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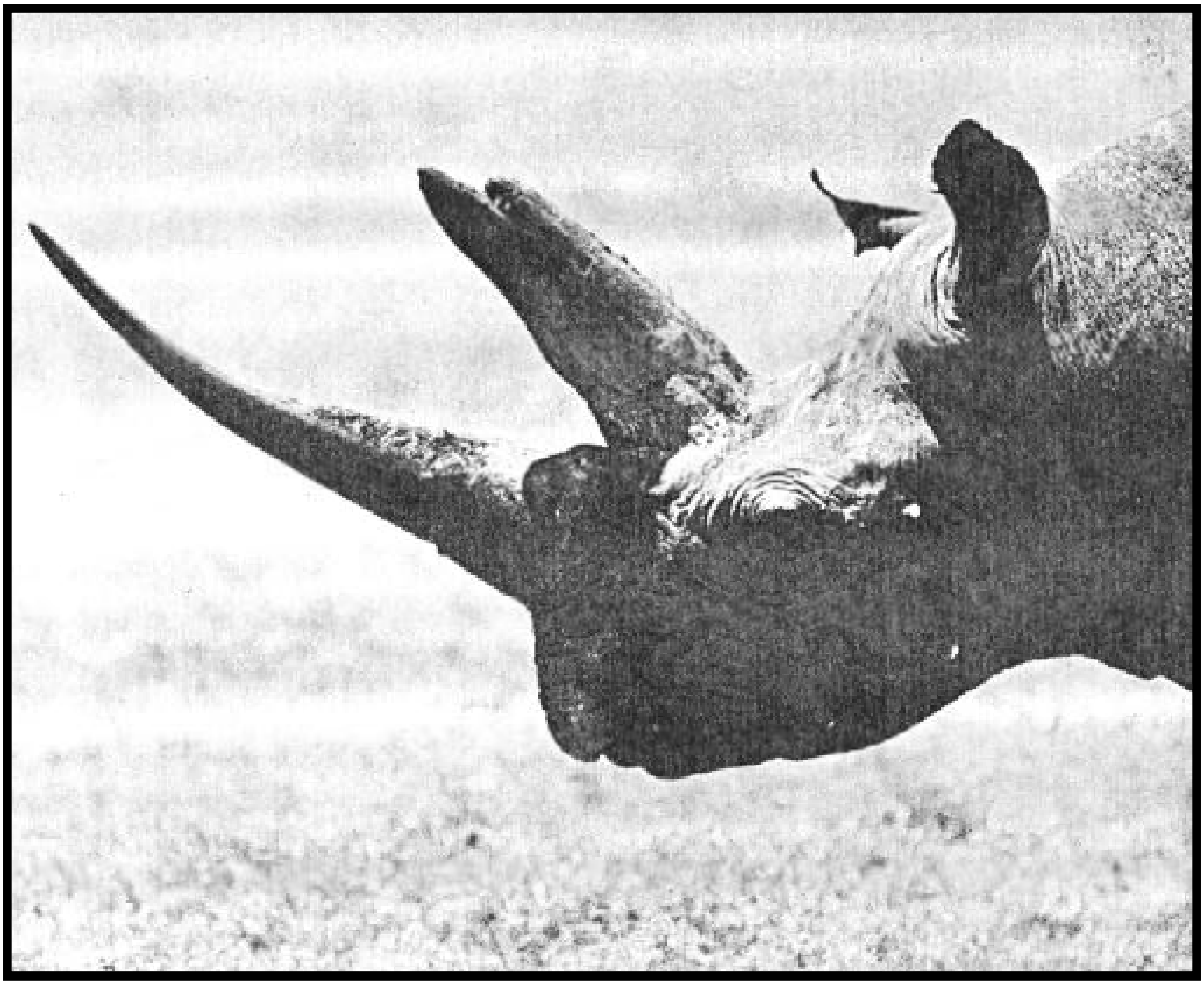
NEWSLETTER OF THE AFRICAN ELEPHANT AND RHINO SPECIALIST GROUP



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COVER PHOTO
Black rhinocerous Amboseli Garne Reserve, Kenya.
M. Boulton/WWF

Chairman's Report

I. Crisis management or prediction and prevention?

Black rhino emerged as the top priority in the Action Plan drawn up at the last meeting of the AERSG held at the Victoria Falls in September 1985 (see below.) It now seems likely that in the last two years the black rhino population of Africa has declined by some 50% from an estimated 8 800 to less than 4 500. Two of the continent's major populations have been hit hard by poaching. Recent reports from the Luangwa valley suggest that less than 200 rhino remain. Reports from the Selous, in addition to that by Borner and Severre (this issue), suggest that few rhino may be left in that Reserve. Once again there will be calls for surveys, a crisis declared, and a flurry of action by Government and NGO's will follow. This has happened in Kenya, in Uganda, in the CAR and, rightly, will happen in Tanzania. These responses have usually been linked to severe elephant poaching and have been too late for rhino.

At the Hwange Meeting in 1981 the key rhino (and elephant) populations of Africa were identified and Governments and conservation organisations were urged to take steps to maintain the status of these populations and the protected areas in which they lived. With the wisdom of hindsight the priorities for species and areas developed at Hwange provided a predictive template of where the greatest threats from poaching were going to develop. I doubt if this was fully appreciated at the time and the following factors were perhaps not realised or sufficiently explicit:

(i) The value of rhino horn would greatly increase and with it the rewards and incentives for poaching;
(ii) The threat to key populations would correspondingly increase;
(iii) The major challenge was not merely to maintain the conservation status of these key populations but to greatly improve the existing capacity to protect and manage them before the poachers struck;
(iv) An early warning system is essential and requires an appropriate, continuous and reliable monitoring system;
(v) A fail safe step against extinction, such as captive breeding, is needed even if the endangered population is as high as 12 000 (as it was considered to be in 1981).

A basis for predicting future threats to susceptible populations exists. It comprises a combination of the scoring and ranking procedures used at Hwange together with a fuller analysis of the resources conservation agencies possess to protect and manage their wildlife. Information on manpower, financial and material resources across Africa provides a comparative basis on which to judge what is required to contain a serious poaching threat. Both Government agencies and NGO's need to be clear about the magnitude of funds and types of resources required to sustain effective protection and management of protected areas. Investment in field protection may, however, be completely undermined if the legal framework or institutions of the country make it easy to dispose of illegal rhino horn or ivory. Similar considerations apply if poaching is part of a high level crime syndicate. The tendency has been to regard monitoring as a high tech affair requiring aircraft and experts and accurate population estimates. While it is necessary to have good population estimates, and it is a great pity the extensive surveys of the seventies were not continued, it is possible to effectively monitor wildlife populations and poaching activities with very simple techniques. The work of Conway (1984) in the Chirisa Safari Area of Zimbabwe and of Bell (1983) in Malawi provide a sound basis for the development of cost-effective and appropriate monitoring systems. Had these been in place in the Luangwa or the Selous, for example, it may have been possible to mobilise support and action against poaching, before drastic declines occurred.

There is a need to move towards predictive and preventative conservation measures. The priorities defined in the AERSG action plan in September take cognisance of this need and it is my hope that we can stimulate the provision of more effective guidelines in this direction.

II. Some gains (and losses) since July

Raoul du Toit was appointed Scientific/Executive Officer for the AERSG in October and has been actively working on our priority to reexamine the subspecies of black rhino. His paper in this issue outlines his approach to this problem. I sincerely hope that all who can help will contribute to this effort so that the first phase of this reexamination of the subspecies of Diceros bicornis can be completed as soon as possible. It would be very useful to have some hard data to discuss at our next meeting in mid July and for the project to be complete by the end of the year. Decisions will have to be made soon and there is no time to lose.

In August last year I was fortunate to be able to attend the meeting of Specialist Group Chairman in Edmonton and to establish contact with the Chairman of the Captive Breeding Specialist Group and Tom Foose, Conservation Coordinator of the American Association of Zoological Parks & Aquaria (AAZPA). This afforded the opportunity to discuss problems of mutual interest on the captive breeding of African rhino and the development of guidelines for the management of small, isolated populations of rhino.

At the end of January I visited Damaraland in Namibia to examine the present conservation status of rhino and elephant living in desert habitats. One of the immediate developments from this visit is that WICI and the Wildlife Society of Namibia are to support an intensive three month survey of the black rhino in Damaraland. Some 50 individual rhino are known in Damaraland but nearly half of these have not been positively identified in the last 18 months. It is important to establish the current status of these rhino and elephant populations and the survey will be carried out by Garth Owen-Smith who developed the initial identification system for these rhino.

News of the northern white rhino population in Garamba indicates that this population has remained stable over the last year. The Chairman of the Captive Breeding Group, Dr. Ulysses Seal, and Director of the London Zoo, Dr. David Jones, were due to meet with officials of the zoo at Dvu r Kralove in Czechoslovakia early in February to discuss captive breeding of northern white rhino.

The southern white rhino remains secure in South Africa and in captive breeding situations elsewhere in the world. The Zimbabwe population remains at about 200 and steps to increase its range and population size depend largely on making use of the Parks & Wildlife land in the Zambezi valley. A report by Russell Taylor details a first and unsuccessful attempt in this direction.

The Government of CAR held a conference at the end of October in which they formulated policy for the protection of elephant and rhino and also stopped the system of collectors' permits in the country. Trade in ivory, other than by the Government, was banned and a batch of confiscated ivory was sold to provide funds for elephant conservation in the CAR.

Reports of very high levels of ivory poaching from the Selous and the Luangwa Valley continue. The numbers of elephant in the Luangwa are now considered to be in the region of 25 000 while the Selous population is not known and a survey is urgently needed to establish the present size of the population and the severity of poaching. The Tanzanian Government has invited Dr. Douglas-Hamilton to carry out such a survey, Dr. Borner's and Mr. Severre's

paper includes data on trends in elephant poaching up to the end of 1984. I have received first hand reports of very much higher levels of elephant poaching in the 1985 season with one observer encountering an average of 10 elephant carcasses per day.

The Norwegian Aid Agency, NORAD, will be funding the Luangwa Integrated Rural Development Project in Zambia and Dr. Richard Bell has been appointed co-Director. This project will probably incorporate many of the activities and responsibilities of the Save the Rhino Trust (SRT) Unit which has been conducting anti-poaching operations in the Luangwa over the past five years.

The ivory quota system adopted at the last meeting of CITES came into effect at the beginning of this year and we carry a note on the quotas submitted thus far. Moves to establish an Ivory and Elephant Management Council for Africa have progressed and draft terms of reference have been circulated to member Governments. Proposals for such a Council were formally discussed at a meeting of Government representatives in Dakar in April last year.

Vice-Chairman David Western has been visiting the tropical forests of Africa, while Esmond Martin is in the Far East engaged on a project aimed at reducing the demand for rhino horn.

The annual AERSG meeting was held in September at the Victoria Falls. It was an intensive two day meeting which covered a lot of ground and provided a valuable forum for the debate of a number of thorny issues. The major output from this meeting is the revised Action Plan and this is given in full below.

III. Current Action Plan.

(As defined at the Victoria Falls Meeting in September, 1985)

FIELD PRIORITIES

1. Develop a Conservation Strategy for the Black Rhino.

The continuing rapid decline of black rhino populations in most parts of its range coupled with the fact that many viable populations do still exist in the wild merits the placing of black rhino, in contrast to white rhino, as the top priority for conservation action. The development of a continental conservation strategy for the species involves three major, and preferably concurrent, actions:

1.1 Examine the taxonomic status of presently described subspecies of black rhino so as to provide a sound basis for ordering priorities for action amongst the now geographically separated populations in Africa.

1.2 Develop National Conservation Plans for those countries with more than 100 black rhinos. Priorities for action would need to be examined once the results of the taxonomic studies were available and the national plans had been drafted.

1.3 Promote the dissemination of information and expertise necessary to implement and support the international and national rhino conservation plans.

2. Northern White Rhino.

2.1 Encourage efforts to co-ordinate the breeding of existing captive northern white rhino.

2.2 Examine the taxonomic status of the northern white rhino. A key issue in deciding on the resources to be invested in the conservation of northern white rhino is the extent to which they have diverged from the southern white rhino populations.

