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THE
MAMMALS
OF THE
SOUTHERN AFRICAN
SUBREGION

BY

REAY H.N. SMITHERS

D.Sc. M.I.Biol.

Senior Research Officer
Mammal Research Institute
University of Pretoria

WITH COLOUR PLATES BY

CLARE ABBOTT



University of Pretoria, Pretoria
Republic of South Africa

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Order PERISSODACTYLA

XL. Family RHINOCEROTIDAE

Rhinoceros

Four genera of fossil rhinoceros are known from the early Miocene Epoch of some 23 million to 19 million years ago, whose ancestors, at present unknown, must have lived during the Oligocene Epoch which preceded it. These four genera are *Brachyotherium*, *Aceratherium*, *Dicerorhinus* and *Chilotherium*.

The two rhinoceros, the square-lipped rhinoceros, *Ceratotherium simum*, and the hook-lipped rhinoceros, *Diceros bicornis*, arose from a common stock and fossil remains recorded from Plio-Pleistocene beds of some four million to three million years old show that they occurred throughout Africa from south to north during this period. A fossil species, *Ceratotherium praecox*, Hooijer & Patterson, 1972, whose remains have been recovered from fossil beds at Langebaanweg, was among the commoner of the large mammals in the assemblage, which dates back to the Miocene, some seven million years ago.

Both species of rhinoceros that occur in the Subregion, the square-lipped and the hook-lipped, formerly occurred widely in the southern parts of Africa. The square-lipped rhinoceros, however, never occurred very far south of the Orange River, extending only marginally into the northern parts of the Cape Province and was generally absent from the Orange Free State and parts of the southern Transvaal, although in the east it occurred throughout most of Natal, except in the extreme south. The hook-lipped rhinoceros on the other hand had a wider distribution and occurred from the Cape throughout most of southern Africa, except in parts of the Orange Free State and southern parts of the Transvaal (du Plessis, 1969).

With the increase in settlement of southern Africa from the seventeenth century, both species were gradually exterminated throughout the greater part of their former distributional range, the square-lipped rhinoceros eventually being found only in a limited area in Natal (see **Distribution**, *C. simum*), and the hook-lipped faring only slightly better (see **Distribution**, *D. bicornis*). Happily, more enlightened policies eventually saved both species in the Subregion from extinction and led to the square-lipped rhinoceros being made available by Natal Parks, Game and Fish Preservation Board for translocation to areas where they are looked after safely, as well as to Zoological Gardens both in South Africa, in surrounding countries and overseas. Attention is being given to similar action in respect of the hook-lipped rhinoceros. Other National Parks organisations in the Subregion have concerned themselves with the future of both species and have contributed, either by making areas available into which they have been reintroduced, or have themselves undertaken reintroductions. While there still remains a great deal to be done as far as the hook-lipped rhinoceros is concerned, the future of the square-lipped rhinoceros in the Subregion appears to be secured.

The situation regarding members of the Family in other parts of the world and the square-lipped and hook-lipped rhinoceros in eastern and central Africa has reached a critical stage. Extraliminally to Africa, Lovejoy (1979) reported that only 1 200 Indian rhinoceros, *Rhinoceros unicornis*, 300 Sumatran, *Didermoceros sumatrensis*, and 55 Javan, *Rhinoceros sondaicus*, still exist.

In reviewing the status of the hook-lipped rhinoceros *D. bicornis*, in the northern parts of its distributional range, Lovejoy (1979) revealed a depressing picture. In the last decade in Kenya the population has dropped from 15 000 to

1 500. In the Tsavo National Park 95% have been lost, in Amboseli 80% and in Ngorongoro 70%. In Tanzania 85% have been lost in the Manyara National Park, almost all of these losses being due to poaching.

The situation as far as the square-lipped rhinoceros is concerned is no better and efforts are presently being made to arrest the declining numbers of both species by the International Union for the Conservation of Nature, African Rhino Group.

Key to the genera after Ansell (1974a)

1. Upper lip square; pronounced nuchal hump visible when the head is raised; skull longer and narrower, with occipital part produced backwards beyond the condyles
... genus *Ceratotherium*

Upper lip pointed and prehensile; no such nuchal hump; skull shorter and broader, with occipital part not produced backwards beyond the condyles

... genus *Diceros*

Genus *Ceratotherium* Gray, 1868

No. 295

Ceratotherium simum (Burchell, 1817)

Square-lipped rhinoceros

Witrenoster

Plate 23 No. 1

Colloquial name

The colloquial name white rhinoceros so often used originates from the name given to them by the early Dutch hunters, *witte renoster*, or in Afrikaans *witrenoster*, which was used to distinguish them from the "black" rhinoceros, *Diceros bicornis*, Barrow (1801/4), Harris (1852) and Selous (1908) used the name *wit* or white, so it has been in use for nearly two hundred years. In spite of this, *C. simum* is not white, nor is *D. bicornis* black, and furthermore both species are inclined to assume the colour of the soil on which they live through mud wallowing and dusting. One of the most obvious characters that differentiate them is the square lips of *C. simum* (Fig. 295.1) and the hooked, prehensile upper lip of *D. bicornis* (Fig. 296.1), which are adaptations to their feeding habits. While it is preferable to distinguish them on the basis of these features, in Afrikaans the names *witrenoster* for *C. simum* and *swartrenoster* for *D. bicornis* are well entrenched and, therefore, are retained.

Taxonomic notes

Burchell (1817) originally described this species from a specimen from "the interior of South Africa", the type locality later being fixed by Shortridge (1934) as near Kuruman, Cape Province. Two subspecies are recognised, *C. s. simum* from the southern part of their distributional range and *C. s. cottoni* (Lydekker, 1908) from parts of Central and East Africa.



Fig. 295.1. Head: square-lipped rhinoceros, *C. simum*, to show the "square-lips" of the species and the hump on the neck which shows clearly when the head is raised.

Description

With a shoulder height of up to about 180 cm the males with a mass of some 2 000–2 300 kg and females 1 400–1 600 kg, the square-lipped rhinoceros ranks after the elephant and the hippopotamus in size, although not in mass (see No. 203 hippopotamus) as Africa's third largest land mammal. They have a barrel-shaped body and short, thick-set limbs. Characteristic features include the long head with long, continually growing horns, one in front and a shorter one behind; pointed ears fringed with hair; wide squared-off lips; a distinct hump on the neck and a hump on the back, just in front of the thighs. The thick skin is prominently folded on the front of the shoulders, on the upper part of the hind limbs and at the junction of the fore limbs and the body.

The colour of the skin is grey, but, like that of the elephant, is often obscured by a coating of soil or mud and so takes on the general colour of the soil on which the individual lives. The skin on the body appears naked, but is seen, at close quarters, to have a sparse coating of bristly hairs. The skin may reach a thickness of about 2 cm on the shoulders, the thick dermis covered with a thin layer of epidermis barely 1 mm thick. Scattered over the surface of the skin are sweat glands which, when the individual is under stress, exude droplets of sweat. Underlying the skin there is a thick layer of fat which, on the abdomen, may reach a thickness of 5 cm.

