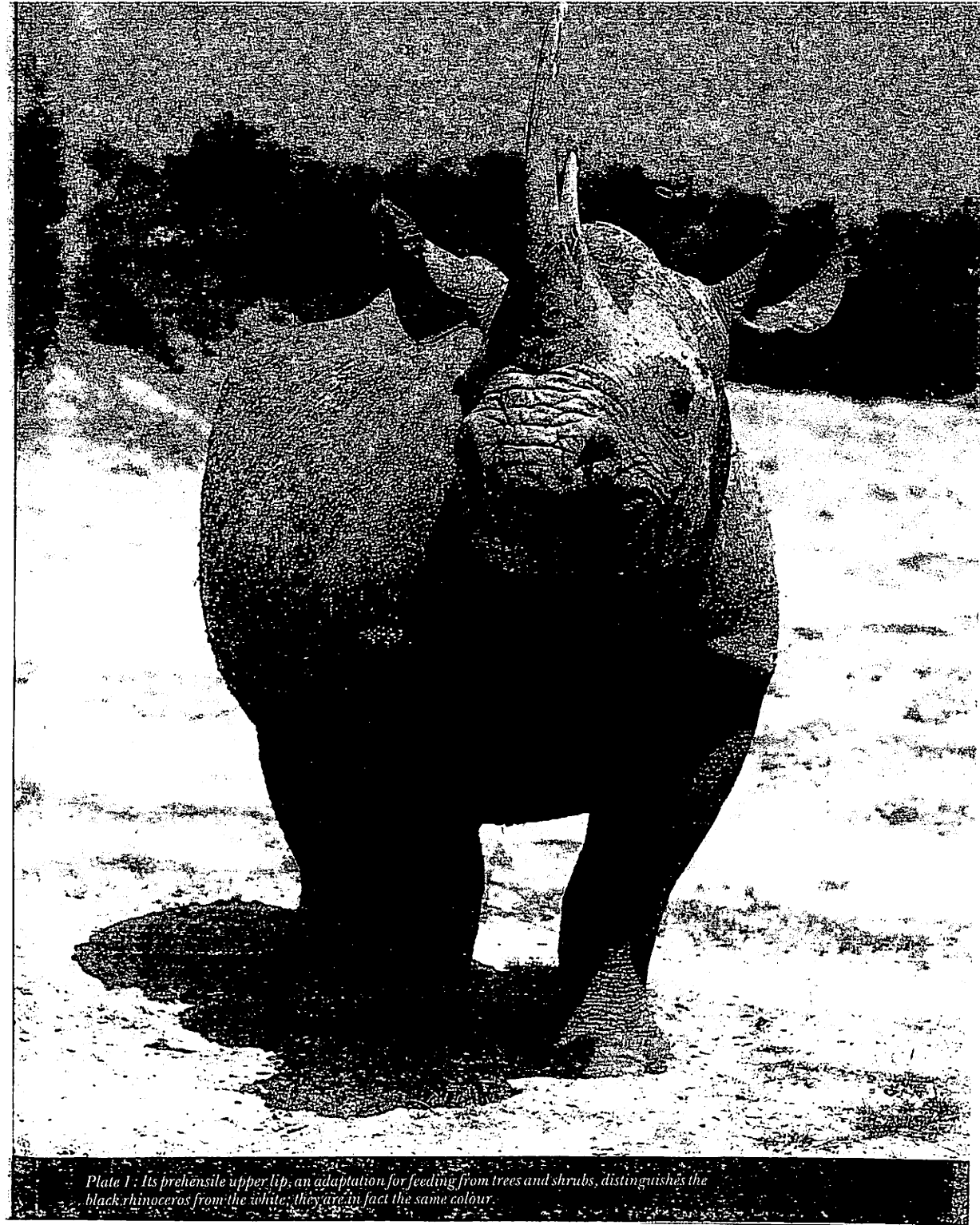


Plate 1: Its prehensile upper lip, an adaptation for feeding from trees and shrubs, distinguishes the black rhinoceros from the white; they are in fact the same colour.



Plate 2: The snows of Kilimanjaro look down across plains which are now virtually denuded of black rhinoceroses. This photograph was taken in the mid-seventies when the species was fairly common.



Plate 3: Although they occasionally compete for water, giraffes and rhinoceroses can ignore each other ecologically because they exploit different niches.

two species. Nevertheless, in this account, I shall stick to the familiar 'black' and 'white', misleading though they are as names. In due course Kingdon's names will probably be used, as they become better known.

Even today, there is some uncertainty about whether the two species are different enough to be separated into two distinct genera, but at the end of the nineteenth century there was a brisk argument among zoologists about the taxonomy of the black rhinoceros itself, some claiming that there were two species in Africa, the black rhinoceros proper, *Rhinoceros bicornis*, and the 'blue', *R. keitloa*. The difference between them was supposed to be in the relative length of their horns. In a typically strongly argued paper, which he read to the Zoological Society of London in 1881, Selous demonstrated (with the aid of a collection of horns some of which came from animals that he had shot himself) that they are both the same species. A wider knowledge of the species has since shown that individuals vary in size, and in the size of their horns, partly at least in response to local conditions, tending to be smaller in drier habitats. Nowadays they are both included in the single species *Diceros bicornis*.

The black rhinoceros is separated from the white by its ecological requirements, even when the two species inhabit the same general area. As a browser, it can colonise areas of rugged hilly terrain where grass is scarce, up to heights of 9,000 ft (2,700 m). It avoids both the open grassland used by the white rhinoceros, and

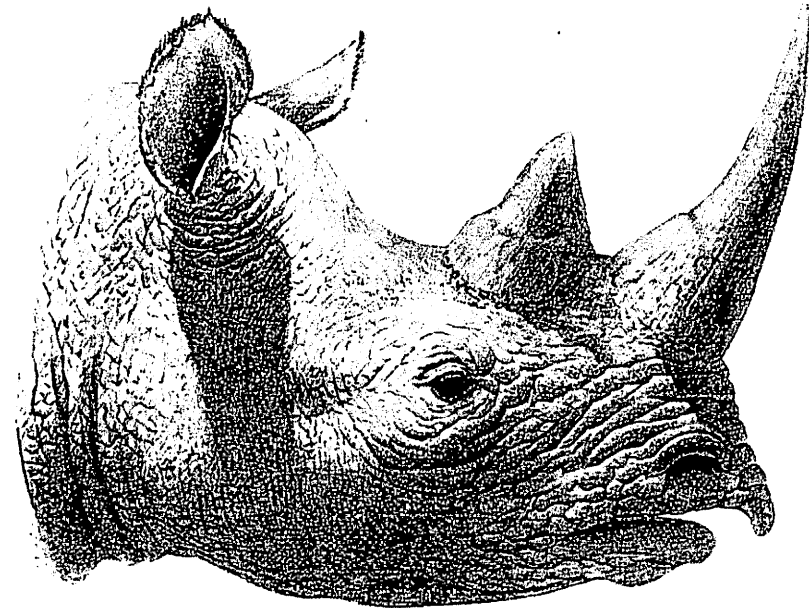
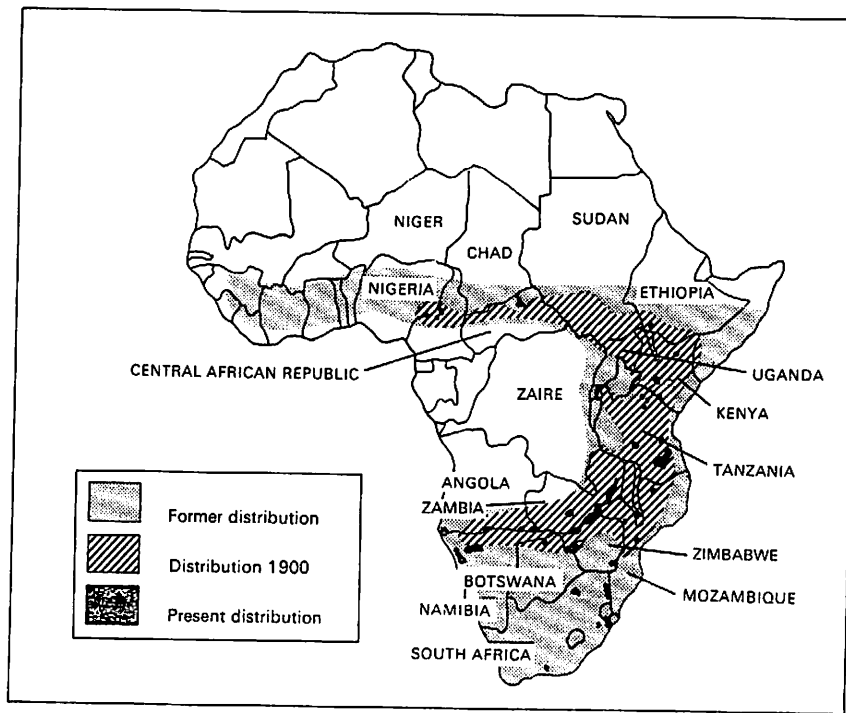


Figure 10: The black rhinoceros has a prehensile upper lip, typical of a browsing animal. However, it can also feed on fruits, and plants such as clover

very dense cover, preferring the edges of small wooded areas. Thus, originally, it had a very wide range, which covered the southern third of Africa, and stretched northwards between the east side of the Rift Valley and the east coast. North of there, the species inhabited a broad band of open woodlands stretching from the Horn of Africa to the west coast south of the Sahara.

Towards the end of his first visit to South Africa, Selous, although himself a hunter, became alarmed by the impact of hunting, and the sharp decline which he had witnessed in both species of rhinoceros. He remarked as early as 1881 that the black rhinoceros had been 'almost exterminated in the westerly portions of the country', though it was still fairly numerous in the south-east. By the turn of the century, its range had contracted still further. It was rare or extinct in the north-western and north-eastern extremes of its range, and disappearing fast in the south, as the result of very heavy shooting pressure from the white settlers there. By then, the only sizeable populations were to be found in East Africa: the numbers dwindled further north in the Sudan and Somalia. Today, as described below, the range of the black rhinoceros is contracting so fast that it would be better recorded in a daily newspaper rather than a book, which takes time to get into print. The only countries in which it is anything like secure, in spite of its earlier near-extinction in those regions, are South Africa, Namibia and Zimbabwe; though



Map 1: Past and present distribution of the black rhinoceros

even in Zimbabwe it is under heavy attack from organised poachers.

