

Oryx

The International Journal of Conservation

The original paper was published in the *Journal of the Society for the Preservation of the Wild Fauna of the Empire* (1903-1925 and 1926-1950) or in *Oryx*, the journal of Fauna and Flora International (from 1951).

The website of the journal is (from 2008):

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The Black Rhinoceros in Zambia

W. F. H. Ansell

In Zambia's main wildlife areas, such as the Luangwa valley and the Kafue national park, the black rhinoceros populations are now stable and in some places even increasing—a striking reversal of the pre-war situation. Provided effective control can be maintained by the Department of Game and Fisheries, the author, who is a member of the department, suggests that there is no reason why they should not continue to thrive.

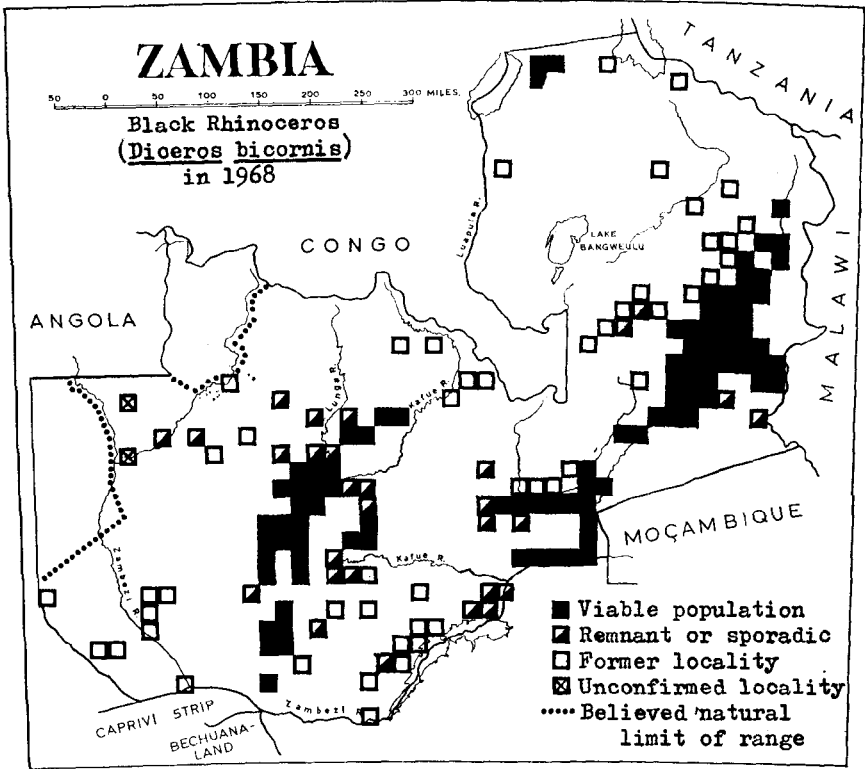
The black rhinoceros *Diceros bicornis* is the only rhinoceros species definitely recorded from Zambia, though the white rhinoceros *Ceratotherium simum* may once have occurred between the Zambezi and Mashi rivers.* Pitman 1934, Grimwood, Benson & Ansell 1958, Ansell 1959b, 1960, and Sidney 1965:69–72, dealt with the past and present status of the species in Zambia. This paper, written in response to an IUCN enquiry, amplifies and brings up to date the previous accounts, and in general follows the outline of the IUCN questionnaire. The recent situation has been assessed from data in the records of the Game and Fisheries Department and information from departmental colleagues; where no other authority is cited these are the sources. I have also had access to certain of the old District Note Books, now in the National Archives, Lusaka.

General Distribution

The map shows present and former distribution, plotted by the $\frac{1}{4}^{\circ} \times \frac{1}{4}^{\circ}$ square locus, corresponding to the 1:50,000 map sheet. It is clear that many gaps in both former and present occurrences are due to lack of records. The suggested natural limit of range, shown by dotted lines, is inferred both from lack of records in the areas concerned and from the limits in the adjacent countries of Angola and the Congo (Shortridge, 1934: 415; Schoutedden, 1945: 263–265; Hill & Carter, 1941: 148). East of these suggested limits, except in obviously unsuitable habitat, the species must once have occurred throughout Zambia, both on the plateaus and in the low-lying Luangwa, Luano and middle Zambezi valleys. It may always have been absent, however, from the limited montane areas of the extreme north-east. The boundaries of administrative provinces and districts, the Kafue national park and the game reserves, mentioned below, were shown on the end paper map in Ansell 1960, and have been little, if at all, altered since.† Goddard (1967b) has pointed out that the species is very sedentary, and that adults probably stay for life within a restricted home range. It seems likely, therefore, that the individuals recorded outside the regular range as known today may have been immature, though there is no definite

* The Zambian form was believed to be the nominate race, though Katanga specimens had been referred to *D.b.holmwoodi* Sclater (Ansell, 1960: 52), until a recent revision by Groves (1967) placed Zambian animals as *D.b.minor* Drummond, with *holmwoodi* a synonym.

† But the names of two provinces have been changed: Western Province to Copperbelt Province and Barotse Province to Western Province.



evidence. Alternatively, small resident populations may have survived unnoticed.

The following account considers first the areas with viable populations in 1968, then other areas, in each case in order from west to east.