The horns, which are composed of a mass of tubular filaments similar in substance to hair, are outgrowths of the skin and are not attached to the bone of the skull. The horns vary greatly in proportion to one another and the front is almost invariably longer than the hind. The record length of a front horn from the Subregion is 158 cm (Best & Best, 1977), its accompanying rear horn 56.6 cm, a length which is often exceeded in individuals with even shorter front horns. This is 30 cm longer than the record front horn length of individuals from East Africa. In the hook-lipped rhinoceros, *Diceros bicornis*, both horns tend to be of more equal length and the base of the front horn is rounded. In the square-lipped rhinoceros, *C. s. simum*, the front horn has a straighter transverse edge in front. The tail is relatively short, in adults up to about 100 cm, and has a sparse fringe of bristly hair.

The limbs have three digits, each armed with broad, stout nails, which mark clearly in the spoor. The front feet are slightly larger than the hind, however, there is a less marked difference between them than in the hook-lipped rhinoceros. The cushioned pads on the soles of the feet have a hard surface with a mosaic of irregular cracks and, characteristically, have a distinct indentation on their rear edges, which marks in the spoor, and distinguishes it from the hook-lipped rhinoceros in which the indentation is absent. (Fig. 295.2). The lower lip has a hard surface; the upper is sensitive and soft which allows the individual to detect and then crop grass to within 1 cm of the ground.

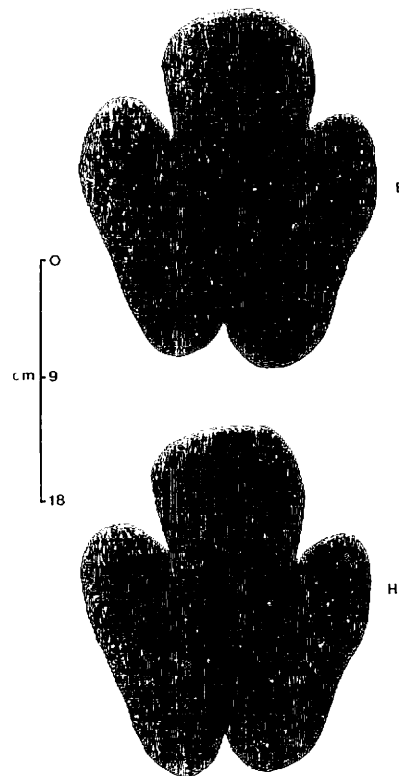


Fig. 295.2. Spoor: square-lipped rhinoceros, *C. simum*.

Distribution

The square-lipped rhinoceros, from the evidence of skeletal remains and their depiction in rock art, at one time occurred from the coastal areas of Morocco, Algeria and Tunisia, through the Sahara and East Africa to the Republic of South Africa.

Today naturally occurring populations are found in two widely separated and very restricted pockets, one in East Africa, the other in Natal. There is no doubt that at one time, during the Pleistocene Epoch, their distribution was continuous from Morocco through the Sahara to parts of the Cape Province, the break caused by climatic changes which rendered the intervening terrain unsuitable for them.

In the Subregion they came close to joining the quagga, *Equus quagga*, and the blue antelope, *Hippotragus leucophaeus*, as yet another species to disappear from the scene. Renshaw (1904), reporting on the situation at the turn of the century, stated that there were said to be only about 10 alive in Zululand. In 1922 it was estimated by Vaughan-Kirby, the first Game Conservator in Zululand, that only 20 individuals survived in the reserves. This may have been an under-estimate as the first official count made in 1929 revealed that there were 120 in the Umfolozi Reserve and 30 on adjacent ground and by 1960 an aerial count gave a total of just over 700.

Whatever the true figure may have been during the early part of this century, there is little doubt that numbers had reached a dangerously low level and it was only later through the dedicated efforts of Vaughan-Kirby, of the Natal Provincial Administration, and other dedicated conservationists, that action was taken to ensure their continued existence.

From this nucleus they have been widely translocated and there is hardly a country in southern Africa that has not reintroduced them and surplus numbers have been made available to zoos and wildlife parks throughout the world, assuring the survival of the southern square-lipped rhinoceros.

The situation of the northern square-lipped rhinoceros, *C. s. cottoni*, is less secure and there has been a drastic reduction in numbers and a shrinking in their distributional range since 1975 (Kingdon, 1979). In parts of the southeastern Sudan and southeastern Central African Republic their status requires confirmation. From both these areas there are only unconfirmed reports of their occurrence.

South of the Sahara, excluding the Southern African Subregion

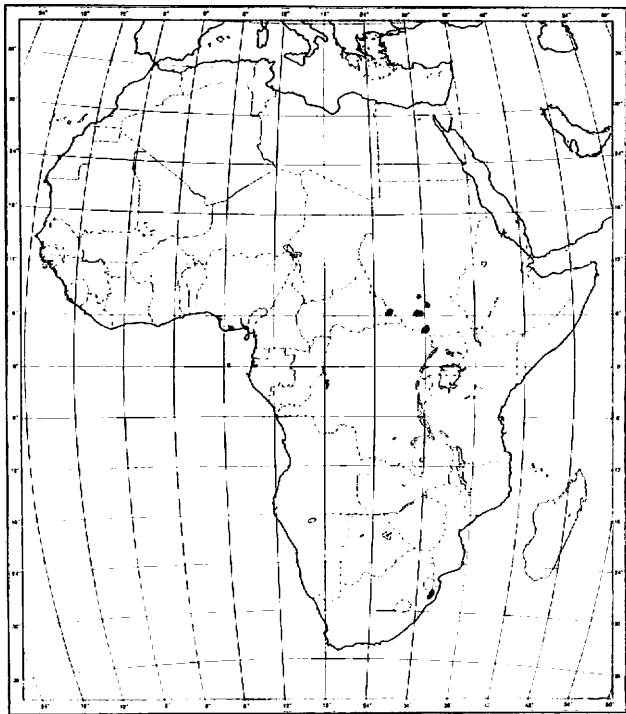
The northern square-lipped rhinoceros now only occurs in the southwestern Sudan, in scattered areas on the west bank of the White Nile (Bahr el Jebel), their distribution extending marginally into northeastern Zaïre. The present situation in Uganda is unknown.

Barber (1980) believed that they may be extinct in the Central African Republic, except possibly in the extreme southeast in the Zemorga Reserve, where a small number may still be present.

Southern African Subregion

Restricted, at the end of the nineteenth century, to the area now known as the Umfolozi Game Reserve, they spread naturally in the 1930s and 1940s to the Hluhluwe Game Reserve through the Corridor. At present they are confined to the Umfolozi-Corridor-Hluhluwe Game Reserve Complex in Natal. They have subsequently been reintroduced to the Mkuzi, Itala and Ndumu Game Reserves in that Province.

The last record of naturally occurring individuals in the three neighbouring countries was of one which was shot in Zimbabwe at Mpanda's Kraal in the northeast of the country in 1895. In Botswana, Selous (1908) stated that he shot one at Thamma Setsi (Tamuseche Pan) on the Zimbabwe border in 1874, but they persisted beyond this date in this area as he recorded their spoor in 1877. In Mozambique one was shot at Marcorsa (SE 1733 D4) by the late Sir Hugh Beadle in 1935.



Habitat

Player & Feely (1960) listed four basic habitat requirements: areas of short grass, for which they have a marked preference; the availability of water for drinking and in which to wallow; adequate thick bush cover; and relatively flat terrain.