There was a time when the range of the black rhinoceros was determined by the climatic conditions: it inhabited forests and woodland everywhere unless they were too dry, as in parts of East Africa, or too hot and humid, like the lowland forests to the west of the Rift Valley. Now, its range is determined by the reach of the financial resources of countries to whom the horn is valuable as the material for dagger handles.

Diet

The black rhinoceros is usually described as a browsing animal, a method of feeding for which it is conspicuously well-adapted. It feeds on leaves and twigs from a wide variety of shrubs in the acacia woodland community, often using its horn to pull down and even break branches until their ends come within reach of its prehensile upper lip. In open grassland, it pulls up seedlings of colonising trees, thus improving the pasture for itself and other grazing animals. However, it has a wider diet than this when circumstances permit: it will pick up fallen fruits from the ground as well as taking those which it can reach from trees, and it is able to feed on grass which is long enough to be twisted together into bundles. Green clover and other herbs are acceptable if they are all that is available.

Black rhinoceroses, in the Ngorongoro Crater in Tanzania, have been known to pick up and eat wildebeeste dung, during periods when browse is in short supply, and the grass has been cropped too closely by other species for the rhinoceroses to eat. Such behaviour might have satisfied a need for minerals and trace elements; but equally there might have been a good deal of sustenance still remaining in the droppings.

During the rainy season, the black rhinoceros ranges freely, feeding over a wide area. When the dry weather comes, it stays within 3 miles (5 km) of permanent water. It needs to drink once a day, or even more often if possible, following regular routes between its feeding and watering places. In especially arid conditions, black rhinoceroses can dig for water, using their front feet to throw the sand out behind them until they have made a hole which might be as much as 20 in (50 cm) deep.

The tracks which black rhinoceroses use as they travel through the bush are followed by many other species, either to go to and from the same watering hole, or just as convenient passages. There is often a groove in the ground about 20 in (50 cm) wide, and as much as 14 in (30 cm) deep, beneath a tunnel through the bushes 6 ft (180 cm) high. The advantage to the other animals is twofold: following an already cleared track saves them effort, but it also enables them to move quietly and less conspicuously.

Unlike the other animals of the bush, the black rhinoceros seems to take a particular delight in crashing through cover. Having no regular predators as an adult, it has no need to move stealthily; and there is a suggestion that by brushing against the vegetation it leaves a scented trail consisting of flakes of mud and pieces of dead skin which, together with sprayed urine and traces of dung, communicate its presence, and possibly also its identity, to the next rhinoceros to come along.

Daily Routine

The daily routine of the black rhinoceros is very similar to that which the white rhinoceros follows in hot weather. It feeds morning and evening, and sleeps in shade or in a wallow during the heat of the day. The species has become largely nocturnal in most parts of its range, probably as the result of natural selection, which has eliminated the more diurnal individuals which were the most likely to be shot. Accounts by early hunters mention meeting black rhinoceroses regularly by day during the first years of the Europeans' exploration of the lands north of the Cape; but in later years, before the rhinoceroses were so nearly wiped out, they were more likely to hear them moving around or drinking during the night.

As early as 1873, Selous was moved by the sight of a group of elephants drinking in daylight. He writes in his account of that year: '... what a glorious sight it must have been to see these gigantic animals walking in the open with their slow majestic step' — and he was one of the first hunters to venture into that part of Africa. When their persecution comes to an end, black rhinoceroses will no doubt resume a more diurnal way of life, as elephants have done in parks where they are protected, and as black rhinoceroses themselves have in parks such as Hwange in Zimbabwe.

Because rhinoceroses cannot sweat, they need regular access to water to keep cool. Wallowing plays an important part in the life of the black rhinoceros, as it does in other species. As well as helping to lower the body temperature, it probably gives some protection against flies, not only during the process but afterwards, when a coating of dried mud must offer some barrier to biting insects. Whether it 'conditions' the skin, as most people say, is open to conjecture: rolling between wallowing sessions may be more important in this respect.

Like the white rhinoceros, the black rolls regularly in dust or ash, probably as a form of grooming. 'Rhino sores', areas of cracked and often inflamed skin, occur most commonly in the hollow behind the elbows of the front legs, the one area which is not scrubbed by a roll on a patch of sandy or gritty ground. However, the skin between the thickened shield plates is remarkably thin and flexible, and might well benefit from regular damping.

Social Behaviour and Status

Black rhinoceroses have a different social organisation from that of the white rhinoceros. The males are solitary, but they do not hold territories in the strict sense of the word. Each has a preferred feeding area, whose boundaries usually overlap with those of its neighbours, but the breeding territory is not as clearly defined as that of the white rhinoceros. Males which make regular use of the same waterhole live in what have been called 'clans', loose communities centred around the waterhole. Each clan covers an area about 3 miles (5 km) in radius, that being the maximum distance which each rhinoceros is prepared to walk each day to reach permanent water. Within the clan, males seem to know each other, and to tolerate the presence in passing of one of their own. A male outsider wandering into the clan area will be challenged if he meets one of the resident males; intruding females are challenged less strongly.

The home range of female black rhinoceroses varies in size depending on the availability of food: in the thickest bush which is suitable for the species it might be

as little as 1.2 sq miles (3 sq km), but in more arid country, with sparse cover, as much as 34.7 sq miles (90 sq km) may be occupied by a female and her calf.

Except where they gather in wallows, black rhinoceroses do not form large groups: five is the largest party usually seen together, though groups of as many as 13 have been recorded, probably a temporary assembly as two or more groups met. Females travel with their last calf close at heel, occasionally accompanied by the previous calf if it was a female. Family groups of this kind need a larger feeding range than single animals, and probably for this reason females with young are notably more aggressive towards other rhinoceroses.

A young animal which has been displaced by the birth of its mother's next offspring is usually driven away, but instead of wandering off alone through the bush, it pairs up with another, of either sex, usually near its own age. The two may then wander long distances from their birthplace before settling down to the normally sedentary life of their species.

Encounters between male black rhinoceroses are very rarely aggressive, unless a stranger wanders into a clan area. If this happens, the animal which is on its home ground is usually successful in driving the intruder away. Snorting and pawing the ground are the prelude to a series of short charges, which usually stop about 20 ft (6 m) short of impact. Sometimes the intruder will charge as well, but the two animals seldom make contact: instead they adopt stiff-legged poses, tails in the air, until the tension between them gradually relaxes, and one moves calmly away.

However, during a time of ecological stress in East Tsavo, before the drought of 1960–1, all the rhinoceroses were found to be wounded, and some were killed in fights. This was evidently abnormal behaviour, produced by conditions of extreme hardship.

There is a dominance hierarchy among neighbouring bulls, similar to the pecking order among ground-feeding birds. There is more than one level of subservience, but postures and symbolic charges replace fighting in maintaining each bull's position in society. Sometimes a dominant intruder may displace one of the members of the resident clan. If this happens, the defeated animal moves off and challenges the occupant of the next range, until the social system has settled down once more.

Breeding

Most fights between adult rhinoceroses involve animals of opposite sex. The Kenyan naturalist, C. A. W. Guggisberg, made a study of the courtship and mating behaviour of the black rhinoceros, and found that cows often attack bulls which are making advances towards them. However, he also gives a dramatic account of a violent conflict, between a cow and a bull known as 'Split ear', in which the bull was the aggressor.

The battle began when the bull, which was to be seen regularly with the same cow, started showing signs of excitement — snorting, and opening his mouth and curling his lip in what Guggisberg calls a 'sexual yawn'. The first attack was very short, ending with the two animals standing nose to nose, after which the bull backed off, rubbed his nose on the ground, scraped with his hind legs, defaecated, and scraped again.

After a time he began circling the cow, snorting continuously and twisting his tail over his rump. During most of this display the female stood as motionless as a statue. When she once turned towards 'Split ear' in an aggressive manner, he trampled with all four feet on the spot he stood on, looking for all the world as if he were dancing. A few moments later he launched another attack. But the cow drove him back, opening her mouth wide and uttering the same snarling sound I had once heard in the Lake Manyara National Park, a sound that might be rendered as *chrachrachrachra*, the 'ch' to be pronounced as in 'Loch'. 'Split ear' again rubbed his nose in the grass and shredded the surrounding bushes with his horn. This game went on for some time, accompanied by a lot of snorting and snarling.

The fight became more and more violent, with both contestants playing an equal part, attacking the other with shoulders and horns. The bull actually lifted the cow with his head more than once, so that only her back legs were on the ground. The contest lasted for four or five minutes before the cow ran away, the bull charging after her. Soon, they were fighting again, but finally the cow seemed to surrender.

She stood motionless, while 'Split ear' walked around, rubbing his nose on the ground, ploughing up the grass and tossing whole loads of branches into the air. He sprayed a bush, scraped several times, and worked himself into such a state that he finally advanced once more upon the cow. This time she did not snarl her defiance, but retreated before him, walking backwards. 'Split ear' quietened down almost at once, and when we left the battlesfield, with dusk descending on the plains, he was ambling about rather aimlessly.

Courtship does not always involve fighting, though most females respond violently to the male's first approaches. The male's usual preliminary to an attempt to mount is to lay his head across the female's back. This is preceded by a courtship display which consists of brushing the ground with his horn, charging at bushes, and darting back and forward on stiff legs, frequently spraying urine. This war-dance seems to have the effect of rousing the male to the point at which he dares to make the final advance: but it evidently affects the female as well, giving rise to what may often be a violent response.

However, the display seems to have little effect on nearby males, which rarely fight over oestrus females. In a recognisable group of rhinoceroses, it was found that one cow was courted, if not actually mounted, by three different bulls in eleven days. The significant observation during this period was that the male who first mounted her showed no interest or concern while she was being courted by the others, even though he was close at hand. There seems to be no sexual jealousy among black rhinoceros males; but that may be because members of a clan know each other well, and have often tested their relative strengths. They therefore have no need to fight repeatedly to remember which must give way to which in the social hierarchy.

