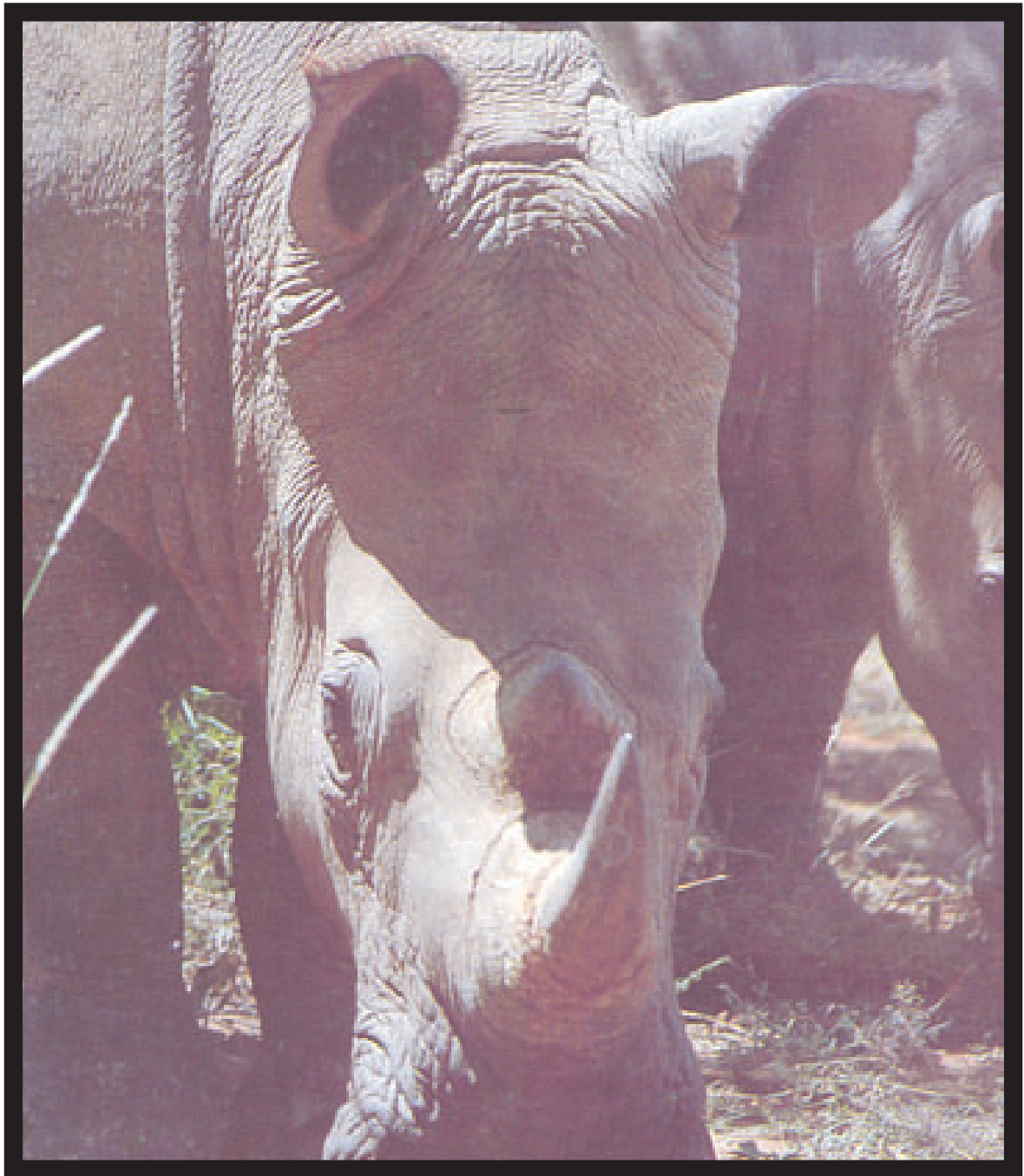


Pachyderm

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1990

NUMBER 13



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AND NATURAL RESOURCES
SPECIES SURVIVAL COMMISSION



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A notice to contributors

Pachyderm is a biannual publication of the African Elephant and Rhino Specialist Group (AERSG), one of the specialist groups of the Species Survival Commission (SSC) of IUCN. *Pachyderm* offers information, news and opinions about issues related to conservation and management of elephants and rhinos with especial reference to Africa.

We welcome articles written in a popular style and research papers. Contributions, which should normally be no longer than 2,000 words, are acceptable either on disk, in any usual format, or as manuscripts, which should be double spaced with a wide left-hand margin. References should only be for verification. Illustrative materials such as graphs, maps, black and white photographs must be included and should be kept simple in order to make the message clear. The deadline for articles for inclusion in the next issue is 15 October 1990.

Contributions do not reflect the views of AERSG, SSC or IUCN.

C.G. Gakahu
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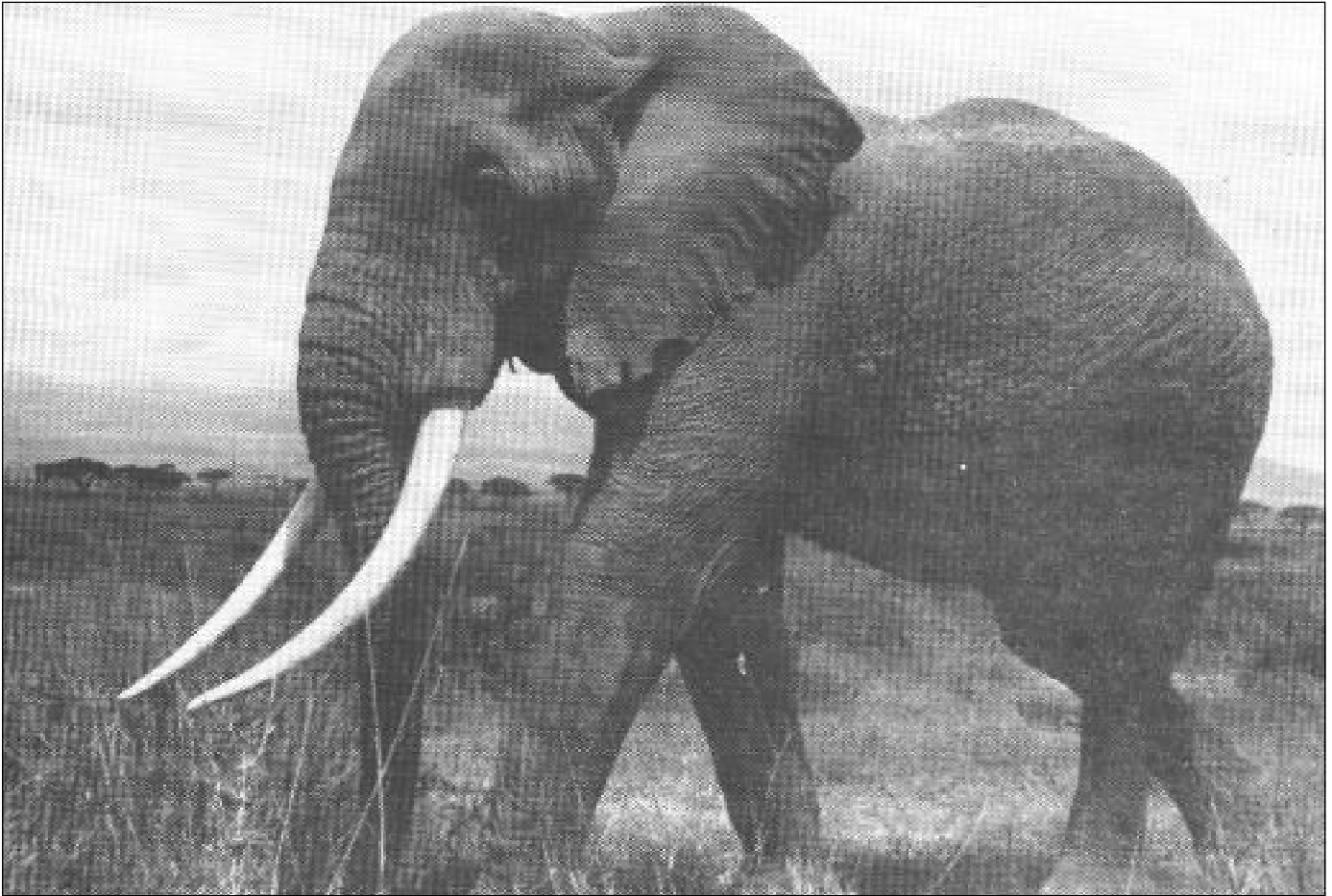
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Is the Tide Turning for Elephants and Rhinos?

David Western

The debate between those who favour banning and those who prefer controlling the ivory trade came to a resolution of sorts at the Lausanne meeting of CITES in October, 1989: elephants were listed on Appendix I of the convention. The upgrading of the African elephant to endangered species status and the prohibition of commercial trade in ivory was heralded as a victory by the abolitionists. The reality was a contorted compromise that could enable the trade to resume within months, if the spirit of the watered-down Appendix I legislation is honoured.

The rowdy meeting in Botswana in July, 1989, ended with a resolution to deploy a special envoy to find common African ground. The mission never had a chance. The two factions held firm to their convictions. A heated press war did little to help. To the contrary, it widened the gulf and polarized international opinions over the economic uses of elephants. The irony was that African countries were not arguing over utilization which most accept and practise. The issue was, quite specifically, whether the ivory trade was sustainable. Zimbabwe championed the case for continued trade by comparing its growing herd under utilization practices with East Africa's slumping populations under protectionist policies. Other African countries were convinced that continued ivory exports from the south would encourage illegal trade and push their remnant herds to extinction.

The lines were drawn too simply. The future of the African elephant hinges not only upon whether the global ivory market can be regulated within sustainable levels, or whether Africa can muster the means to protect elephants, but upon both. The reality is that the global nature of the ivory market makes it impossible to isolate elephants in one country from the effects of trade in another.

At that time, the African Elephant and Rhino Specialist Group (AERSG) had not produced a unified ivory trade policy. In July, 1989, I asked each of the three regions to draw up a statement on the ivory trade as a prelude to a continental declaration. The chances of any unified position were slim, given the highly polarized and emotionally charged regional views. But the faltering efforts of the African Elephant Working Group (AEWG) and the prospect of a debacle at the Lausanne meeting called for an effort to find common ground.

I must interject a personal view at this point. Most of us commit time and effort to AERSG because we want to find solutions to problems of elephant and rhino conservation. To do so we must look beyond the confines of the few populations we know best, and beyond our national boundaries. We have to take a larger view, to look for solutions that can gain wide support. To do otherwise in the

case of species traded globally would be

to suffer the tyranny of small decisions and half measures. Sometimes we have to put aside our personal convictions in the interests of enforceable agreements. I hold strong convictions about the ivory trade. I think that a complete ban on trade gives elephants the best chance of survival, simply because control of commercial trade in commonly held resources has proved futile in virtually every case, be it whales, marine fish, hardwood trees, leopards or American bison. But, in the interests of finding a solution that can accommodate different proven policies, I see the need to make an effort for compromise, however much it goes against the grain.

Enough members felt the same way for AERSG to forge the only common African statement on the ivory trade. The following is a full text of that statement:

The African Elephant and Rhino Specialist Group recognizes that the African elephant is declining rapidly over most of its range, but that some populations, particularly in southern Africa, are presently safe and expanding. Although a number of factors threaten the elephant, poaching for ivory, poor trade controls and lack of adequate conservation and management programmes in Africa, are the most important.