These requirements are met in the wooded grasslands, common in many parts of the Subregion where they formerly occurred. This woodland is interspersed with wide open vleis carrying the palatable grasses which form their principal food. Reintroduced to areas where these conditions prevail and which provide a supply of sweet water, the species is flourishing. The type of woodland is a secondary consideration for its function is to provide shade from the sun during the hotter parts of the day. In parts of East Africa they occur in *Combretum* woodland, but are at home whether the woodland is mopane, *Acacia* or other types providing palatable grasses and water are available. Although there are steep slopes within the habitat they generally avoid these, although they will traverse them freely to feeding grounds or to water.

Habits

Square-lipped rhinoceros occur in small groups consisting of a single dominant or territorial bull, subordinate bulls, cows and their offspring.

The territorial bulls occupy clearly defined territories, which they defend against the trespass of other bulls from neighbouring territories. These territories, in the Umfolozi Game Reserve in Natal, vary in size from 0.75 km² to 2.60 km² (Owen-Smith, 1973) which is smaller than those of the hook-lipped rhinoceros, *D. bicornis*, which in Hluhluwe was found to vary from 3.90 km² to 4.70 km² (Hitchins, 1969). The boundaries of these territories often coincide with topographic features such as watercourses, the crests of watershed ridges, but never with roads. On the boundaries of these territories there are narrow, common zones 50–100 m wide, which may be visited by neighbouring territorial bulls. The territorial bulls mark their territories by spray urination along the boundaries or by defecating in established latrines in their vicinity. They remain very closely confined to their territories unless they are deposed by more dominant bulls or die. Owen-Smith (1973) recorded that, only on five occasions during his study in Umfolozi, did territorial bulls move more than 100 m beyond their own territory where this had an available water supply. Where water is not available seasonally within their territories, the territorial bull will leave it every three or four days to drink.

When a territorial bull trespasses into the territory of an adjacent territorial bull and is confronted, it normally takes avoidance action and serious fights are usually avoided by the trespasser returning to his own territory. Demonstrations in these encounters may take the form of short charges with much dust raising or, at closer quarters, horn clashing. Where a territorial bull is accompanied by a female in oestrus, however, serious fighting may ensue involving wounding of the contestants. This may be caused by the horn or by heavy shoulder battering and may lead to internal injury. Where a territorial bull is deposed the victor may allow him to remain in the territory providing he clearly demonstrates his submissiveness. Where encounters take place involving territorial and subordinate bulls, the latter usually respond with snorting, snarling or shrieking, but they seldom actually engage the territorial bull, although there have been instances when they have been killed in such encounters.

The territories include areas of short and tall grasses and woodland or bush cover, providing for the needs of the territorial bull and, in part, for the remainder of the group. Where this does not include a water supply, a narrow corridor is used leading to it. Within the territory the dominant bull usually has a number of favourite resting places in which he lies up in the shade during the heat of the day, either standing or reclining on his belly or side. The territorial bull alone sprays urine which is directed backwards between the hind legs. Having defecated, he scatters his dung by kicking with the back feet. Sometimes the urine emerges as a stream and the dung is deposited without scattering. While these actions are particularly common near territorial boundaries, they may take place anywhere within the territory itself. When the territorial bull has to leave his territory to drink, he urinates in a stream in the manner of subordinates (Owen-Smith, 1973).

Subordinate bulls are tolerated by the territorial bulls, providing they remain submissive, and they spend most of their lives within his territory, although they may make occasional explorations outside it. Several subordinate bulls may live in a territory of a single territorial bull. Subordinates do not spray urinate on patrol boundaries as do the territorial bulls.

Cows on the other hand have home ranges that overlap with those of other cows and may overlap the territories of as many as seven territorial bulls (Owen-Smith, 1973). In areas with good grazing and water the home range of individual cows may be as small as 6 to 8 km². With deteriorating food supplies this may increase to 10–15 km² and, if there is no water available, be increased to 20 km² to accommodate this need.

Communication is established by a series of vocalisations and subtle displays. Owen-Smith (1973) recognised 10 of the former and 15 of the latter. Territorial bulls are normally

silent, even in encounters, but may occasionally snort when another moves nearby. During courtship of a female, they may squeal when trying to block a female in oestrus from leaving their territory. Other members of the group may snort or snarl, which is a sign for others to keep their distance; they pant, when maintaining contact or as a sign to join up; shriek, as an attack inhibiting signal; squeal for protection eliciting or as a distress signal in calves; or puff when suddenly alarmed.

Subtle displays may involve pulling the ears back as a sign to the other to keep off; advancing steps often accompanied by a snarl are used as a threat; charges; prodding with the horn or staring at each other, horn against horn, as intimidatory gestures. Horn against horn clashing is a more intense ritual attack, which may develop into horn wrestling and finally jabbing with the horn. Side rubbing may be a means of more closely cementing the bonds within a group and head flinging in the young is an invitation to play. Although square-lipped rhinoceros have preputial glands, in the region of the penis or vulva, olfactory communication appears to be limited to the odours of the urine and dung.

Territorial males will frequently investigate the cows within their territories, presumably to ascertain if they are in oestrus, but the cows take little notice of each other. The young are inquisitive and will investigate other members of the group.

Square-lipped rhinoceros walk slowly, their heads held close to the ground, their nostrils in close contact with it to the extent that, in sandy soil, the broad mouth may clearly mark in the spoor. When in a hurry they move with a graceful trot, timed from a vehicle as up to 28 km/h, and under stress canter and gallop at up to 40 km/h. They tend to use established routes to water or to preferred grazing areas, these leading across high ridges and through dense woodland. In cool cloudy weather with high winds they tend to shelter in thickets but seem less affected by rainstorms. Cows and subadults do not seem so prone to use established sheltering places as do the territorial bulls.

Square-lipped rhinoceros pay little attention to other mammalian species, even at close range. Predation on them, except by man, is minimal, although rarely they may be killed by lions. Pienaar (1970a) recorded an unusual incident of an elephant killing one at a water hole.

They are often accompanied by red-billed oxpeckers, *Buphagus erythrorhynchus*, which remove ticks from their hides. These birds serve the useful purpose of warning them of approaching danger and they are alert to the alarm calls of these birds.

Square-lipped rhinoceros have poor sight but acute senses of smell and hearing. They respond more readily to moving objects, which are only discerned at ranges of 10-25 m, than to those at rest. Owen-Smith (1973) recorded that, when downwind, they respond with alertness to human scent at about 800 m, and are continually investigating odours when moving. The ears which can be rotated independently, orientate quickly to face any strange sound and are continually moving, even when the individual is apparently asleep. They are temperamentally quieter and less prone to be provoked than hook-lipped rhinoceros which, in comparison, are inclined to be irascible and bad-tempered.

During the summer months, square-lipped rhinoceros indulge in mud wallowing or lying in muddy pools as a means of thermoregulation, but more especially for the purpose of coating the body with a layer of mud as a means of ridding themselves of ecto-parasites. Following mud wallowing they will rub themselves on the trunks of trees or boulders which eventually, through continued use as rubbing posts, become debarked and polished. Mud wallowing is infrequent during the winter months (Owen-Smith, 1973).