Kafue National Park and adjacent areas

Rhinoceros may be only sporadic in the north-western corner of the park from the Lushimba stream northwards, along the northern boundary to the East Lunga river; and in the extreme south-east from the old cattle cordon road east to the Nanzhila Flats, where only odd individuals have been reported from time to time. East of the Kafue river, between the river and the Mumbwa/Mankoya road, the only report is of spoor on the Musingashi stream, seen by game guards in September 1965, 1426-D-1.* Elsewhere in the park, they are reasonably well distributed, though not in large numbers and seldom seen, the best areas being lower Lufupa river and its tributary streams from Ntemwa down; the upper Lubuji and its tributaries; the Musekwa and Mukombo streams; the Shishamba and Luansandza drainage; and the Musa river. Clearly the park was established in time to preserve a viable population; its

* $\frac{1}{4}^{\circ} \times \frac{1}{4}^{\circ}$ locus, corresponding to the 1:50,000 map sheet.

status is satisfactory, but there has been no striking increase. The game-carrying capacity of the Kafue is clearly much lower than that of the Luangwa valley. Protection of elephant and hippopotamus in both areas has not resulted in anything like the increase in the park that it has in the valley.

Rhinoceros still occur in areas adjacent to the park and they have been reported in western Mumbwa District and the Namwala District north of the Kafue river. In March 1949 fresh spoor was seen in the Big Concession, about 3 miles north of Chitamba (= Chikwamba) Hill, 1426-D-3, according to the then District Commissioner; P. Whitehead, then game officer at Mumbwa, reported one seen 10 miles from Nienaber's farm, 1426-D-4; in 1956 spoor of two was frequently seen in the south-west corner of the farm, and Whitehead reported that they were more plentiful in western Mumbwa District than had been supposed. Pitman (1934: 341-342) had reported "a thriving colony" in the area south of the Nambala Hills and east of the Mumbwa/Namwala road, and in 1949 W.R. Bullock and I confirmed that they still lived in thickets near the Chibila stream, about 15°08'S., 26°58'E., a few miles south-west of Nambala Mission. In 1961 L.A.C. Hewson thought that there were about 15 there. Since then considerable tsetse control activity has affected rhinoceros distribution, though none was shot. In particular, the erection of tsetse fencing and the institution in 1962 of fly round patrols resulted in rhinoceros leaving the thickets near the Chibila and moving west to the Lutale stream and south to the Chalobeti Hills, 1526-B-4. There have been several reports in recent years of rhinoceros in the area round Tepula game guard's post, on the Nansenga stream about 15°18'S., 26°41'E. In 1959 Hewson (pers. comm.) found spoor about two miles north of Tepula, and in 1961 saw two rhinoceros about 5 miles west of the camp. In 1963 E.B. Evans found spoor near Tepula, and Hewson also found two rhinoceros on the Lutale just south of the Mumbwa/Namwala road crossing, about 15°09'S., 26°52'E. During 1965 there were several game guard reports from the vicinity of Tepula, including the Mwako and Chalobeti Hills on the Mumbwa/Namwala District boundary, 1526-B-3 and B-4. The tsetse fence now runs between the Chibila and Lutale streams, crossing the Lutale south-east of the Chalobeti Hills, then westwards south of the Chalobeti and Mwako Hills to the Nansenga stream, continuing south to the Mumbwa/Namwala road and following it to the south-west. It is believed that no rhinoceros are now left east of the fence in the vicinity of the Chibila. West of the fence it seems clear that there is a fair population centred round the Mwako Hills and Tepula post. It seems certain that rhinoceros were there before the tsetse operations started farther east and were augmented by animals displaced by these operations. I am grateful to L.A.C. Hewson for details of the tsetse control in this area and its effect on rhinoceros.

In 1959, and again in 1963, Hewson found rhinoceros spoor near the lower Lukomeshi stream, Namwala District, south of Mpamba Hill, 1526-C-2. Though shown on the map only as a remnant, there may well be a small breeding population there. Because of the distance Hewson, I think rightly, discounts a suggestion that these were animals displaced

by the tsetse operations; he believes that they have always been resident there. It is not unlikely that some rhinoceros occur in the part of Namwala District west of the Lukomeshi drainage and east of the Kafue River, and between there and the Mumbwa/Mankoya road.

South of the Kafue park Vaughan (in Sidney, 1965: 71) reported only a single individual known from the Sichifula controlled hunting area in 1953, but several subsequent records indicate that there is a viable, if small, population in the western part. In January 1962 three animals, one a juvenile, were reported by the tsetse control staff near the Sichifula river and the sawmills railway, 1725-A-2, and in October R.A.R. Part reported a female with a calf of 3-3½ feet on the cordon road between Simamba and Muduli Pool, 1625-D-3. In February 1963 a rhinoceros was disturbed by the Forest Department staff in the Shamabombo Forest, 1625-C-4, west of the sawmills railway, just outside the Sichifula area. In May 1963 a game guard reported three, two adults and one smaller, at a pool four miles south of Kalundakatumba Hill in the west of the Sichifula area; it was thought rhino were resident in a nearby thicket. In October 1965 Part saw a female with a calf "the size of a large warthog" in the Bombwe Forest, 1725-A-4. In June 1966 spoor of a single animal was reported two miles south of Ndundumwense, 1626-C-1, by the head game guard then stationed there.

North of the Sichifula area and west of the Kafue boundary game guards reported a rhinoceros in November 1959 on a tributary of the Mulobezi River, probably locus 1625-B-3, and a few years ago J.M.C. Uys recorded spoor between the Mulobezi and Mwezi streams, 1625-C-2.