2.3 Support the rehabilitation of Garamba National Park with northern white rhino as a component of the ecosystem.

3. Desert Elephant.

Continue to monitor the status of elephant populations in Mali, Mauritania and Namibia and to urge appropriate conservation action.

4. Forest Elephant.

The second phase of the study of forest elephant numbers and distribution (i.e. the classification and delineation of elephant habitats and land use strata) should be initiated as soon as possible. A sound knowledge of the size of the forest elephant population is crucial to decisions about the management of African elephant and the regulation of the ivory trade.

5. West African Elephant.

Convene a regional arm of the AERSG in West Africa and encourage a re-assessment of the status and distribution of elephant within West Africa.

6. Selous Game Reserve.

A full census of the rhino and elephant populations of the Selous is needed urgently. Existing and planned surveys of the Garamba National Park and the Luangwa Valley should proceed.

7. Central African Republic.

Continue to support rhino and elephant conservation initiatives in the CAR despite recent major reductions in the populations of these species.

TRADE PRIORITIES

1. Rhino Horn.

1.1 North Yemen. Take action to reduce demand for rhino horn and, if possible, close down the trade.

1.2 East Asia. Take action to reduce the demand for rhino horn and, if possible, stop the trade in horn.

1.3 Investigate the movement of rhino horn within Africa.

1.4 Investigate the discrepancies between reported declines in rhino populations and the amount of horn appearing in the trade.

1.5 Inform Governments of the value, and potential value, of their rhino populations and so encourage the allocation of more resources to their conservation.

2. Ivory.

2.1 Encourage the formation of a wildlife division within Interpol or if this is not feasible the formation of an equivalent organisation linking wildlife law enforcements agencies.

2.2 Investigate the internal trade in ivory and ivory products in central Africa (i.e. Zaire, Cameroun, CAR and Congo).

2.3 Investigate the internal trade in ivory and ivory products in West Africa (i.e. from Senegal to Niger and Nigeria).

2.4 Continue the development of ivory and elephant population models as an aid to the interpretation of ivory trade statistics.

RESOURCE MANAGEMENT

Promote the conservation and management of elephant populations in Africa by providing information and advice on:

1. Monitoring elephant populations
2. Management and harvesting
3. Legal and administrative frameworks
4. Law enforcement
5. Ivory trade

The main focus of conservation action for elephants in Africa has been on anti-poaching and on attempts to halt the ivory trade. While these may be the most appropriate actions in some cases there are many circumstances where positive management of elephant, as a valuable aesthetic and economic resource, may be more successful. African Governments and wildlife agencies need to be made more aware of the options available to them.

David Cumming

References are listed on page 4.

Rhino and Elephant Poaching Trends in the Selous Game Reserve

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INTRODUCTION

The Selous Game Reserve covers an area of 55 000 km^2 and is the largest Game Reserve in Africa. In 1981 it harboured the largest elephant and black rhino populations on the African continent (85 000 elephant and 3 000 black rhino; Borner, 1981).

The vastness and inaccessibility of the Selous Game Reserve were the best protection for wildlife living within it and, although the area is very difficult to patrol, poaching was minimal during the seventies (Douglas-Hamilton, 1976). Poaching for trophies began to increase by 1981 (Borner, 1981; Douglas-Hamilton, 1984). The Shell Company began prospecting for oil in the Selous five years ago (1981) and roads and tracks now criss-cross most of the north-eastern part of the Game Reserve. These roads make poaching much easier, both by vehicle in the dry season and on foot. The depressed economic situation of the country and rising prices of ivory and rhino horn were associated with a countrywide increase in poaching.

During the 1984 hunting season the authors received reports from professional hunters that poaching, both of elephants and rhinos, had increased alarmingly. Similar reports were received from the Wildlife Division Project Manager and from field staff in the reserve. These reports stimulated the present survey.

METHODS

Professional hunters, staff and clients of the Tanzania Wildlife Corporation (Tawico) and staff of the Wildlife Division were interviewed during 1984. A standard questionnaire form was used as the basis for the interview. Each of the persons interviewed had accompanied a 21 day hunting safari in any of the years 1981 to 1984. In most cases only one person per safari was interviewed. In some cases the Wildlife Division warden, who carried out patrols from the safari hunter's camp, was also interviewed. In such cases two sets of data were collected from the same safari. The indices of live or poached animals seen, or of poaching incidents and sign, are the number seen by one observer during a 21 day safari.

A weak point in our observations is that some of the data depended on memory; most of the professional hunters kept written records, while some of the information provided by Wildlife Division staff was based on memory. Information on anti-poaching activities was provided by the Project Manager and one (If us (E.S.) visited hunting camps and all the sector headquarters.

The time of data collection did not correspond with the main poaching season. Data were collected during the hunting season which runs from July to December while the main poaching activity occurs from January to March, during the rains, when there is no hunting and the road system is largely closed even to vehicles of the Wildlife Department.

The results reported here refer mainly to the central part of the Game Reserve. The north is reserved for photographic safaris and these camps were not visited while early rains meant that fewer camps were accessible in the southern (Liwale) sector of the reserve.

RESULTS

The indices of poaching activity within the Selous show a clear increase between 1981 and 1984 (Table 1 and Figure 1). The index for numbers of elephant poached also shows a clear upward trend over the four year period (Table 2 and Figure 1).

The number of live rhino seen per safari observer shows a marked decline while the index for poached rhino found showed no change

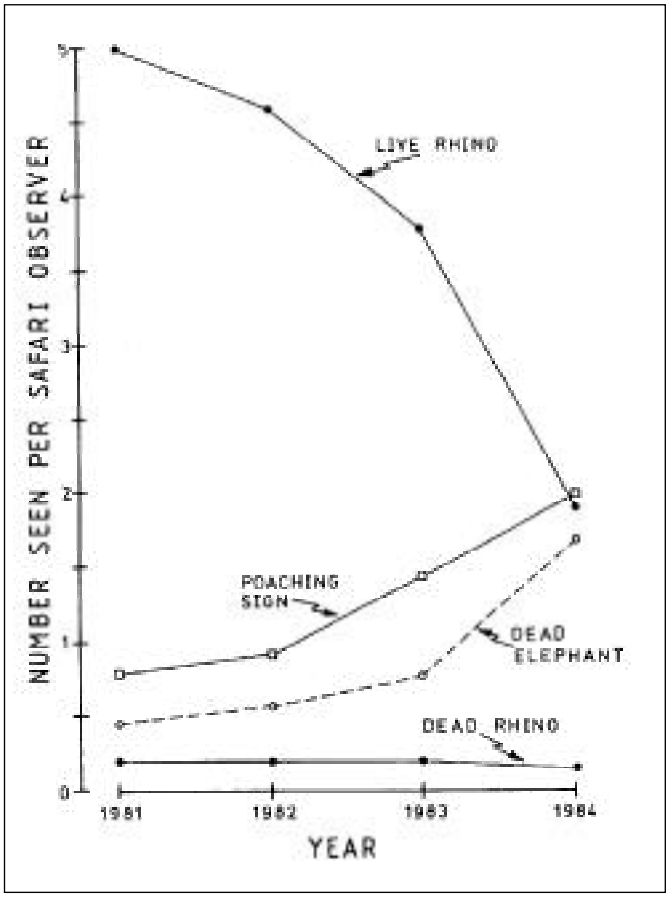

Figure 1. Trends in poaching of elephant and rhino in Selous Game Reserve, shown as the numbers of animals seen or frequency of poaching sign encountered per safari observer on a 21 day safari, in different years.

Table 1. Poachers and poaching sign encountered each year by observers on 21 day safaris

Sign	1981	1982	1983	1984
Poachers seen	5	3	10	38
Poaching camps	2	5	7	14
Poachers' tree caches	0	0	2	11
Snare and trap lines	2	7	18	37
Tree felling	5	6	14	37
Fire	9	12	21	47
Total poaching sign	23	33	72	148
Safari observers	29	36	50	93
Sign/safari observer	0.79	0.92	1.44	2.00

during the four year period (Table 3 and Figure 1). These data suggest a high constant offtake and that the population was being depleted at an increasing rate (with declines in the index of rhino seen of 9%, 16% and 51% over the periods 1981-82, 1982-83 and 1983-84 respectively). The ratio of live to dead rhino encountered on safaris also showed a marked decline (Table 3).

Table 2. Numbers of poached elephant seen each year by observers on 21 day safaris

	1981	1982	1983	1984
Poached elephant seen	13	21	39	158
Safari observers	29	36	50	93
Poached elephant/safari observer	0.45	0.58	0.78	1.70

Table 3. Numbers of live and poached rhino seen each year by observers on 21 day safaris

	1981	1982	1983	1984
Live rhino seen	145	164	192	175
Poached rhino seen	6	8	10	13
Safari observers	29	36	50	93
Live rhino/safari observer	5.0	4.6	3.8	1.9
Dead rhino/safari observer	0.2	0.2	0.2	0.14
Ratio live/dead rhino	24.2	20.5	19.2	13.46

DISCUSSION

The elephant population of the Selous Game Reserve showed nearly identical densities in surveys carried out in 1976 and 1981 (Douglas-Hamilton, 1976; Borner, 1981) suggesting a stable population. Since 1981, there is little doubt that elephant poaching has increased drastically.

The data gathered on rhino are less conclusive, mainly because rhino numbers are much lower and observations of live and poached rhino are accordingly rare. The available data nevertheless suggest an alarming rate of decline in the rhino population. In October, 1985, a recount was made on the ground by the Mweka College of African Wildlife Management of some blocks that had been counted in 1981 (Borner, 1981). In the largest block (54.8 km^2), near Behobeho, where 15 rhino had been seen in 1981, none were seen in the recount, nor any rhino sign. During the College researchers' entire trip through eastern and northern parts of the Reserve, no rhino were seen.

According to the Reserve administration and the safari hunters, poachers enter the Selous mainly for ivory as the elephants are easy to find and the ivory can be disposed of more readily than rhino horn. While the poachers may take elephant as their main target they are unlikely to spare a rhino when they find one.

Several factors have contributed to the increase of commercial poaching in the Selous.

1. The difficult economic situation in the country combined with high prices for ivory and rhino horn have provided an increasing incentive for poachers.

2. The local ivory carving market provides a ready outlet for illegal ivory and rhino horn. There are numerous licensed ivory carvers who indulge in illegal business. Existing regulations are not effectively policed or are difficult to enforce and numbers of influential people are involved in the illegal trade. These problems are less prevalent with the export of raw ivory, which is under more centralised control.

3. One of the main factors previously protecting the reserve, its inaccessibility, is no longer effective. Oil exploration by Shell Company has opened the southern and eastern sectors of the reserve to both foot and motorised poaching. In 1981 and 1982 there were no records of motorised poaching while in 1983 two cases were recorded and in 1984 nine cases.

4. Declining financial resources and operational equipment have meant that the Reserve management has not been able to meet the challenge of increased poaching. Funds available for paying the per diem allowance for overnight patrols in 1984 were one seventh of those available in 1980. Even more serious is the lack of equipment for anti-poaching activities such as vehicles, road building machinery, camping gear, radios, uniforms and firearms. It is simply impossible to control effectively an area larger than Switzerland with five Landrovers or with allowances that cater for only two patrol nights per ranger per year.

CONCLUSION AND RECOMMENDATIONS

The results of this survey, and reports from safari operators and field staff during 1985, suggest that the rhino and elephant populations of the Selous Game Reserve have entered a critical phase. The Tanzanian Government is determined to face the responsibility of protection but has difficulty increasing its support for the Reserve. A large input of funds and equipment is needed very soon if the poaching trends in the Game Reserve are to be reversed.

Thus, a concerted effort by conservation organisations to assist the Selous is imperative. The Shell Company could also assist.

The most urgent requirements for the Selous Game Reserve are:

1. Two anti-poaching vehicles for each of the six Section HQ's;
2. Funds for patrol allowances and fuel;
3. Equipment (uniforms and camping gear) for rangers;
4. An improved radio communications network;
5. Spares for road building equipment and vehicles;
6. Establishment of an ecological monitoring programme;
7. A management plan for the reserve and its buffer zones;
8. Closure of the internal ivory market by withdrawing all ivory carvers licenses.