Evidently the female can play a more active role in courtship: there is an account of a courting pair of rhinoceroses which were disturbed by suddenly becoming

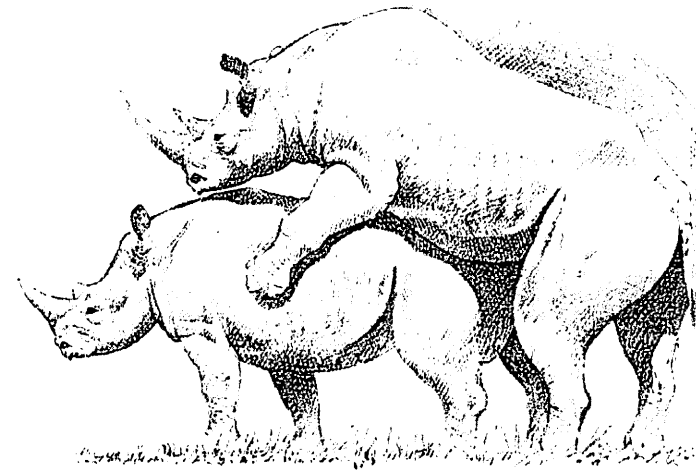


Figure 11: Black rhinoceroses mate for 20 to 35 minutes at a time, several times a day

aware that they were being watched by some people in a car. The male, on getting wind of the car, turned and trotted off into the bush; but the female, apparently unaware that he had gone, performed a series of alluring gestures to the car, tossing grass with her mouth, and strutting stiff-legged towards it. When she, too, smelled the car, her behaviour changed abruptly: she charged, hitting it with a loud crash, before leaving the scene with angry snorts.

Black rhinoceroses have often been seen mating in zoos, though only rarely in the wild. In Frankfurt Zoo, copulation lasted from 20 to 35 minutes, and took place several times a day, figures which agree with occasional sightings in the wild. Wild pairs have been seen to move around together for as long as four months, but more often the male wanders away after a few days.

There is a famous account of the 'altruistic' behaviour of three female rhinoceroses towards a fourth, seen in Nairobi National Park in 1958. Three of them were walking close together, the middle one supported by the other two, while the fourth walked close behind. The middle female was in labour, and one of the others kept rubbing her flank with the side of her head and her horn. Three days later, a newly-born calf was found close by.

No one has ever seen a wild rhinoceros giving birth, and the chances are that very few other rhinoceroses have seen it either. The mother-to-be hides when her calf is due, retiring into thick cover, usually alone: the Nairobi National Park incident is the only report of midwifery among rhinoceroses. Most descriptions date back to the first successful captive birth, in Brookfield Zoo, Chicago, in 1941. Since then, black rhinoceroses have bred in captivity regularly, and a good deal of information has been gathered which, though interesting, need not necessarily represent what happens in the wild.

Gestation is between 446 and 548 days, depending on the zoo which provides the

information: the average seems to be 460 days, or about 15 months. Presumably the uncertainty arises from the fact that no zoo keeper has ever been sure when his female charges have been impregnated. Copulation takes place at regular intervals of three and a half weeks throughout pregnancy, suggesting that the oestrus cycle is uninterrupted.

Mating and birth occur throughout the year. The mother remains secluded for a couple of weeks, defending her newborn baby against all comers. Bulls in zoos have been known to attack small calves: there is nothing to say that this is typical behaviour for the species, but if it were, it would explain the mother's reclusive behaviour. She avoids wallowing while she is suckling a small calf, probably for hygienic reasons. She has two teats, between her hind legs, and she normally suckles the calf standing up.

The previous calf is driven away by its mother when she produces her next: at this time it might be anything between two and five years old, but still not fully grown. The newborn calf weighs between 55–88 lb (25–40 kg), about four per cent of its mother's weight: this is typical of all species of rhinoceros. Although it can stand and walk within ten minutes of being born, the calf is plainly very vulnerable to accidental (or deliberate) trampling. The young calf stays very close to its mother at all times, following her movements closely: if danger threatens, the female swings sideways to interpose her body between her calf and the approaching predator. Later in the calf's life, this behaviour causes the radial formation, horns outwards, which is the typical response of a group of black rhinoceroses at bay: each is trying to protect the one next to it by standing broadside on.

Black rhinoceroses are usually fully grown at about seven years of age, though one in London Zoo was still growing at nine years old. They reach sexual maturity at about six or seven. A male's chance of breeding depends on his position in the social hierarchy, but a female can breed before she is fully grown. In the wild, a

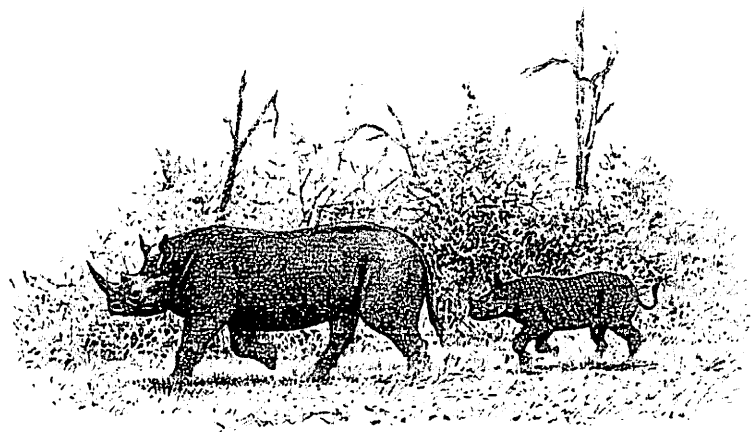


Figure 12: The black rhinoceros calf follows its mother, perhaps as an adaptation to travelling through thick cover: she is better able to clear the way

female breeds only every two to five years, because of the time required to rear the calf; in a wild population, a quarter of the females breed each year. Their life expectancy is not accurately known, but in zoos black rhinoceroses can live for 40 years. Guggisberg estimated that two females which he knew at Amboseli, who were known to staff and visitors as Gladys and Gertie, were between 20 and 30 years old when he first met them in 1954, and in 1966 they were both alive and well. His estimate of their likely longevity was between 50 and 60 years.

Unfortunately, they did not live for so long. They were speared to death by a group of Masai, not much more than a year after Guggisberg last saw them. Although their horns were taken and undoubtedly sold for profit, the main motivation for the killing, so the naturalist/cameraman Alan Root tells me, was defiance or bravado on the part of the warriors who were responsible. This common and unfortunate response by rural Africans to the establishment of game reserves is discussed further in Chapter 11.

Signs and Signals

The sounds made by black rhinoceroses are not as varied as those of the white, but apart from puffing and snorting they have a few vocalisations whose function may be guessed at. Calves and their mothers communicate with a variety of squeals. A calf which had lost sight of its mother repeated a faint sound which has been described as 'mfee', a pathetic bleat from an animal which was three-quarters grown, and weighed at least 1,650 lb (750 kg). In moments of panic, a calf can produce a loud and penetrating squeal: males will come to investigate this sound from as much as half a mile (a kilometre) or so away. Fighting adults grunt and scream at each other; and adults approaching waterholes where others are already wallowing make a puffing or gasping sound which may serve to avoid conflicts by giving the group an early warning of their approach.

The most frequent signals used by the black rhinoceros are based on scent. Urine-spraying is very common along their trails to and from water, especially by dominant males within their feeding territory. Bushes, clumps of grass, tree stumps and conspicuous stones are all marked regularly, often during the male's morning tour of his borders. Females spray when they are in oestrus, no doubt to announce their condition to nearby bulls, but their spraying is undirected, and in the form of a jet of liquid rather than the forceful aerosol puff produced by males. Similarly, when they are defending their young from the attentions of other adults, females produce scent-signals which are delivered at random into the air.

The use of dung as a means of signalling is similar in black and white rhinoceroses. Black rhinoceroses use communal dung-heaps beside their regular tracks through the bush; in places where both black and white share the same area, these communal heaps may be used by both species. Scraping with the hind legs is a common piece of behaviour after defaecation; its function is not to conceal the droppings, but rather to make them more conspicuous. Furthermore, by picking up the scent of his droppings on his hind feet, a male rhinoceros might be able to leave his individual imprint on a considerable length of trail, in much the same way as the urine-sprays, for the benefit of later passers-by.

There have been some experiments to find the function of dung-scented trails.

Biologists towed bags of the dung of known individuals through the bush for distances of up to half a mile (a kilometre), observing the effect on other rhinoceroses in the area. They found that the animals would follow the scent left by the bags much more intently and for longer distances if the dung was from a member of their own clan, or another individual with which they had regular contact. Dung from rhinoceroses which lived further away, outside their immediate social circle, aroused much less interest. This suggests that the identity of an individual animal is apparent to another from the scent of his droppings, and no doubt also from his urine. Scenting the area in both ways must provide to passers-by a constantly updated record of the population present, including the sexual condition of the females.

Parasites and Predators

Black rhinoceroses are particularly vulnerable to 'rhino sores', which are usually just behind and below the shoulder, in the area which they find most difficult to scratch while rolling. The sores are inflamed, often septic, patches of skin, as much as 8 in (20 cm) in diameter, which are infested with a small filariform worm called *Stephanofilaria dinniki*. The five other species of this genus of worm are all parasites of cattle: the intermediate host is a biting fly which breeds in dung. In visiting the communal dung-heaps along their trails, the rhinoceroses pass the infection around the population: almost every individual has sores caused by this worm.

Over 20 species of ticks have been found feeding on black rhinoceroses, some of them specific to the rhinoceros, and others impartial parasites on elephants as well. The ticks provide a regular food-supply for oxpeckers, birds related to starlings. Every rhinoceros carries two or three of these grey-brown birds, with their bright orange beaks, pecking industriously at the ticks on its skin. The birds not only remove the parasites; they also cause the rhinoceros some discomfort, by sticking their sharp beaks into ears and nostrils, and pecking at any open wounds or sores. However, they perform a service of another kind by acting as an alarm system. Although they have become accustomed to cars in game parks, in the same way as the rhinoceroses themselves, in open hunting areas the oxpeckers fly up with loud screeching calls when humans approach.

There is a reported sighting from Natal of a female black rhinoceros which was being cleaned of ticks by turtles as she lay in a wallow; in one case, six turtles were to be seen climbing on to the rhinoceros' body to pull the ticks out in their mouths.

Among its internal parasites, the black rhinoceros numbers bot-flies, whose larvae live in its stomach, and several species of tapeworm.

The black rhinoceros has few predators. Lions have been known to kill adults, and to take a calf if they can separate it from its mother; but her defensive behaviour is such that this is a rare event. A more serious predator is the spotted hyaena, which takes calves so successfully that it seriously restricts population growth. In areas where the breeding of black rhinoceroses is a primary aim of park managers, it is usually necessary to control or eliminate the spotted hyaena.