There is clear agreement that ivory off-take must be reduced to levels compatible with the conservation of the species. Opinions differ, however, on how that can be achieved. Many CITES member states have proposed, or support, an Appendix I listing. Some southern African states consider that their elephant populations are not

currently endangered and that harvests from well-managed populations are sustainable, indeed vital, to their conservation programmes.

AERSG fully supports those countries wishing to adopt an Appendix I listing, but contends that the legislation will be inadequate, perhaps counter-productive, without strong supporting measures. These include strengthened conservation and management policies, increased national and international funding and awareness campaigns to educate the public in Africa and internationally on the conservation issues, including sustainable utilization programmes.

AERSG considers that the southern African position must be accommodated in the interests of elephant conservation in the region and in the interests of supporting the CITES Convention. The dual listing of African elephants on Appendix I and Appendix II is supported but must be accompanied by strong controls to ensure that trading nations do not become a conduit for illegal ivory.

In the light of this position AERSG recommends that a meeting be held, before the CITES meeting, between those countries which have proposed the transfer of the African elephant to Appendix I and the countries of southern Africa. Such a meeting may allow the development of an amendment to the current proposal so as to accommodate the best interests of both parties. More specifically it may allow those states which wish to place their populations on Appendix I to do so without forcing those states which wish to retain their populations on Appendix II to take out a reservation.

Should the dual listing of elephant populations be agreed then AERSG urges that the following steps be taken:

1. The development, by producer states, of clear and openly stated criteria on which their elephant management programmes are based.
2. The introduction of simple and stringent controls on the movement of both raw and worked ivory between producer states and trading partners to preclude the laundering of illegal ivory.
3. The introduction of mechanisms for routinely verifying the origin of ivory shipments between legal trading partners.
4. The introduction of a moratorium by range states wishing to export ivory until such time as adequate criteria and controls have been developed and implemented.
5. A declaration by each of those states opting for Appendix I on how they intend to deal with confiscated ivory, ivory originating from management programmes such as problem animal control, and ivory from natural mortality. The volumes of ivory involved and its disposal should be clearly and openly reported to the CITES secretariat.

The statement was adopted as the underlying policy of IUCN and went a long way to bridging the gap between opposing views. It was a position many parties could live with if they had to, but no one was willing to give up easily their deeply held convictions. The entrenched positions made the Lausanne meeting more a circus than a caucus. A straight Appendix I vote never had sufficient support, but neither did a split listing with a moratorium on trade. What emerged was the Somali Amendment, a compromise which listed the species as endangered, but provided for countries with

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Elephants in Amboseli National Park, Kenya

well-managed populations to resume trading as soon as a technical committee and a mail ballot of member states gives the green light. In principle this compromise falls far short of the moratorium proposed by AERSG or the straight Appendix I listing called for by the pro-ban lobby.

The Somali Amendment failed to please the pro-traders. Zimbabwe, Botswana, South Africa and China among others, filed reservations with the intention of ignoring the Convention on ivory trade. And, in the most astonishing and duplicitous turn around, Britain filed a six-month reservation on behalf of Hong Kong after having urged all CITES members at Lausanne to forgo the three months grace period and stop all trade with immediate effect.

There can be little doubt that ivory trading on the international market has slowed to a trickle. Not even Hong Kong is able to off-load much stock. Elephants appear to be safer as a result of the global ban. However, this conclusion may be too simple. We have little evidence yet that the trade down-turn is reflected in reduced poaching in Africa. Anecdotal reports indicate a drop in illegal hunting in Tanzania and Central Africa, but hard evidence is scant. More to the point, these reports preceded the CITES legislation, suggesting that decreased trading had more to do with domestic bans in Europe, the United States and Asia than with the international ban imposed in January.

The uncertainties must be resolved. I believe that AERSG is the appropriate organ to convene an international workshop to review all the evidence and look ahead to the consequences for elephants. This could be done immediately before an African elephant conference proposed in 1990. I am exploring the possibilities with AERSG members and other agencies. The same forum could also enable AERSG to take a closer look at the status of rhinos and the success of various conservation measures across the continent.

Africa's rhinos have taken a back seat to elephants over the last two years, despite their more precarious state. The preliminary results of the present AERSG Africa-wide census of black rhinos are not encouraging. The numbers are down from some 3,800 in 1987 to probably 3,000 today. The rate of loss is slowing considerably, with some indication that protective measures are working in South Africa, Namibia, Zimbabwe and Kenya. But these are the exceptions among the countries within the rhino's range. The price of horn on the Asian market is still rising, and demand is sufficient to spur further poaching. As little as a ton of horn a year

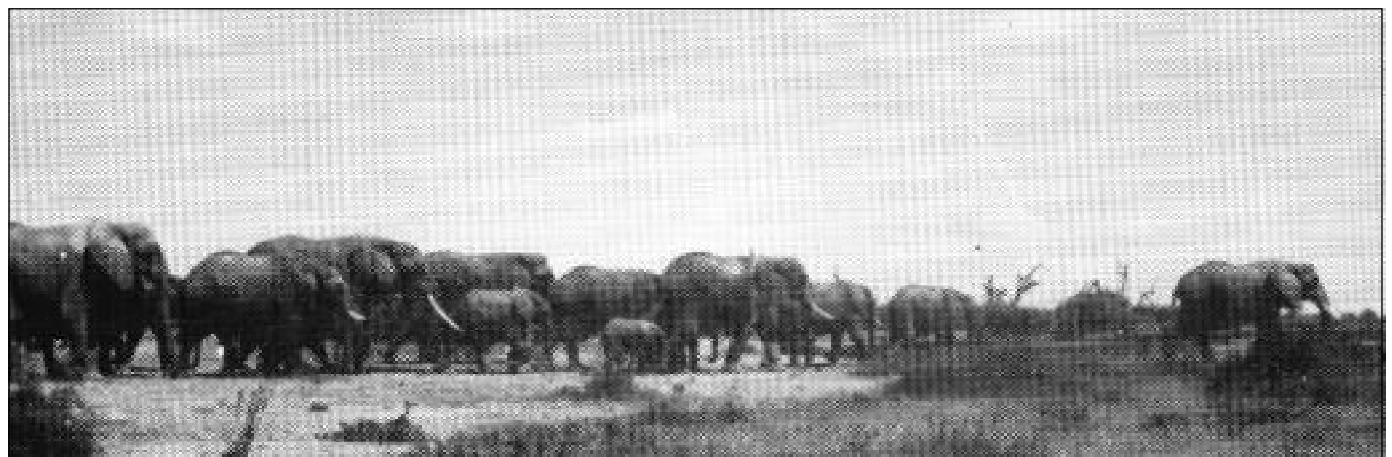
entering the world market will keep the rhino count on its downward path. Small, outlying populations decline towards extinction as a result of illegal hunting and the built-in demographic and genetic effects which assail small and isolated groups. It seems that little can be done to protect rhinos in the face of persistent trade in horn. A tremendous effort will be required to reverse this.

The question of how much horn is entering the market is almost academic when the volumes involved are so small and the markets so diffuse. This point is brought home by a series of articles on the undetected volume of rhino horn entering the trade. In *Pachyderm* No 11 I suggested that between a third and a half may be un-accounted for, and that the missing fraction would be found in either unknown markets or underestimated known markets. In this issue of *Pachyderm*, Esmond Bradley Martin and Terry Ryan calculate that very little is missed. Tom Milliken and Cecilia Song, after a survey of South Korean medicinal shops, disagree. Whatever the real market level, the point is that trade measures are insufficient.

The message emerging is that a decade of efforts to throttle trade by squeezing markets has failed to stop poaching. Field efforts are, in contrast, succeeding where the effort is sufficient. This is not to say we should abandon trade studies and lobbying, but, clearly, field efforts are more fruitful.

The opposite may prove true for elephant conservation. If trade bans are slowing the rate of poaching then they have succeeded where field efforts have failed. Different solutions may apply to elephants and rhinos despite the common threat of commercial trade. Perhaps we should not be surprised given the ecological differences between the species and the disparities in uses of their products. Rhinos can be transported easily, require little area and can be safeguarded. Elephants are difficult to transport, use an enormous home-range and are hence far more difficult to protect. Rhino horn, except in North Yemen, is used as a drug in widely scattered markets and, as with illegal drugs, trading in it is difficult to detect and suppress. Ivory, on the other hand, is a luxury commodity, worn or used for pleasure or prestige and, like leopard-skin coats, is a fashion and hence susceptible to public opinion.

The time has come to take stock, to ask what has worked and what has failed in the chequer-board of elephant and rhino conservation programmes across Africa. This is a role I hope AERSG will play later this year.



“... pacing along as if they had an appointment at the end of the world.” Isak Dinesen 1885—1962. Amboseli National Park, Kenya.

The Rhino Horn Trade in South Korea: Still Cause for Concern

Cecilia Song and Tom Milliken

Introduction

The international effort to save the five extant species of rhinoceros from extinction has intensified over the last decade in response to unprecedented losses in Asia and Africa. While habitat loss, fragmentation and encroachment are long-term concerns, the rhino poaching crisis and international trading in rhino products are the most important unresolved threats jeopardizing continuation of the 60-million year existence of the Rhinocerotidae family.

World populations for all species have dropped from an estimated 70,000 in 1970 to less than 11,000 today.¹ Of Africa two species, the black rhino (*Diceros bicornis*) has suffered tremendous losses and has vanished from some areas. Current opinion is that less than 3,800 individuals exist, with only sizeable populations of more than 400 animals remaining anywhere in Africa.² The white rhinoceros (*Ceratotherium simum*) has not fared any better with the northern sub-species virtually extinct and only some 4,650 white rhinos alive today. 90% of these are in South Africa and Zimbabwe.³

The status of the three Asian species is critical. While protective measures in India and Nepal have allowed the greater one-horned Indian rhino (*Rhinoceros unicornis*) to recover to a population level of some 1,650 individuals, the Javan rhino (*Rhinoceros sondaicus*) is one of the rarest animals in the world: a small population of about 60 individuals remains in Java.⁴ Widely dispersed populations of the Sumatran rhino (*Dicerorhinus sumatrensis*) total merely some 300 to 600.⁵

The extensive illegal trade in rhino horn is driven by demand in North Yemen, where it is prized as a material for making traditional dagger hilts, and in Asia where it is used as an ingredient in traditional Oriental medicines. Conservationists have singled out North Yemen as the largest market for illegal African rhino horn, but recent diplomatic initiatives to curtail the trade have met with some degree of success.^{6,7} On the other hand, the more diffuse Asian trade is proving far more difficult to control. Despite legal prohibitions in most countries against rhino horn importation and exportation, possession and domestic sales are rarely regulated thus giving rise to an uncontrollable situation. Only Hong Kong has imposed effective legal measures to curtail domestic consumption.

In view of the serious situation facing all rhino species, the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) at the Sixth Meeting of the Conference of the Parties in 1987 approved Resolution Conf. 6.10 urging exceptional measures to help save rhinos. The recommendations called for the enactment of complete prohibitions on all trade and sale, both domestic and international, of rhino products, the "destruction of all government and parastatal stocks of rhinoceros horn", the development of substitutes for rhino products and the exertion of pressure on countries which continued to trade.

This study of South Korea's rhino horn trade is a component of the



to WWF International. It was to ascertain the demand and use of rhino horn and rhino horn products in South Korea through consumer market surveys, statistical analysis of trade data and interviews with government, industry and academic figures. This report describes the current usage of rhino horn in South Korea and presents recommendations for a strategy to curtail domestic consumption.