Food

Square-lipped rhinoceros are grazers with a preference for feeding on short grass, which they are capable of cropping to within a centimetre of the ground. Lacking incisor teeth, the movable and extremely sensitive upper lip is extended over a grass clump, pressing the grass against the hard lower lip to be cropped with an upward movement of both lips. The process is sometimes assisted by a slight movement of the

head. As the individual feeds the head is held low, the wide nostrils maintaining contact with the grass. They are specific in their feeding and will carefully avoid eating unpalatable grasses or herbs. Owen-Smith (1973) gave the bite width of an adult female as about 20 cm and estimated that about 48% of daylight hours are taken up in feeding. In doing so they stand in one place, moving the head in an arc, then take a step forward to repeat the process. They may chew the food for a moment or two, but do not ruminate.

Owen-Smith (1973) showed that, in Natal, four species of grasses constituted 74% of the food intake, these being: *rooigras*, *Themeda triandra*; buffalo grass, *Panicum maximum*; small buffalo grass, *P. coloratum*, and Gonya grass, *Urochloa mosambicensis*, the first named being by far the most heavily utilised. Some 30 other species are eaten to a lesser extent. Other species such as the resinous turpentine grass, *Cymbopogon plurinodis*, are rigorously avoided. The highly palatable species, couch grass, *Cynodon dactylon*, was rare in this area, but where rhinoceros have been reintroduced, as for example in parts of Zimbabwe, this ranks high in their diet. The actual species of grasses eaten varies within limits, according to their availability. There is variability in the status of the grasses eaten according to the season of the year, sprouting green grass being preferred. Very infrequently they chew the bark off exposed roots of the tree fuchsia, *Schotia brachypetala* (Feely, pers. comm.).

Square-lipped rhinoceros drink water regularly and are dependent on its availability. Owen-Smith (1973) found that most drinking is done between 17h00 and 21h00 and continues after sundown, less drinking taking place during the day. During the dry season one to four days may elapse between drinking, two to three days, however, being the commoner interval. They are usually able to satisfy their mineral requirements from their food, but Owen-Smith (1973) recorded geophagia, the eating of soil, especially around termitaria.

Reproduction

Square-lipped rhinoceros may drop their calves at any time throughout the year. Owen-Smith (1973) detected peaks in calving in Natal, in March and July. One calf is born after a gestation period of about 16 months, compared with the hook-lipped rhinoceros, *D. bicornis*, where it is 15 months.

Territorial bulls can detect when cows are in pro-oestrus for they form a close attachment with a cow for a considerable time before mating. During this period he will take active steps to prevent her from leaving his territory, chasing her, squealing and sometimes horn clashing with her until she remains. Until she is in oestrus she will drive him off with snarling and snorting. Interested subordinate males are actively driven off by the territorial bull during this period (Owen-Smith, 1973).

The calf has a birth mass of about 40 kg. The female usually breaks away from the group to give birth. For the first three days following parturition the calf is unsteady on its feet, thereafter it keeps close to its mother who is strongly protective. At birth the wrinkled skin is pale grey with a pink tinge. Bigalke, Steyn, de Vos & de Waard (1950) recorded that the outer horny layer of skin is moulted at about one and a half to four months, revealing a new paler skin. A further moult takes place at about 10 months.

The calf weans at about a year old and separates from its mother at about two to three years of age. If the female loses her next calf, the bond between them may be re-established. The calf reaches puberty at an age of four or five years. During the association of the cow and her calf the calf usually precedes its mother when moving, being guided by gentle prods of her horn. This is in contrast to the hook-lipped rhinoceros, *D. bicornis*, where the calf usually runs by her side or behind her.

Females have a pair of inguinal mammae.

Skull (Fig. 295.3)

The skull is more elongated in this species than in the hook-lipped rhinoceros, the occipital crest rising high at the back of the skull. The crest has a broad rugose area on top to provide a firm attachment for the huge muscles that actuate the raising and lowering of the heavy head. The high crest

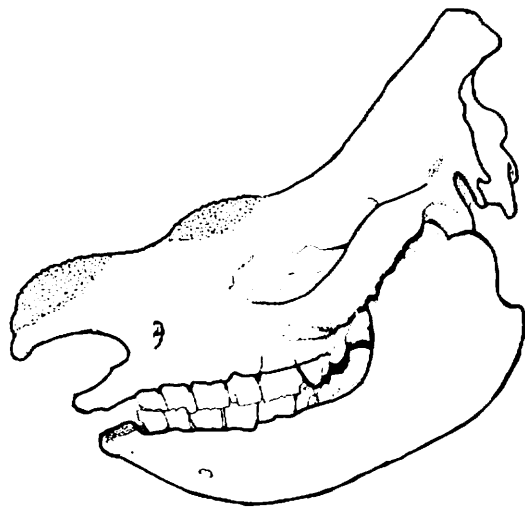


Fig. 295.3. Skull: square-lipped rhinoceros, *C. simum*.
TL Skull 76,0 cm.

also provides for a broad area at the back of the skull for the attachment of the other neck muscles. The zygomatic arches are heavily built to give a firm attachment for the masseter muscles that actuate the lower jaw, which, at their posterior edges, broaden out to give these an extra wide area of attachment for the lower end of these muscles. The lower jaw is massive, particularly so at the level of the posterior angle, the condyles very broad and fitting into deep sockets.

The earliest known fossil form of the species, *Ceratotherium praecox* Hooijer & Patterson, 1972, has been recorded from Langebaanweg, Cape Province. In other parts of Africa this species is known from fossil beds laid down some seven million years ago. It has four incisor teeth which are lacking in the extant square-lipped rhinoceros. The dental formula of the adult square-lipped rhinoceros, *C. simum*, is:

$$\frac{I_0^0}{0} \frac{C_0^0}{0} \frac{P_3^3}{3} \frac{M_3^3}{3} = 24.$$

The upper and lower second molars are the largest of the cheekteeth. All cheekteeth are broad faced and have convoluted enamel layers on their biting surfaces and are adapted to grinding up the food.

In the deciduous dentition they have four premolars on either side in the upper and lower jaws, the anterior premolar being the last to erupt and which, in adolescence, is lost and not replaced. Some, however, may persist into early adulthood. There is no sign of the incisors or canines in the deciduous dentition, which are sometimes present in the hook-lipped rhinoceros, *D. bicornis*.

Genus *Diceros* Gray, 1821

No. 296

Diceros bicornis (Linnaeus, 1758)

Hook-lipped rhinoceros

Swartrenoster

Plate 23 No. 3

Colloquial name

Alternative name: Black rhinoceros.

Taxonomic notes

Seven subspecies of this rhinoceros have been listed from the Continent by Ansell (1974a), of which only two are admitted as occurring in the Subregion: *D. b. bicornis* which formerly occurred widely in the Subregion and now has a restricted distribution, and *D. b. minor* (Drummond, 1876) from northern South West Africa/Namibia and Angola. The validity of the latter seems doubtful in the absence of adequate material.

Description

Adult hook-lipped rhinoceros stand about 160 cm at the shoulder and have a mass of up to about 1 000 kg. Hitchins (1968b) gave the mean mass of live individuals from the Hluhluwe Game Reserve, Natal as males 852 kg (n=8), females 884 kg (n=6).