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We are indebted to Dr. R. Faust, Director of FZS, who initiated the survey and gave his full support, and to all those who supplied information.

Finally we would like to thank SWRI for permission to carry out the survey.

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Re-appraisal of Black Rhinoceros Subspecies

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INTRODUCTION

One research priority of the current action plan of AERSG is to "examine the taxonomic status of presently described subspecies of black rhino so as to provide a sound basis for ordering priorities for action amongst the now geographically separated populations in Africa". This does not imply that conservation efforts should be delayed while tile rhino taxonomy is being clarified, but simply that an attempt has to he made to consider genetic variation in a systematic way when developing future action plans.

The most comprehensive recent paper on black rhino classification is that of Groves (1967), in which seven subspecies are described according to skull dimensions. However, the sample size on which this classification was based was very small; a total of only 74 adult skulls were measured (and of these over half were **Diceros bicornis minor** and **D.b. michaeli**). An unpublished revision of the subspecies by C.P. Groves (in litt., November 1985), based on measurements of about twice the number of skulls, has not greatly altered his original classification, although he no longer regards **D.b. bicornis** as one of the extinct subspecies. However, his conclusions remain tentative since three of his suubspecies still have less than 10 representative skulls, and the clinal variation within subspecies such as **D.b. minor** has not been clearly establisbed.

By measuring as many as possible of the skulls of rhino that have been poached or have died naturally in African wildlife areas, the issue of rhino taxotnomy could be investigated in much more depth. This paper is essentially to outline a standard procedure for the measurement pf skulls and to make a plea to all those in a position to collect such data to please do so and to submit the information to the AERSG office in Harare. All sources of information will be acknowledged in ensuing reports. The morphometric studies will hopefully be complemented by biochemical studies on rhino blood, using techniques such as mitochondrial DNA sequencing.

AGE DETERMINATION

It is obviously important to ensure that any skull measurements used to differentiate subspecies are those of adult animals; only skulls in which the third molar is erupted and in wear need be measured. Further approximate age determination of skulls can be carried out quickly in the field by studying the degree of attrition of the adult maxillary dentition.

This age determination is made possible through the work of Hitchins (1978), who outlined age criteria for black rhino in Zululand based on tooth eruption and wear. He assigned chronological ages to his different age classes through reference to a limited number of known-age animals and to incremental lines in tooth cementum. In each upper premolar and molar, depressions between the cups (the prefossette and the postfossette) gradually become isolated holes as the cups erode, and finally disappear altogether; the successive stages of wear of these features serve as a fundamental criteria in Hitchins' system.

As an extension of Hitchins descriptions of age classes, each stage of wear of the prefossette and the postfossette can be assigned a numerical value, as shown in Figure 1. A total "tooth wear index" can be calculated for a skull by adding up the wear values assigned to the postfossettes of teeth in the row PM^{2}"– M^{2}, on either the left or the right side of the maxilla. (PM^{1} and M^{3} do not have the

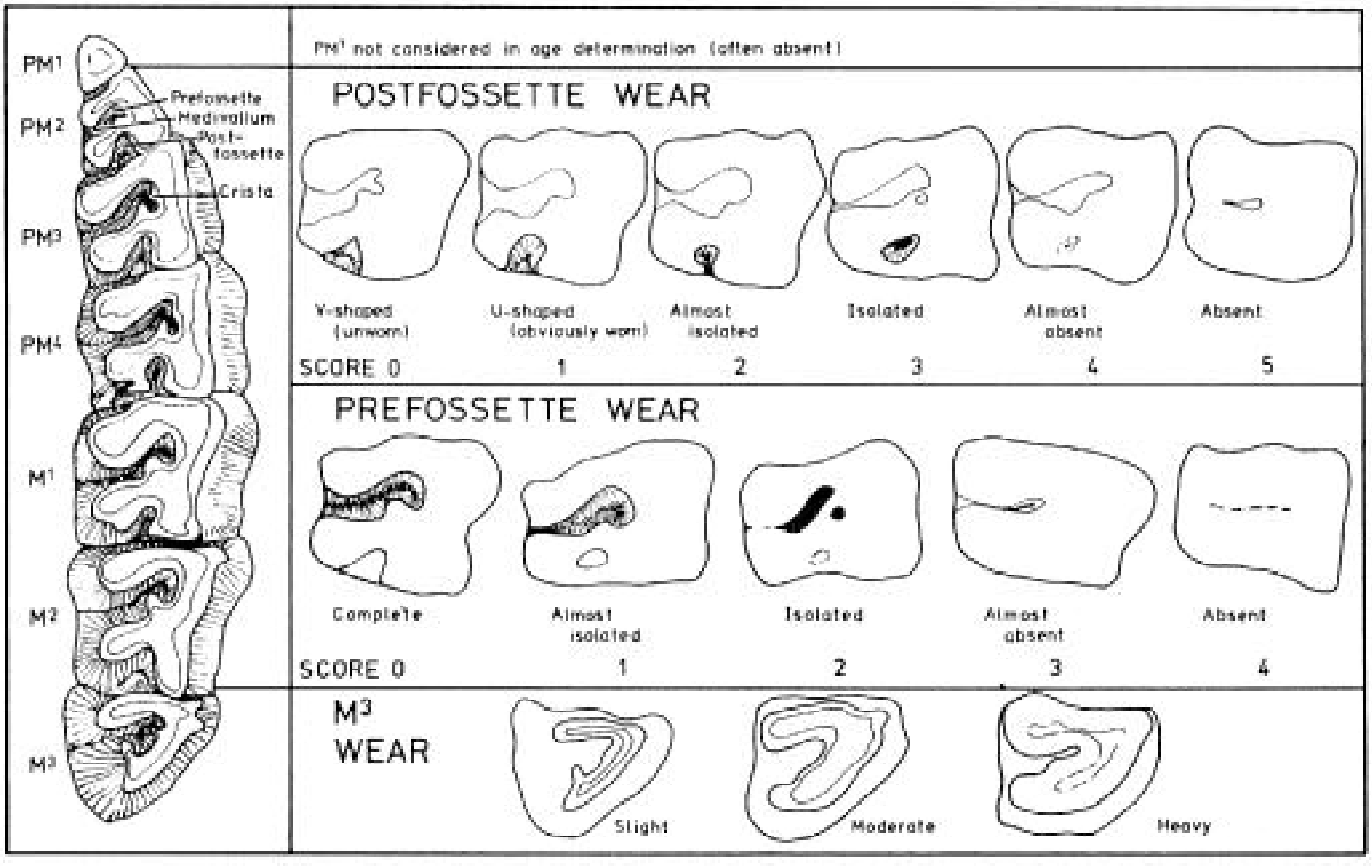

Figure 1. Stages of wear of maxillary teeth. For age determination, score wear of prefossette and postfossette of each tooth in row PM^{2}-M^{2} (either side) and add up scores to get tooth wear index, which can be related to approximate age in Figure 2.

same wear pattern as the other teeth, and the former is often missing anyway, so the wear of these teeth is not incorporated in the index). Hitchins' age classes, with the relevant ageing criteria and tooth wear indices for maxillary dentition, are presented in summarized form in Table 1.

Using Hitchins' information on chronological ages corresponding to different stages of tooth wear, the relationship between age and tooth wear index can be plotted (Figure 2). The relationship is not very precise because there is overlap in the ages Hitchins assigned to his different age classes, and because the tooth wear index for each age class has a range of values; nonetheless, it seems that the age of a skull can be determined to'±4 years from its maxillary tooth wear index. Fortuitously, between the ages of about 22-33 years, the tooth wear index has the same numerical value as the approximate age.

The rough relationship between age and tooth wear depicted in Figure 2 may not pertain to all rhino populations in Africa, since diets and consequently tooth wear will vary. If the tooth wear patterns of any known-age animals elsewhere in Africa can be studied, the relationship may then be replotted if necessary.

SEXUAL DIMORPHISM

Joubert (1970) found no evidence of sexual dimorphism in the skulls of black rhino in Namibia, and Foster (1965) was also unsuccessful in finding a criterion to determine the sex of rhino skulls at Tsavo, Kenya. Through their lack of reference to rhino sexual dimorphism, Groves (1967) and Goddard (1970) imply that this does not exist at a level that can be measured in skulls. Hence it is presumed that skulls do not necessarily have to be sexed in order for their measurements to be used as a basis for classifying rhino subspecies, but further information on sexual dimorphism is required.

Table 1. Summary of criteria outlined by Hitchins (1978) for age determination of black rhino in Zululand, showing derivation of tooth wear indices corresponding to Hitchins' age classes. (Criteria in brackets have been inferred from Hitchins outline)

HITCHINS' AGE CLASS	TOOTH	POSTFOSSETTE Wear	Score	PREFOSSETTE Wear	Score	OTHER FEATURES (Not scored)	TOOTH WEAR INDEX
x	PM2	U-shaped	1	(Complete)	0	Crista absent	
	PM3	U-shaped/almost isolated/isolated	1-3	(Complete)	0	Crista worn/absent	
6-12 yrs	PM4	v-shaped/U-shaped	0-1	(Complete)	0		2-5
	Ml	v-shaped	0	(Complete)	0	Crista absent	
	M2	v-shaped	0	(Complete)	0	Crista disappearing	
	M3					Erupting/not in wear	
XI	PM2	U-shaped/almost isolated	1-2	Almost Isolated	1		
	PM3	U-shaped/almost Isolated/isolated	1-2	(Complete)	0	Crista worn/absent	
7-13 yrs	PM4	V-shaped/U-shaped	0-1	(Complete)	0		4-8
	Ml	U-shaped	1	(Complete)	0		
	M2	V-shaped	0	(Complete)	0	Crista absent	
	M3					Sight wear	
XII	PM2	(U-shaped/almost isolated	1-2	(Almost isolated)	1		
	PM3	Almost Isolated/Isolated	2.3	(Complete)	0		
9-15 yrs	PM4	U-shaped	1	(Complete)	0	Crista absent	7-11
	M1	Almost isolated/isolated	2-3	(Complete)	0		
	M2	(V-shaped/U-shaped)	0-1	(Complete)	0		
	M3					Light to moderate wear	
XIII	PM2	Isolated	3	Almost Isolated/isolated	1-2		
	PM3	Almost isolated/isolated	2-3	Almost isolated/isolated	1-2		
13-19 yrs	PM4	Almost isolated/isolated	2-3	(Complete)	0		
	M1	(Almost isolated/isolated)	2-3	(Complete)	0		
	M2	V-Shaped/U-Shaped	0-1	(Complete)	0		
	M3					Moderate wear	11-17
XIV	PM2	(Isolated)	3	(Almost isolated/isolated)	1-2		
	PM3	(Isolated)	3	(Almost isolated/isolated	1-2		
18-24 yrs	PM4	isolated/almost absent/absent	3-5	(Complete/almost isolated)	0-1		
	M1	(Isolated/almost absent)	3-4	(Complete)	0		
	M2	U-shaped/almost isolated/isolated	1-3	(Complete)	0		
	M3					(Moderate to heavy wear)	15-23
XV	PM2	(Isolated/almost absent)	3-4	Isolated(/almost absent)	2-3		
	PM3	Isolated (/almost absent)	3-4	Isolated	2		
23-31 yrs	PM4	Isolated(/almost absent/absent)	3-5	Almost isolated	1	Medivallum disappearing	22-31
	M1	Absent	5	Almost Isolated	1		
	M2	U-shaped/almost isolated/isolated/ almost absent/absent	1-S 2-3	Almost isolated	1		
	M3					Heavy wear	
XVI	PM2	Absent	5	Absent	4	Medivallum absent	
	PM3	Absent	5	(isolated)	2	Medivallum absent	32-37
29-37 yrs	PM4	Absent	5	(Almost isolated/isolated)	1-2		
	M1	Absent	5	(Almost Isolated/isolated)	1-2		
	M2	Isolated/almost isolated/absent	3-5	(Almost isolated(/isolated)	1-2		
	M3					Heavy wear	
XVII	PM2	(Absent)	5	(Absent)	4		
	PM3	Absent	5	Isolated	2	Medivallum absent	
33-41 yrs	PM4	Absent	S	Isolated	2	Medivallum absent	39-41
	M1	Absent	5	Absent	4	Medivallum absent	
	M2	Absent	5	(Isolated/almost absent	2-3		
	M3					Heavy wear	