Background

South Korea has long been identified as a major Asian consumer of rhino horn. Dr Esmond Martin's visits to South Korea in 1980, 1982 and 1986 included surveys of Oriental medicine clinics in two major cities, information concerning rhino horn use, importation routes and prices, and descriptions of the evolving legal status of the trade under South Korean law. Martin documented the extensive demand for rhino horn as an ingredient in Chung Shim Won balls, a common medicine throughout the country.^{8,9,10}

The fact that South Korea is not a Party to CITES has meant that international trade controls have remained largely inapplicable to the country's importation policy. Since 1983, however, the South Korean government has enacted a number of internal legal measures which first curtailed rhino horn consumption, then limited and, finally, banned importation. While these moves have been welcomed by conservationists, the extensive domestic practice of over-the-counter dispensation of rhino products goes unregulated and demand remains high. In this context, it is feared that illegal shipments of rhino horn may still be entering South Korea for internal consumption.

Table I
Oriental Medicine Clinics Selling Rhino Horn or Derivatives in South Korea,
November-December 1988

	Seoul	Taejon	Kwangju	Taegu	Pusan	Total	%
Clinics with:							
Rhino horn & Chung Shim Won Balls	21	4	2	3	4	34	
Powder & Chung Shim Won Balls	3	2	0	0	0	5	
Chung Shim Won Balls	27	1	1	2	1	32	
	—	—	—	—	—	—	
Clinics with Rhino Horn	51	7	3	5	5	71	64
Clinics with No Rhino Horn	8	5	2	19	6	40	36
	—	—	—	—	—	—	
Total	59	12	5	24	11	111	100

Source: TRAFFIC Japan Consumer Market Survey

Methodology

In the current study, TRAFFIC Japan staff visited Oriental medicine shops in the cities of Seoul, Taejon, Kwangju, Taegu and Pusan between 10 November and 2 December 1988. These cities are the major population centres of South Korea and together account for 40% of the country's population of 40 million people.

The principal researcher is South Korean and posed as a potential customer for medicine to send to sick relatives in Japan, usually describing an ailment for which rhino horn products are generally prescribed. Thus, during the ensuing 15 to 40 minutes of conversation, often the shop proprietors themselves raised the subject and, it is believed, gave truthful information. Unfortunately it was not possible to talk with South Korea importers and wholesalers although it is doubtful whether they would discuss with relative strangers illegal activities. However, arrangements have been made with South Korean NGO's to monitor the activities of importers and information should become available in the near future.

Government officials at the Ministry of Health and Social Welfare, Forestry Administration and the Korea Customs Service were interviewed with respect to government regulations and enforcement policies. A leading scholar at the Oriental medicine faculty of Kyung Hee University in Seoul was contacted and he kindly discussed current and possible future research efforts with

respect to rhino horn substitutes. Finally, TRAFFIC conducted a literature search for information and reports pertaining to the South Korean rhino horn trade.

Availability of Rhino Horn

A total of 111 Oriental medicine clinics were visited in the five cities surveyed, of which 71 shops, or 64%, had rhino horn or rhino horn derivatives for sale (Table I). Of the 71 shops, over half were in

possession of raw horn or powder and all offered the medicinal balls called Chung Shim Won.

The pattern of rhino horn availability was not uniform throughout the country (Table I). In Taegu, a traditional centre of Oriental medicine in South Korea where a special district of clinics exists, only 21% of the establishments surveyed had rhino horn. In Pusan, where less than half the small number of clinics visited stocked rhino horn, it appears that availability has dropped considerably for in 1982 Martin found "every one of the eight main clinics' had horn for sale."¹¹ However, both surveys in Pusan rely upon small data samples and therefore should not be treated as conclusive evidence. About 60% of the handful of shops visited in Kwangju and Taejon had rhino horn or derivative products for sale. In Seoul 86% of the clinics seen, including



South Korea is the world's biggest importer of deer antlers.

Table II
Comparison of Numbers of Oriental Medicine Clinics
Selling Rhino Horn, Including Derivatives, in Seoul, South
Korea

Year	Number of Clinics Surveyed	Number Selling Rhino Horn	Percentage Selling Rhino Horn	Average Retail Price / Kg US \$
Martin 1980	30	19	63	1,436
Martin 1982	76	47	62	1,797
Martin 1986	108	55	51	1,771
TRAFFIC 1988	59	51	86	4,410

Sources: TRAFFIC Study and Data from Martin¹³

almost all in the Tongdaemun (East Gate) and Kyung Dong market districts, offered rhino horn products.

Martin, citing survey trends and declining prices, concluded that “demand for rhino horn is decreasing in South Korea”.¹² Table II compares previous surveys conducted in Seoul with the current result. It indicates a sharp increase in the percentage of clinics dealing in rhino horn products and a reversal in the city of the tendency suggested by Martin’s work.

To assist the study, Martin provided TRAFFIC Japan with the names and addresses of the 108 Oriental medicine clinics in Seoul which he surveyed in 1986. Of the 55 clinics which Martin identified as having rhino horn, 12 of the 13 revisited in the current survey continued to offer either rhino horn or Chung Shim Won balls for sale. Of the 53 establishments reported as not offering rhino horn in 1986, the seven re-surveyed all had rhino horn in stock.

Whether this represents actual growth in rhino horn availability since 1986 or reflects different survey methods and samples remains indeterminate. However, Western provided considerable evidence to suggest that a large portion of the rhino horn illegally entering international markets. has gone undetected in previous accounts of the trade.¹³ If this is true probably previous surveys have underestimated the rhino horn available in South Korea.

Uses of Rhino Horn

A review of traditional Korean medicine prescription books found 16 different medicines which include rhino horn as an ingredient: it is rarely used alone except as a cure for nose-bleeds.¹⁴ Table III lists these medicines by use, number of ingredients and weight of rhino horn in each prescription. One to 80 g of horn is combined with anything from four to 30 other ingredients to make the various preparations prescribed for ailments as diverse as rashes, eye diseases, stomach ulcers, mental disorders and swollen feet.

While all these medicines are prescribed from time to time, most rhino horn is used in prescriptions of Uhwangchongshimwon, otherwise known as Chung Shim Won.

According to Korea’s traditional medicine literature, Chung Shim Won balls are particularly effective for the treatment of high blood pressure, unstable mental conditions such as hysteria, disorders of the autonomic nervous system and insomnia among other ailments.¹⁵ Martin also reports the use of Chung Shim Won balls for nose-bleeds, paralysis, body pains, and “contaminated blood”¹⁶(sic), although this could not be verified in South Korea’s authoritative sources of traditional medicine ingredients and prescriptions, Pang Yak Hap Pyun.^{16,17,18} In China, Jufang Niu Huang Quingxin Pills have been identified as the equivalent of Chung Shim Won and are used for treating rheumatism, hemiplegia, paralysis, convulsions, epilepsy and fever.²⁰

A total of 30 different ingredients including rhino horn are combined to make Chung Shim Won. The typical prescription is given in Table IV.

This recipe is the basic production unit and, after several hours work, yields about 100 balls individually wrapped in gold foil. Generally, special orders are for this quantity and many apothecaries said they mix the ingredients in front of the customer in order to demonstrate that all the listed substances are properly included. Most of the clinics also keep Chung Shim Won balls in stock for small quantity, over-the-counter sales.

Some pharmaceutical companies manufacture patented Chung Shim Won balls. An administrative order issued by the Ministry of Health and Social Affairs in 1983 prohibited the import or use of rhino horn for pharmaceutical purposes. The price of company manufactured balls is between 3,500 and 4,000 won (US\$5 to 6)

Table III
Korean Herbal Medicines which contain Rhino Horn

Name	Use	Number of ingredients	Amount of Rhino Horn
Sogaktaechongtang	Rashes	9	5.62g
Shihosogaktang	Mental disorders	6	3.75 g
Hwanchonghwang	All kinds of eye diseases	29	30.00 g
Sonbanghwalmiyongum	Stomach ulcers	10	3.75 g
Yongyanggaksan	Children’s fits	11	26.25g
Kamikilyongtang	Blistered lips caused by rashes on the face.	12	3.75 g
Uhwangchongshimwon	Strokes. Loss of consciousness, excessive phlegm and saliva constricting the throat, dizziness, trouble with speech. Also for troubles with mouth, eyes, and use of hands and feet. Fever in the back or the heart.	30	8.00 g
Sogaksoonmatang	Urination during sleep, high blood pressure, mental unrest, hysterics, insomnia and mental disorders. Paralysis, pain in area between the nose and the forehead, mouth mobility dysfunctions, paleness in the upper part of the cheeks. Also for fever inside and outside body (sic), and swollen gums and face accompanied by pain. Erysipelas.	9	6.00 g
Kumichongshimwon	Fever and diseases of the heart	9	80.00 g
Chongshimkontamhwang	Epilepsy and general treatment for all kinds of strange diseases. Eliminates fever when it effects secretions inside the body.	8	20.00 g
Yongnoianshinhwang	Five kinds of epilepsy both acute and chronic. Eliminates fever after smallpox.	13	40.00 g
Sogakchihwangtang	Nosebleeding and when dried blood remains in the vital organs or when the face becomes blackish.	4	4.00 g
Sohapyyangwon	General treatment for all kinds of diseases. Also for delerium.	15	80.00 g
Hwangryontang	Swelling of the tongue, when the body is dry and feverish and needs moisture owing to fever in the heart; or when the tip of the tongue is bleeding and stiff.	9	2.00 g
Soongmahwangryontang	Feverish face	10	1.00 g or 2.00 g
Sogaksodokum	Erysipelas, smallpox and nettle rash	5	6.00 g

Sources: Dung Maek Pang Yak Pyun (Korean Medicine Prescription Book), Won Shik Bae (ed.), 1987, Jea Shin Pang Yak Hap Pyun (Korean Medicine Prescription Book), Ui Kun Kim (ed.), 1976

which is substantially less than for those sold at the clinics. This implies they lack the most expensive ingredient, rhino horn. Proprietors of the medicine clinics asserted that their Chung Shim Won balls are more effective because not all ingredients are present in the company product and those that are of inferior quality.

Prices for Rhino Horn

Rhino horn is one of the most expensive ingredients used in traditional Korean medicine and is generally kept in locked safes. The retail price was found to range between 50,000 and 300,000 won (US\$ 75 to US\$ 451) for the traditional Korean measure of 37.5 g. Using the average price of 110,000 won, raw rhino horn currently has a market value of 2,933,000 won or US\$ 4,410 per kilogram. This is a remarkable increase in value since Martin's figure of US\$ 1,771/kilogram (Table II). Similar price rises have been witnessed in Taiwan over the same period, indicating that the phenomenon is occurring elsewhere.²¹ The retail price of Chung Shim Won balls, which weigh about 3.75 g apiece, ranged from 4,000 won to 18,000 won (US\$6 to US\$ 27) in 1988, with a mean of 7,700 won (US\$ 11.50). Martin stated that Chung Shim Won balls were US\$6 each, indicating that the price of the balls has also increased substantially.²² (During the current survey, 665 won equalled US\$ 1).

Substitutes for Rhino Horn and Extent of Their Use

It has been suggested that water buffalo horn was gaining acceptance as a substitute for rhino horn.²³ During the current survey, water buffalo horn was found to be used at certain clinics for making Chung Shim Won balls but only for customers who could not afford the expense of rhino horn itself. The belief in the efficacy of rhino horn remains strong and water buffalo horn is still not widely recognized as an effective substitute equal in therapeutic value. Consequently, customers prefer to use Chung Shim Won which contain rhino horn, and clinic proprietors clearly promote these as being more effective than those made with substitutes.