Some characteristic features which serve to distinguish them from their near relative, the square-lipped rhinoceros, *Ceratotherium simum*, include their possession of a prehensile upper lip (Fig. 296.1), which is used in grasping

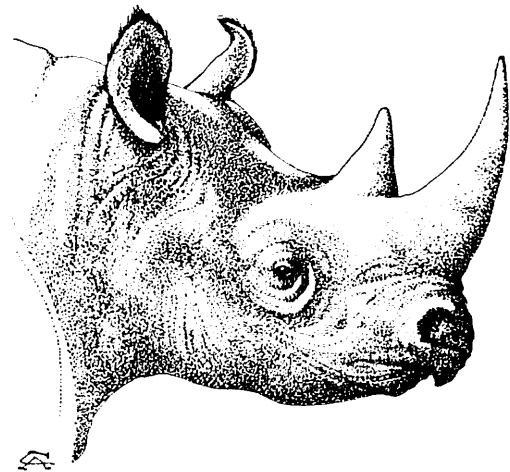


Fig. 296.1. Hook-lipped rhinoceros, *D. bicornis*, to show the hooked lip of the species.

the twigs of the woody plants on which they feed, the shorter head, longer neck and smaller, rounded ears. The outline of the back is also different in the two species, the hook-lipped rhinoceros lacking the hump on the shoulders, which is well developed and an obvious feature of the square-lipped rhinoceros (Fig. 296.2). The hook-lipped rhinoceros carries its

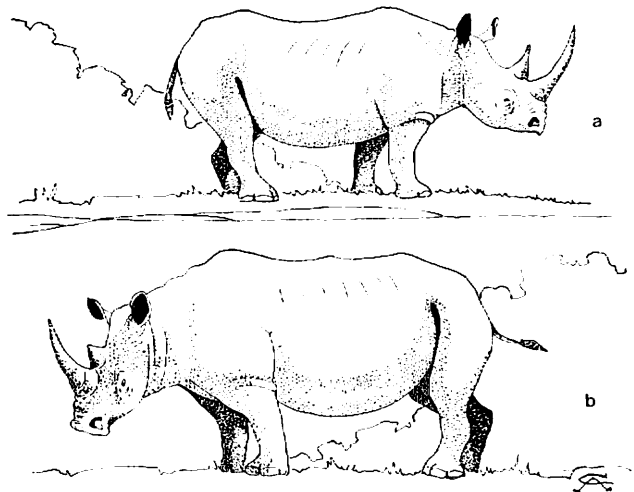


Fig. 296.2. Outline of the body:
(a) hook-lipped rhinoceros, *D. bicornis*.
(b) square-lipped rhinoceros, *C. simum*.

shorter head higher than the square-lipped rhinoceros.

In overall colour they are dark grey, the under parts lighter grey. Like the elephant and the square-lipped rhinoceros, they tend to take on the colour of the ground on which they live, through their habit of wallowing in mud and dusting themselves after bathing. The skin is thick with a sparse scattering of hairs. They have eyelashes and hairy fringes to the ears and the end of the tail. The folding of the skin is confined to an area above the knees, on the front limbs, across the nape behind the ears and on the flanks. Scattered throughout the skin are sweat glands which exude droplets of sweat when the individual is under stress.

The horns which are composed of a mass of tubular filaments, similar in substance to hair, grow from the skin and are not attached to the underlying bone. In spite of this the bony surface of the skull is rugose under the bases of the horns to allow a firm attachment of the skin to the skull in these areas. The front horn is normally the longer of the two, the maximum length recorded by Best & Best (1977) for a specimen from northern Natal being 105 cm, with a rear horn of 52 cm, which is surpassed by several from East Africa where the maximum is 120 cm and 44.5 cm respectively.

The limbs have three digits each armed with broad, stout nails which mark clearly in the spoor (Fig. 296.3). The front

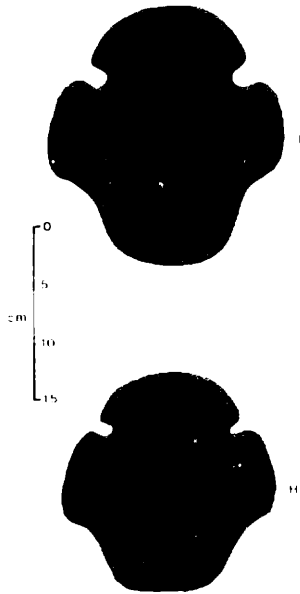


Fig. 296.3. Spoor: hook-lipped rhinoceros, *D. bicornis*.

feet are larger than the hind as they have to carry the great mass of the huge shoulders, neck and head. The cushioned pads on the soles of the feet have a hard surface with a mosaic of irregular cracks. The pads are rounded at the back and lack the indentation characteristic of the square-lipped rhinoceros. This aids in distinguishing the spoor of the two species as does the proportionate size of the nails which are larger in the square-lipped rhinoceros.

Hook-lipped rhinoceros suffer from skin lesions caused by a filaria parasite. At their fullest development these lesions take the form of black, blood-encrusted areas which ulcerate and haemorrhage. These are usually situated on the skin behind the shoulders, but also occur on the chest, neck and fore legs. All adult Natal hook-lipped rhinoceros have these lesions. The calves are free of these until they are about six months old, when the lesions begin to appear as bare pink patches on their chests. By the age of three years they are found on the chest and sides, but only appear behind the shoulders of the individual at the age of four and a half to five years. These lesions are not related to their state of health and appear on perfectly healthy individuals (Feely, *pers. comm.*). Oxpeckers, *Buphagus* spp. which frequent the backs of rhinoceros in search of ticks, flies and the blood issuing from these lesions, tend by their activities to keep the lesions open. The association of the rhinoceros with these birds has, however, mutual benefits, for, by their loud chattering and calling, they alert the rhinoceros to danger, even when the animal is resting or sleeping.

Distribution

It is a sad reflection that a species, which formerly had such a wide range in the Subregion, should have suffered such a drastic reduction in its distributional range within historical times. Van Riebeeck's Diary of 1652 recorded rhinoceros as occurring on the slopes of Table Mountain and as being common on the Cape Flats. At that time no European was aware that two species occurred in Africa and this species did not have a distinguishing name. Names differentiating the

two species must have come into use only towards the end of the eighteenth century, when the hunters and pioneers entered the area north of the Orange River and first saw the square-lipped rhinoceros. From this date onwards the distribution of both species of rhinoceros shrunk in the face of human pressures. The last hook-lipped rhinoceros was shot in the Cape Province about 1853 and in the Orange Free State in 1842. In the Transvaal, the last record of a naturally occurring hook-lipped rhinoceros was of a solitary female seen in the Kruger National Park in 1936 (Pentzhorn, 1971). In Natal, the proclamation of the Hluhluwe and Umfolozi Game Reserves in 1897 and the Mkuzi Game Reserve in 1912 came just in time to save them from extinction in this province.

Since these days, with a growing appreciation of wildlife as a natural resource with economic, recreational and aesthetic values, as a further measure to ensure the future of the species, surplus hook-lipped rhinoceros have been translocated to a number of areas in the Subregion where they formerly occurred. Their limits of distribution are still rapidly altering, for example, within recent years in Zimbabwe, the remnants of two isolated populations in the Chipinga and Mtoko Districts, threatened by land development, were translocated to the Gonarezhou National Park.

The distribution, as depicted, shows a scattered and discontinuous occurrence and, except where they are afforded protection in National Parks and reserves, the continued existence of some of the smaller island populations is doubtful. In Kaokoland and Damaraland in northern South West Africa/Namibia, Viljoen (1982) estimated the population as at January 1982 as about 30, a precarious situation.