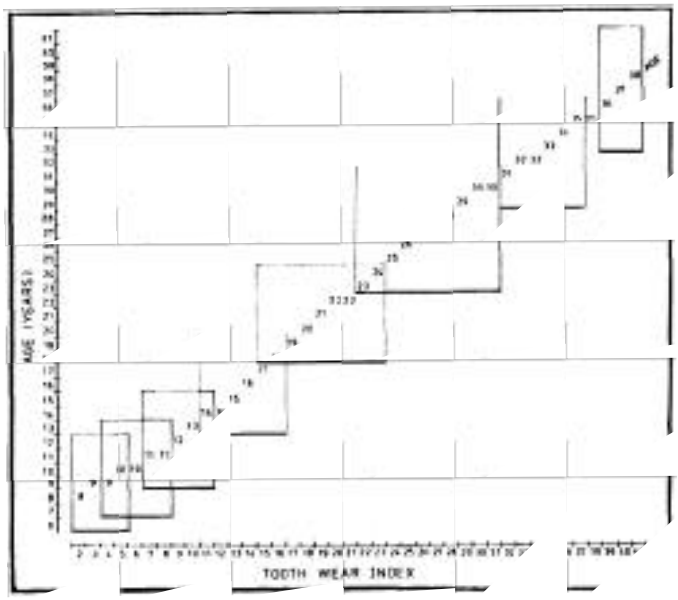

Figure 2. The relationship between tooth wear index and chronological age of Zululand black rhino. Squares represent Hitchins' (1978) age classes (vertical dimension) and corresponding values of the tooth wear Index (horizontal dimension). Having presumed that tooth wear is progressive, a line has been drawn through the centres of the squares and the ages along this line have been indicated, so that approximate age (±4 years) for a given tooth wear index can be ascertained.

SKULL MEASUREMENTS

Measurements should be in millimetres whenever possible; they can be made quite accurately with a steel tape and a couple of rulers, set-squares or straight planks.

Figure 3 shows the various measurements that are required. Most of these are standard for this type of work on skulls (e.g. von den Driesch, 1976), but since some slightly different measurement techniques may have been used by other researchers, additional measurements ("occipital depth"; "condyle depth") are included to cover all possibilities. Essential measurements are indicated with an asterisk.

***Toothrow Length** can be measured on either side (in the cranium, not the lower jaws) and is of six teeth only; it does not include the first premolar, which is often absent anyway. The measurement is from the anterior edge of the second premolar to the posterior edge of the last molar.

M^2 Height is from the anterior crest on the buccal (cheek) side of the second upper molar to the bone directly below; if a gumline is still visible on the tooth, a second measurement can be made from the crest to this line. These measurements are not absolutely essential but t would be useful to have these data to relate them to the tooth wear index.

*** Basilar Length** is the distance from the front lower border of the foramen magnum to the front edge of the premaxilla. If the premaxilla are missing (which has to be checked since these delicate bones do tend to break off) then the measurement should be to the most anterior points of the maxilla, with a note to this effect.

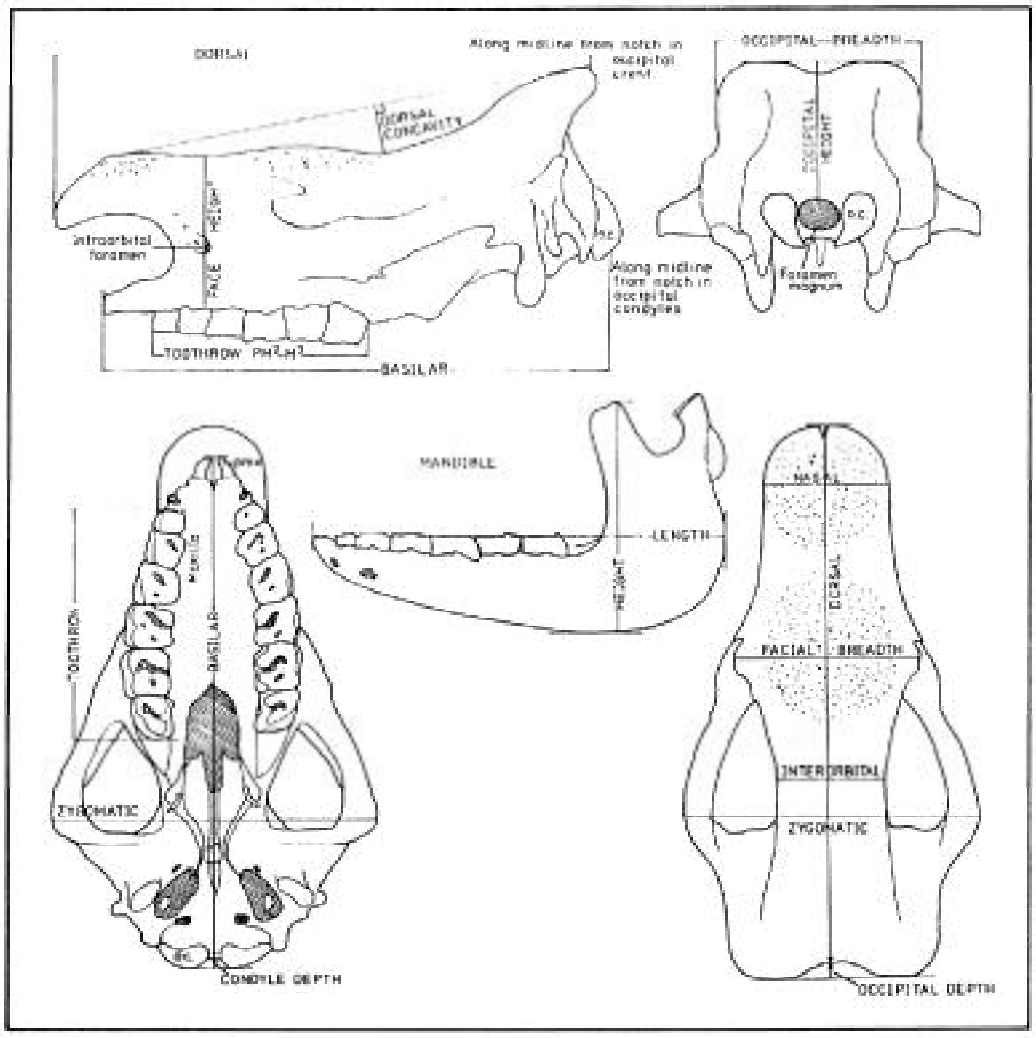

Figure 3. Required measurements of black rhino skulls. (see also Appendix 1).

Condyle Depth is the distance from the posterior edge of the occipital condyles to the front lower border of the foramen magnum.

*** Dorsal Length** is a midline measurement from the rim of the occipital crest to the front of the nasals. Sometimes there is a bump in the centre of the occipital crest, but the measurements should nonetheless be taken on the midline, including this bump.

Occipital Depth is the depression between the wings of the occipital crest, measured horizontally on the midline of the skull (i.e. an extension of the dorsal length).

*** Zygomatic Breadth** is the greatest width of the skull.

*** Interorbital Breadth** is the narrowest distance between the orbits.

Facial Breadth (anterior interorbital breadth) is the width across the roughened area that bears the posterior horn. This appears to be a particularly variable dimension, possibly with little statistical significance, because of the very irregular growth of bone on either side of the skull in this area.

*** Nasal Breadth** is the width across the roughened nasal boss that bears the anterior horn.

Face Height is measured from the rim of the tooth sockets perpendicularly across the infraorbital foramen to the upper surface of the nasals.

*** Dorsal Concavity** place a ruler or flat plank on top of the skull, along the midline, so that it rests on the nasal boss and the centre of the occipital crest. The maximum perpendicular distance between this plane and the concave surface of the cranium (between the orbits) is then measured.

*** Occipital Breadth** is the greatest breadth across the back of the braincase.

*** Occipital Height** is measured vertically on the midline from the dorsal edge of the foramen magnum to the highest part of the skull.

Mandible Height is the greatest height of the lower jaw.

Mandible Length is the greatest length of the lower jaw. (The absence of a lower jaw, and hence the impossibility of obtaining the mandible measurements, does not mean that a data sheet is not required for that skull; an incomplete set of data is better than none at all. Similarly, if skulls are damaged, those measurements that can be taken should still be recorded).

OTHER INFORMATION

It is or course important to state the source area of skulls as accurately as possible (preferably in coordinates of latitude and longitude). If the sex of the animal is known (not inferred from the skeletal material) then this should be noted so that the degree of sexual dimorphism can be examined. If the age of the animal at death is known (not inferred from the tooth wear or other such factors) then this should also be noted so that the method of age determination outlined in this paper can be tested.

Intraspecific genetic variation in black rhino may well be a clinal situation, related to fine adaptation of the animals to varying ecological conditions over their geographical range. Such slight ecological adaptations may not be reflected in the skull dimensions or even in any of the biochemical features that will be examined. However, it does seem reasonable to hypothesize that there may be a change in overall skull size, toothrow length or other morphological features, according to rainfall, altitude, vegetation, etc. (as with the African elephant). It is therefore desirable that some basic environmental information is collected to enable ecological classification of rhino populations and to see if habitat factors can in fact be related to subspecific taxonomy. If such information cannot be readily obtained when skulls are first measured, then this should not be allowed to delay the submission of the skull data sheets, since the information can be obtained later from reference works (provided locations can be identified).

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Black rhino, Ngorongoro, Tanzania. W. Dolder/WWF.

APPENDIX 1

AERSG INVESTIGATION OF BLACK RHINO TAXONOMY

RHINO SKULL MEASUREMENTS

* essential data No._____

*01 Measurements by _____ 02 Date _____

* 03 Collection _____(Collection Ref. No.) _____

* 04 From (locality) 05 Sex _____ 06 known age _____ * 07 M^3 wear SLIGHT/MODERATE/HEAVY

Tooth wear index	POSTFOSSETTE	PREFOSSETTE	
	PM^2 _____	_____	
	PM^3 _____	_____	
	PM^4 _____	_____	
	M^1 _____	_____	09 M^2 height (ant. buccal)
	M^2 _____	_____	to bone _____
			to gumline_____

08 Total index of wear _____

* 10 Toothrow length (PM^2-M^3) _____ 19 Face height _____

* 11 Basilar length _____ * 20 Dorsal concavity _____

12 Condyle depth _____ * 21 Occipital breadth _____

* 13 Dorsal length _____ * 22 Occipital height _____

14 Occipital depth _____ 23 Mandible height _____

* 15 Zygomatic breadth _____ 24 Mandible length_____

* 16 Interorbital breadth _____

17 Facial breadth _____

* 18 Nasal breadth _____

25 Altitude _____ 26 Mean annual rainfall _____

27 Habitat _____

28 Notes_____

_____

_____

The Rhinos of the Central African Republic

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Probably the least-known country in Africa today, with large areas of savanna woodland still unexplored, the Central African Republic has been thought, until recent times, to harbour the two genera of African rhinoceroses: **Ceratotherium simum cottoni,** the northern white rhino; **and Diceros bicornis longipes,** the West African black rhino. Despite the belief in the presence of the white rhino, few specimens are known to have been collected in the country, and records of its former occurence are rare.

In 1932, M. Lavauden, the French Conservator responsible for central and western Africa, summarised some of the information concerning the occurrence of the northern white rhino. This suggested that its range extended from just north of Lake Albert in Uganda, northwest along the border between the Sudan and the Central African Republic (formerly Oubangui-Chari), as far as Goz Beida in Tchad (Figure 1). In 1927, the French Commission SupÈrieur de la Chasse was informed that the white rhino no longer existed in French territories (but then, somewhat illogically, t was given absolute protection by a law dated 25 August 1929) (Lavauden, 1934).

However, in 1927 the British Sudan border post at DjÈnÈnÈ seized a larger number of white rhino horns alleged to have come from Tchad, which were probably the 150 which Guy Babault saw in Khartoum and which were reported as originating from Abecher (Lavauden, 1934).