Researchers at Kyung Hee university, one of the leading academic institutions in South Korea with an Oriental medicine faculty, have conducted experiments on rhino horn substitutes in the past.²⁴ Currently, Dr Duk-kyun Ahn is seeking financial support to review the usage of rhino horn in South Korean traditional medicine and to continue experiments on the efficacy of various substitutes including bovine, water buffalo and saiga antelope horn. Dr Ahn also is attempting to identify appropriate substitutes for other substances which derive from endangered species, especially musk and bear gall bladder which are used widely in South Korea.

Legal Measures Taken to Control the Import and Use Of Rhino Horn

Over a period of years, South Korea's control policy for rhino horn importation and domestic use has been developed through a series of legal measures taken by government ministries. The first was in November 1983 when the Ministry of Health and Social Affairs issued an order under the Pharmaceutical Law prohibiting the import of rhino horn for medicinal purposes and its use as an ingredient in patented medicinal products. Then, in

Table IV
Prescription for Chung Shim Won Balls

English or Common Name	Scientific or Pharmaceutical Name	Amount
Chinese Yam Root	<i>Dioscorea Batatas</i>	28.0 g
Licorice Root	<i>Glycyrrhiza uralensis</i>	20.0 g
Ginseng Root	<i>Panax ginseng</i>	20.0 g
Cattail Polen	<i>Typha spp.</i>	10.0 g
Medicated Leaven	<i>Massa Fermentia</i>	8.0g
Rhinoceros Horn	Rhinocerotidae spp.	8.0g
Young Soybean Sprout	Glycine mas	8.0g
Saigon Cinnamon Twigs	<i>Cinnamomum cassia</i>	6.8 g
Donkey skin Gel	<i>Colla asini</i>	6.8g
Peony Root	<i>Paeonia lactiflora</i>	6.8 g
Lush Winter Wheat	<i>Ophiopogon japonicus</i>	6.8g
Baical Skullcap Root	<i>Scutellaria baicalensis</i>	6.8g
Tangkuei Root	<i>Angelica sinensis</i>	6.8 g
"Guard against Wind"	<i>Ledebouriella sesloides</i>	6.8g
Cinnebar	<i>Cinnabaris</i>	6.8 g
	<i>Atractylodes macrocephala</i>	6.0 g
Hare's Ear Root	<i>Bupleurum scorzoneraefolium</i>	6.0 g
Balloon Flower Root	<i>Platycodon grandiflorum</i>	6.0 g
Almond Kernal	<i>Prunus armeniaca</i>	6.0 g
Sclerotium of		
Tuchkahoe, China-root	<i>Poria cocos</i>	6.0 g
Szechuan Lovage Root	<i>Ligusticum wallichii</i>	5.0 g
Cow or Water Buffalo		
Bezoar or Gallstone	<i>Bos taurus domesticus</i>	5.0g
Saiga Antelope Horn	<i>Saiga tatarica</i>	5.0g
Musk	<i>Muscus spp.</i>	5.0g
Processed Resin of		
Borneol Camphor	<i>Dryobalanops aromatica</i>	4.0g
Realgar	Realgar	4.0 g
	<i>Ampelopsis japonica</i>	4.0 g
Dry Ginger	<i>Curcuma zedoaria</i>	3.0 g
Jujube Fruit	<i>Ziziphus jujuba</i>	20 pc
Gold paper		

Source: *Pang Yak Hap Pyun* (Korean Medicine Prescription Book)

July 1984, the Ministry of Trade and Industry made an order rendering the import of rhino horn for purposes other than medicinal use subject to special permission from a provincial governor. The most recent and far-reaching measure, effective from 28 June 1986, was the total prohibition of rhino horn importation under the Wildlife and Hunting Law which is administered by the Forestry Administration.

Review of South Korean Trade Records

Although a rather confused legal situation prevailed in the mid-1980s, South Korean Customs statistics show no rhino horn imports between 1984 and 1987. In 1988 an astonishing 1,900 kg was reported as coming from Japan, but this was later affirmed by Korean government officials to be cow horn erroneously classified.³¹

Overall, South Korean records from 1970 to 1983 show a relatively high level of importation, most of which contravened the conservation policies of the source countries. Between those dates, a total of 2,857 kg of rhino horn was received from 11

Table V
South Korean Imports of Rhino Horn 1970-1988

Country	CITES entry into force	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984-1987	1988	Total
USA	01.07.75	-	-	20	-	-	-	-	-	-	-	-	-	-	-	-	-	20
India	18.10.76	-	-	-	30	-	-	-	19	-	20	-	-	-	-	-	-	69
HongKong	31.10.76	2	-	-	-	30	-	-	-	-	-	-	5	-	-	-	-	37
Malaysia	18.01.78	-	-	-	-	-	-	-	-	-	30	21	-	-	-	-	-	51
Kenya	13.01.79	-	-	-	-	-	-	-	-	-	-	-	-	35	-	-	-	35
Indonesia	28.03.79	-	-	-	214	97	200	204	207	51	208	93	127	200	300	-	-	1,901
Japan	04.11.80	1	2	31	9	6	12	8	15	-	-	89	-	28	-	-	*(1,900)	#201
China	08.04.81	-	-	-	-	-	-	-	-	-	-	-	10	-	-	-	-	10
Thailand	21.04.83	-	-	-	-	81	-	65	66	-	40	4	-	-	-	-	-	256
Singapore	28.02.87	-	50	197	-	-	-	-	-	-	-	-	-	-	-	-	-	247
Burma		-	-	-	-	-	-	-	-	-	20	10	-	-	-	-	-	30
Total		3	52	248	253	214	212	277	307	51	318	217	142	263	300		*(1,900)	#2,857

*Later confirmed to be cow horn (Personal communication; Rhee and Lee) #Excluding 1988 trade

Source: South Korean Customs Statistics

Notes to Table V.

United States: No rhino species occur in the United States. The 20kg of rhino horn from there possibly represents hunting trophies.

India: Rhino populations in India have enjoyed complete protection since 1972 under the Wild Life (Protection) Act. Since October 1976, all exports of rhino horn have been subject to CITES regulations. The 69 kg of rhino horn reportedly received would have been illegal under India's domestic laws and CITES.

Hong Kong: The Territory allowed exportation until March 1986 but the five kg of rhino horn imported from Hong Kong in 1981 was illegal under CITES, as none of it was reported in Hong Kong's CITES 1981 annual report. Significantly greater volumes of rhino horn are believed to have been traded between Hong Kong and South Korea over the period examined.^{22, 23}

Malaysia: The 51 kg of rhino horn received from Malaysia occurred after CITES came into effect in peninsular Malaysia in 1978. A CITES Annual Report was not filed by Malaysia in 1979 and the 1980 report did not include any rhino horn exports to South Korea. Exports to two other Malaysian states, Sabah and Sarawak, were not subject to CITES controls until a later date.

Kenya: Kenya did not file a CITES Annual Report in 1982. Under domestic legislation the export that year of 24 kg of rhino horn would have been illegal.

Indonesia: This country is recorded as supplying a remarkable 1,901 kg of rhino horn to South Korea. This figure seems all the more excessive in view of the low density and the legally protected status of indigenous populations of rhinos. Both the Javan and Sumatran rhinos, Indonesia's two species, have been protected under the Wild Animal Protection Ordinance of 1931 which prohibits hunting, capture, killing, trading or possession of listed species.²⁴ Moreover, CITES prohibitions against exportation have been in effect since 28 March 1979: the legal export of rhino horn has never been reported in Indonesia's CITES Annual Report. Thus the 720 kg imported between 1980 and 1983 was illegal trade under CITES and previous trade would have contravened domestic legislation.

Japan: Japan was a fairly steady source of rhino horn until CITES took effect in late 1980 and largely curtailed exports to South Korea. From 1980 to 1987, the only trade with Japan recorded by South Korea Customs is one in 1982 of 28 kg. However, according to Japan's 1982 CITES Annual Report, four shipments of rhino horn totalling 133 kg were exported to South Korea under the "pre-convention" exemption allowed under Article VII of CITES. The 28kg of rhino horn correspond to one of these four shipments: apparently not all Japanese exports to South Korea are recorded in Korean statistics. In 1988, South Korea reported receiving 1,900 kg of rhino horn from Japan but, as previously mentioned, this actually represents cow horn mistakenly recorded in Customs statistics.²⁵

China: It is not known whether the import of 10 kg of rhino horn from China took place before or after April 1981, the date CITES came into effect. If the transaction took place after CITES became operative it would have contravened the Convention.

Thailand: Sporadic trade with Thailand totalled 256 kg but was conducted before Thailand became a party to CITES. Regardless, Thailand's highly endangered populations of Sumatran rhinos are protected under the Wild Animals Reservation Act of 1972, which bans hunting and exportation, so all trade from the country is illegal. (Javan rhinos were also historically distributed in Thailand but are believed to have been extirpated.)²⁶

Singapore: The 247 kg of rhino horn reportedly received from Singapore all resulted from trade in the early 1970s. No rhino species are distributed in Singapore but Singapore's role as an entrepot for both African and Asian rhino horn is well known.²⁷

Burma: Burma is one of the few countries which has not joined CITES and lacks a domestic policy which forbids the export of rhino products. Two species of rhino, the Sumatran and the Javan, have historic distributions in Burma, but their current status is unknown, although occasional and largely speculative reports indicate that at least one species is extant.



A South Korean pharmacist holds here a rhino horn which was made into Chung Shim Won balls and sold to patients in traditional clinics for the purpose of curing high blood pressure, paralysis and various types of pain.

countries (Table V) with Indonesia, Singapore, Thailand and Japan apparently accounting for over 90% of the trade.

Illegal Trade

Martin has consistently claimed that official government statistics represent only part of South Korea's rhino horn imports.³² When importation was legal, high customs tariffs and other taxes provided a ready incentive for importers to conceal shipments of rhino horn. Certainly, it has been demonstrated that the major portion of Japan's exports in 1982 were not recorded on South Korean Customs data. Either they evaded Customs or, less likely, remained in transit and did not officially enter the country. During a number of the interviews with Korean shop owners, Japan was cited as a source of rhino horn but whether these remarks referred to the situation before or after the import ban was not clarified.

Hong Kong also was mentioned as a leading source of rhino horn and some proprietors implicitly suggested that the trade continues although no direct evidence was forthcoming. After officially banning rhino horn exports in March 1986, Hong Kong has recently taken measures to curtail all use of rhino horn in the domestic market. This could have precipitated the re-export of unregistered rhino horn stockpiles to South Korean buyers. As with Japan, imports of rhino horn from Hong Kong have not always been acknowledged in official South Korean statistics.³³

Confiscations

Martin reported South Korean Customs officials as saying "there are only a few attempts to bring rhino horn into the country now"³⁴. During the current survey the South Korean Customs Service in Seoul was unable to produce any record of recent rhino horn confiscations at ports of entry.

Domestic Regulation of Distribution and Use

South Korean importers, wholesalers and dealers involved with rhino horn or derivative products have never been required to submit stock inventories to the authorities. There is no reporting requirement for the amount of rhino horn used or sold through the Oriental medicine clinics. Thus there are neither records of the amount of rhino horn in South Korea when the import ban was imposed nor

any record of the amount which has been since consumed. This situation provides an ideal climate for the continued import of rhino horn. During the current survey, none of the clinic proprietors made a point of identifying their rhino horn as deriving from stocks predating the import ban probably because there is no compulsion to do so.