The species is, in other parts of Africa, seriously endangered. The wholesale price of rhinoceros horn has risen twenty-fold in the last four years and remains in high demand in the Yemen Arab Republic as a raw material for making traditional Arab dagger handles. Believing that conservation measures in themselves are insufficient to ensure the future existence of the species, the International Union for the Conservation of Nature through its Rhino Group, is endeavouring to control and if possible stop the trade in rhinoceros horn (Newsletter No. 2, IUCN, Rhino Group, 1980).

In the Republic of South Africa, the hook-lipped rhinoceros was afforded protection just in time to save them from extinction and their reintroduction from this now healthy nucleus in Natal to other reserved areas in the country has done much to ensure the continued survival of the species in the Subregion. The situation in the Republic is indeed much healthier than in other parts of their distributional range.

South of the Sahara, excluding the Southern African Subregion

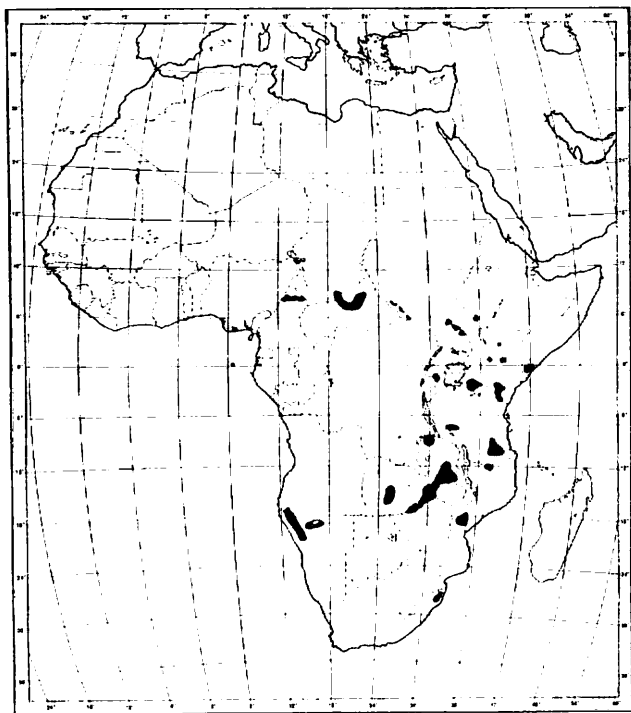
They are recorded from the northern Cameroun, in the Benoue and Boubandjidah National Parks and in the Rare Reserve and their vicinity. A few may still occur in the southern parts of St. Floris National Park in the northeastern parts of the Central African Republic; in restricted areas in the southwestern Sudan, with scattered reports from the southeast; and in Uganda. They have a discontinuous distribution in Kenya and may still occur in southern Somalia. They occur in parts of northern Tanzania and in two areas in the south; in Zambia in the Kafue National Park, the Luangwa Valley and near Lake Mweru in the north. They are afforded protection in reserves in eastern Malawi and there are scattered sightings from Mozambique, north of the Zambezi River, where they are still found in the Rovuma National Park in the north. A few may still remain in the extreme southwest of Angola where they were formerly present between the Cunene and the Kwito rivers, but no up to date information is available from these areas in which continuing warfare may well have resulted in still further reduction in their numbers, if not in extermination.

Southern African Subregion

A small number still exist in Kaokoland and Damaraland in northwestern South West Africa/Namibia, and in the eastern parts of the Etosha National Park, to which animals have

been translocated from farming areas to the south. The largest concentration is in the Oljovasandu area in the southwest of the Park. There are other widely scattered records south to 21°30'S and east to about 17°E.

Until about 1971 a few hook-lipped rhinoceros survived in the Kwando River area, in northern Botswana, wandering regularly between this area and the eastern Caprivi Strip. By 1974 it was thought that none remained. In Zimbabwe they are confined to the Zambezi Valley and adjacent parts of the escarpment from the western end of Lake Kariba to the Mozambique border. In Mozambique, south of the Zambezi River, they occur in the Gorongosa National Park. In Natal they occur in the Hluhluwe-Corridor-Umfolozi Game Reserve Complex with some spill over on to adjacent ground. A few survive in the area north of the Mkuzi Game Reserve and east of the Pongola River, and a small number have been reintroduced to Ndumu and Itala Game Reserves (Feely, *pers. comm.*).



Habitat

The hook-lipped rhinoceros, being a browser, requires that its habitat provide an adequate supply of this food in the form of shrubs and young trees up to about 4 m high. They will push over higher growth to obtain the edible parts which grow out of reach (Feely, *pers. comm.*). Well developed woodland or thickets in which to shelter during the heat of the day or in inclement weather and a water supply, not only for drinking but also in which to bathe and mud-wallow are also important.

While not usually associated with open plains country, the hook-lipped rhinoceros occurs in a wide range of habitats ranging from forest to savanna woodland and scrub, from sea level to at least 1 500 m in the Subregion and up to 2 700 m in East Africa (Kingdon, 1979).

They are dependent on water and, in the Subregion, are seldom found more than 10 or 15 km from it. Kingdon (1979) stated that in East Africa the maximum dry season distance from water was found to be about 25 km. Where it is not available, they will dig for it in the sand in river beds, excavating with their fore legs.

Bush encroachment improves the habitat for this species.

Habits

Hook-lipped rhinoceros tend to be solitary in habit, the only stable bond being between the female and her calf, but even this is only of a temporary nature, persisting into the female's next pregnancy and ceasing altogether with the birth of her next calf. Other associations, such as that of an adult male

with a female, or with a number of individuals of all age classes, are transitory.

It has been assumed that, because they have strategically placed dung heaps and spray their urine on bushes, they are territorial in the sense that adult males will defend a territory against trespassers. Guggisberg (1966), Goddard (1967) and Schenkel & Schenkel-Hullinger (1969) who studied the species in East Africa, all agree, however, that they are not territorial. Goddard (1967) found that their home ranges overlap and if individuals meet they tend to avoid each other. Guggisberg (1966) stated that when bulls fight they do so over a female and not over a piece of territory.

The size of their home ranges differs according to sex, age and the type of habitat, immature animals usually occupying larger areas than adults. In the Hluhluwe Game Reserve Hitchins (1969) found that the size of the home range varied according to the nature of the habitat. Where there is a high proportion of thicket and dense stands of woody plants, mature males as well as mature females with their calves have home ranges of some 200 ha to 220 ha. In more open country this increases to about double this area. Hitchins (1969) found that they do not occupy territories in the sense of areas exclusively held and defended against other hook-lipped rhinoceros. Joubert (1969) believed that in South West Africa/Namibia the size of the home range varies with the density of the population as well as the availability of food and cover. Where their feeding areas are far from water, they are nomadic in habit and will share tracks, feeding and resting sites and water supplies with others.

Although adult bulls are inclined to be aggressive towards other bulls, they tend deliberately to avoid contact. Serious fighting, however, does take place especially between bulls over a female in oestrus, between bulls and cows, but rarely between cows. There is a high mortality in males between eight and 10 years old as a result of fighting and serious fighting occasionally takes place between adult hook-lipped and square-lipped rhinoceros bulls (Feely, *pers. comm.*). In meetings between bulls there may be some testing behaviour, which takes the form of one rushing forward with lowered head and screaming, to simply lifting the head and staring. A bull will approach a cow with a stiff legged gait, head swinging from side to side, or may jerk the horn in the air. If the cow shows signs of aggression, the bull usually retires. In fighting, the front horn is used to buffet the other, the action taking place with tail raised, ears flattened and with much screaming and squealing.