Eastern Kasempa and south-western Ndola districts

Rhinoceros occur in Kasempa District, east of the East Lunga River, where Uys has reported them in recent years on the Kaungashi stream, 1326-D-3 and D-4. They are also still present in the adjacent part of Ndola Rural District west of the Luswishi River, i.e. the Mininga, Mafunshi and Lwambowo drainage, 1327-C-1 and C-2, though the latest actual record is of spoor reported in 1959 by one of my staff near the Mininga/Mafunshi confluence. In the area between the East Lunga and the Luswishi rhinoceros may be more plentiful than previously supposed, as it is closed and uninhabited because of sleeping sickness; this must provide a reasonable degree of sanctuary, despite heavy poaching. They may also extend, although unrecorded, into the extreme north-western tip of the Kabwe (formerly Broken Hill) District, 1327-C-3.

Middle Zambezi Valley, from the Kafue confluence to Feira

Only a remnant population was thought to survive in this area until, in August 1960, a prospector, R.B. Gordon, reported one at his camp on the Chakwenga River in the escarpment, and another seen, plus spoor of several more, in the valley floor between the Chongwe and Chakwenga rivers. P. Morris, who in 1964 brought the area under game department control, tells me that fifty or more rhinoceros were shot by tsetse control hunters in the valley in 1946 and 1947; most of the re-

mainder, according to F.H.S. Drake, moved into the escarpment hills. Since 1952-1953, when the villages were moved out because of sleeping sickness, the area has remained unoccupied, though heavily poached. In 1964 a game department patrol reported spoor of several rhinoceros in the escarpment foothills, and since then more have been recorded in the valley floor. In 1967 a game guard saw groups of three, two and one in a single day. Presumably, with the control of poaching and entry since 1964, the rhinoceros have emerged from the foothills and re-established themselves in the valley proper where there are now a good number. Provided departmental control continues they should increase.

Luano and Lukusashi valleys

The Luano valley comprises the lower course of the Lunsemfwa river, and the valley of its tributary, the Lukusashi river, joins it 20 miles above its confluence with the Luangwa. Rhinoceros still occur there and occasionally wander to the adjacent plateau areas. In 1962-1963 spoor of three or four was seen in the lower Mulungushi drainage, tributary to the Lunsemfwa, 1428-D-4 (G. Lyon, pers.comm.). In November 1960 J.M.C. Uys noted signs that they were increasing between the Lunsemfwa river and the Great East Road from mile 100 to Luangwa Bridge.

In 1956, in the Lukusashi valley, L.B. Estcourt, then of the game department, reported "reasonable numbers" on the upper Chifukwe, 1430-B-1, and also some near the Lukusashi/Lunsemfwa confluence and on the Njongo stream, 1430-C-1. There have been no further reports, but, in view of the numbers in the adjacent lower Luangwa and Luano valleys, there seems no reason to doubt that numbers there are still reasonably satisfactory.

Mweru Marsh Game Reserve

It now seems clear that rhinoceros were not exterminated in the Mweru Marsh area many years ago, nor reduced to odd vagrants from the Congo, as was thought (Pitman, 1934: 15; Sidney, 1965: 71), but that a breeding population survived in the area of the present game reserve and continues today. In 1958 C.A.R. Savory reported at least two at Muzombwe Hill, S829-D-1. In a survey in March 1962 L.D.C. Allen, game officer in charge, and his game guards, recorded 12 animals seen, plus spoor of five others made within the previous 24 hours. In September 1962 J.A. Whellan saw three rhinoceros in the reserve, a cow with calf and one of undetermined sex nearby but not associated with them. On October 11, 1962, P.S.M. Berry saw a single animal near Muzombwe, and next day another at Chamani, S829-D-1. After questioning his game guards Berry concluded that there were then about 20 rhinoceros in the reserve, but that the thickets were so dense there might have been more. S.G. Sempelwe, the present game officer there, saw nine on different occasions in 1966 and 1967, but does not think there are more than 20. They are almost entirely resident in the reserve, though a few sometimes stray into the adjacent controlled hunting area. It seems likely that Sempelwe's view is conservative.

Luangwa Valley and part of the adjacent eastern plateau

The Luangwa valley has always been the main stronghold of rhinoceros in Zambia and remains so today. Records are so numerous it would be pointless to list them. They still occur at least as far north as the Kaunga stream, about 10°35'S., and southwards are seen regularly from about 11°30'S. (R.J.Dowsett, in MS.*). Naturally the greatest numbers are in the game reserves, but they are widespread in the valley floor, and at least some occur down the Petauke and Feira reaches of the Luangwa. On the Eastern Province plateau a breeding population still exists in north-eastern Chipata, formerly Fort Jameson, District (Wilson & Edwards, 1965), as well as the adjacent plateau portion of the Lukusuzi Game Reserve, in southern Lundazi District.

Table 1 lists recent estimates of the Luangwa populations by J.M.C.