Conclusions

Although the importation of rhino horn has been banned in South Korea since June 1986 and Korean Customs statistics show no import since 1984 (except for the misidentified entry in 1988), it is still widely available in Oriental medicine clinics throughout the country.

It is impossible to identify rhino horn of illicit origin in the market place. South Korean regulations prohibit only the use of rhino horn in patented medicine while the sale and use of rhino horn at the Oriental medicine clinics is uncontrolled.

Therefore, it is imperative for South Korean authorities to develop a policy to regulate domestic possession and sale of rhino horn.

Consumption of rhino horn continues to be driven by the market for Chung Shim Won balls, the medicine in which the majority of rhino horn is used. Consumer demand has not abated in the face of dramatically rising prices which have increased by at

least 150% over the last two years. The *belief* in the effectiveness of rhino horn remains strong and alternative substances, such as water buffalo horn, are not gaining the wider acceptance claimed by some observers. Few efforts are being made to identify and promote substitutes.

It seems that, for the time being and as a result of South Korea's strong economic performance over the last few years, rising per capita income has largely mitigated the necessity to seek cheaper alternatives. It is unlikely that demand for rhino horn will decrease significantly in the near future. As a result, illegal importation and concomitant poaching will be encouraged.

Recommendations

1. The South Korean government should require a general registration of all existing stocks of rhino horn and, thereafter, only allow possession under a licensing system.

Registration procedures should be designed to ensure that over-registration in expectation of obtaining future, illegal imports does not occur.

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2. A deadline should be set, from which time the use of rhino horn would be banned. The ban should apply to the import, export, sale, purchase, offer for sale, or offer for purchase of rhino horn and any product containing or claiming to contain rhino horn.
3. In the interim between registration and ban, the South Korean government should require all individuals or establishments which possess, dispense or use rhino horn at either the wholesale or retail level to keep accurate records on the amount acquired, sold, or used, and periodically file inventory reports with appropriate government authorities.
4. An intensive effort to identify substitutes for rhino horn in traditional medicine prescriptions needs to be made. Research on this topic, at Kyung Hee University in particular, should be supported and any suitable alternatives given as much publicity as possible.
5. A monitoring system needs to be established in South Korea immediately so that developments in the rhino horn trade can be scrutinized.

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Medicines from Chinese Treasures

Esmond Bradley Martin

Today China is the only country in the world still making significant quantities of medicines containing rhino horn. Having exhausted its own supplies by the eighth century, it became a major importer. The rhino horn medicines are both consumed locally and exported. Notwithstanding the fact that China joined CITES in 1981, rhino horn has continued to come into the country, principally from North Yemen, Hong Kong, Macao and Taiwan, with smaller quantities smuggled in from Singapore and Thailand. The manufactured medicines go mainly to South East Asian countries.

At the end of 1988, the Chinese CITES Management Authority, under the Ministry of Forests, demanded that all import/export corporations and drug factories register their stocks of rhino horn.

Table I
China's 1989 Rhino Horn Stock Registration

Establishment	Amount in kg
China National Corporation of Traditional and Herbal Medicine (based in Beijing)	3,405.8
Tianjin Medicine & Health Products Import/Export Corporation	407.0
Guangdong Drug Corporation	1,550.2
Yunnan Drug Corporation	989.6
Beijing Drug Corporation	469.3
Tianjin Drug Corporation	435.2
Shanghai Drug Corporation	410.9
Liaoning Drug Corporation	242.2
Jilin Drug Corporation	202.2
Qinghai Drug Corporation	101.0
Xinjiang Drug Corporation	75.0
Hubei Drug Corporation	45.9
Gansu Drug Corporation	30.5
Tibet Drug Corporation	10.0
Others	1,500.0
Total	9,874.8

**Although the word 'Corporation' is used in the names of the above establishments when translated from the Chinese, all but the first two would be classified as 'factories' in English usage.*

Source: China Endangered Species of Wild Fauna and Flora Import/Export, Administrative Office,

Table II
Average Consumption of Rhino Horn per Year

Establishment	Amount in kg
Beijing Drug Corporation	150
Shanghai Drug Corporation	150
Guangdong Drug Corporation	100
Tianjin, Drug Corporation	100
Others	150
Total	650

Source: China National Corporation of Traditional and Herbal Medicine.

Details of the results obtained in December 1989 are in Table I. The total amount held was 9,875 kg; however, this does not include rhino horn in retail medicine shops, museums or private ownership. The industrial stocks are undeniably the largest in the world, and more importantly are still being used to make medicines. Between 600 and 700 kg of rhino horn are being used each year and, if demand continues at the same rate, the drug factories have enough supplies to last at least 15 more years (Table II). As far as conservationists are concerned, since some of these rhino medicines are getting onto the international market they are further encouraging the demand for rhino horn. At the Ottawa CITES meeting in 1987 member states including China, were requested to ban all internal trade in rhino products. Hong Kong and Macao, two major importers of Chinese manufactured medicines, have complied, but China has not, arguing that the horns being used were acquired before joining CITES.

In order to exert control over the export of rhino horn medicines China has, however, recently changed its law. As from the end of 1988 all exports of these medicines require a permit from the Chinese CITES Management Authority. No such permits have been issued. Instead, traders especially from South East Asian countries have been buying the medicines wholesale and taking them out of the country. Personal luggage is not usually examined. As an example, on my three trips to China in 1985, 1987 and 1990 none of my baggage was ever opened when I entered or left the country. In addition, some Chinese corporations exported some medicines without asking for permits in 1989.

In April 1990 when I went to China as a guest of the CITES Management Authority in Beijing, I visited a number of import/export corporations and also drug factories which make rhino horn medicines. At the Beijing Tong Ren Tang Pharmaceutical Factory, first established 320 years ago and now the most famous in the country, a manager stated that in 1970 a five-year study was initiated for the purpose of finding the best substitute for rhino horn. The research by various institutes and involving scientists from Tong Ren Tang was completed in 1974 and water buffalo horn was shown to be almost as effective as rhino horn. Consequently, that year the factory started to use water buffalo horn as well as rhino horn. At about that time the China National Corporation of



These magnificently carved rhino horn antiques which were photographed in a Chinese warehouse may be pulverized, like many others have been, for making into medicines.

Traditional and Herbal Medicine had a stock of 14 tonnes of rhino horn. A major supplier of horn to medicine factories, this corporation now has under four tonnes. The fact is that ten tones were consumed in the making of medicines in the late 1970s and the 1980s decade despite the use of water buffalo horn in some of the products by one of the most important medicine factories.

The Tong Ren Tang Pharmaceutical Factory today manufactures three febrifuge patent medicines containing rhino horn: An Kong Niu Huang, Zi Xue San and Jufang Zhi Bao; the first of these is for adults and also reduces inflammation; the latter two are for lowering fevers in children. When I asked why buffalo horn could not be substituted in these medicines, I was told that expensive stocks had to be used and that overseas Chinese still believed rhino horn to be superior and would not buy such drugs if it was omitted. In visits to drug factories in Tianjin and Guangzhou the answer was always the same. The overseas Chinese are portrayed as scapegoats for continuing to demand rhino horn as an ingredient in patent medicines. They are in fact the major buyers and provide large sums of foreign currency required to recoup the expense of stock purchases and to make profits.

On this trip to China I was given the unique opportunity of visiting the official rhino horn storerooms. No other foreigner nor even the staff of the Chinese CITES Management Authority had ever been inside these storerooms which contain vast amounts of rhino horn. The largest quantity is made up of small cut pieces, most of which are the remains of African horns which were used in North Yemen for making dagger handles. The next most common form of rhino horn is powder, also from North Yemen, either imported directly or via Hong Kong. The only other country which uses rhino horn powder in quantity is South Korea where Chung Shim Won balls are made. Elsewhere, pharmacists who sell rhino horn prefer having recognizahle pieces so that their customers can see what they are getting is genuine. Except in the storeroom of the Guangdong Drug Corporation in the suburbs of Guangzhou there are few whole horns. Many of these are of Indian rhino origin while others are Sumatran back horns, really small protrusions, knob-like in appearance. The latter are referred to as Buddha's eyes by the employees. I saw almost no full horns or large parts from African white or black rhinos. The few which do exist in China are usually found in markets and medicine shops. In February, 1990, Andrew Laurie saw African horn for sale retail in Chengdu, Sichuan province, for US \$3,936 or 18,500 yuan per kg and Sumatran horn for US \$24,468. It was not possible to ascertain what percentage of the chips, powder and full horns were Asian compared with African. However, in the Guangdong Drug Corporation storeroom the manager estimated 10%, adding that Asian horn was far superior medically to African. Personally, I believe that of the almost 10 tonnes of rhino horn in the official stores less than 10% is of Asian origin because so much comes from North Yemen where only African horn is made into dagger handles.



In the Tong Ren Tang pharmaceutical factory in Beijing, An Kong Nui Huang balls are being made, some of which contain rhino horn.

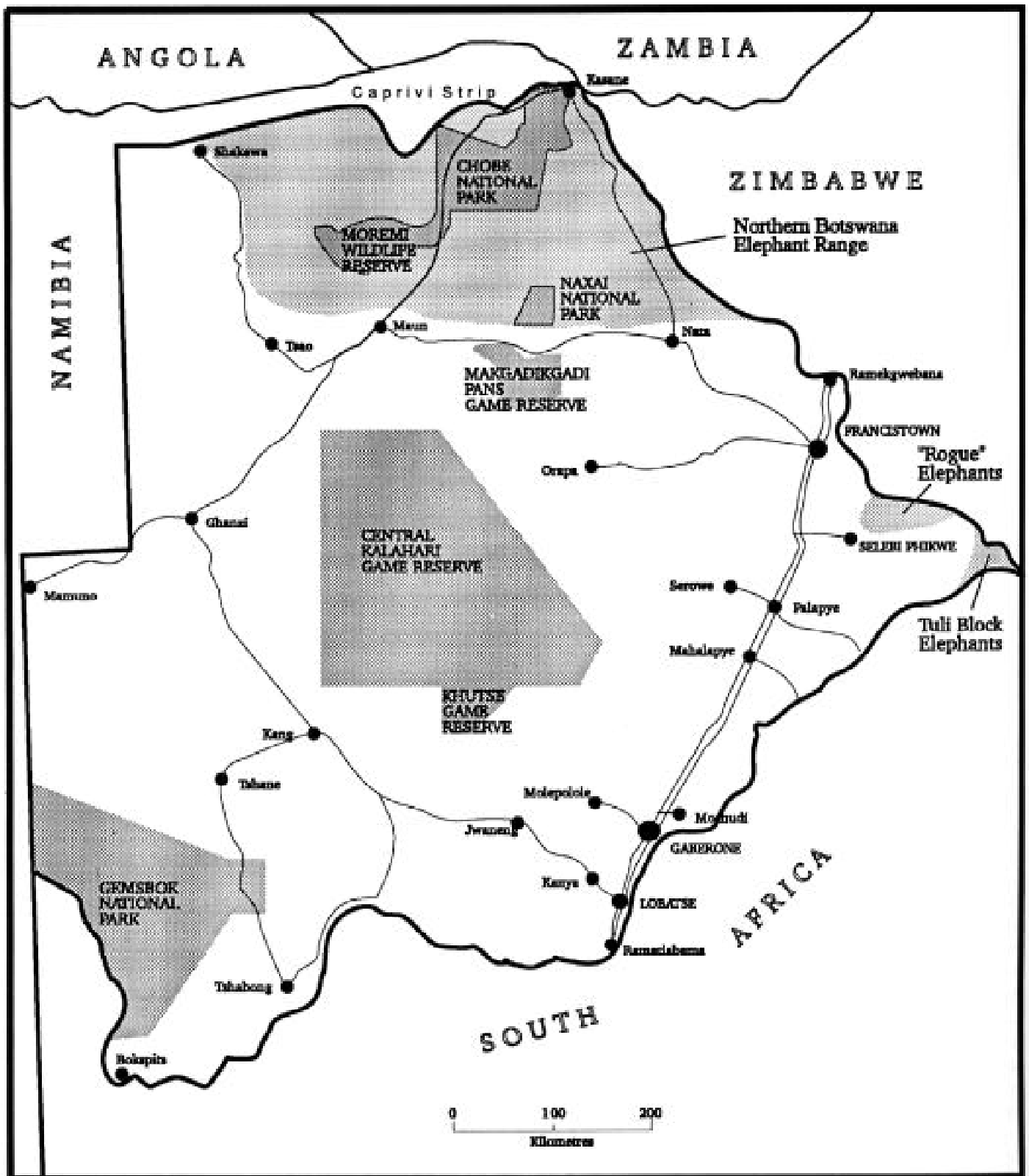
Inside locked rooms in godowns in Tianjin, Beijing and Guangzhou one sees a jumble of 25kg sacks, plastic bags, crates and boxes containing chips, powder, whole horns, together with the most amazing form of stock to be used for making medicine, that of antique rhino horn carvings. In the storerooms I visited in Tianjin, Beijing and Guangzhou, all had sacks heedlessly piled together, full of antique plates, cups, libation bowls, brush holders and figurines. I even saw quite a few Sumatran, Indian and Javan carved horns. The Buddhist figures on some small dishes lend me to believe they originated in Laos or Cambodia. All the rest were carved in China; none had been worked in Africa. The antiques were mostly intact and in excellent condition but some were damaged and chipped. Our visit produced a few more casualties. Since we had specifically asked to see all the rhino horn stocks, bags of these antiques were tipped in front of us onto concrete floors, producing more nicks and scratches. Whenever we finished examining the antiques, they were simply gathered together and dumped into sacks, with no attention paid to preventing pieces from damaging one another. The storeroom staff obviously had no idea of the true value of these magnificent works of art carved in the Ming (1368-1644) and Ch'ing (1644-1911) dynasties by master craftsmen probably attached to the workshops of the Emperors.