During the heat of day they retire to the shade of thickets or woodland to sleep, either standing motionless or lying with their legs curled under them. They tend to rest on the tops of ridges but they will also lie in dusty hollows, sometimes in the full sun, or by water holes or mud wallows. Sometimes they sleep lying flat on their sides, a position never adopted by the square-lipped rhinoceros (Feely, *in litt.*). As they are unable to roll right over, they wallow in mud or dust on one side, then rise, and wallow on the other side. While asleep the ears move restlessly, rotating in all directions or flick quickly from back to front. They are active during the early morning or late afternoon. Where they are undisturbed they usually drink in the evening and, where they are harried, do so after dark. In dry country, where feeding grounds are far from water, they only drink every second or third evening.

Hook-lipped rhinoceros deposit their dung in latrines, but will also defecate on paths or fortuitously anywhere in their home range. The latrines may be used by a number of individuals. Usually a small bush marks the centre of the latrine. After deposition the dung is vigorously scraped by the bulls with alternate kicks of the hind feet which leave scrape marks on the ground which, in soft ground, may reach a depth of 0.3 m (Feely, *in litt.*). Possibly the adherence of portions of the dung to the hind feet may mark the presence of the individual on tracks. In northern Natal, many latrines are used by both species of rhinoceros (Feely, *in litt.*).

Urination may take place in a fine stream or the urine may be ejected by the bulls in a spray in short bursts, backwards on to a bush or other object. Cows likewise, when moving, may squirt small quantities of urine. Spraying of urine may have the effect of advertising the individual's presence in an area.

Lions and spotted hyaenas have both been reported as attacking adults, with the outcome usually in favour of the rhinoceros. They exhibit no fear of the larger predators and generally disregard even the near presence of other mammals. They normally give way to elephants, but aggressive encounters during drought conditions at waterholes with these and with buffaloes have been recorded. In parts of their distributional range predation on calves does not appear to be a major factor in mortality, although Hitchins (1969) believed the contrary to be the case in the Hluhluwe Game Reserve in Natal, where spotted hyaenas, *C. crocuta*, take a toll of the young. Goddard (in Moss, 1976) witnessed five incidents in which spotted hyaenas unsuccessfully tried to pull down calves. There are nevertheless records of calves being killed by lions and spotted hyaenas.

Hook-lipped rhinoceros vocalise in a number of ways, the most commonly heard being the repeated loud snort given when the individual gets a fright or is angry. They grunt and growl when fighting and may squeal or scream loudly.

They appear heavy-footed when walking, but are extraordinarily agile when provoked. At a gallop they can cover the ground at speed and can spin around within their own length. Their sight is poor, but their senses of hearing and smell are acute.

While they have a reputation for being irascible and bad tempered, this depends on circumstances. A charge may in fact be an investigation of a possible source of danger. Human scent will normally make them move off, but their reactions depend on whether they have been hunted or harried, or left in peace. A charging hook-lipped rhinoceros will swing away from a rifle shot or, at closer quarters, to a loud shout, and they seldom return to press home an attack. When seriously annoyed or when wounded they may work out their anger on inanimate objects such as bushes or termite mounds, attacking them with lowered horn and demolishing them.

In contrast to the square-lipped rhinoceros, the hook-lipped rhinoceros in northern Natal has a distinct dislike of horses, so that riders in rhinoceros country have to exercise caution (Feely, *in litt.*).

Food

They browse, manoeuvring the food into their mouths with the aid of the prehensile upper lip, biting shoots off with the premolar teeth and grinding the food in the massive molar teeth. Sticks and thorns are included in the diet, different parts of different plants being utilised. In some cases only the outer tips of the shoots are taken, in others the twigs as well. Small forbs which grow low on the ground are also eaten and small quantities of grass are taken at certain times of the year, usually during the wet season (Moss, 1976). They are selective feeders and reject dry plant material (Goddard, 1968).

Through browsing, rhinoceros prune the bushes on which they feed, so that they become rounded on the sides and top. The bushes show little sign of the breaking or tearing which characterises elephant feeding.

While a wide range of browse plants are utilised, Goddard (1970b) listing over 200 species in East Africa, in the southern populations the following rank high in their diet: *Acacia* spp; *Bauhinia* spp; *Diospyros* sp; *Commiphora* spp; *Croton* spp; *Diplorhynchus* spp; *Vitex* spp; *Disperma* spp; *Aloe* spp; *Euphorbia* spp; and the fruits of the sausage tree, *Kitelia pinnata*, as well as other wild fruits. Examination of the wide range of species eaten in such widely separated areas as South West Africa/Namibia (Joubert, 1969), East Africa (Schenkel & Schenkel-Hullinger, 1969) and Zimbabwe (Smithers & Wilson, 1979) shows that the following plants are eaten in all three areas: *Acacia* spp; *Grewia* spp; *Bauhinia* spp; *Combretum* spp; *Cordia* spp and *Euphorbia* spp.

Hitchins (1968a) listed a wide range of browse plants eaten in the Hluhluwe Game Reserve, in northern Natal. As a result of this woody plant diet, the dung of this species is much paler in colour and is coarser grained than that of the square-lipped rhinoceros. The woody parts pass through only partially digested, and their presence in the dung marks it as that of the hook-lipped rhinoceros, as compared with the dung of the square-lipped rhinoceros in which the dung is composed of partially digested grass stems.

Where water is freely available they drink daily, usually in the evening, but if it is situated at some distance from their feeding grounds they may only drink every second or third day. In East Africa, Goddard (1968) suspected that in arid regions they could survive without water for long periods, obtaining their moisture requirements from succulent plants such as the finger euphorbia, *Euphorbia tirucalli*, *Sansevieria* spp or *Cissus* spp. In parts of East Africa the finger euphorbia is found to constitute 70% of their diet during the dry season.

Goddard (1968) in his detailed study of the diet of the hook-lipped rhinoceros in East Africa found that during the dry season, when the grass had dried up and elephants turned to browse for their sustenance, they competed with rhinoceros for food. It was only during periods of prolonged drought or in severely overcrowded conditions, however, that the browsed vegetation suffered drastically. In the Tsavo National Park in Kenya during the 1960-1961 drought, through a combination of these factors, it was estimated that over 280 hook-lipped rhinoceros died from malnutrition, being particularly vulnerable because of their sedentary habits (Goddard in Moss, 1976).

Reproduction

Hook-lipped rhinoceros may drop their calves at any time throughout the year, no fixed breeding season having been detected in the Subregion.

Pre-copulatory behaviour involves complex encounters between a bull and a cow, the cow squirting small amounts of urine on to the ground, the bull then sniffing this and performing "flehmen" (Moss, 1976). In the initial stages of courtship events are largely governed by the cow. The bull approaches her circumspectly in a stiff-legged gait, his hind legs dragging on the ground, and, face to face, they spar with their front horns or nudge one another with the sides of their heads. The bull horns the cow between the hind legs and under the stomach. She may attack him from time to time, but during courtship no serious or vicious fighting takes place (Goddard, 1966; Schenkel & Schenkel-Hullinger, 1969). Courtship may last for several hours, during which the bull may mount the cow on frequent occasions, the pair walking and feeding between mountings. When successful copulation takes place it may last for thirty minutes or even longer during which the bull remains silent and the cow emits periodic low-pitched squeals (Goddard, 1966). During courtship the bulls are extremely intolerant of other bulls and vicious fighting may ensue.