Table 1

Game Reserve or Controlled Hunting Area	Approx. area in sq. miles	Uys	Allen and Berry	Patton	Dean
Senga CHA	6700	120	—	20 ¹	2 ¹
Luangwa Valley(N) GR	1790	150	—	55	41
Munyamadzi CHA	1390	50	—	45	43
Lundazi-Chewa CHA (less Luambe and Nsefu GR)	1530	50	80-90	} 45	} 23
Luambe GR	127	} 30	25-30		
Nsefu GR	83		25		
Lukusuzi GR	1050	50	80 at least		
Luangwa Valley(S) GR	3200	400	—	70 plus	170
Kunda CHA	1870	20	—	1 ²	16 ³
Sandwe CHA	590	15	—	—	—
Chisomo CHA (Luangwa part)	450	—	15 ⁴	—	—

¹ Southern part only, south of the Lunzi River

² Nominal—numbers considered too few to make an estimate

³ Part of area only

⁴ Estimate by Berry alone

Uys (*in litt.*), L.D.C. Allen and P.S.M. Berry (*in litt.*), P.B. Dean (*in MS.*), and D.R. Patton (*in MS.*). As Dean's and Patton's original figures were recorded by blocks suitable for air survey, I have adjusted them *pro rata* by areas to coincide with the reserves and controlled hunting areas by which the other estimates were made, which gives a reasonably approximate basis for comparison. Uys' estimate is based partly on flying over the valley and partly on ground observation, and that of Allen and Berry on ground observation. All three observers have considerable experience of the areas for which they give figures. Dean's and Patton's figures are based on air survey, but in view of the limitations of this as a census method for rhinoceros, as found by Goddard (1967 a),

* Now published *Puku* No. 5 1969, p. 221.

it seems certain that they must be well below the true population figures. In the Luangwa Valley (South) game reserve, for example, Patton estimated only 10 for his Block IV, roughly the area between the Luwi and Kapamba streams, and Dean's map shows no rhinoceros around Mfuwe. But in 1964 I knew of at least six in an area of about 15 square miles centred on Mfuwe, and there were certainly several more within a mile or so of the Luangwa River between the Luwi and the Kapamba. In March 1965 Berry counted eight in a short march south of Mfuwe, five of them in less than half a mile. Dean acknowledges the difficulty of estimating rhinoceros from air counts, and makes the reservation that his figures are probably conservative. He thought that there was a minimum of 200–265, probably more, in the Luangwa Valley (South) game reserve plus the Munyamadzi corridor. Goddard (1967 a) found that even under ideal conditions only 50 per cent of a known population was detected from the air. Assuming that this would hold good for the Luangwa valley, and that, for the purpose of the argument, Dean's figure surveys were made in ideal conditions, doubling his above figure gives 400–530, which agrees remarkably closely with Uys' estimate of 400 (southern game reserve) plus 50 (Munyamadzi). Similarly Dean's figure for the Lukusuzi game reserve, taken as about 2/3 of his Block V, works out at about 40—just half of Allen and Berry's figure for the reserve. The close agreement between Uys', Dean's and Patton's figures for the Munyamadzi corridor alone is puzzling as it does not agree with the much lower estimates of the latter two observers in comparison with Uys's figures for other areas.

In support of their Lukusuzi estimates Allen and Berry point out that the escarpment is a particularly favoured haunt, though rhinoceros occur throughout the reserve. (Presumably the escarpment would not easily be covered by air surveys, which might mean that even more were being overlooked than in other air surveys). In the Lundazi-Chewa controlled hunting area, despite a relatively heavy human population, there is a considerable rhinoceros population. The six that Berry found around the Chichele salt pan in November 1966 were certainly only a few of the Nsefu game reserve's total population. It is worth noting that Sidney (1965: 69) assessed the population in 1958 as probably 10–20, against the "official" estimate of about six, and she was certainly not given to false optimism.

Berry (*in litt.*) also states that rhinoceros occur in the Luangwa valley part of the Chisoma controlled hunting area and on the watershed between the two rivers in addition to the Lukusashi Valley; he puts them at about 15. He has several times seen spoor along the Luangwa, and once at a salt pan on the watershed, 1330-D-4. Slightly south-west of this Estcourt recorded the species in 1956 on Somboyo Ridge, 1330-D-3. On the other hand Berry considers that in Petauke District east of the Luangwa River (apart, presumably, from the Sandwe area, where Uys estimates about 15), there are virtually none, or at most only a few strays.

Goddard (1967b) gave average home ranges for adult and immature rhinoceros of both sexes in two study areas of Tanzania. Pooling these data gives an average of roughly 10 square miles. However, Goddard

also pointed out that home ranges of individuals may overlap considerably, even up to 40 per cent, and he found a ratio of one rhinoceros per 1.2 square miles in the Ngorongoro area, and one per 2.5 square miles in Olduvai. These areas are limited compared with the vastly greater tracts in the Luangwa valley, and clearly Goddard's data cannot be applied directly as a measure for assessing the Luangwa carrying capacity. Nevertheless, much of the valley is unquestionably excellent habitat for rhinoceros, which have been adequately protected there for many years, and Goddard's data at least indicate that there is nothing inherently improbable about the optimistic estimates by Uys, Allen and Berry.

The areas with remnant populations of sporadic occurrence are:

Barotse Province (now Western Province)

Pitman (1934: 52) noted that there were still a few rhinoceros in the Mankoya District, and so did Lancaster (1953: 46). Pace Sidney (1965: 69), who stated that the species was extinct in Barotse, a few remain along the border of Mankoya District with the Kafue national park, where spoor of two was reported in 1950 near the Lalafuta source, 1425-D-1 (Ansell, 1959: 336); and according to L.A.C. Hewson (pers.comm.) one was reported killed about 1964 in Mankoya District, probably locus 1525-A-3, some way west of the Kamano and Katobo game guard posts. Recent departmental records within the park, but close to the Mankoya border, are: Malakati stream, 1525-C-2, 1957; near Katobo, 1525-C-2, 1963; near Katoka post, 1525-C-4, 1964; and near Kamano post, 1525-A-2, 1965. However, numbers remaining in the eastern border areas of Mankoya District are doubtless small, and may be only odd wanderers from the park. Apart from the park border a very few may survive farther west in the border area between Mankoya and the Kasempa and Kabompo districts, crossing the border from time to time. An instance of this was recorded in 1934 (Ansell, 1959 b: 336), and in 1963, according to Uys, local hunters told game guards that rhinoceros sometimes came over from Mankoya District but only stayed a short time.