The trading corporations and medicine factories have been purchasing rhino horn antiques from every possible source since the Revolution in 1949. Some have come from Chinese private collectors while others have been supplied by racketeers dealing in items stolen from the museums. In fact, there are very few rhino horn antiquities to be seen in any of China's museums today. There is no way of telling how many of these valuable works of art have been ground down into powder by the drug corporations. The policy of the Guangdong Drug Corporation is to use the powder, chips, and full horns first, then damaged antiques and finally, the perfect works of art. However, even this corporation has admitted to having already pulverized antique rhino horn cups. It seems that in practice whatever is handiest is used.

There is little doubt that the primary purpose of the drug corporations is to earn as much foreign currency and as large a

Botswana's Problem Elephants

C.A. Spinage



Republic of Botswana

profit as possible. They are ignoring an option which would increase their profits, help with rhino conservation, preserve for posterity examples of China's cultural heritage, conform to CITES regulations and be internationally welcomed: namely, the auction of these superb antique rhino horn carvings on the world market.

As early as 1963 when the population was judged to be much smaller than it is today, Child considered that the elephants in northern Botswana were exerting a destructive effect on woody vegetation along the Chobe River riparian strip. Particularly affected were mature *Acacia erioloba*, which were killed by ring-barking. This view was upheld by subsequent workers such as Sommerlatte², Simpson³ and Moroka⁴. Sommerlatte estimated an average of 5,746 elephants to occupy the 11,000 km² Chobe National Park from 1973-1975, whereas by 1987 the number had increased to 12,220.⁵ For an area of 22,500 km², Sommerlatte estimated 12,035 elephants, whereas 17,817 were reckoned to be present in 1983.⁶ Beginning in 1980, aerial surveys suggested a population of 39,511 elephants in the 8,000 km² range of northern Botswana, which by 1989 had risen to almost 60,000, implying a mean annual rate of increase of 5%. Approximately 23% of the range lies in protected areas where, in 1987, 42% of the elephants were found in the dry season and 26% in the wet season.⁷ The Table shows various estimates made during the 1980s.

The total numbers also fluctuate according to the season when the count was made, for an estimated 10,000 elephants move into Zimbabwe in the dry season.⁸ But a similar annual percentage increase has been experienced in this contiguous Zimbabwe population, in spite of a culling programme.⁹

Table
Elephant Population Estimates for Northern Botswana
1980-1989, (80,000 km²)

Year	Estimate
1980/81	39,511
1984	42,792
1985(i)	50,000
1987(ii)	44,670
1989(ii)(iii)	63,500

(i) rounded estimate

(ii) mean of wet and dry season counts

(iii) wet season was 75% of area corrected for whole area

The Department of Wildlife and National Parks in Botswana has proposed a cropping programme to maintain the Botswana population at around 60,000 by removing a number equal to the estimated 5% annual increase. This would create an overall density throughout the 80,000 km² range of 0.75 elephants/km². The chosen total population number does not relate to the maximum permissible elephant density which would arrest the decline in mature tree survival and permit tree regeneration, but is lower than that calculated by Fowler at which an elephant population might come into self-regulating equilibrium, namely a density of 0.93/km².¹⁰ Rather the total is based upon the logistics of cropping and pragmatic considerations regarding tourism.

History of the Chobe Elephants

Within recorded history the Chobe area of northern Botswana has always been favoured by elephants. When he hunted from the Shinamba Hills in the southeast of the present park in July

1853, Chapman found elephants to be very numerous there, meeting one herd of 500 cows.¹¹ But in January 1855 at Shinamba he reported:

After travelling [eastward] 30 miles over ground that two years ago was covered with spoor. I fell in with nothing . . . I continued . . . till March . . . Our search for elephants continued without success. They seemed to have all migrated into the tsetse country.

Although he supposed that they had migrated northwest, a major movement in the dry season is west-east into the Hwange area of Zimbabwe; but one cow elephant radio-collared in the Shinamba area in March 1987, did move directly northwest to the Linyanti, while a cow marked to the east of Shinamba and a bull marked to the southeast, also moved northwest.¹² Clearly these movements from the Shinamba area are of very long standing.

When Selous arrived at the Chobe River in 1874 he found elephants, but not apparently in large numbers, and they appeared to be wary.¹³ He noted:

A little after midday we crossed the spoor of a large herd of elephants that had come down to the river to drink during the preceding night. As I knew from former experience, that the elephants about here seldom stood except at long distances from the river . . .

and later:

This was one of the largest herds of elephants I have ever seen; I am afraid to say how many of them there were, but I think there must have been from 100 to 200 at least.

In 1891 the first game law was introduced in the then Bechuanaland Protectorate, and in 1893 licences for elephant hunting. There is little record of hunting at this time for the great days of the ivory scramble were already over. Only 305 lbs of ivory were exported to South Africa by rail in 1936 and none the previous year when recording began. After this date ivory exports were lumped with Miscellaneous animal products¹⁴ and can no longer be traced.

In 1932 all game was protected in the Chobe district, this prohibition lasting until 1943. It appears to have been fairly effective, as contemporary references indicate.

The Government Veterinary Officer reported in 1935: The natives say elephants and buffalo were common in the thick bush about Kataba and Kasinka last year, This has not been the case for many years. There is no doubt that game has very largely increased in the last few years. Elephants were in large herds along the Chobe River all last winter as they used to be in Selous' time - the seventies.¹⁵

The Kasane Resident Magistrate was driven to inquiring whether he could shoot an elephant in self defence if needs be. He wrote:

At present it is most difficult to be able to plan with certainty to go from Kasane to Kazangula (*sic*) in the afternoon. I have on three or four occasions had to turn back because of elephants on the road. They are quite peaceful . . . They are not a menace but merely a nuisance.¹⁶

I got into Kasane . . . from Kachikau. There were elephants from Kabulabula to Kasane. They have dug the road to pieces and I could smell and hear them all the way.¹⁷

Komana's forest, probably the present Chobe Forest Reserve, had earlier been referred to as the breeding place of the elephants by another Resident Magistrate.¹⁸ However Child reports that one man living along the Chobe noted that in 1933 there was a well-known herd of 20 to 25 head between Kazungula and

Kasane but that otherwise the species was scarce along the river.¹⁹ This does not fit with the Resident Magistrate's reports, or was he making a fuss about only 25 elephants? Child further reports that elephants had been unknown to the bushmen living around the source of the Ngwezumba for several generations until about 1945. Then within a single year the whole area to the north, as far as the Chobe, filled with elephants which came from the direction of Masame, moved towards Lesuma and then across to the Chobe west of Kasane. A Lozeides who moved to Seron-della in 1946 and who did not see an elephant in the region until 1949 is quoted by Simpson who also recorded that the movement was eastward, starting west of Kachikau and Ihaha.²⁰ Between 1930 and 1954 Botswana recorded one its worst drought cycles. In the 1940s, summer rainfall along the Chobe river, as measured at Kasane, was very low with the moving average well under the long term mean of 677.5 mm (n=66). However, the rainfall for 1945 at Kasane was only 14.5% below the long term average compared to a shortfall of 58% at Tsabong in the extreme south of the country, while in 1946 it was 17.8% above average, so that this may have accounted for the alleged influx of elephants.

Little hunting seems to have followed the dropping of protection in 1943, which was due to concern at the eastward spread of tsetse, for in 1953 the Officer in Charge of the Francistown police noted that no ivory in that year had been exported on permit and he suspected that it was being smuggled out. In Ngamiland, however, 44 licences were issued by the tribal chief for elephants in 1952- 1953.

Following complaints from the 'Chobe Concessions', which was exploiting the timber in the Chobe area in 1952, the compound manager was authorized to shoot the bull elephant in each herd that was causing trouble in the Concession. It was proposed to withdraw the permission the following year because the manager went shooting unaccompanied by a member of the police and because he appeared to be selecting the best bulls, as the tusks were up to over sixty pounds which is high for this part of the world. He is recorded as recently exporting 305 lbs of ivory, but this would only amount to three or four elephants. It was stated that there should be no shooting of animals which allegedly do damage miles from anywhere in the forest of the Concession. Thus it appears that there was little, if any, elephant hunting in the area.

In 1960 the Chobe Game Reserve was declared, and in 1967 it became a national park. Child states There is general agreement among local people, living as far apart as Gweta, the fringe of the Okavango, Kachikau and in the eastern Caprivi, that its elephant population has increased very rapidly, especially during the last ten years.²¹ In 1966, for example, they were reported for the first time from areas to the eastern Makarikari, where they have not been known for many years. Child believed that this was due to immigration from an overpopulation of elephants in the Hwange area, but rainfall was above average in these years and that may have accounted for the movements. Child also provides evidence

for an increase in elephants on the Caprivi side by reference to the rapidly rising number of garden raiders shot after 1962.

Simpson considered that counts of elephants along the water front showed a build-up in the five years to 1971, although his figures were not comparable with those of Child. 22,23. According to Sommerlatte ~ the 20,000 cattle population in the Kachikau Enclave and along the Chobe river front collapsed to virtually nil due to outbreaks of trypanosomiasis and streptothricosis and this opened up the area to occupation by elephants.