Malbrant (1952) records seeing horns of this genus in the hands of merchants at Birao in 1933, and three years earlier apparently saw one on the Aouk to the north of Birao (Malbrant, 1930). Lavauden (1932) considered that there was no doubt that small numbers of white rhino existed at that time southeast of Abecher in the region of Goz Beida; further, a museum horn of this genus comes from east of Mangueigne in Tchad. Lavauden also supposed that the rhino to the northeast and east of Yalinga was the white, and in 1934 he noted a white rhino killed northwest of Zemio (Lavauden, 1934).

Lavauden's map has for long been taken as representing the distribution of the northern white rhino, but may not be entirely accurate. Shortly before his death in 1979, M. Etienne Cannone (a French hunter who went out to Tchad at the age of eighteen and is credited with killing over a hundred black rhino on the Aouk River) informed M. Lefol that he had also shot about a dozen white rhino in this region, on the Doseo, Mya and Keita tributaries, probably about 1936/7 (Lefol, pers .comm. 1985). This report extends the range of the white rhino 135 km further west than that indicated by Lavauden. Furthermore, if the pair of horns which Denham and Clapperton brought back from the southeast of Lake Tchad in 1824 (Malbrant, 1952; Bovill, 1966) are indeed those of a white rhino from Gaulfey (latitude 12˚ 25'N, longitude 1 4 50' E), then the range clearly extended even further west in this region. Denham recorded the white rhino to be'"by no means common here" (Bovill, 1966); but"it seems likely that these horns are those of the black rhino, the base being round.

Figure 1. The distribution of the northern white rhinoceros, after Lavauden (1932), with additions.

The former hunting inspector AndrÈ FÈlix is alleged to have shot a white rhino between 1920-36 near Badia, which is on the Sudanese border to the east of the park which bears his name. The reason why the rhino shot by Cannone and AndrÈ FÈlix are not on record is presumably because the animal was theoretically protected by law.

It seems to have been Blancou (1952) who originated the story of the possible survival of the white rhino in the Central African Republic. He thought that the last survivors in Tchad and the north of the Central African Republic had been shot about 1935, but that there was a faint chance a few might survive in the east, along the Sudanese frontier, from near the sources of the Kotto River southwards. Jeannin (1951) wrote that the Goz Sassoulko National Park "in Chad" harboured 80 white rhino. Although this area was originally a part of Tchad, at independence it became part of the Central African Republic; but the "park" was de-gazetted to a reserve in 1940, and in 1960 the greater part was entirely de-gazetted, leaving the western part of 3 300 km^2 as the Aouk-Aoukale Faunal Reserve. Blancou (1948) was convinced, however, that all rhino had been exterminated there before 1939, and that the species to the southeast and south of the region (where some did still exist in 1981) was the black rhino. Gromier (1941) wrote that he saw horns of the white variety from Birao in 1931, and that a few years before 1941 he had seen several from the Vakaga region. He considered the white rhino to be probably extinct, although there were reports at that time that it still existed at Lake Mamoun, and between the Ouandjia and Vakaga Rivers. The Hunting Inspector, who was known under the pen-name of Saint-Floris, aptly summed it all up by calling the white rhino "the Loch Ness monster of French Equatorial Africa" (Gromier, 1941).

But old stories die hard, and when I came to the Central African Republic in 1974 it was Still thought that the white rhino might exist in the Zemongo Faunal Reserve. Jan Rugsten claims to have made two sightings of white rhino, possibly both of the same animal, on the upper Ouarra River (Figure 2) in 1974 at about latitude 06˚ 10'N, longitude 26˚ 00'E (Rugsten, pers. comm.), but all other reports of rhino in this area have been of the black rhino. In view of the uncertainty, why should it be supposed that the animal might still exist in the Zemongo Reserve? The basic reason is that the wildlife resources of this 10 100 km^2 area (first gazetted as a hunting reserve in 1925 and Upgraded to a faunal reserve in 1940) have never been surveyed. The reserve remains today the least-known part of the Central African Republic; part of a vast, uninhabited wilderness extending along almost the entire border with the Sudan. In the latter part of the 19th century parts of this area were probably well-inhabited, until the dervishes from the Sudan descended the Vovodo River about 1883 to pillage the country.

Further pillaging probably took place about 1902 under the slave-raiding armies of Senoussi, who had his headquarters at NdÈIÈ (where one of his descendants occupied the position of sultan until 1985). In 1909-10, sleeping-sickness delivered the final, devastating blow, from which the area has never recovered.

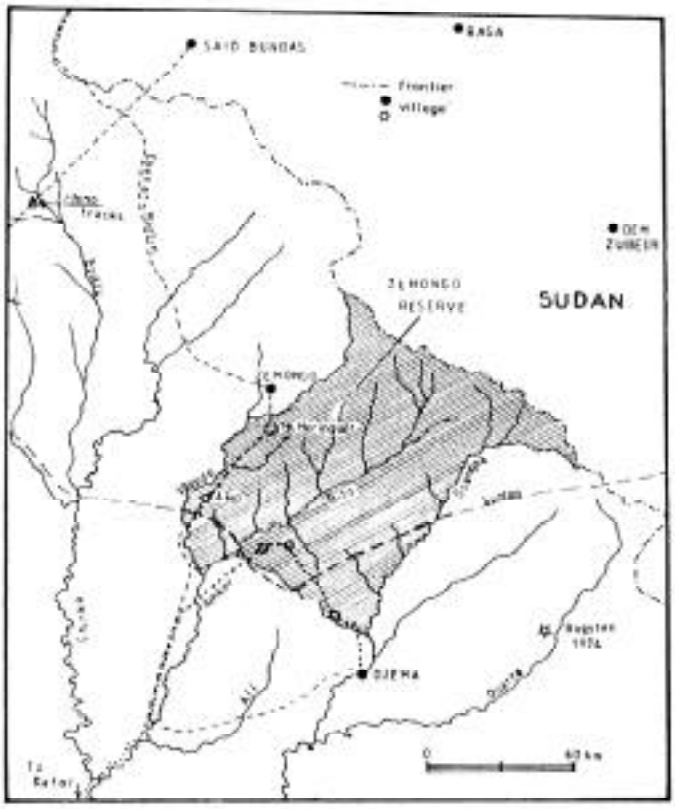

Figure 2. Movements of early visitors to the Zemongo Reserve. Lupton, c.1882; Junker, 1883; Ebener-Martin, 1909-10; and white rhino sighting of Rugsten, 1974.

The first European to visit the region appears to have been an Englishman, Frank Lupton (governor of the Bahr el Ghazal Province of the Sudan) in about 1882. But he only crossed the southwest extremity (Figure 2) as did the explorer Junker, in 1883. In 1909-10, a French military detachment explored part of the area. From the former village of Zemongo, one of the team, M. Ebener, crossed the Vovodo River which forms the western boundary of the present reserve, and followed the east bank from Mount Meringuet to the village of Ano **(=** Ango?); he then re-crossed the Vovodo and continued south. Ebener, in Martin (1913), records that there was a route from Rafai, along the Vovodo to Mount Meringuet, where it branched to Raga and Dem Zubeir. This was used mostly by Greek and Syrian ivory traders.

The only reference to rhino in this account concerns their presence on the banks of the Boulou River, about 120 km to the northwest of Zemongo (Martin, 1913). The next visit seems to have been that of the Anglo-French boundary survey at the beginning of 1922, which traced the northeast boundary. Grassard (1925), the French mission leader, reports that some rhino tracks were shown to the team, but they were rare. He does not say where this was along the border with Sudan, but mentions that the Karas knew certain points between Birao and NdÈIÈ where they were sure to find rhino. This is the area where the black rhino has been known to exist in recent times. Comyn (1911) reported the white rhino as "pretty numerous" in the Sudan, northeast of Raga and about 210 km from the Zemongo Reserve. Christie (1924) said that white rhino were numerous in 1916 on the Congo side of the Mbomou River, about 220 km south of the Zemongo Reserve.

Thus it was reasonable to suppose that, if the white rhino had survived, then might be in the vast, unknown Zemongo wilderness, which no European has yet traversed. One person is known to have ventured 30 km inside the reserve along the Bita River, and Rugsten (pers. comm.) went about a third of the way up this river in the 1 960's, hunting crocodiles; but these limited expeditions did not yield information on white rhino.

The picture has now changed in any case, for the search for ivory in the late 1970's and early 1980's has motivated large Sudanese gangs'— equipped with automatic weapons—— to penetrate the eastern part of the country with donkey and camel trains. These poachers may have covered the Zemongo area as well as they have covered the surrounding regions. Alternatively, since is such a large area, and much of it without water in the dry season, they may not have ventured too far from traditional routes.

About 1981 there was a report of a white rhino being seen near Golongosso in the north of the country, near the Aouk River, in an area which has been fairly intensively hunted in recent years and which is known to have contained black rhino (I saw rhino tracks there in 1976 but did not examine them closely). The report emanated from an American tourist-hunter and his Portuguese guide, both of whom had probably never seen a rhino before. Investigation showed the report to be unreliable, and there seems to be little doubt that they saw a black rhino. The tourist allegedly photographed it, but the photograph has never been produced.

The famous elephant hunter, Karamoja Bell, hunted this area along the Aouk about 1919 and reported rhino (among other species) as being numerous: ". . .I will ... merely remark on the extraordinary numbers of rhino we met.., on several occasions our boys got into trouble with them and they had to be shot in order to avoid accidents" (Bell, 1960). Since Bell was capable of identifying white rhino, and in his book specifically refers to seeing them in the Lado Enclave, he probably would have made it clear that the rhino along the Aouk were white if this was the case. We know from Cannone that some did exist there, but they seem to have been relatively uncommon and are only reported from the Tchadian side. Unfortunately, the recent report from Golongosso has found its way into the literature (Anon, 1983; Western and Vigne, 1984; 1985); it is certainly nonsense to suggest that there may be a "reasonable" population in this area, as the first of these references postulates. The last black rhino to the north of the Aouk River (near to the Bahr Tao, Keita and Midjik Rivers in Tchad) were seen by hunters in 1978; and Lefol (pers.comm.) records seeing the last tracks of one on the Golongosso side in 1983 (near Gaskay, 25 km south of Golongosso).

The black rhino once ranged westwards in Africa almost to the borders of Burkina Faso (formerly Upper Volta), about 75 km southeast of Niamey in Niger. Barth (1857-8) reported: "Here again the footprints of the elephant were extremely numerous; but by far more interesting, and of much higher importance to me, were the traces of the rhinoceros, an animal which at present seems to be wanting entirely in the regions between the Niger on the wet and the Shari towards the east." But today the black rhino is extinct west of Cameroun, and the last stronghold was, until 1961, the Central African Republic. Before this date, it seems to have been distributed thinly throughout the area of the Republic east of about 1 9 between latitudes 07 to about 10 in the east extending south to 06 (Figure 3). The highest density of black rhino in those areas which were explored .was in the Bamingui-Bangoran National Park (an area of 11 560 km^2 gazetted in 1933) and in a region of 1 400 km^2 immediately to the east. Although Corfield and Hamilton (1971) reported finding only some old tracks in the park, they spent but a brief time in the fringe areas; they did report the rhino as common in the 860 km^2 Vassako-Bolo Strict Nature Reserve (which is in the centre) although no reason is given for this. When I started studies in the Bamingui-Bangoran National Park in 1976, it soon became apparent to me, based upon experience that I had gained in the Kenya Aberdares and other rhino areas of East Africa, that rhino were