In the Senanga District on the east bank of the Zambezi River 7 or 8 miles above Sioma Falls, 1623-D-1, R.A. Japp (*in litt.*) reported some survivors up to about 1952 or 1953, based on spoor seen and reports from local villagers, but he was unable to say if they were still there in 1965. On the map this is shown as a former locality, but a remnant may survive.

Apart from these places, however, it seems clear that no rhinoceros are likely to survive in Barotse. Former localities are: above Munyekanga (= Manyekanga) Rapids, 1724-A-3 (Gibbons, 1898); the middle and upper Kakengi, 1623-B-2 and B-3, where they survived to about 1931 or so (Soane Campbell, in Pitman, 1934: 50, 52); the Wanyau Plain, 1623-B-1, where two were shot in 1935, and the Siloana Plains, 1622-D-4 and 1623-C-3, where they are believed to have survived to about 1945 (records in Senanga District Note Book, Zambia National Archives). No doubt at one time they were generally distributed through the Senanga, Sesheke, and Mankoya districts, and probably also, though

I have no records, in south-eastern and north-eastern Mongu District. Although I have noted that there seemed no reason to suppose that the species had ever occurred in Kalabo District (Ansell, 1959 b: 335) (and this still holds good for virtually the whole district), I have since found an undated though evidently very old record, in the District Note Book of spoor seen near Beacon 37, on the Angola border, 1622-A-1, at the extreme south-western corner of Kalabo District.* It seems possible that rhinoceros may have occurred, at least sporadically, in the extreme southern tip of the district, which has faunal affinity with the adjacent part of Senanga District (Ansell, 1959 b: 347).

North-western Province

Recent reports from the North-western Province (outside the Kafue national park and the area east of the East Lunga river already dealt with) are: in 1962 a rhinoceros was hit by a slow-moving vehicle about 23 miles from Kasempa on the Mumbwa road, 1326-C-1, but apparently not hurt; and two reported some 22 miles northwest of Kasempa (Ansell, 1965: 7); in 1963 spoor found near the Katondombela/Chifuwe confluence, 1324-C-4, and a second-hand report of a rhinoceros in the vicinity of the Kabompo/Dongwe fork, 1323-D-4, in southern Kabompo District (Ansell, *loc.cit.*), may have been of animals from across the Mankoya border (see above under Barotse Province). If the Kabompo/Dongwe record were correct it is certainly the most westerly report in the province in recent years, though old reports suggest that rhinoceros once occurred north of Balovale, and also near the Kabompo/Zambezi confluence (Ansell, 1959 b: 335). Mr. G.G. Suckling, who hunted for years in the province, informs me (*in litt.*) that he also used to hear rumours of former occurrence in the vicinity of the Lunkunyi and Makondu streams, 1323-A-4, and that old hunters insisted that rhinoceros once occurred along the left bank of the Kabompo River between the present-day Chizera and the Lunga game reserve, 1324-B-2. There is, however, no acceptable evidence that they ever occurred across the Kabompo River in the area north of 13° South and west of 25° East, and a second-hand report of two seen a few years ago on the Kabompo-Mwinilunga road is unconvincing; without corroboration it must be discounted.

Southern Province plateau

The only recent records from the Southern Province plateau, apart from the Kafue, the Sichifula area, and that part of Namwala District north of the Kafue River already dealt with, are: in 1966 C.T. Duval (pers. comm.) found fresh spoor on the forest edge just south of the Mulele Plain, 1526-C-4; and in October 1967 a rhinoceros was found dead in Chief Mukobela's area, 1526-D-3, about 13 miles east of Namwala (S.M. Yamba, pers.comm.). As rhinoceros no longer occur normally in the Chief's area it is believed that the animal had been wounded somewhere else. In February 1969, a German volunteer stationed at Choma,

* I have taken this record as referring to *Diceros bicornis*, which seems most likely, but it is not impossible that it could have been *Ceratotherium simum* (see Ansell, 1959 a).

Erwin Koch, had a close-up view of a rhinoceros about 14 miles north-west of Masuku mission, just above the Zambezi escarpment, 1727-A-1.

Former localities in the plateau are: near Choma, where it is believed to have survived no later than about 1900 (W.F. Bruce-Miller, *in litt.*); Magoye, 1909; along the old Kalomo/Namwala road (Knowles-Jordan, 1959: 140); around Kabulamwanda, 1526-D-4, where T. Jones told Uys they survived to about 1934; and the Nyawa area of central Kalomo District, 1725-B-2 (Pitman, 1934: 9).

Middle Zambezi, above the Kafue confluence

Because of the Kariba dam and consequent resettlement of villages inundated by the lake, the Zambezi Valley upstream of the Kafue confluence, though sparsely inhabited, has been better known in recent years than the area between the Kafue and Feira, and it seems unlikely that any considerable population of rhinoceros would have been overlooked. They were common near Kariba gorge in the 1930's (Pitman, 1934: 9), and still surviving in the 1950's (Ansell, 1959 b: 336), though only in low numbers compared with the south bank of Lake Kariba (Roth, 1967: 223). No doubt some still remain on the north bank around Kariba gorge, but with little prospect of increasing. Upstream to the Batoka gorge, 1726-C-4, it seems doubtful if more than a remnant can possibly survive, although as late as 1951 one of my guards reported seeing two pairs and a single animal on the upper Nakasanga stream, 1627-C-4 or 1727-A-2 (mentioned by Sidney, 1965: 69, without details, and wrongly calling it the Nalusanga).