There is a collection of stories about battles between black rhinoceroses and other species of animal, especially elephants, which have been supposed since classical times to be their sworn enemies. Some of these stories should be taken with

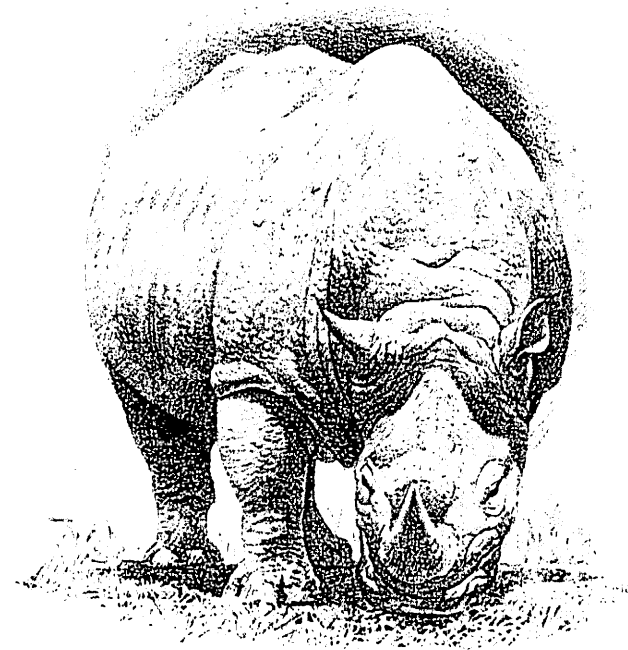
a pinch of salt, but other accounts come from reliable eye-witnesses. Guggisberg, for example, was shown a rhinoceros which had been drowned by a hippopotamus; the hippo had evidently dragged the rhinoceros into the water by one leg, and killed it with its tusks. Selous published a series of photographs showing a fully grown female rhinoceros being dragged into a pool by a crocodile. There are several reliable accounts of elephants killing rhinoceroses, and folk wisdom has it that, although bull elephants tolerate them, female elephants simply cannot stand their presence.

The supposed ferocity of the black rhinoceros is another fruitful source of travellers' tales. Alan Root has told me of several serious attacks recently in game parks in Kenya and Tanzania, and the literature is full of hunters' stories of fatal attacks and narrow escapes. On the other hand, there are stories which stress the clement of bluff in the charge of a rhinoceros. The chief factor which makes the black rhinoceros more dangerous than the white is its habitat: in thick bush it is more likely to be taken by surprise than the white rhinoceros in open grassland. It can charge very nimbly at up to 30 miles (50 km) per hour, and will attack with its horn any unidentified object. People on foot in the bush are extremely vulnerable, but cars have also been severely damaged by startled animals. Some of the earlier accounts mention that the attacking animal had been wounded by an inefficient hunter, but recent reports are from protected areas where there is no hunting, and poaching is rare. It is tempting to conclude that the apparent change in the reaction of the black rhinoceros to the scent of humans, from its timid curiosity in the reports by Selous to the ferocity which is so often reported nowadays, is the result of its maltreatment by our species. It may indeed be true that natural selection favours individuals which can keep humans at a distance. Whatever the truth, the conflicting evidence suggests that prudence is the most sensible course. Wandering about in trackless bush, or, worse, in bush with rhinoceros tracks, is to invite attack.

The greatest enemy of the black rhinoceros is mankind. Because its favoured habitat is fertile and well-watered, it has come into conflict with humans since long before the arrival of Europeans in Africa. Its uncertain behaviour must have made it an alarming neighbour to cattle-herders, and its feeding habits make it a threat to crops such as cotton. As the human population grows — and that of Kenya is growing fastest in all Africa — the demand for land for settlement is increasing, and with it the call for the control or elimination of rhinoceroses. However, the level of poaching is such that the problem is solving itself, from the point of view of those who would rather not share their land with rhinoceroses: there will soon be none left outside the parks and reserves, if indeed they can be protected there.

5

The White Rhinoceros



THE WHITE RHINOCEROS

Scientific name: *Ceratotherium simum*

Common names: White rhinoceros, Square-lipped rhinoceros,
Grass rhinoceros

Range and numbers

Southern race: 1984 figures

South Africa	3,330
Botswana	200
Zimbabwe	200
Namibia	70
Swaziland	60
Kenya	30
Mozambique	20
Zambia	10

Northern race: 1986 figures

Zaire	17
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Total in 9 countries	3,937
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Source: *Oryx* 19, 4; *WWF Yearbook* 1985/86

Length of head and body (males larger)	12-14 ft	(3.6-4.2 m)
Height at shoulder	5-6 ft	(1.5-1.85 m)
Weight	5,070-7,936 lb	(2,300-3,600 kg)
Length of front horn (northern race)	37-40 in	(95-101 cm)
(southern race)	37-79 in	(95-200 cm)

Distribution and Status

The common name of the white rhinoceros has nothing to do with its colour, but derives instead from the Afrikaans word describing its mouth: *weit*, meaning 'wide'. It is adapted to graze short grass, with a mouth like the business end of a lawnmower, and it would seem to be the ideal large herbivore for huge areas of African grasslands.

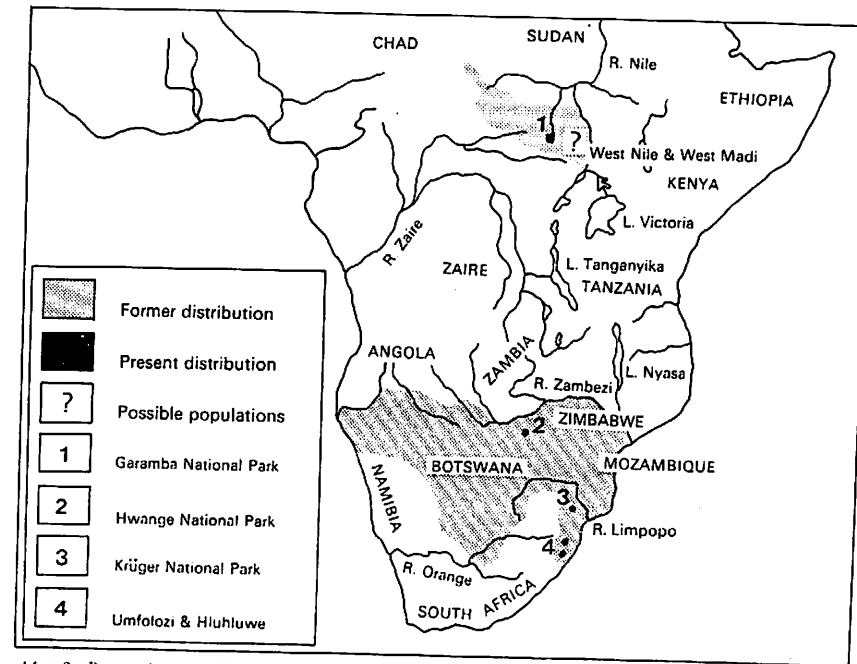
There is good evidence that the distribution of the white rhinoceros was once much wider than it is now. Cave paintings have been found in the northern and central Sahara, in Tanzania, and in the Kalahari which are clearly intended as portraits of this species. Even before Europeans began to explore southern and central Africa, it had disappeared from some of those areas, perhaps from over-hunting, or possibly from changes in the vegetation during droughts. It needs large quantities of food and it depends on permanent water: it is possible that having

died out in certain areas during particularly severe droughts it was unable to recolonise them in the face of competition from more efficient animals which could move more freely to exploit such food and water as was available. Its territorial behaviour and rather slow rate of breeding make it a poor colonist, very slow to expand its range at the best of times.

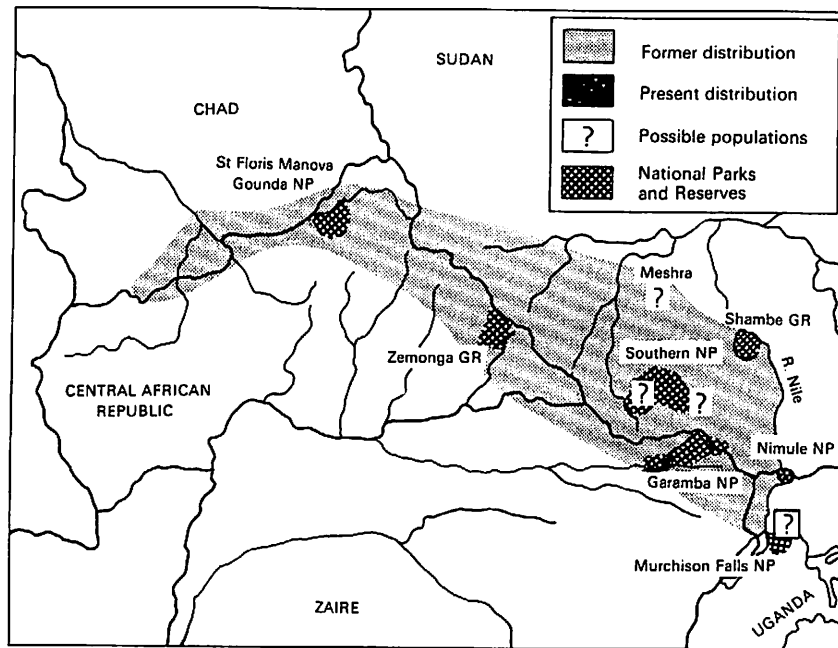
The species was described in South Africa in 1817, but it was not discovered in Uganda until 1907. It is generally considered as being one species with two races, geographically separated but not markedly different in appearance or way of life.

Selous noted the rapid decline in the numbers of the white rhinoceros between the years 1872 and 1877 in southern Africa. During his expedition in the region of the Upper Chobe River in 1879, where he found no trace of white rhinoceroses, all the Bushmen whom he met said that they were 'finished'. He found a few later between the Umniati and Hanyane Rivers, in what was then called North-eastern Mashuna Land, now western Zimbabwe. Although the names of many of the rivers have changed since the time of Selous, the Umniati is still as he knew it, and from the rest of his description the remnant animals were not far from what is now Hwange National Park.

The present distribution of the species is in two parts: the northern race, which is extinct except in Zaire, where 17 individuals survive in Garamba National Park, and the southern race south of the Zambesi. In 1984 the northern race survived in Sudan (10), Uganda and the Central African Republic (1 each). There was a



Map 2: Past and present distribution of the white rhinoceros



Map 3: Past and present distribution of the northern white rhinoceros

refuge at Waka Swamp, on the flood plain of the Nile, where the last survivors in the area were protected, but between 1984 and 1986 they were wiped out by poachers. Their decline in the north is relatively recent: the early white hunters avoided the area because it was so heavily infested with malarial mosquitoes, and the local people had no use for the animal until a demand grew for horns for medical and, much more recently, ornamental uses. The peak of rhinoceros poaching for this market came in the early 1950s, and by the early 1960s numbers had fallen so low that poaching had almost come to a stop for lack of animals to hunt. There was another burst of poaching during the 1980s in Sudan and Zaire, which left only the Garamba animals alive.