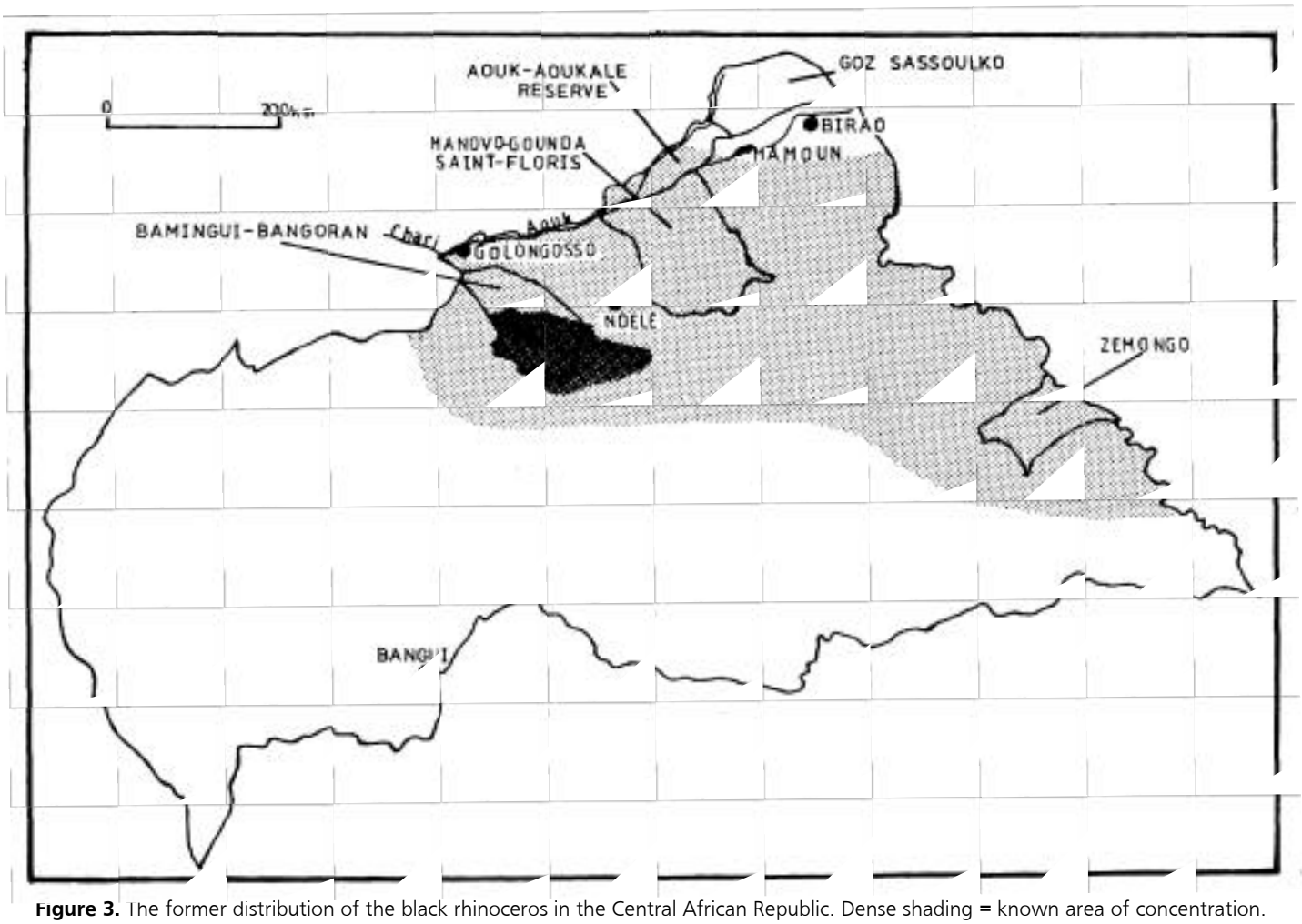

Figure 3. The former distribution of the black rhinoceros in the Central African Republic. Dense shading = known area of concentration.

reasonably abundant. There were snortings outside the tent at night, workers were tree'd, and a rhino came into the game

guard students' camp at night. Figure 4 shows plots of some of the fresh tracks and scrapes that I came across. Actual sightings were not common because of the nature of the sudano-guinean woodland, which makes it much more difficult to spot animals than is the case in the more open vegetation of eastern Africa. In other parts of the country, where the signs were much rarer, one must presume that there must still have been a sufficient density of black rhino to permit breeding contacts to take place (unless, of course, the rhino were already dying out).

Air surveys of the Bamingui-Bangoran Park, conducted by FAO in August 1977, reported a calculated total of 170+/- 70 (Spinage et al., 1977); but in view of the relatively dense vegetation and the fact that the survey was flown with a low-wing aircraft at 200 kph, I consider, from my ground contacts, that the real total was probably closer to 600 (a density of 0.05 rhino km^2). Subsequent counts conducted in the area to the east of the park, where the density was thought to be high, suggested a population of 60+/-20 (IUCN, 1981), or a density of 0.04 rhino km2. To this we must add the fact that the rhino occurred at a lesser density over some 170 000 km^2; so assuming this density to be, say, one quarter of that in the centre of concentration (equivalent to 150 in the park), we arrive at a possible total of 2 125 for the rest of the country. Adding to this those in the park and the adjacent area, and rounding off, I suggested that there might be 3 000 in the whole country in 1981. Subsequent studies in the Manovo-Gounda-Saint Floris area to the north of the Bamingui-Bangoran area revealed a much higher density than had been supposed: about 0.03 rhino km 2 in the 770 km^2 study area (Hulberg and Carroll, 1982). Thus I am reasonably confident of my somewhat tenuous extrapolation, considering that the vast area concerned was for the most part almost completely unknown bio-

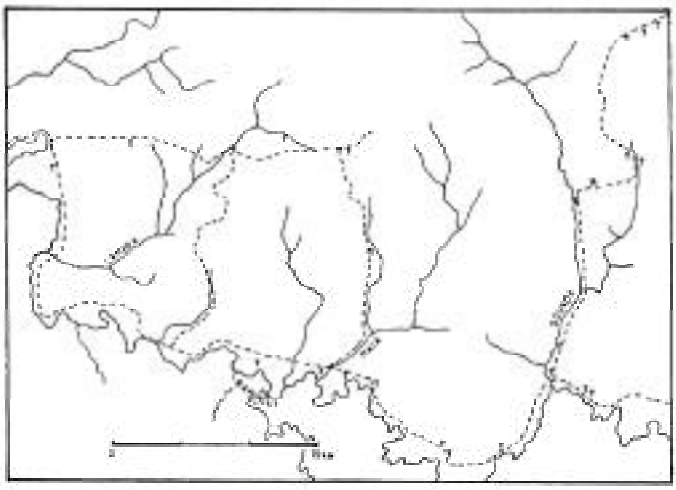

Figure 4. Some fresh rhino tracks and scrapes seen in the Bamingui-Bangoran National Park, 1980-81. T = track or scrape; R= 2 rhinos sighted; D = dead rhino (young one died in mud in dry season).

logically. However an alternative total of 440 has been proposed (IUCN, 1981) based upon a 1953 guess of 400 (Sidney, 1965), when the country was even less known that it is today. Whatever the true total may have been, it has undoubtedly been greatly reduced since the beginning of 1982.

During an air survey conducted in May-June 1985 by FAO/IUCN, no rhino were seen from the air, despite an intensive survey at 15% coverage of the former high-concentration area to the east of the Bamingui-Bangoran Park. Tracks seen at the beginning of 1985 show that the odd animal still exists in the southeast of the Manovo-Gounda-Saint Floris Park, and in the hunting sector near Ouanda DjallÈ, and rhino probably still exist in the Bamingui-Bangoran area. But it is feared that the species will become extinct in the Central African Republic in 1986, as the intensity of poaching by Sudanese horsemen, primarily in search of ivory, is at a level that can only be termed anarchic.

I have recently (1985) had the opportunity to measure the skulls of three adult black rhino from Bamingui and one from the Manovo-Gounda-Saint Floris region; and found the measurements to be closer to those of the Sudan race **D.b. brucii**, than they are to **D.b. longipes**. Thus it appears that the principal race in the Central African Republic may have been the now very rare **D.b. brucii**, and not **D.b. longipes** as Groves (1967) supposed; the Chari-Logone rivers forming the dividing line between the eastern and western races, it is hoped that a more extensive sample of skulls can he measured to verify this.

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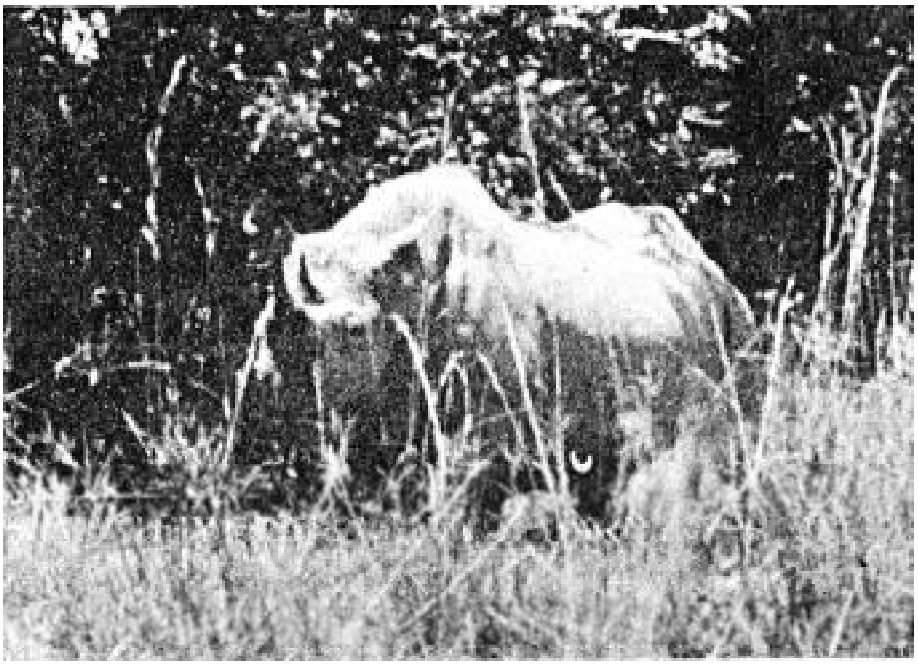

Rhino in the Bamingui-Bangoran National Park.

The Unsuccessful Introduction of White Rhinoceros to Matusadona National Park, Kariba.

R.D. Taylor
Matusadona National Park, P. Bag 2003, Kariba, Zimbabwe

INTRODUCTION

The plight of the rhinoceros, both white and black, throughout Africa, is widely known and well documented. Although the conservation status of the southern white rhino (**Ceratotherium simum simum**) is relatively secure, especially in South Africa, in Zimbabwe a small national population of approximately 200 animals requires building up. Apart from Parks and Wild Life land in the Zambezi Valley and the Sebungwe region, there is little habitat elsewhere in Zimbabwe in which to increase the distribution and population size of the species.

There is no clear evidence, as yet, that the white rhinoceros was historically widespread in the Zambezi Valley. However, it is possible that this was so during the previous century and before, particularly above the Zambezi escarpment. Selous (1881), Coryndon (1894) and others record that white rhinoceros were common in Mashonaland up until 1890, and the more recent researches of Roth (1967) and Tomlinson (1977) indicate that the species was previously widespread in the country as a whole. The Zimbabwe Department of National Parks and Wild Life Management supports the re-introduction of species previously known to have occurred in a particular locality, and wherever possible this is encouraged. Indeed, the country's present population of white rhinoceros has been built up since 1962 through introductions from Zululand, following the depletion of the indigenous population shortly after the turn of the century (Davison and Condy, 1963; Tomlinson, 1977).

A major risk to introducing white rhino to the Zambezi Valley and the northern Sebungwe was the possibility of trypanosomiasis infection. An experimental introduction was, therefore, a necessary prelude to any long-term or large-scale introductions. Because Matusadona is well protected, accessible and infested with tsetse fly, this Park was chosen for an initial introduction. White rhino for translocation became available during the widespread drought which ravaged much of the country between 1982 and 1984 (Pitman, 1983). Regrettably the experimental introduction was not conducted as planned and I report here the failure of the exercise.

Figure 1. Translocation of white rhinoceros in Zimbabwe from Mushandike Sanctuary and Doddieburn Ranch to Matusadona National Park during 1983.

TRANSLOCATION AND RELEASE

During the latter half of November 1983, two white rhino (one male, one female) were captured at Mushandike Sanctuary near Masvingo and translocated to Matusadona. A further three rhinos (one male and two females) were transferred from Hwange National Park where they had been held since August following their capture on Doddieburn Ranch near West Nicholson (Figure 1). All five rhino travelled in standard rhino translocation crates on trucks and trailers.