Western Province (now Copperbelt Province), east of the Luswishi River, and eastern part of the Central Province plateau Pitman (1934: 86) cited a record of former occurrence of rhinoceros in the headwaters of the Luswishi River, presumably 1227-C-2; east of this there are records of past occurrence near Chingola, 1227-D-2 (A.E. Beech, *in litt.*), northwest of Mpongwe, 1328-A-3 (A.O. Johansen, pers.comm.), and near Ndola (Knowles Jordan, 1959: 140).

The only recent records from the Central Province plateau, except those already noted from Mumbwa District, are of wanderers from the Luano Valley. In 1958 one such animal was shot near Broken Hill, now Kabwe, 1428-B-3, and J.A. Gledhill reported fresh spoor at Matakula Hill, 1428-D-3, the animal having evidently come up an old wagon road from the valley. Former localities in the Central Province plateau are: Bell Point, 1429-C-1, and along the northern escarpment of the Luano Valley (Knowles Jordan, 1959: 141), and the hills east of (old) Mkushi, presumably 1429-B-4 (Pitman, 1934: 6). J.M.C. Uys believes that the present Kasanka game reserve is another former site, which is very likely, though there is no post-war record. A record in the Serenje District, in locus 1330-B-2, is doubtless correct, though I cannot trace its source. Finally, Uys believes that they still occur in fair numbers in the eastern part of Lusaka District, between the middle Zambezi and Luano valleys. These would doubtless be connected with the Zambezi population, being just north of the Zambezi escarpment.

Lavushi Manda Game Reserve

Preserving the rhinoceros was a main objective in creating this reserve, following Pitman's report (1934) which showed that they survived west of the Lavushi hills, 1230-B-3. In 1948 W.E. Poles, who considered that only a remnant survived there, recorded a male and two females. In 1959 game guards reported three in the Chimfitumba Plain, in the northern part of the reserve, 1230-B-2, and in 1960 three were seen near the north-eastern boundary—a female with a half-grown calf, and a male a few miles away. These are the last definite records; on the map I have shown the reserve as containing a remnant population, but both Allen and Berry, formerly in charge of the area, believe that none remain there. It might be worth investigating, but unfortunately the game department has been unable to give this reserve much attention recently.

Other areas in the Northern Province plateau

Letcher on his map (1911) noted rhinoceros just north of the present Lavushi Manda Game Reserve, 1130-D-4, and above the escarpment in the vicinity of Mpika, while Hughes (1933) recorded them from the headwaters of the Lupembazi, 1230-B-1, the Lumbatwa, 1231-A-1, the Luwi, 1230-B-3 (not to be confused with the Luwi in the Luangwa Valley (South) game reserve), and Lake Sashiwa, between the Lubansenshi and Lukulu rivers, which I have not been able to trace on any available map. Pitman (1934: 4, 14) noted that a few still remained on the plateau round Mpika, and in parts of the Chinsali District plateau. In the latter district localities listed by E. Munday in the District Note Book (Zambia National Archives) as having held rhinoceros in 1931 were: Chilye Forest, 1032-A-3 (see also Knowles Jordan, 1959: 142); Lufila and Luswa rivers, 1132-A-1 and A-3; Ntambi, 1031-D-1; and one or two other places which I have not been able to trace. A rhinoceros was killed many years ago at Shiwa Ngandu (Knowles Jordan, 1959: 143), and another, also many years ago, at the Kasama golf course (G.C.R. Clay, *in litt.*). In all these areas the species is now believed extinct.

In the early years of the century rhinoceros were widespread in the Abercorn and Mporokoso districts (Ansell, 1959 b: 336), but have long ago disappeared from most of them. Apart from Mweru Marsh Game Reserve, already discussed, a few may have survived in the Sumbu Game Reserve as late as 1959, but it is doubtful if any remain there today.

Luapula Province

I have a record of former occurrence in Kawambwa District, 1028-B-2, but cannot trace details. The Kawambwa District Note Book, undated, but doubtless many years ago, recorded that rhinoceros had "not ever been heard of in the division", and it is virtually certain that none survives in Kawambwa or Nchelenge Districts today, except in the Nchelenge part of the Mweru Marsh Game Reserve, formerly in the north-western corner of the Mporokoso District. I cannot trace any record whatever of rhinoceros in the Mansa (formerly Fort Rosebery)

or Samfya districts, though they probably once occurred there in suitable habitat.

Eastern Province plateau

Rhinoceros must once have been widespread on the Eastern Province plateau, but, except for those in north-eastern Chipata District and southern Lundazi District already noted, the only recent record is of a single bull which survived to about 1959 between Chipata and Chadiza, 1332-D-1 (P.Morris, pers.comm.). (I understand that some rhinoceros still occur in the Vwaza Marsh, northern Malawi, adjacent to north-eastern Lundazi District.)