The drought of the 1980s seems to have had no effect upon the population, although the total amount of rain falling at Kasane from 1978 to 1984 was 20% less than that between 1929 and 1935, a previous bad drought cycle.

Thus the elephant population in this area has probably been increasing relatively undisturbed since about 1914. Hunting increased in the sixties and from 1979 to 1982 a total of 1,515 licences was issued. Probably over 500 licences a year had been issued prior to 1979. Hunting was stopped in 1983 because of an alleged decline in tusk weight, although Melton showed that there was no real evidence for this with the apparent decrease being within the range of normal statistical variability. ²⁴ For 1979 to 1982 the average tusk weight was 17 kg while the mean largest tusk weight of 33.8 kg included a greatest value in 1981 of 39.6 kg. A trade sample of 2,375 tusks imported into Hong Kong between 1974 and 1978 had a mean weight of 14.05 kg which is very high for a trade sample. In 1864 to 1870, William Finaughty's 316 tusks averaged only 11.48 kg. For American hunters between 1968 and 1978, the mean for 65 tusks was 22.42 kg but this was possibly the result of very selective hunting.²⁵

Dynamics of the Chobe Elephant Population

Using the logistic curve relating the rate of increase of a population to an assumed maximum population level, and assuming that the maximum rate of increase has been sustained over a long period of time, it can be shown that the present rate of increase of the population may be accounted for by reproduction alone. There is no necessity to invoke immigration from other regions (it is not known where the figure of 20,000 sometimes quoted as the total population in 1979 comes from), although that is not to suppose that there may not have been an element of immigration from either Angola or Zambia, or both of those countries. Population simulation using a rate of increase, r_m , of 0.071, based on the formula of Caughley and Krebs and close to the figure of 0.07 given by Calef as the maximum possible, suggests that the ecological carrying capacity, K , of northern Botswana would be about 135,000 elephants, or 1.7/km².^{26,27} This rate of increase provides a close fit to the observed population totals between 1981 and 1989. Using a rainfall/biomass regression and assuming a rainfall of 600 mm since the intensity falls off west of Kasane, at the same unimpeded rate of increase and to the exclusion of all other animal biomass, one could expect a total of 186,000 elephants, or a density of 2.3/km² by the year 2214, or 95% of this number, namely 176,600, in the year 2048.²⁸ If the rivenne belt, say up to ten km from water, could accommodate the same density as that formerly observed in the Murchison Falls/River Nile strip and if the population continued to increase at r^{max} there could be a total of 225,000 elephants in the early part of the twenty-second century with 213,750, or 95% of this total, by the year 2044. These

postulated densities are comparable with the 2.1/km² previously recorded in Uganda's Queen Elizabeth National Park which has a mean annual rainfall of 669.5 mm, and densities estimated at 4.6/km² for open country and 12.5/km² close to the River Nile in Uganda's Murchison Falls National Park which has a mean annual rainfall of 1200 mm. A density of 12/km² was recorded in 1,000 km² of the Linyanti area in the 1987 survey. However, the Chobe population does not appear to be increasing at these rates. The closest fits to the observed increase relative to the logistic curve are given by either an *rm* of 0.05 and an asymptote of 475,000 or an *rm* of 0.071 and a total population of 135,000, giving 5.9 or 1.7 elephants /km² respectively. The second fit seems to be the more likely and reaches the asymptotic level in the year 2204, or 95% of it, 128,250, in the year 2043. Neither fit is significant at the 95% level of probability.

The situation has been complicated by the culling of elephants in Zimbabwe, but these animals represent a mean annual off-take over 29 years of only 3.2% per annum, close to the maximum sustainable yield, while hunting in Botswana accounted for about 1.5% of the population annually. Nevertheless, the best fit of the logistic model is for an *rm* of 0.071. Reducing this to account for the removal of hunted and culled animals has negligible effect upon the predicted rate of increase. The model suggests that the population in Botswana could start to reduce its rate of increase in the year 2010, at an estimated density of 1.3/km², so that the level of 1.7/km² would not be reached until after the year 2030.

Botswana proposes, however, to attempt to keep the population at approximately 60,000, representing an overall density of 0.75/km². It would appear from the model that changes in vegetation due to the destruction of mature trees may have started in the

early 1960s at a density approaching 0.2/km² and this agrees with Child's observation of damage in 1963.²⁹

Martin *et al* postulate that in Zimbabwe specified woodland species will persist at an elephant density of 0.5/km² closed canopy at 0.25/km².³⁰ In Botswana, discounting heavily settled sections and assuming that the elephants may move up to 30km from permanent water, there is approximately 7,500 km² available to them along the Linyanti—Chobe river fronts and 9000 km² in the northern Okavango delta region. Thus to maintain a density overall population of no more than 8,250. Preserving the population at 60,000 is equivalent to sustaining a density of some 3.6/km² within reach of permanent water or, even if there is dispersal over the whole 80,000 km² range subsequent to good rains, an overall density of 0.75/km². To achieve an overall density of 0.5/km², the population would have to be held at 40,000.

Excessive destruction of mature trees and loss of canopy cover in the Chobe-Linyanti riparian strip are inevitable unless the elephant population is reduced to the very low level of some 8,250 for the entire range. Such a reduction would be counterproductive for tourism, and it is arguable whether trees are more desirable than elephants especially as there is extensive closed canopy woodland away from the waterfront. Maintaining the population at its current level will prevent woodland regeneration which also depends upon fire, rainfall, and, in some areas, frost. We may assume that periods of accelerated tree growth roughly correspond to peaks in rainfall and that droughts considerably retard what is at best a slow process. Good rains also help by enabling the elephants to spend less time near the waterfront but the converse is equally true.

Even if left to increase to 135,000 or more, there is little likelihood of a disaster such as that in Tsavo when an estimated 5,000

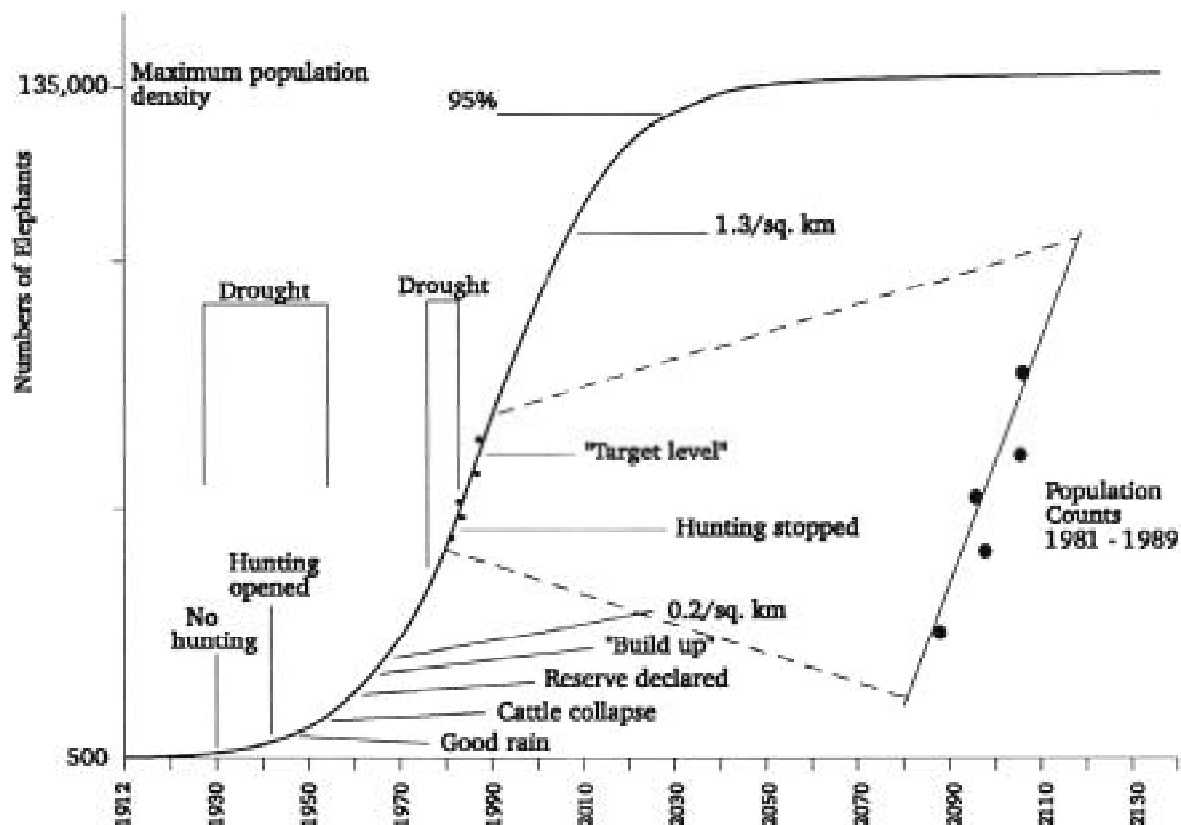


Figure: The logistic model drawn with *rm*=0.07 land showing the fit of population counts over the last nine years

elephants died in a drought year. This is because the elephants at Chobe and Linyanti are probably supported in large measure during the dry season by the extensive flood plain grasses which remain green throughout: in Tsavo's semi-arid ecosystem there was no food resource close to the permanent water. Increasing competition for sustenance would more likely lead to a decline in reproductive ability and a slowing of population growth. A further increase in the present population will lead to increasing conflict with the adjacent agricultural areas unless elephants disperse south and southwest of the Okavango Delta where presently the density is very low. It is not known why the delta is under-utilized by elephants: none has been recorded there nor were any shot during the tsetse control operations.³¹ However, hunting was encouraged close to Maun in the east from 1939, followed by organized game extermination from 1942 to 1967, and so possibly the disturbance factor has kept them away. Should elephants colonise this tract in any number they will come into conflict with the veterinary cordon fence designed to separate the buffalo Foot and Mouth disease carriers to the north from the cattle south of the barrier.

At Savuti, in the southwest of the park, a different situation pertains to that found along the Chobe-Linyanti rivers. The Savuti Marsh is an area of about 100 km containing open grassland in the centre and bordered to the west by a woodland of *Acacia erioloba* and *A. luederitzii*. The area is a marsh in name only. It was wet until the late 1880s when the Savuti River stopped flowing. It remained dry until 1958 when the river flowed again and refilled the marsh. The water supply was more or less continuous until 1981 when again the flow stopped: the marsh finally dried up in 1983. The acacia trees are characterized by being uniformly mature, evidently having grown up in response to the original drying-out of the marsh. But many were drowned by the re-flooding and this has resulted in increased pressure on the woodland remaining on the periphery of the former marsh area. The estimated 3,000 elephants from the Linyanti region which use this area and the surrounding 100 km² or so, mostly in the dry season, are hastening the trees' destruction by ring-barking.³² Hence the forest of dead trees, like that created by the *A. tortilis* woodland flooded by Lake Manyara in the sixties, is only partially attributable to elephants. Regeneration of the acacia trees, it seems, would take place only in a much wetter ground-water phase. A large area of *A. hebeclada* scrub in the south is not touched by elephants at all, possibly because the clay on which it grows is riddled with treacherous sink holes.