In 1980, the populations of the northern race were as follows: Central African Republic 20 (now 0); Sudan 400 (now 0); Uganda 1 (now 0); and Zaire 400. The world population of the northern race has fallen from 821 to 17 in just six years.

The story of the southern race is completely different. Selous was right in his gloomy prediction of its imminent disappearance, but the danger was spotted by other people as well, and the decline was halted in time. The remnant population which survived in Zululand was used as the nucleus from which a thriving new population has been built up in Natal. From a low point in the 1920s, the southern race of the white rhinoceros has grown to a stable and expanding population: in the same period, 1980 to 1984, during which the northern race almost disappeared, the southern race grew from 3,020 to 3,920, an increase of nearly 30 per cent: 830 of



Plate 4: Moving rhinoceroses requires detailed planning and care in the use of tranquillizing drugs. An animal left for too long on the ground may suffer irreparable damage to the nerves of its legs.

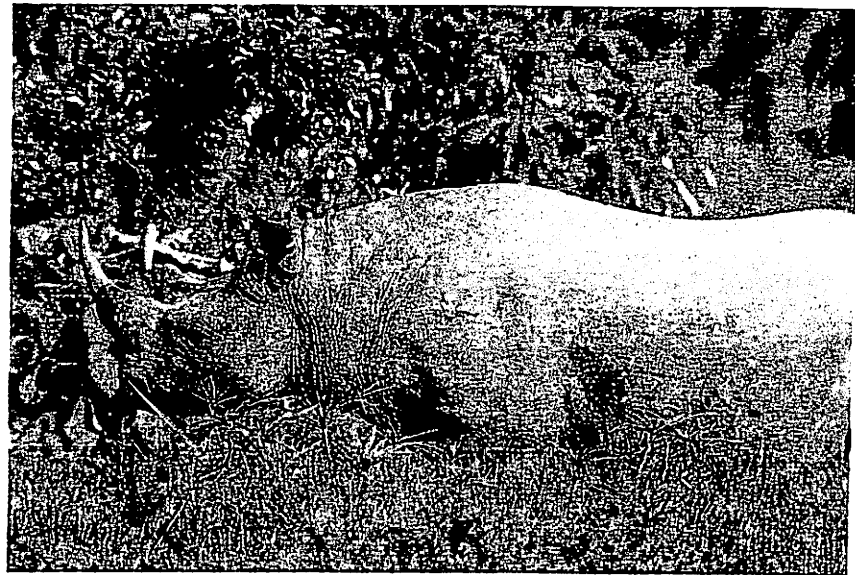


Plate 5: 'Rhino sores' are infected areas of skin, infested with a worm which is transmitted by biting flies which breed in the rhinoceroses' communal dung-heaps.

these animals were born in South Africa. The story of 'Operation Rhino' is given in full at the end of this chapter.

Daily Routine

In cool weather, white rhinoceroses feed and rest alternately, for a few hours at a time, day and night. With the approach of the hot dry weather, the rest period near the middle of the day becomes more of a fixed point, until at the height of the dry season the animals are feeding in the cool of morning and evening, and dozing through the rest of the day. They feed more during the night at this time of year, to make up for lost time during the heat of the day.

Much of their resting time is spent wallowing to keep cool. Rhinoceroses need water for drinking and wallowing at least every two to four days, and if their feeding areas are dry, they will walk as far as 6 miles (10 km) from their home range to find it, following regular paths through the bush. The hollows where water gathers on a hardpan surface are used by other wallowing species, such as buffalo and warthogs: between them, the animals maintain a short grass turf around waterholes which provides regular food for the grazing animals. It has the secondary advantage of reducing the cover which can be used by approaching predators.

At certain times of the year, when the flies are particularly troublesome, the rhinoceroses may cleft to keep away from the shady, damp places which would otherwise attract them, in favour of more exposed places where a breeze keeps the insects at bay. When there is no water for wallowing or grooming purposes, they will roll in dust, presumably to keep their skin clear of ticks and other parasites. All white rhinoceroses use rubbing posts regularly, partly to control skin parasites, but

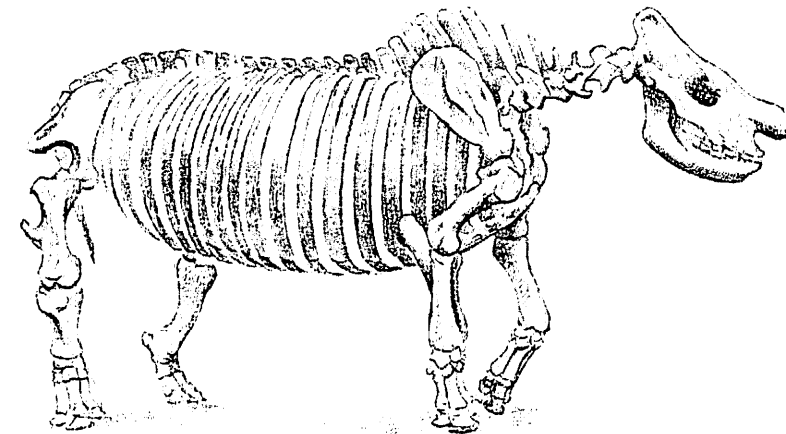


Figure 13: Pillar-like legs with massive muscle attachments give the white rhinoceros its strength and remarkable agility

Plate 6: Black rhino in the Amboseli National Park, Kenya. Both the size of the animal and the length of its horn are directly related to the aridity of its environment.

in the case of dominant males probably also as a means of marking territory by leaving flakes of skin bearing their individual odour.

While they are on the move, whether walking or trotting, white rhinoceroses keep their heads down in the same position as when they are grazing. They look up only when they are alarmed, producing the familiar hump-backed outline where the huge neck and back muscles contract to lift the heavy head. They can gallop at as much as 25 miles (40 km) per hour for short periods, and they are surprisingly agile: one repeatedly climbed a gate 6 ft (2 m) high to escape from temporary captivity.

Social Behaviour and Status

The daily life of a white rhinoceros is regulated by its sex and its position within the social structure of the area. Dominant or *alpha* males hold feeding territories from which they exclude all other adult males. Their concern is not purely to make sure that they have enough food for themselves: the feeding territories will later become their breeding territories, within which they will defend a mate. White rhinoceroses rarely fight, but they often indulge in trials of strength, wrestling with their horns, or charging each other with their shoulders, to settle disputes, and to confirm their social position.

The size of a feeding territory depends on the quality of the food which can be found in it, and on the density of the animals, especially if they are enclosed in a park or in some other restricted area. Typically, where the population of white rhinoceroses is at full density, a male's feeding territory is about $\frac{3}{4}$ sq mile (2 sq km). Subsidiary males may feed within these territories, provided that they respond to challenges from the resident males by making the correct submissive gestures and sounds. After a dispute, the defeated male stops spraying urine or scattering dung, and utters a series of small high-pitched growls. He may then stay in the defended area to feed, if he keeps out of the proprietor's way. Males remain subsidiary in society from the time when they mature sexually, at about seven years of age, until they can displace an existing bull, inheriting his territory and his females, about three years later.

Young rhinoceroses, referred to as subadults, have a privileged position in society, presumably because they are not seen as a direct threat to the resident male's security. They can often encroach on to an alpha male's territory without incurring a full challenge: and if they are challenged, they are able to run away, unlike adult subsidiaries, which are compelled by several factors to stand their ground. The subadult's greatest advantage is superior mobility: quite simply, he can run faster than an adult bull. He can thus turn tail and take off without risking an attack from behind.

The fully adult but socially inferior subsidiary is too slow on his feet to run: but he must stand his ground for another reason as well. In fully occupied terrain, there is nowhere for him to go. Next door there is another defended territory in which his plight will be exactly the same. He therefore has no option but to stay where he is, look and sound submissive, and wait for the dominant male to tire of staring him down. It was estimated that 30 per cent of adult males in a crowded park in Zululand lived in this way, as tolerated subsidiaries in other males' territories.

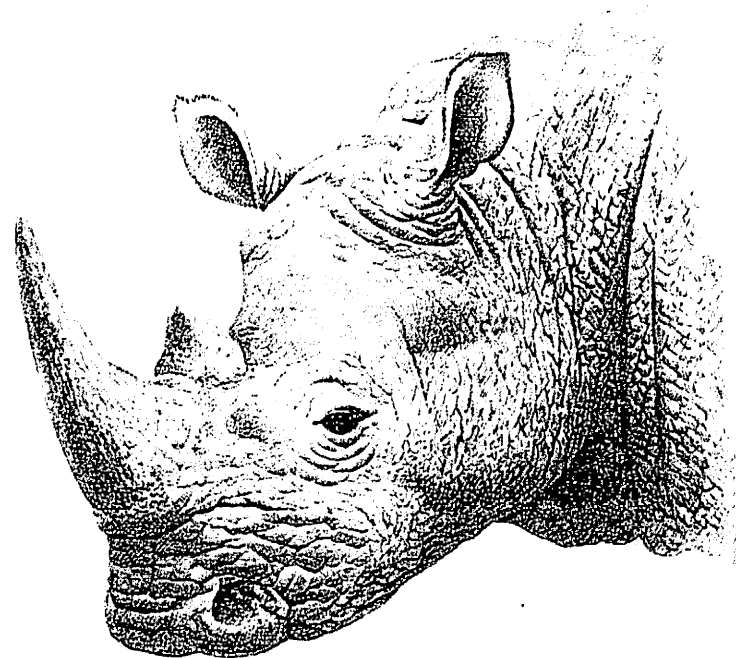


Figure 14: The broad lips of a white rhinoceros enable it to graze short turf. Its wide mouth gave the species its Afrikaans, and later its English, name

The position of the females is different. They too have feeding ranges which are quite clearly defined, but much larger than those of the males. They may move about within a range of about 4 sq miles (10 sq km), passing through male territories without being challenged. The boundaries of these female ranges overlap freely, and mothers with calves are tolerant of each other's presence.

When a female gives birth to a new calf, she chases the previous calf away. By this time, it is two years old, fully weaned, and able to join the subadult society which is typical of white rhinoceroses.