At Matusadona, the rhino were unloaded into a holding boma consisting of three pens with water and shade. The boma was constructed on open grassland on the Kariba lakeshore near Tashinga, the Park headquarters (Figure 2). Animals were fed and watered daily, fodder being freshly-cut

Panicum repens grass. All rhino settled into the pens fairly readily, especially the three Doddieburn rhino which had become well accustomed to pen life at Hwange.

The two Mushandike rhino were released from the holding boma six days after arrival at Matusadona. The three remaining rhino were held for only two days in the boma before their release as they had been penned for nearly three months already. All five animals left the boma site in different directions, with little fuss or difficulty.

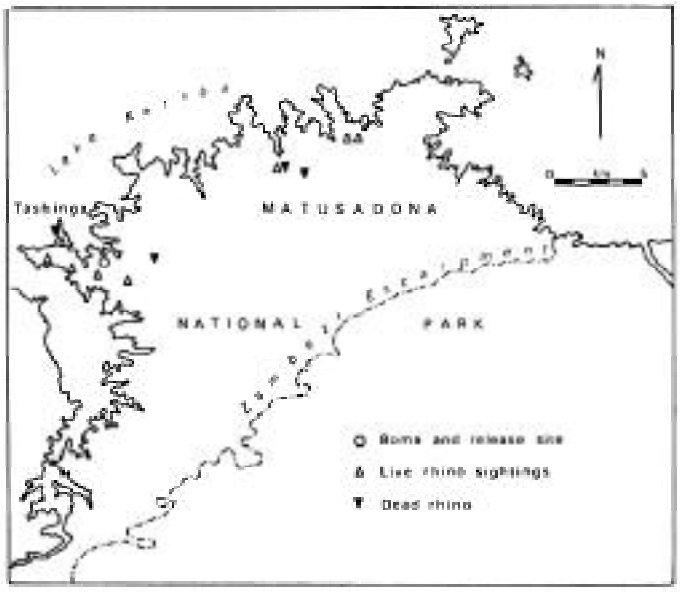

Figure 2. The area of Matusadona National Park below the Zambezi Escarpment into which white rhinoceros were released.

SUBSEQUENT LIVE SIGHTINGS AND MORTALITIES

By the end of November all five rhino had been released and regular sightings were being made in the vicinity of the release site. The first rhino to die was a Doddieburn female who died stuck in mud on the lakeshore. This accidental death gave immediate cause for concern lest a similar fate befall the others. An intensive air search located three of the four remaining rhino all within close proximity of Tashinga. Subsequent sightings indicated that the rhino were beginning to move further afield, as much as 15 km away (Figure 2). Commencement of the rainy season restricted coverage of the Park by staff so that sightings became infrequent.

On 4 February 1984, a female white rhino was seen alive near the Jenje River, but was found dead 36 hours later on 6 February, in almost the same locality. Apart from a prolonged urination, there had been no obvious symptoms of illness when the animal was initially observed on 4 February. The already advanced state of decay prevented the collection of blood or tissue material for pathological examination.

Fears of disease threatening the remaining three animals prompted a search and rescue operation which was mounted over the following four days. Intensive air and ground searches failed to locate any of the rhino. Although the aerial search was abandoned, ground patrols located a further two dead rhino on 17 and 21 February. Both animals had been dead approximately 14 and 10 days respectively, indicating that all three rhino died within days of each other. Although the fifth rhino was never found, it was concluded that the animal had succumbed in similar manner.

PROBABLE CAUSE OF DEATH

Circumstantial evidence led to the strong possibility of trypanosomiasis infection for the following reasons (C.M. Foggin, pers.comm.).

(i) Matusadona National Park is in a tsetse fly (**Glossina** spp.) infested region. All white rhino in Zimbabwe have hitherto been located in fly-free areas.

(ii) All white rhino in Zimbabwe are ex-Zululand stock which has not been exposed to tsetse fly since 1948. Therefore their tolerance to trypanosomiasis could be expected to be low or absent.

(iii) In East Africa, black rhinoceros (Diceros bicornis) tend to be infected with trypanosomes but which only become pathogenic when the animal is stressed (Harthoorn, 1973; Clausen, 1981). Harthoorn (1973) states that black rhino may die of acute trypanosomiasis several days after capture unless treated. Although Berenil (Bayer) (diminazene aceturate) can prevent the stress-induced formation of the disease, Clausen (1981) found that Berenil did not effect complete elimination of the trypanosomes and that, in spite of treatment, one rhinoceros in his study sample died of trypanosomiasis.

This East African problem has not, apparently, been experienced in Zimbabwe and remains somewhat anomalous in the context of black rhino capture in this country. However, in a telephone conversation with Dr. C.M. Foggin, the veterinary pathologist who assisted with the Matusadona problem, Dr. A.M. Harthoorn suggested that white rhino would probably be equally susceptible to trypanosomiasis, especially with no previous exposure.

(iv) The three deaths occurred within a relatively short period, some 2-3 months after the rhinos' release and at much the same time. There was no evidence to indicate that internal parasites or malnutrition were responsible. It seems, therefore, that all three animals could have been exposed to an infectious agent at about the same time and died after incubation and morbid periods of similar duration. This fits the theory that trypanosomiasis could have been responsible.

LESSONS FOR THE FUTURE

In any future such exercises, much more attention should be paid to monitoring the progress of translocated animals than was the case in the Matusadona exercise, especially when being moved into tsetse fly infested areas. Previous releases of white rhino have all been into tsetse tree areas. The following points especially need to be taken into consideration.

(i) A longer holding period is required prior to release. There are numerous records of the disappearance and subsequent death of a number of wild animals following immediate release into new areas. More importantly in the case of white rhino, monitoring any tsetse fly/trypanosomiasis challenge would necessitate keeping animals confined for an extended period.

(ii) Holding pens should be sited in an area where tsetse fly are present, but where the challenge is low, at least initially. In the Matusadona exercise, the pens were situated on open lakeshore grassland where tsetse fly were unlikely. The animals would have encountered tsetse fly only once released, when they moved into the adjacent woodlands.

(iii) Blood smears should be taken as frequently as is practicable which would require a certain level of pen training. Otherwise the rhino would have to be subjected to further chemical or physical restraint before treatment can be effected if illness occurs.

(iv) Chemotherapy with Berenil should be instituted once trypanosomes are found in any quantity and the animal shows clinical symptoms of disease.

(v) An initial single prophylactic treatment with Samorin just prior to translocation may also be of value. It could then be established whether the drug both protects the rhino and allows it to develop the necessary tolerance to the disease. Confinement and observation would then have to be at least 6 months.

(vi) Some form of marking or tagging animals is necessary so that the rhino can be monitored subsequent to their release and more readily located if need be.

(vii) Finally, the ecological suitability of an area to new introductions should he examined critically. In the case of white rhino introductions into the Zambezi Valley, there is perhaps a need to re-examine very carefully the historical record as to the presence or absence of white rhino in the area. The species may well have been an infrequent visitor on the very edge of its range.

The advice and assistance of Dr. C.M. Foggin, Veterinary Research Laboratory, Harare, in the compilation of this report, is greatly appreciated.

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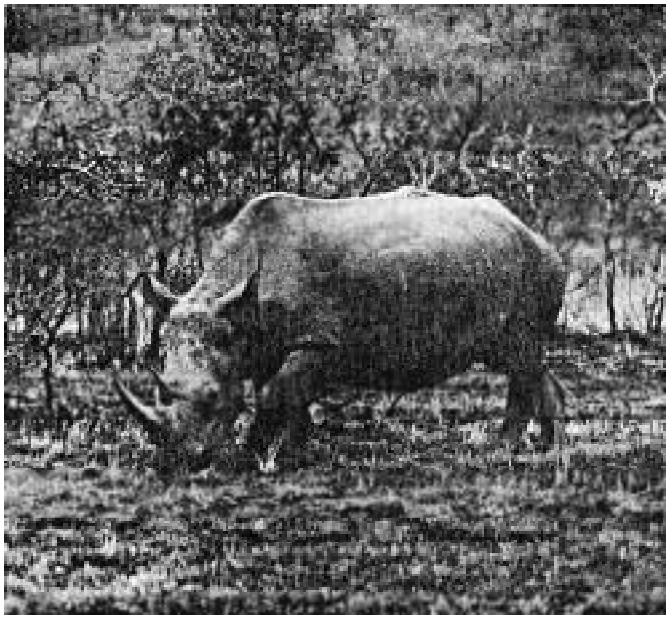

Southern white rhino. F. Vollmar/WWF

Analysis of Tusks from the Central African Republic

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The study of elephant tusks in the ivory trade can provide information useful in the evaluation of the status of exploited populations (Pilgram and Western, 1983; 1984). Members of a WWF/I UCN survey team in the Central African Republic (CAR) were recently given the opportunity to examine tusks which had been recovered from a poaching camp in the Gounda-St. Floris National Park by government security forces. The data obtained have been analysed to obtain an indication of the pattern of elephant mortality in an area where high levels of poaching have recently been reported.

Weight, lip circumference and length were recorded for each unbroken tusk (of which there were 191). These tusks were sexed from the relationship between length and lip circumference, female tusks tending to be slimmer for any given length. Plotting length against lip circumference permits a visual separation between male and female tusks to be made (Laws, 1969). This separation is obvious for mature animals, less so for the relatively small tusks which dominated the CAR sample. Thirteen tusks with a lip circumference exceeding 29cm were all assumed to be from male elephants.

The sample tusks had the following general features.

	Max.	Min.	Average
Length (cm)	155.0	33.0	90.1
Lip circumference (cm)	36.0	11.0	19.0
Weight (kg)	11.5	0.3	3.4

Ages for the CAR sample were calculated separately from weight and lip circumference, following the methods of Pllgram and Western (1983). Each tusk was allocated to a five-year age class, giving the following sample age distributions.

	Method of Ageing							
Age Range (yrs)	weight				Lip circumference			
	Male		Female		Male		Female	
	No.	%	No.	%	No.	%	No.	%
0- 5	8	7.3	–	–	12	10.9	–	–
5-10	46	41.7	3	3.7	58	52.7	11	13.6
10-15	40	36.4	13	16.0	23	20.9	23	28.4
15-20	8	7.3	24	29.6	7	6.4	28	34.5
20- 25	8	7.3	28	34.7	8	7.3	16	19.8
25- 30	–	–	13	16.0	2	1.8	3	3.7
Total	110	100.0	81	100.0	110	100.0	81	100.0

Pilgram and Western (1984) simulated the mortality patterns which would result from a variety of hunting techniques and intensities. The mortality pattern indicated by the CAR sample (based upon tusk weight) and the two simulations to which it appears most similar are shown in Figure 1. These simulations represent selective hunting, i.e., a preference for large tusks and therefore males among animals of similar age. The shape of the CAR frequency distribution curve corresponds reasonably well to the two selective hunting re-

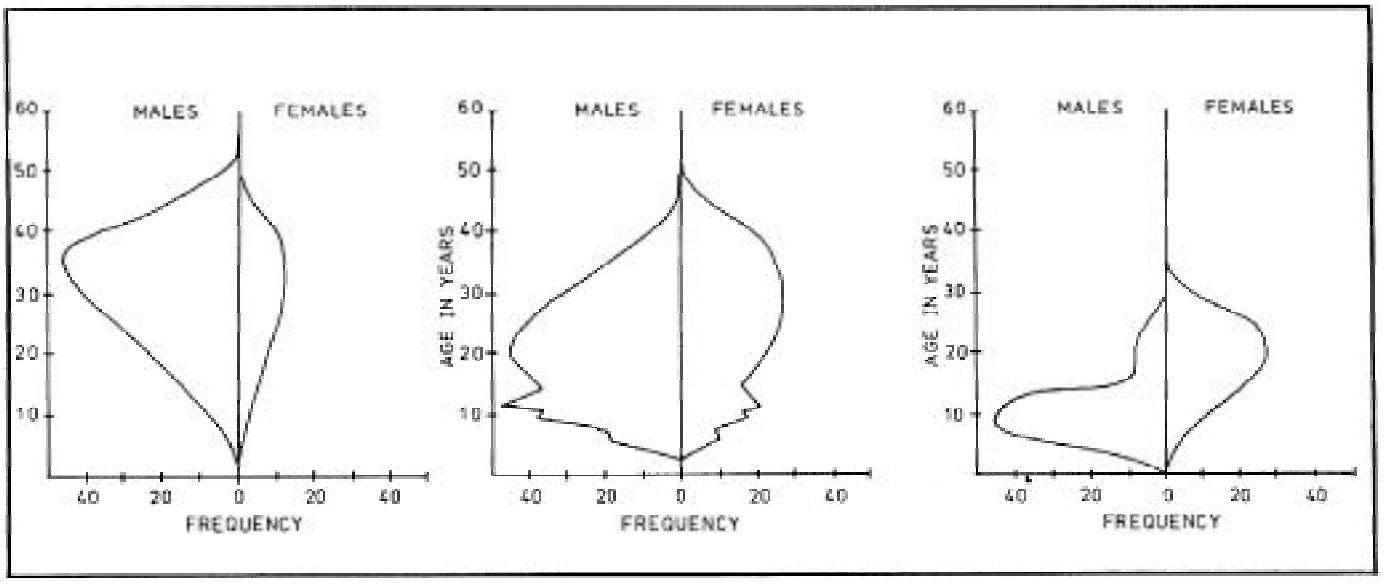

Figure 1. Mortality patterns represented by tusks. Left to right: selective hunting from a mature population; selective hunting from a young population (Pilgram and Western, 1984); empirical results for the Central African Republic sample. The frequencies are adjusted to be on similar scales.

gimes. The peaks occur at younger ages, however, suggesting selective hunting of a very young population. No tusks belong to an animal over the age of 35 and a large proportion of animals, particularly males, appear to have died before reaching sexual maturity, it seems highly unlikely that the mortality pattern indicated by these results would be sustainable for very long.