Abundance

Some aspects of the numbers of rhinoceros in the Luangwa Valley have been discussed above. Elsewhere it is apparent that reasonable populations remain in several areas, but it is extremely difficult to assess numbers in any meaningful way, and there seems no point in attempting to compare past estimates with each other or with present assessments, though it is clear that the 1953 figures from departmental sources given by Sidney (1965: 69-71) were mostly too low. For what they may be worth the most recent assessments by game officers, based on personal observations plus reports from field staff, are given in Table 2, which also show the status of the areas and the effectiveness of the protection. These estimates are inevitably largely subjective, and should not be regarded as accurate, but they are not unreasonable, and at least some may be on the low side.

Breeding

Very little is known about rhinoceros breeding in Zambia. Several records of young have been mentioned above. In the Luangwa Valley breeding is satisfactory, many calves being seen, and J.B. Shenton has noted that a well known individual cow gave birth to two calves between 1950 and 1954. He also notes that in the Kafue national park breeding seems to be less frequent than in the Luangwa valley, and other departmental records tend to support this, but just south of the park in the Sichifula and adjacent area two young calves, in a total of eight rhinoceros seen, were recorded between 1962 and 1965. In the Zambezi valley, below the Kafue confluence, Morris considers that there is a reasonable rate of increase. In the Mweru Marsh game reserve Simpewe considers the rate of breeding slow.

Possible Over-population

Clearly the only area likely to show any evidence of over-population would be the Luangwa valley. Uys considers that the number of rhinoceros dying from fighting, getting stuck in mud, and unknown causes in the southern game reserve constitutes evidence of over-population. Berry also points out that a number die each year when they become stuck in the mud of drying-out lagoons towards the end of the dry season, but he attributes this to attempts to reach the little remaining water in the centre.

Table 2

Area	Status of area	Most recent assessment	Assessed by	Degree of protection	Notes
Kafue National Park	National park, uninhabited	130	J.M.C.Uys (1967)	Good	Possibly optimistic, but well distributed though seldom seen
Sichifula and adjacent parts	Mostly controlled hunting area; mostly uninhabited	10	J.M.C.Uys (1967)	Good in the C.H.A.	Possibly too low. At least eight individuals, including two young calves, seen 1962-1965
Mumbwa West and adjacent Mumbwa/Namwala boundary	Controlled hunting area, mainly uninhabited	10	J.M.C.Uys (1967)	Reasonably good	Probably too low
Eastern Kasempa and south-western Ndola	Closed tsetse area, uninhabited	12	N.J. Carr (1953)	None directly, but access prohibited, though game poaching heavy	See Sidney (1965: 71). There is no more recent estimate. The figure may be too low
Middle Zambezi Valley from Kafue confluence to Feira	Mostly game management area, uninhabited	60-70	P.Morris (1968)	Good. Most rhinoceros are in the game management area	Since game department took over area (1964) rhinoceros found commoner than supposed
Luano and Lukusashi valleys	Only partly controlled hunting area; otherwise inhabited and uncontrolled	60	J.M.C.Uys (1967)	Little or none	Holding their own despite little protection
Mweru Marsh Game Reserve	Game reserve, uninhabited	20	S.G.Simpelwe (1968)	Good	Possibly conservative
Western Province (formerly Barotse)	Outsiders' hunting by permit only. Inhabitants not allowed to kill rhinoceros	? 6-10	W.F.H.Ansell (present paper)	Virtually none	Surviving only in border areas with Kafue NP, and the s.w. Kasempa and Kabompo districts. Estimate arbitrary

North Western Province other than K.N.P. and east of the E.Lunga River	Partly controlled hunting area, Class I, otherwise C.H.A. Class II. All inhabited	? 8-10	W.F.H.Ansell (present paper)	Virtually none	Remnant only. About 5 reported 1962-1963. Survival uncertain
Southern Province plateau, other than K.N.P. and Sichi-fula area	Inhabited; no protection	? 6	W.F.H.Ansell (present paper)	Virtually none	Two recorded in Namwala District s. of Kafue R., 1966 and 1967. Remnant; survival chances poor
Middle Zambezi Valley from Batoka Gorge to Kafue confluence	Inhabited; no protection	?		Virtually none	No recent information. Survival chances poor
Copperbelt Province, (formerly Western) east of Luswishi River, and Central Province plateau	Inhabited; no protection	?		Virtually none	Probably fairly regular in plateau between Luano and middle Zambezi valleys. Elsewhere only occasional wanderers from Luano Valley
Lavushi Manda Game Reserve	Game reserve, uninhabited	Believed extinct	L.D.C.Allen & P.S.M.Berry (1968)	Fair	Latest report: 3 in 1960. Worth investigation
Northern Province plateau (except Lavushi Manda and Mweru Marsh reserves)	Inhabited except for Sumbu and Isangano game reserves	Believed extinct		None	Last tentative report from Sumbu reserve 1949—possibly survived to about 1959. Elsewhere only wanderers from the Mweru Marsh game reserve (<i>q.v.</i>)
Luapula Province	Inhabited, no protection except in Lusenga Plain game reserve	Believed extinct		None	No recent record except in Mweru Marsh Game Reserve (<i>q.v.</i>)
Eastern Province plateau, except southern Lundazi District and north-eastern Chipata District	Inhabited, no protection	Virtually extinct		None	Only recent report: one in Chipata/Chadiza area to about 1959

Relocation

So far there have been no attempts at restocking areas of former occurrence, and there are no plans to do so at present. The only source for such restocking would of course be the Luangwa valley. Such operations have been successful elsewhere (Roth, 1967: 229-230), and presumably there would be little technical difficulty provided the operation was carefully planned. The question would be whether enough animals could be translocated to provide a breeding nucleus for the restocked areas. The Sumbu game reserve has been suggested as a suitable area for restocking by J.M.C. Uys, and the Kafue by J.B. Shenton. Kafue already has a widespread population which has been effectively protected for many years, so the rather slow rate of increase there is probably due to natural limiting factors, but the Sumbu reserve would merit consideration if restocking became possible, and so would the Lavushi Manda and Kasanka reserves.