The gestation period is about 15 months, a single calf being born. At birth calves have a mass of about 40 kg and can walk and suckle within three hours of birth. At this stage the females are extremely intolerant of disturbance.

During the early life of the calf the cow tends to keep to thick bush, the calf always in close proximity, walking at her side or behind her. At a few weeks of age the calf starts to browse, but continues to suckle for about a year. The cow calls the calf by emitting a high pitched mew, while the calf, if it has strayed, calls the cow with a bellowing squeal. The cow will vigorously defend her young. Goddard (1966) witnessed a cow killing a lion in these circumstances.

At birth the calves are lighter in colour than the adults and are sparsely haired. They are alert and playful and appear to have keener eyesight than their mothers. Suckling at first takes place standing up, but, as they grow older, the calves have to lie down on their bellies to reach the teats, a pair of which are situated in the cow's inguinal region.

The calf is rejected by the cow at two to four years of age, either during the cow's next pregnancy or at the birth of the new calf. If rejection of the calf takes place after the new calf is born, the rejection by the female may be active and vicious (Moss, 1976). The rejected calf is not fully grown and continues to grow until it is seven to eight years old. It may join another calf, a bull or another female, the females being usually the more tolerant of their presence. Sexual maturity is reached at about six years old, although Goddard (1966) found that some reach this stage at an earlier age and females have been known to conceive at four and a half years of age. Females have a calf about every three years.

In the first two years of their lives mortality is high.

Goddard (1966) estimated that there was about a 16% loss, caused by predation by lions and spotted hyaenas or lowered resistance to disease caused by lack of food or water.

Skull (Fig. 296.4)

The skull of this species is less elongated, the supraoccipital crest not extending upwards and backwards to the extent seen in the square-lipped rhinoceros. The occipital crest lacks the broad rugose area on top seen in the square-lipped rhinoceros and is narrower. The zygomatic arches are heavily built to give a firm attachment for the masseter muscles that activate the massive lower jaw. While ancestral forms of rhinoceros possessed cutting incisor teeth and, in some, canines, these are absent in the hook-lipped rhinoceros whose dental formula is:

$$\begin{matrix} 0 & 0 & 3 & 3 \\ 0 & 0 & 3 & 3 \end{matrix} M_3^3 = 24.$$

The premolar teeth are molariform, all the cheekteeth being broad-faced and adapted to grinding up the food.

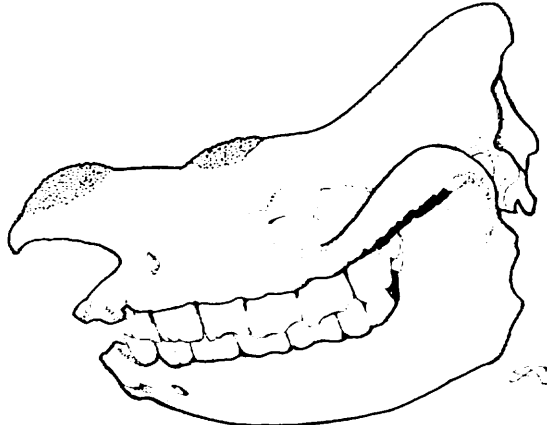


Fig. 296.4. Skull: hook-lipped rhinoceros, *D. bicornis*. TL Skull 55.0 cm.

Plate 23

1. Square-lipped rhinoceros, *Ceratotherium simum* Witrenoster (Species No. 295)
2. Warthog, *Phacochoerus aethiopicus* Vlakvark (Species No. 300)
3. Hook-lipped rhinoceros, *Diceros bicornis* Swartrenoster (Species No. 296)
4. Bushpig, *Potamochoerus porcus* Bosvark (Species No. 299) with two piglets

XLI. Family EQUIDAE

Zebra

Churcher & Richardson (1978) regarded the African fossil equids as being descendants of immigrants that crossed into northeastern Africa during the late to middle Miocene Epoch some 15 to five million years ago. The earliest known of these immigrants was a small equid, *Hipparion primigenium*, which is known from the late middle to early late Miocene beds of East Africa. It was a forest dwelling species that became extinct by the end of the Pleistocene Epoch, perhaps being unable to compete with the antelopes. A much larger species, *Equus burchelli mauritianus*, from North Africa was the ancestor of the later, modern *E. burchelli* subsp. The origins of the mountain zebra, *E. zebra*, and the extinct quagga, *E. quagga*, are obscure. The latter is poorly represented in the fossil record, some of the material being of doubtful validity. Churcher (1970) described a distorted palate with seven teeth from the early Pleistocene which he ascribed to *E. quagga*. Churcher & Richardson (1978) thought that *E. quagga* might well represent the ancestral condition seen in *E. b. mauritianus* as represented by fossil remains from the middle Pleistocene.

Today the Family is represented by three living species of zebras: *Equus grevyi* Oustalet, 1882 of East Africa; *E. zebra* Linnaeus, 1758 of the Subregion and southwest Angola, and *E. burchelli* which has a wide distribution from the northeastern parts of the Subregion west to Angola and north to East Africa. Ansell (1974a) gave the chromosome numbers of the three species: *E. grevyi* 2N=46; *E. zebra* 2N=32, and *E. burchelli* 2N=44. The quagga, *E. quagga*, which occurred in the southwestern parts of the Subregion, became extinct towards the end of the nineteenth century.

In the equids the mid-toe on the foot is fully developed and ends in a hoof, only the vestiges of digits two and four (the splint bones) being present.

The dental formula of the zebra is similar to all extant equids; the deciduous dentition is:

$$I D_3^3 C D_1^1 P D_4^4 = 32.$$

and the dental formula of the permanent dentition in adults is:

$$I_3^3 C_{0-1}^{0-1} P_3^3 M_3^3 = 36 \text{ or } 40.$$

In the females the canine teeth are rudimentary or absent, but they are present in the males. In the juveniles the deciduous canines are present but never pierce the gums.

The deciduous first premolars are rudimentary and are soon shed, not to be replaced. The deciduous incisors have narrow necks and the permanent incisors are columnar with broad cutting faces. The incisor teeth have an enamel-lined hollow (the infundibulum) running down the centre for a variable length. As the incisor teeth wear down to flat surfaces, the shape of this hollow can be used as a criterion for age class determination. This has been defined for Burchell's zebra, *E. burchelli* (Smuts, 1972) and Hartmann's zebra, *E. z. hartmannae* (Joubert, 1971b). The cheekteeth have high crowns with folds of enamel on their occlusal surfaces.

Key to the species after Meester, Davis & Coetzee (1964)

1. The dark stripe running down the middle of the upper parts of the body forming a distinct "gridiron" pattern on the croup; a dewlap present; ears large, their mean length over 200 mm
... *E. zebra*

The dark stripe not forming a "gridiron" pattern on the croup; no dewlap; ears smaller, their mean length under 200 mm
... *E. burchelli*