The method used to age this sample of tusks was developed from an examination of ivory collected in East Africa. The extent of variations in the relationship between tusk dimensions and age in different elephant populations have not been quantified. It is conceivable that elephants found in the CAR may be consistently younger or older for given tusk dimensions than their East African relatives, possibly older if they are forest elephants (**Africana loxodonta cyclotis**). Remarkably different parameters would be required, however, in order to suggest that anything other than very young elephants have been sampled in this case.

The WWF/IUCN aerial survey found a massive decline of elephants in this region and evidence of high recent mortality (Douglas-Hamilton **et al.,** 1985), results which are consistent with the mortality pattern derived from the tusk sample. In the absence of census data, the analysis of tusks in the ivory trade is clearly a powerful tool available to those concerned with elephant conservation.

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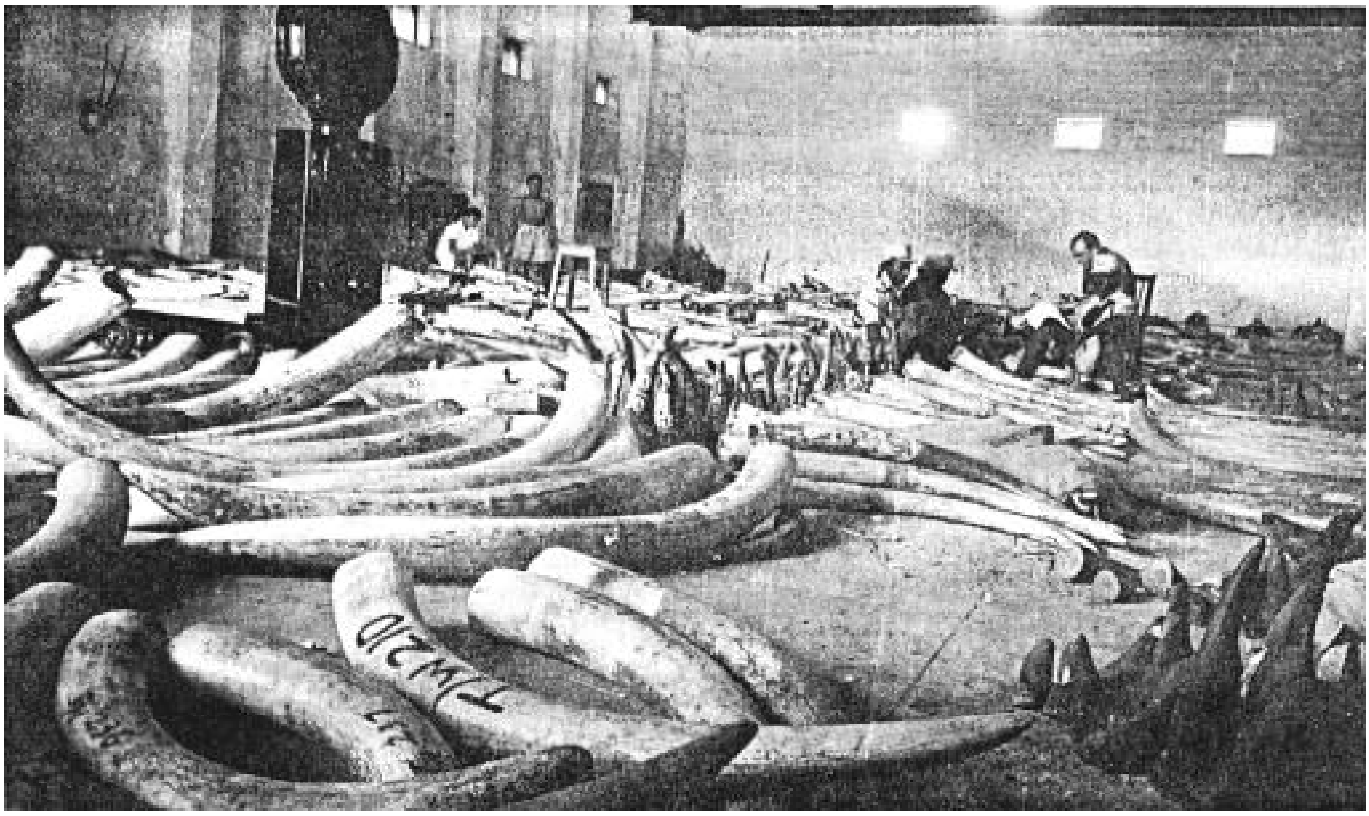

The Ivory Room, Mombasa, in past days. P.R.O. Bally/WWF.

GARAMBA RHINO

The status of northern white rhino in Garamba National Park, Zaire, appears to have remained stable during 1985. A total of about 13 individuals were seen regularly, of which there were 4 adult males, 4-5 adult females, 3 sub-adults and 2 infants. Despite the two births during the year, the total number remained the same as in 1984, with a couple of adults that were previously thought to be present either disappearing or being confused with the others. There was no evidence of recent rhino poaching within the park.

AERSG ANNUAL MEETING, 1986

Plans for the 1986 annual meeting of the Group are that it will be held from 14-18 July, 1986, probably in the Luangwa Valley, Zambia. Members will be informed of final arrangements as soon as possible.

1986 IVORY EXPORT QUOTAS

According to the CITES procedures that have been agreed upon by Party-states, the CITES Secretariat in Switzerland is to be notified annually by each African country having an elephant population of the number of tusks that are likely to be exported, legally, from that country. This "quota" document is required to be submitted by 1 December of the year prior to that to which the quota applies. Those countries not submitting a quota figure will be presumed to have a zero quota (i.e. no intention of exporting tusks) until the Secretariat is informed otherwise. Party-states with elephant populations but not expecting to export tusks are supposed to submit a zero quota to the Secretariat by the same date in order to clarify their intentions.

These measures have not been designed to give the Secretariat a regulatory function, but rather to provide a means by which the trade in raw ivory can be closely monitored. A referral mechanism is meant to operate whereby an exporting country provides both the importing country and the CITES Secretariat with specific details of a shipment of ivory, and the importing country checks that any documentation is authentic, by consulting either the relevant authority in the exporting country or the Secretariat. Illegal shipments of raw ivory (i.e. shipments made without the authority of a producing or re-exporting country) can thus be detected and brought to the attention of both exporting and importing states.

By the end of January, 1986, the CITES Secretariat had received the following quotas from African countries (CITES, 1986).

	NO. OF TUSKS
Botswana	520
Cameroon	300
Central African Republic	0
Congo	1 200
Ghana	0
Mauritania	0
South Africa	12 100
Sudan	12 971
United Republic of Tanzania	16 400
Zambia	5 800
Zimbabwe	14 000
Total	63 291

In the case of several countries (e.g. Cameroon and South Africa), the figures include substantial quantities of tusks that are already held in government or commercial stores.

In 1984 the mean weight per tusk imported into Japan and Hong Kong was 6.7 kg (CaIdwell and Barzdo, 1985); assuming the same mean weight would apply to the tusks that are to be exported during 1986, the total maximum quantity of ivory that will be entering the international trade legally from the countries that have thus far submitted quotas is 424 tonnes. Estimates for ivory exports from Africa in previous years were up to 644 tonnes in 1983 and 410-450 tonnes in 1984 (CaIdwell and Barzdo, 1985).

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Since the above was written, the CITES Secretariat has received a further four ivory export quotas: Mocambique (120 tusks), Niger (nil), Zaire (10 000 tusks), and Somalia (17 002 tusks — total current stock, to be sold and exported by the end of April, 1986).

RHINO POACHING IN ZIMBABWE

Since the last report in Pachyderm (No.5) on rhino poaching in the Zambezi Valley, there have been continued incursions of Zambian poachers into the Zimbabwean side of the valley, and some successes in the struggle to contain their activities. During 1985, a total of 71 rhino, and 23 elephant, were known to have been killed by well-armed gangs crossing the Zambezi.

Two poachers were shot by Zimbabwean patrols during the year, and eight captured; three of the major poachers in one gang were convicted of killing six rhino and were each sentenced to 11 years in jail, plus being collectively required to pay Z$ 30 000 in compensation for the rhino that they had killed.

During 1985, the Zimbabwean Ministry of Natural Resources and Tourism announced its intention of recruiting an additional 500 game scouts, of which the first 100 (who are ex-combatants) have now been trained and deployed. Conservation bodies within Zimbabwe launched a fund-raising campaign, and in December equipment worth Z$2 7 000 was handed to the Department of National Parks and Wild Life Management to assist in the anti-poaching campaign. SAVE, of the United States, have arranged recent donations of radio equipment worth over US$22 000; an aircraft previously presented to the Zimbabwean wildlife authorities by this organisation is also playing a vital role in the campaign.

Once the rainy season commenced in the Zambezi Valley, the poachers took advantage of the lack of safari hunters and tourists, and the denser vegetation cover, to cross into Zimbabwe frequently along a 450 km front extending from the Luangwa/Zambezi confluence in the east to wildlife areas bordering Lake Kariba in the west. In the first two months of 1986, they are known to have killed at least six rhino and an elephant. However, they have suffered heavy losses, with nine poachers being killed and four being arrested in a series of engagements during this period. The gangs are operating in numbers of 2-4, equipped with both .375 hunting rifles (of recent manufacture) and AK47 automatic assault rifles, the latter being carried for use against the Zimbabwean patrols. Since early 1985,12 hunting rifles have been captured from the poachers.

Since these poachers were all Zambian citizens, there have been diplomatic repercussions, with strong condemnation in the Zambian Parliament for what is regarded as excessive reaction by the Zimbabwean anti-poaching forces. However, President Kaunda of Zambia has stated that he cannot criticize the Zimbabwean Government, "since poaching. whether committed in Zambia or elsewhere, is wrong". The Zimbabwean media have given maximum publicity to the events, with a firm anti-poaching stance.

The Zimbabwean Minister of Natural Resources and Tourism, Mrs. Victoria Chitepo, has stated that the rhino poaching will be resisted to the fullest extent. In November, 1985, she introduced a new clause in the Parks and Wild Life Amendment Bill, specifying mandatory sentences of five years in jail or a fine of Z$1 5 000 for first offenders convicted of killing rhino and other protected animals, and seven years or Z$35 000 for second offenders.

The aim of **Pachyderm**, the AERSG Newsletter, is to offer members of the group, and those who share its concerns, brief research papers, news items and opinions on issues directly related to the conservation and management of elephant and rhino in Africa. All readers are invited to submit articles (up to 3 000 words), black and white photographs and graphics for publication; articles may be edited. Material published in **Pachyderm** does not necessarily reflect the views of AERSG, SSC, IUCN or any organisation supporting AERSG.

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