The young rhinoceros has a certain number of options open to it at this age. Some find a companion, usually of the same sex as well as age, but others attach themselves to a childless female, which seems to function as an 'aunt', or quasi-foster mother. Some such females acquire more than one young companion, sometimes as many as five. In good feeding areas, or often at wallows, these gatherings form a focus for all passing subadults, as if they were the equivalent of a youth club, where playful wrestling and greeting behaviour are the order of the day. Sights such as this have led some authors to conclude that white rhinoceroses are gregarious animals; for short periods they are, but more typically they move in small groups of females and young of various ages, wending their way between the solitary males.

Breeding

Females are sexually mature at about seven years of age. When they come into oestrus they begin to spray urine while passing through male-held territories, advertising their condition and inviting courtship from the dominant males. A female with a calf comes into oestrus about six or eight months after giving birth. Mating takes place all the year round, with peaks at times when there is a flush of good green grass. In South Africa, this is between October and December: further north, the peak occurs between February and June.

Courtship is a slow and cautious ritual, taking between five and twenty days to complete. The male behaves cautiously for two reasons: he is threatened not only by the female, but also by her calf, which at over six months old is distinctly possessive: it is still nursing from its mother, and will continue to do so for another six months or more. The male corrals the female by repeatedly chasing her back from his boundary with loud wailing calls.

Males have been reported to attack young calves, and the calf is in danger of being killed by the furious bull during courtship. The mother protects her calf from the time when it is first born, by standing over it, and as it grows bigger, from close beside it. When an oestrus cow is in a group in the territory of an alpha male, the action can become confused, as each cow seeks to protect the young rhinoceros beside her: the end result is often to leave the animals standing in a ring, horns outwards, a position often reported by early hunters as evidence of the loyalty of white rhinoceroses to one another.

Eventually the bull overcomes the aggression of the female sufficiently to complete his courtship, by laying his head across her back, and eventually mounting her. Copulation takes as long as half an hour, after which the female moves out of the bull's territory, taking her calf with her.

The gestation period of the white rhinoceros is 16 months. By the time the mother is ready to give birth to her new calf, her previous offspring is two years old, and ready to move into the next phase of its social life. Its mother chases it off just

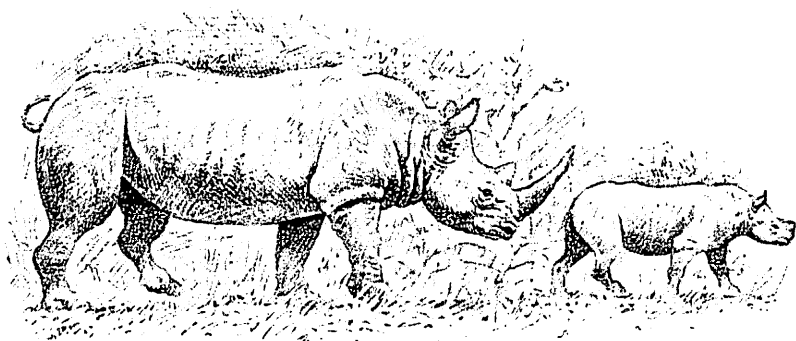


Figure 15. The white rhinoceros calf always walks ahead of its mother as they travel round their territory

before she moves away from the group to give birth in solitude. Twins have been seen, but a single calf is the rule. She stays alone with her new calf for a few days before she will tolerate the close presence of other rhinoceroses. In this respect, white and black rhinoceroses behave in a very similar way.

Female white rhinoceroses breed at two or three year intervals, and they can live for between 40 and 50 years: on average, a female which is allowed to live out its natural life span can produce ten or eleven calves. By comparison with other ungulates, this is a very slow rate of reproduction. However, in the natural state, the white rhinoceros is immune to predation: coupled with the highly ritualised combat which has reduced casualties by replacing open aggression, this immunity produces a very low natural mortality. This slow replacement rate was the main cause of the very rapid decline of white rhinoceros populations under pressure from European hunters.

Signs and Signals

The white rhinoceros makes a wide range of sounds, which have been given different meanings, depending on the social situations in which they are heard. The contact call between two animals meeting at a distance is a husky panting sound, rather like a cough. A juvenile whines after its mother, and squeals loudly when alarmed, perhaps by temporarily losing sight of her. The threat calls given by resident alpha males to intruders into their territories begin with a low growl, which is replaced by a fierce bellow as the threat becomes more intense. The submission sound which turns away the wrath of the alpha male has been called a chirping call; it sounds like a high-pitched growl. As the alpha becomes more energetic in his threat, the intensity of the submission call increases, until it might be described as a shriek. On the very rare occasions when fighting breaks out, it is a very noisy affair, as the threats and submissions rise through their various levels of intensity.

The wails of a courting male are often accompanied by a sound called 'hic-throbbing'; its significance is not clear, but it may have something in common with the very deep abdominal growls of elephants, which are now known to be transmitted for long distances through the ground, and detected by other elephants through their feet. A short burst of low-pitched, high intensity sound would be ideal for this purpose.

The most conspicuous signs made by rhinoceroses to each other are the scent-messages conveyed by dung-piles and urine-spraying. Their function is primarily territorial, though there is some other significance in the dung-piles which accumulate beside regularly used trails between feeding areas and watering places. It seems as if a passing animal is stimulated to defaecate by the sight or scent of such a mound, as if it were a social duty. These trailside mounds can become quite tall, because they are not kicked about by their contributors. Dung-kicking is a privilege reserved to the dominant male in a territory. The trailside mounds may serve as an indication of population density in an area, or as confirmatory signposts on a trail which may be used only every three or four days.

Territorial dung-piles, which are distributed all over the territory until there are about 15 per 0.4 sq miles (1 sq km), are recognisable because they have been

kicked by the resident male. Other passing rhinoceroses often add to them in the same way as to the trailside heaps, but they do not kick. There has been a good deal of discussion of this distinctive habit of alpha males, which leaves grooves in the ground after a long period of occupation. It may simply serve to indicate to an outsider that the area through which it is passing is occupied territory, as opposed to the no man's land crossed by the regular trails.

Urine-spraying is restricted to the boundaries of territories, and is the principal mark of ownership. The sprays are emitted in two or three short bursts: a male patrolling his borders produces such markers about every five or six minutes. They have an important effect on the outcome of conflicts between the alpha bull and intruders into his territory: the intruder must be aware as soon as he has crossed the boundary that he will be the loser in any confrontation with the proprietor of the territory.

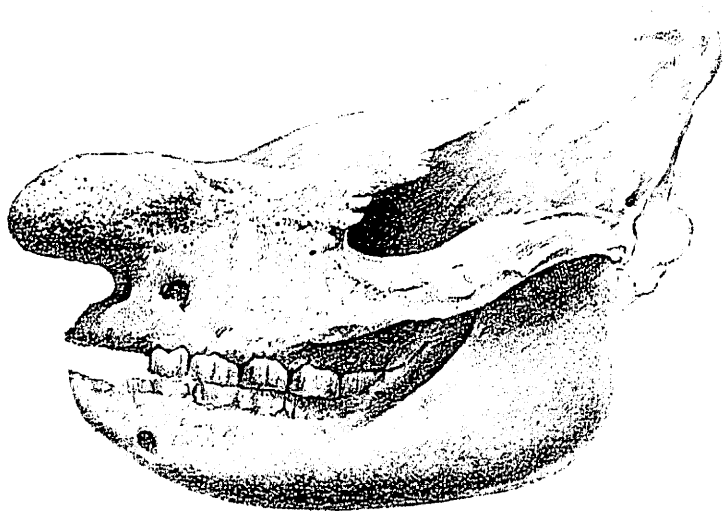


Figure 16: The skull of a white rhinoceros shows the bony boss which supports the horn

Horns

Selous shot a female white rhinoceros with a front horn measuring 108 cm (3 ft 7 in in his account), and found it worthy of comment: the record is in fact over 6 ft 6 in (2 m), but such huge horns are very rare nowadays. Probably few rhinoceroses reach a sufficient age to grow them. The females' horns are longer and thinner than those of the males.

The front horn usually has a smoothly polished and slightly flattened leading surface, from regular contact with the ground during grazing. It is sometimes used for digging, when the grass is too short to graze and the animals have to turn their attention to roots as their main source of food. It is not unknown for the horn to be

torn off during digging, especially the very long thin specimens grown by females. A female in Berlin Zoo whose front horn was torn off in an accident in May 1963, had a visible bump where the horn had been by July; by December, the horn was 5 in (13 cm) long, and by March 1967 it had reached a length of 13½ in (34.5 cm), growing at 0.2 in (0.5 cm) per month. Among the white rhinoceroses at Whipsnade Park in England there are two or three whose horns have been damaged but not removed: there is evidence of regeneration, but it is lumpy and irregular, producing some grotesquely deformed horns. For cosmetic reasons, it might have been as well if the horns had been removed when they were first damaged, so that they would have grown again in a more typical form. The thought of horn regeneration, if it always happens at the rate described for Berlin Zoo, raises the spectre of a regular source of income to zoos with tractable herds of white rhinoceroses, from selling horns which could be removed at regular intervals.

'Operation Rhino'

The white rhinoceros was considered to be extinct in 1892, only 75 years after the explorer Burchell had discovered it. However, a few individuals survived in the valley of the Umsolozzi River, in Natal: when they were found, in 1897, the government of South Africa declared the valley a preserve. From then on, the population increased steadily, until in 1930 there were thought to be about 30. By 1960, the population numbered 1,500, there and in the neighbouring Hluhluwe Reserve. The area was overstocked, and there was a risk that the rhinoceroses would damage their habitat by overgrazing it. Five hundred individuals had already been shipped out to other parks, and to zoos around the world. The decision was taken to move some of the rhinoceroses to England, to form a breeding herd in Whipsnade Park, under the aegis of the Zoological Society of London.

The Natal Parks Board carried out the operation. The original plan was to dart 40 rhinoceroses and transport them by truck and ship halfway across the world. In the event, only 20 animals were moved, eight males and twelve females: but the operation was a success, and the herd at Whipsnade has produced 34 calves since 1970, of which over 20 have been sent away to other captive breeding herds, in nine different countries.

Elsewhere in South Africa, the white rhinoceros population is now at full capacity. Indeed, at Pilanesberg National Park, up to ten white rhinoceroses per year are shot by trophy-hunters, at a price of \$10,000 each. Ron Thomson, the pioneering wildlife biologist, in his *On Wildlife 'Conservation'*, uses a scale of status when describing wildlife which ranges through ten grades of rarity, with endangered status at the top of the scale. (Animals going beyond 'Endangered' are extinct.)