Conservation Status

Rhinoceros are completely protected in Zambia except for some five or six allowed annually on licence to safari clients in the Luangwa Valley. Permits to capture two alive for zoological gardens were also issued in 1968. Uys considers that the high cost of a rhinoceros permit (K 400.00, = £200 + sterling) has brought a realisation of their value, resulting in heavier sentences for poaching—up to two years' imprisonment compared with the previous inadequate fines.

On the whole the staff is adequate for protecting the Kafue park and most game reserves, but not for all the controlled hunting areas where rhinoceros occur.* Approximate figures for the main areas concerned are 100 guards in 33 posts for the Kafue and adjacent areas; 150 guards in 48 camps for the Luangwa Valley; 20 guards in 5 camps for the Zambezi valley below the Kafue confluence; and 14 guards in 5 camps in the Mweru Marsh game reserve.

Uys considers that about 50 rhinoceros are poached annually. L.D.C. Allen estimates 30-40 for the Luangwa Valley alone; in 1968 he had 163 horns in his store, largely from the 1965 amnesty, and he considers that the proximity of the Malawi and Mozambique borders provides incentives for commercial poaching. Berry and Shenton, however, think Allen's figure too high, and suggest 10 to 15 for the Luangwa Valley. Morris thinks that one or two only may be poached each year in the Zambezi valley below the Kafue confluence. In Mweru Marsh area the only figure available is 3 horns produced in response to the 1965 amnesty. Neither Berry, Morris nor Simpewe considers poaching a serious problem in their respective areas. In all areas the number killed in defence of life or property, allowed for in the game laws, appears to be negligible.

Only horns legally obtained may be exported officially. Figures of government sales for the past five years, supplied by P. Morris, have

* In the draft revision of the game laws now under consideration national parks and game management areas are retained, and game reserves and controlled hunting areas, as such, discontinued. This is unlikely to have any effect on the *de facto* protection of rhinoceros.

been: 23 lbs. in 1963; 7 lbs. in 1964; 10 lbs. in 1965; 10 lbs. in 1966; and 18 lbs. in 1967. Uys considers that there is a considerable traffic in illegal horn, and that horn confiscated or handed in as government trophies should not be sold, as even a legal sale maintains an illicit market. There can be no doubt of the need for a complete ban on trade in rhinoceros horn.

Cause of Decline

All department colleagues consulted were unanimous that hunting has been the reason for decline of rhinoceros, and it is clear that no other cause need be invoked. There is still plenty of suitable habitat for them, and they have no serious natural predator except possibly the lion, which probably has little overall effect. Mitchell (1966) has pointed out that they do not appear to compete for food with other large ungulates, even where the latter are in heavy concentration. Rinderpest, which caused such havoc towards the end of the last century, evidently does not affect rhinoceros (Spinage, 1962: 56; Simon, 1962: 73).

Summary and Conclusion

While there can be no doubt of the great reduction in range and numbers of rhinoceros that followed the opening-up of the country and the influx of firearms, it seems clear, in view of the present stable, or even increasing, populations in the main wildlife areas, that the alarming decline noted by Pitman (1934) and re-emphasised by Sidney (1965) has largely been halted, and to some extent reversed. The striking thing is that in so many areas a breeding nucleus, capable of responding to the protection that only came much later, managed to survive. Much of Zambia is sparsely inhabited, with large tracts of remote and uninhabited areas, but effective protection dates only from about 1946, and for many years after Pitman's time there was at most an embryonic faunal administration. In the ten years since Miss Sidney made her survey, there has been continuous protection and increases can be assumed, and more information is now available due to the more detailed records kept by the Game and Fisheries Department. Nevertheless it seems clear that her view (Sidney, 1965: 69-72) was unduly pessimistic. In Zambia's main wildlife areas the rhinoceros situation is, on the whole, satisfactory; with continued effective control by the game department there is no reason why rhinoceros should not continue to thrive in these places. The Sumbu, Lavushi Manda, and Kasanka game reserves could perhaps be restocked from the Luangwa Valley if such an operation proved feasible.

Acknowledgments

I am most grateful for valuable help and up to date information to the following departmental colleagues: Messrs. L.D.C. Allen, P.S.M. Berry, L.A.C. Hewson, P. Morris, J.B. Shenton, S.G. Simpelwe, and J.M.C. Uys; also various past and recent records to Messrs. A.E. Beech, W.F. Bruce-Miller, G.C.R. Clay, C.T. Duval, A.O. Johannsen, G. Lyon, G.G. Suckling, and S.M. Yamba. Mr. W.R. Bainbridge, Chief Game Officer, kindly made available the manuscripts of Dean's and

Patton's papers. I also wish to thank Mr. B. T. Burne, of the Zambian National Archives, who allowed me access to a number of District Note Books, which supplied useful data on former distribution.

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Pollution of the Environment

Both the British and the US governments are concerned about environmental pollution. In Britain the new Secretary of State for Local Government and Regional Planning, Anthony Crosland, has been given the task of investigating the problem and making recommendations. In the USA President Nixon has created a cabinet-level Environmental Quality Council, chaired by himself, and a Citizen's Advisory Committee on Environmental Quality, chaired by Laurance S. Rockefeller.