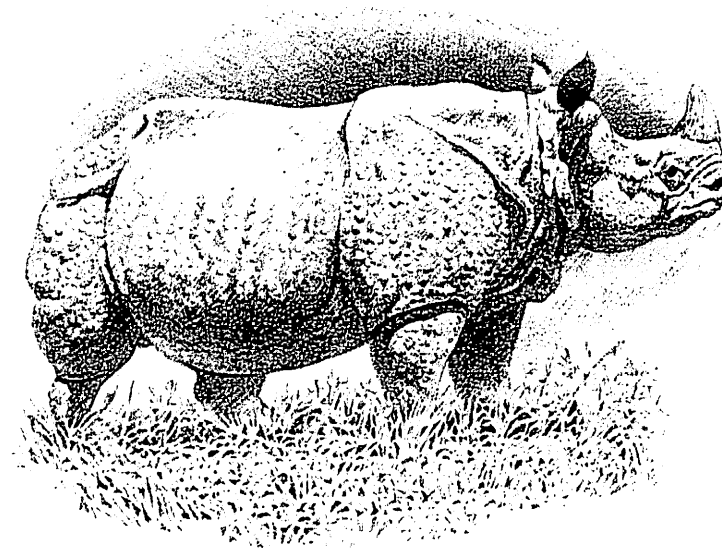
Thomson estimates that the white rhinoceros in southern Africa has moved from Endangered status to 8 on the scale in just 50 years, and is no longer in need of protective management.

The northern race of white rhinoceros has had almost an exactly opposite fate. Since its discovery in 1907, it has suffered at the hands of white sport hunters, and later commercial poachers, until it is virtually extinct throughout its range. The Congo civil war reduced that country's population of rhinoceroses from over 1,000

to less than 100. Between 1961 and 1964, white rhinoceroses from Kenya and Uganda were darted and collected together in Murchison Falls National Park: but the upheavals in Uganda during and after the reign of Idi Amin effectively wiped out the white rhinoceros in the country. In 1979 there were said to be as many as 25 white rhinoceroses in Kabaleze National Park, but by 1980 they were all gone, as were the 80 animals reported from Ajai's Reserve, which was designated especially for the white rhinoceros. By 1986, the only remaining animals from which a new population could have been built up were the 17 individuals in Zaire. Garamba National Park is the subject of a major rehabilitation programme under the guidance of the World Wildlife Fund, for the sake of its remarkable populations of buffalo, elephant, hippopotamus and giraffe. The remaining rhinoceroses will no doubt be encouraged to expand their numbers within the Park, but there seems very little hope that they will ever re-occupy their once extensive range elsewhere in northern Africa.

6

The Great Indian One-horned Rhinoceros



THE GREAT INDIAN ONE-HORNED RHINOCEROS

Scientific name: *Rhinoceros unicornis*Common names: Great Indian one-horned rhinoceros,
Indian rhinoceros

Range and numbers (1985 figures)

INDIA	
Kaziranga	1,195
Manas	75
Pabitora	67
Orang	60
Laokhowa	40
Jaldapara	20
Other locations	30
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Total in 10 locations	1,487

Note: small populations are reported from six other locations in India from which there is no current estimate.

NEPAL	
Chitwan	400
Bardia (1986)	4
PAKISTAN	
Lal Suhanra	2
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Total world population	1,893

Source: Species Conservation Monitoring Unit
1987: WWF Yearbook 1985/1986

Length of head and body	7-14 ft	(2.1-4.2 m)
Height at shoulder	3½-6½ ft	(1.1-2.0 m)
Weight	3,300-4,400 lb	(1,500-2,000 kg)
Length of horn	8-24 in	(20-61 cm)

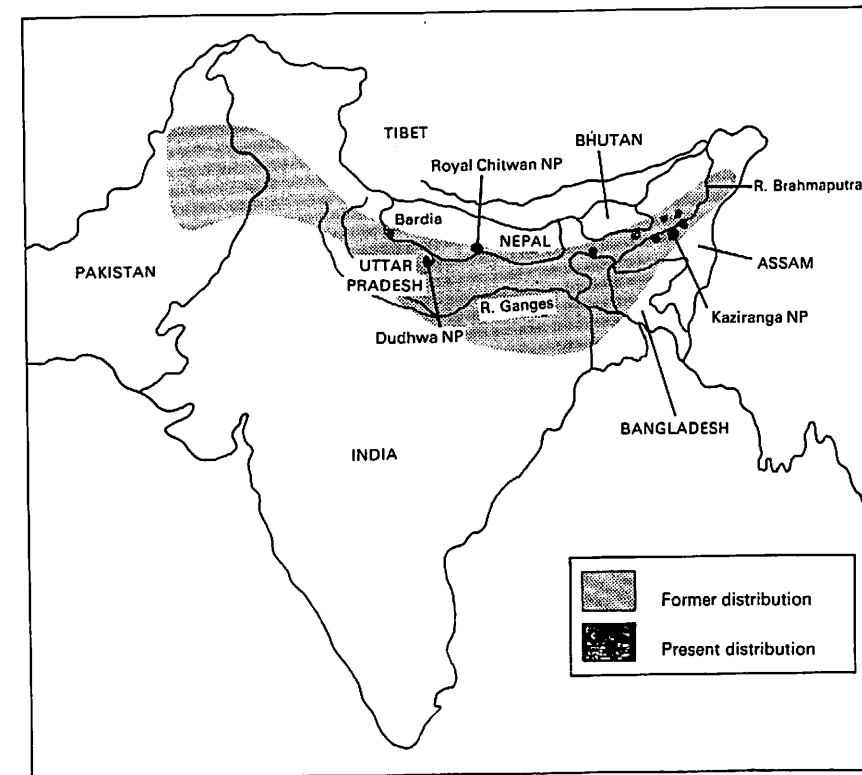
Distribution and Status

The great one-horned rhinoceros once ranged extensively across the plain of the Ganges, from the Indus Valley in the west all the way to Assam. There are accounts of rhinoceros hunts during the reign of the Moghul Emperor Zahiruddin Mohamed Babur (1505-30), when the species was to be found right across the north of India to Peshawar, near what is now the border between Pakistan and Afghanistan. However, its population dwindled sharply during the nineteenth century, under pressure from the expanding human population, for whose crops it

was a very efficient competitor. The second cause of its decline was the very heavy hunting which developed to satisfy the demand for its meat, blood and horn for medicinal and ritual uses. European hunters took a significant number during the heyday of the Raj, without ascribing any supernatural powers to the rhinoceros, but merely for the sport of killing a large, albeit inoffensive, animal.

The original wide range of the one-horned rhinoceros has contracted eastwards, until only a few reserves in northern India, and one in Nepal, continue to support it in any significant numbers.

It is fortunate that there are any left at all. It was only in 1910 that the hunting of rhinoceroses was banned in Assam and Bengal, by which time most of the survivors were to be found in Assam, apart from the separate population in the terai of southern Nepal, an area of swampy grasslands surrounded by tall forests. The first reserves to be declared, at Kaziranga and Manas, still hold the two largest populations of rhinoceroses in India. Kaziranga was promoted from a Forest Reserve to a Game Sanctuary in 1926. It was closed to all visitors, and immediately became the haunt of a large number of poachers. When Kaziranga was opened to the public in 1938, the activities of the poachers ceased; they were unable to



Map 4: Past and present distribution of the great one-horned Indian rhinoceros

continue their predation under the eye of a steady stream of observant, and very often official, visitors. The rhinoceros population at Kaziranga has risen nearly five-fold since a survey in 1959 by the great biologist of India, E. P. Gee: he estimated the number in the reserve at that time as 260.

The royal hunting grounds at Chitwan in Nepal became a reserve in 1973, after a survey by Gee in 1958 had shown that there were between 300 and 400 animals left. Although their numbers fell sharply thereafter — Gee's estimate in 1964 was below 185 — the success of the reserve is clear from the figures for the 1985 population, which is once more around the 400 mark.

The reasons for the success of rhinoceros conservation in Nepal were outlined in 1985 by Dr Esmond Bradley Martin, the American biologist, in *Oryx*. He pointed out that the Nepalese people who live within reach of the park are deterred from poaching not only by the presence of 500 armed men of the Royal Nepalese Army, but also by an enlightened attitude on the part of the Park authorities (which means the King of Nepal, who has absolute authority in his country). Rhinoceroses which die of natural causes within the Park are made available to the people, so that the parts of the animal which are important in religious observances may be removed and used.

The hide is used to make containers for the libations of milk and water which play a central part in the ceremony of *Shraddha*, by which both Hindus and Buddhists commemorate their parents and grandparents on the anniversary of their deaths. The meat, including the liver, is used for medicinal purposes, and the dried blood is used by women to ease menstrual pain, and by men occasionally as an aphrodisiac. Rhinoceros urine may be bought at the zoo in Kathmandu, but it is often collected in the field in the form of soaked sand. It is regarded as a powerful medicine for a wide range of complaints. The bones may be used to make oil lamps for religious purposes, or rings to ward off evil spirits. The horn and hooves, which are highly regarded, are not available, since they are the property of the King. They are removed and taken away to the Palace.

The effect of this policy has been to undermine the market for poached rhinoceros products, partly because of the near certainty of being arrested and severely punished (with up to five years in prison and a fine so steep as to be unpayable, which will put the family into debt for years), and partly because such products as are really important for their religious or medical value are relatively easily available. As a result, not one rhinoceros has been poached within the Park's boundaries since 1976. This represents an enormous achievement, considering that between 1950 and Gee's estimate in 1964 the population had been reduced from 800 to about 185 animals. In 1986, four one-horned rhinoceroses (three females and one male) were removed from Royal Chitwan National Park and placed in the Royal Bardia Wildlife Reserve, in western Nepal, to form the nucleus of a new breeding group.

All the signs are that despite its much reduced range, the one-horned rhinoceros population is increasing steadily in the areas where it is now so carefully protected.

Diet

A great deal has been learned about the diet of the one-horned rhinoceros in the

wild, since the first captive animal in England was fed on rice, sugar and hay, with liberal offerings of wine. Even then, in 1739, the animal's keepers noticed that it seemed fonder of fresh greens of various kinds; the diet offered to rhinoceroses in modern zoos reflects much more closely their natural food.

The one-horned rhinoceros is principally a grazing animal, moving about its feeding range to take advantage of fresh growth wherever it is to be found. Although it is usually described as a creature of swampy areas and grassy riverine plains, it will also move into drier grassland, and even into higher wooded country, especially where stream beds and ravines give it access from lower-lying land. When the newly-planted rice crop is growing, rhinoceroses from wildlife reserves often move into agricultural land to feed on the young shoots — coming into direct conflict with the neighbouring people. Other crops which are taken include corn, wheat, mustard, lentils and potatoes.

The one-horned rhinoceros is adaptable in its use of its feeding apparatus: the semi-prehensile upper lip which enables it to feed on tall grasses and slender twigs can be folded out of the way when it needs to graze on short, fresh grasses. Bamboo shoots and water hyacinth are also acceptable; in eating the latter, the rhinoceroses are doing themselves a favour, by keeping their wallows open.

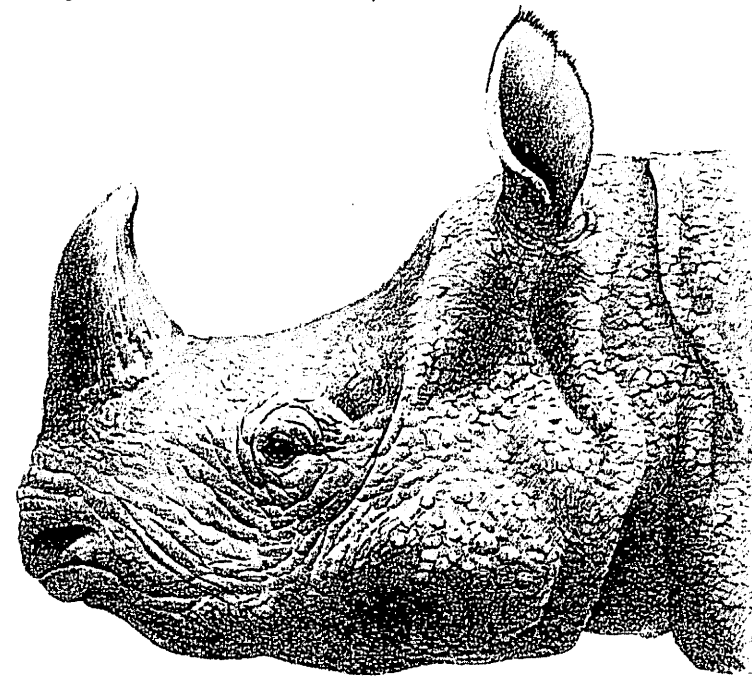


Figure 17: The upper lip of the Indian rhinoceros is adaptable: it can be used to grasp bunches of grass, or tucked out of the way for grazing shorter turf

Grass

In preparing areas of reserves to increase the number of one-horned rhinoceroses they can support, and more particularly to reduce the incentive for the animals to stray into neighbouring agricultural land, managers often cut the tall elephant grass beside rivers. This encourages the growth of new grass, and attracts rhinoceroses to feed on it.

However, the cutting must be done in a restrained way, since the tall grass is not only an important feature of the habitat of the rhinoceros, offering shelter as well as food, but also the home of a very large number of other animals, including tigers. A conflict of interest has arisen on the borders of Royal Chitwan National Park, between the Park authorities and the local people. It is based partly on the people's need for long grass with which to thatch their houses: they also need short grass on which to graze their cattle. There is a clear temptation for them to enter the park to kill two birds with one stone: in removing their thatching grass they are also preparing a fresh pasture for their domestic stock.

In 1986, a total of 80,500 tons (81,812 tonnes) of grass was removed from the Park by local people. They paid a fee for the privilege of cutting it, but reports suggest that roughly 100 times more grass was taken than was paid for. Furthermore, cattle are driven into the Park almost daily to feed, competing with the rhinoceroses for the precious grass.

One suggested solution to this problem has been to transport the cut grass out of the Park, and to supply it to the people who need it as roofing material or as fodder for their cattle. The problem of cattle invading a reserve is one which is common all over the world, though in Chitwan people might be less anxious to let their stock wander inside the Park boundaries, in view of the number of tigers which flourish there.

Daily Routine

The daily routine of the one-horned rhinoceros is even more leisurely and peaceful than that of the African species, since it spends little time or energy in conflict. It spends the latter part of the afternoon in the shade of the forest, leaving for more open feeding areas as evening approaches. During the early part of the night it feeds, usually choosing an area of short turf, either where the grass is recovering from being burned or where it has been heavily grazed some time previously. The edges of rivers or pools are favoured places, where new grass is always growing on the rim of the denser stands.

Towards midnight, the rhinoceroses rest, the adults lying down in the feeding area, ready to resume grazing in the early morning. Females with young calves may retire at this time to the tall elephant grass, where the youngsters are less vulnerable to the unannounced approach of a tiger; but a fully grown adult has no enemies, and can rest safely in relatively open terrain.

By morning, the adults begin to move into cover, grazing quietly as they go, only to emerge towards noon to go to their wallows. From midday until late afternoon, they remain almost completely submerged, in social groups of as many as nine together, adults and young in the same sleepy association.

Wallowing not only protects the rhinoceroses from the attacks of insects, and

keeps their skin supple; it also prevents sunburn, and the overheating which is inevitable in such a bulky animal. The placid movements of undisturbed rhinoceroses seem as if they are designed to reduce the generation of unwanted heat. However, their movements can be very nimble when the occasion demands.

Mobility

Most hunting authors of the nineteenth century drew attention to the surprising speed and agility of the one-horned rhinoceros. Following a wounded animal through the tall grass in order to finish it off was demanded of the true sportsman; it must have been a nerve-racking ordeal for anyone who had seen the awesome spectacle of a rhinoceros at full gallop. The fact that a charge is rarely carried through would have been small consolation to a hunter, no matter how heavily armed, shouldering his way through grass 10 ft (3 m) tall, where the visibility is little more than 3 ft (1 m) at best. The pursuit had fatal results on more than one occasion; but still the one-horned rhinoceros retained its reputation as a timid, inoffensive animal, always readier to run than to fight.

Many rhinoceros hunts were undertaken on elephant back, but the security of a perch high above the ground was illusory, since Indian elephants are terrified of rhinoceroses. Training them to stand their ground in the face of a charge was considered virtually impossible: it has been one of the triumphs of the Tiger Tops lodge in Royal Chitwan National Park to produce a team of elephants which will refrain from panicking when their mahouts gather them into a half-circle around a rhinoceros, for the visitors to admire and photograph. Probably, familiarity has reduced each species' unease in the presence of the other; encounters with tourist-laden elephants have become part of the rhinoceroses' daily routine in that splendid and spectacular Park. Nevertheless, the discipline of the elephants is very apparent, as one sits on the trembling back of an elephant with a rhinoceros in full view.

Social Behaviour

The one-horned rhinoceros is not territorial in the same way as the African species. Wolfgang Ullrich, former Director of the Dresden Zoo, described the division of the grass jungle into 'public' and 'private' areas, connected by paths which also have 'public' or 'private' status. The public areas include wallows and bathing places, which are open for the use of all rhinoceroses. Private paths lead to grazing areas, about 5,000 sq yd (4,000 sq m) in extent, which are defended by individual males, females, or females with calves. Each animal also defends its own sleeping place in the elephant grass, approached by another private path.

There is no urine-spraying or aggressive patrolling to defend these areas, however. Bulls occasionally fight with intruders into their feeding area, but more often a short grunting charge is enough to settle the conflict. The females, too, fight for territory, though they more often keep their distance within their own area, as if by common consent. It is not unusual to see rhinoceroses with apparently severe wounds and old scars, produced by their opponents' sharp lower incisors during these territorial skirmishes. However, since their feeding territories are large and

often out of sight of each other, confrontations are more often accidental than deliberate.

There is no evidence of the use of dung as a territorial marker, though the one-horned rhinoceros establishes and uses communal dung-heaps in the same way as its African relatives. This probably has a social function, as it were a continuously updated directory of animals present in the area. The heaps can become enormous, as much as 16 ft (5 m) across and over 3 ft (1 m) high; they are added to by every animal which passes them. There are reports of rhinoceroses pausing in full flight to defaecate on a dung-heap, which suggests that it is a social imperative of the highest order to update the directory, even more vital in times of stress than when the community is at peace. The dung-heaps are always in public, not in private places; beside wallows and bathing pools, and near the entrances to the tunnel-like public paths leading into the elephant grass. They might serve as signposts through the otherwise featureless grasslands.

Wallows are open to all comers. Seven individuals were seen leaving one pool, trotting off in different directions when they were disturbed. New arrivals at a pool are challenged by those already wallowing, answering their grunts and snorts with their own. When the wallowing animals snort back, the newcomers are able to join the party unopposed; it looks very much as if a password had been demanded, given, and accepted.

Apart from grunting and snorting in alarm or in social greeting, the one-horned rhinoceros has a limited vocabulary. Captured animals produce a bellow of panic (or rage?), and courting females, especially those observed at close quarters in zoos, make a whistling sound during the courtship chases.

Courtship and Breeding

The courtship of one-horned rhinoceroses has been observed only rarely in the wild, but frequently in zoos, especially the Basle Zoo, where one-horned rhinoceroses have been breeding successfully since 1956.

Females are sexually mature from about three years of age, and bulls from seven or nine years old. A female comes into season for 24 hours every five to eight weeks, advertising her condition by spraying urine, and uttering her strange whistling sound with every breath. The male reacts to her signals by spraying urine himself, and by chasing her; in the zoo the animals were seen to take turns in driving each other round and round their enclosure, following their exertions with long periods of rest. The female remains close to the weary bull while he is recovering his breath, until eventually he begins his attempts to mount her. The intimate signals between the partners are essentially the same as in the African black rhinoceros, with the difference that the partners bite each other gently with their incisors, instead of tussling with their horns. Mounting is preceded by the bull laying his head across the female's hindquarters, in just the same way as the black rhinoceros. Copulation lasts for an average of an hour; the longest recorded at Basle Zoo lasted for 83 minutes. When it was over, the animals paid no further attention to each other.

The gestation period is about 16 months: 12 pregnancies at Basle lasted for between 462 and 489 days. The Basle female showed signs of irritability just before the birth, becoming nervous, and making mock attacks on her keeper, whom she



Plate 7: Wallowing is an important activity for all rhinos. Mud acts as a cooling agent and it probably also protects against parasites, as well as keeping the skin supple.