Problems of Another Kind

In the east of the country there is a separate population of elephants which poses a problem of another kind. This population, of unknown size, comes from Zimbabwe, regularly breaking through the border veterinary cordon fence. Furtive, aggressive and with no protected area to retire to, the animals maraud through a relatively densely settled area, disappearing whenever attempts are made to track them down. The following extracts from a resident's 1989 letters speak eloquently for themselves:

... I will deal with my home village, which is Tobane. At Tobane in the past elephants found a home belonging to a resident east of Tobane, these elephants brought her house down at her cattle-post and threw out her belongings.

At our cattle-post at Tshutshumane, the same elephants found the herd-boy's bag of sour milk, brought the sack down and spread milk all over, unprovoked by anyone.

After the disastrous drought, the elephants found a field with a good harvest and devoured all the produce.

At my late uncle's place they brought down the kraal and almost brought down the hut with some property.

The latest incident, these elephants came to our cattle-post and brought down the kraal and [the] calves were panic stricken and fled into the bush.

... the animals after doing all havoc and being satisfied, left for an unknown place.

... everybody after the effects of drought did all to plough, oily to feed the aggressive elephants which ate all [the] produce and went into residence[s] to devour what was kept there.

Gentlemen, when you banned elephant hunting way back in 1983, it was my pleasure and everybody's that these animals would not be provoked by hunters, they would remain calm and keep peace with us. However, this is not the situation, these elephants are very aggressive and feel they've been licensed to harass us together with our property.

... If at all the concept of conservation has all these after effects, the policy has driven off feeling for humans for [that of] wildlife by those charged with the responsibility to implement this. I personally view your department as an enemy to mankind ...

... Even if it is worldwide said [the] African elephant is almost going to extinction, should human beings suffer for [the] preservation of these animals

And:

... I have seen very good articles on preservation of African elephants, and the major role played by these creatures. However, a look is only made at this but human beings' life is threatened and nothing is done. Is this what the Government wants? Is it the whole thing behind conservation?

... Fear is mounting that if these animals cross [the] Motloutse [River], anyway which they do but do not travel to the fields, should this occur there will be weeping and gnashing of teeth, and this will occur because elephants are licensed to do as they please

The Tuli Block Elephants

Not far to the east of where the rogue herd operates, are an estimated 550 to 600 elephants in the Tuli Block, concentrated mainly in the private Mashatu Game Reserve at the junction of the Shashi and Limpopo rivers, but ranging over about 300 km².

Although some assert that this is all one population with the rogue elephants referred to above, the behaviour of the rogues is quite different to that of the Mashatu elephants, and a connection therefore seems unlikely. In 1941 these elephants comprised a remnant herd alleged to number 40 to 50 and General Smuts, Governor of South Africa, created a sanctuary for them on the South African side of the frontier and requested the Bechuanaland Protectorate Government to do the same on their side.

The Chief, Tshekedi Khama, refused to consider the idea of a sanctuary on his tribal land saying that the elephants were already protected and only shot when they damaged plantations. General Smuts urged the Government to press the point, fearing that the land would be sold to farmers, but Chief Tshekedi Khama would not reconsider his decision. The outcome was that the sanctuary on the South African side was soon re-gazetted as farmland while the elephants on the Botswana side became so numerous that in 1956 a Game Control Unit was set up to control them, the unit eventually becoming the Department of Wildlife and National Parks. Today, protected in a private game reserve, this population also has exerted a considerable destructive effect on the riparian woodland and many large mature trees have been killed by ring-barking while no regeneration is taking place. So far the Government has hesitated to authorize any reduction in numbers, since this could be politically misconstrued while elephant hunting is prohibited in the country. With an estimated total of 590, the density is about 0.6/km². There is some suggestion that the population has remained much the same size in numbers since 1976, but these elephants come into increasing conflict with surrounding farmland. Although partly restrained by electric fencing, this can only be a temporary solution unless the population reacts rapidly with a decreased rate of recruitment due to shortage of food, as perhaps it may now be doing. However, to reach a total of 590, as recorded in 1976, without immigration the population would have had to number around 250 head in 1940. Since elephant

populations have often been underestimated by a factor of ten, it is quite possible that there were five times as many elephants in 1940 as was thought to exist. The reason why this population may be stabilizing at the relatively low density of 0.6/km² could be the scarcity of perennial grass in the area. Formerly so heavily overgrazed by cattle that livestock rearing became uneconomical, the area was turned over to hunting before becoming a private game reserve: the entire populations of wildebeest and zebra died recently in the drought due to the lack of grazing. The elephants must therefore depend principally upon browse.

The Future

Whatever may be the criticisms levelled at the logistic curve as expressive of population growth in the elephant, certainly the population in northern Botswana is heading for a much higher level than presently exists; and with an observed 6.4% of calves in the population it must be increasing at a near maximum rate.³³ Limitations of habitat will eventually come to bear on this rate of increase, at density levels that we may suppose have been witnessed elsewhere in Africa. But the unstable Kalahari sands which occur in the area, will not have the same resilience to vegetative loss as the fertile soils of, for example, Uganda's Queen Elizabeth National Park with its similar rainfall. The consequences to this habitat of uncontrolled, or even inadequately controlled, growth in elephant numbers could be catastrophic.

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How Much Rhino Horn has come onto International Markets since 1970?

Esmond Bradley Martin and T.C.I. Ryan

To deal with the international trade in rhinoceros horn it is essential that all major markets are known. If the number of rhinos dying during a certain period is estimated and the equivalent horn weight compared with total identified sales over the same time, then some indication of whether a so-far unidentified market exists should be evident. Undoubtedly there is a large difference between the weight of horn from dead rhinos and that vended, and this apparent discrepancy has led Western to postulate that some large market remains undiscovered. We argue against this and show that supply and demand agree within reasonable limits of error.

Asian rhinos supply a small but very valuable part of the total weight of rhino horn. The amount of Javan rhino horn put onto the market since 1970 has been negligible because so few have died. In 1969 the Schenkels, who were working in the Ujong Kulon Reserve in Western Java where probably the only viable Javan rhino population exists, estimated that there were 25 animals.¹ This population expanded to just under 60 by 1979 but declined to 54 in 1984,² largely due to disease which killed at least five animals in 1981 and 1982, and it has remained at about 55 since then. From 1967 to 1986 there was very little poaching of Javan rhinos,³ but some died from natural causes. Perhaps no more than three horns on average (Javan rhinos have only one horn) could have been supplied to middlemen each year, so probably less than two kg of Javan horn have been sold annually.

It is not known how many Sumatran rhinos existed in 1970; conservationists were grossly underestimating their numbers long before then. In 1958 Bernhard Grzimek wrote that the world population of this species was no more than ten.⁴ In 1968 Werner T. Schaurte, in an IUCN publication, estimated between 150 and 170;⁵ and a year later Rudolf Schenkel, then Chairman of the IUCN Asian Rhino Specialist Group, and E.M. Lang estimated that there were between 50 and 100 Sumatran rhinos left.⁶ The most recent range, supplied by Nico van Strien, is the most realistic: between 539 and 991.⁷ This conforms to what wildlife traders believe, and also it makes sense when we consider what is known about the supply of Sumatran rhino horn, hide, nails and other products found on markets since 1970. This species has been under dire threat from poachers and has also lost much of its natural habitat; during the past ten years we have found a reasonably large quantity of Sumatran horn for sale in the traditional medicine shops of eastern Asia. It seems likely that there must have been a minimum of 2,000 Sumatran rhinos in 1970. Bearing in mind the annual recruitment rate, this population could have sustained 3,000 deaths during the 18-year-period to date. Since the mature Sumatran rhino carries horns totalling about 269 gm in weight,⁸ the carcasses could have yielded at most an average 45 kg of horn per year. But of the 3,000 a number would have died from natural causes in the depths of the tropical rain forest which is their home; the horn on these animals would be lost. Thus a figure of 25 kg annually would be a more probable figure for the amount of horn coming to the trade.

For Indian rhinos the statistics are fairly accurate because censuses have been carried out over the past quarter-century in both India and Nepal by wildlife departments' personnel⁹ and independent scientists such as G. Caughley,¹⁰ A. Laurie,¹¹ J. Spillett¹² and E. Dinerstein.¹³ Also there is information available on Indian rhino horn entering the market as some has been sold officially, unlike the case of Sumatran rhino horn.

From 1969/1970 to 1978/1979 the Assam Forest Department sold 210.39 kg of Indian rhino horn.¹⁴ Some 39.50 kg offered for tender in 1979/1980 were not sold due to criticism against marketing a product from an endangered species and since then no rhino horn has been sold officially by any Indian authority. All horn collected from dead rhinos is being stockpiled. In addition to that sold officially poached horn was, and still is, available to traders. Twenty-seven Indian rhinos were illicitly killed between 1970 and 1978 in Kaziranga National Park, Assam,¹⁵ where 75% of Indian rhinos live. From 1979, figures for the whole of Assam, which contains 95% of the total Indian rhino population (1,295 in 1986), show that a minimum of 400 animals were poached in the nine years up to December, 1987.¹⁶

Given an average weight of 722gm per horn¹⁷, the poached animals yielded some 310 kg of horn which together with official sales make a minimum total of some 520kg put onto the market from Assam between 1970 and 1987. Furthermore, during this period some rhinos were poached in the state of West Bengal¹⁸ and Nepal's Royal Chitwan National Park; these supplied perhaps another 40 kg to traders. Horn recovered from rhinos found dead of natural causes in Chitwan after 1975 has not been sold nor put onto the international market.¹⁹ It would, therefore, seem that the total amount of horn from the greater one-horned rhinoceros over the past 18 years is at least 560kg, an average of 31 kg per year.

Table
Estimates of Asian Rhino Horn coming onto the Market

Species	Average kg per year	@	Av. horn wt. per animal (gin)	=	Approximate no. of rhinos
Javan	2		676		3
Sumatran	25		269		93
Indian	31		722		43
	—				
Total	58kg				

(NB: When compared with the more than 50 times as much African rhino horn on the market this total weight is very small but its value is astounding. At some US\$ 10,000 a kg the wholesale value per annum is US\$ 580,000 whereas 3,000 kg of African horn would fetch US\$ 2,000,000.)

While African rhinos have provided the market with over 50 times as much weight of rhino horn as have the Asian animals quantifying the amount exported to Asia, using sources within Africa, has proved to be impossible because of the lack of reliable data. Most African countries have no statistics at all and of those that have published annual customs reports on rhino horn exports, such as Kenya and Tanzania, the amounts shown are roughly only half of what actually went out.²⁰ Of the 19 African countries still possessing wild rhino populations none now has legal trade in rhino products and practically all horns that leave the continent are smuggled: it is also now illegal for most Asian consumer countries to import rhino products. Even in the early and mid- 1970s, when trade in rhino horn was mostly legitimate, some major user countries, such as China and Hong Kong, kept no records of imports while the official statistics from Taiwan, Japan and South Korea were inaccurate as import levies encouraged both smuggling and the falsification of in-voices.²¹ In North Yemen, which was the single largest rhino horn importing country from 1972 until the early 1980s, the official statistics for the 1970s are erratic and for the 1980s non-existent.

Let us look first at the estimates for black and white rhino populations. David Western and EBM calculated that there were 65,000 black rhinos in 1970, using data from John Goddard for East Africa, counts for southern Africa and by applying studies of rhino population densities to central and west Africa. This figure has been generally accepted as a reasonable approximation. From the combined efforts of over 30 scientists, including Kes Hillman, David Cumming, Anthony Hall-Martin and Martin Brooks, all members of the IUCN African Elephant and Rhino Specialist Group, David Western and Lucy Vigne obtained estimates for 1980 of 14,785²³ and 8,800 for 1984²⁴. In 1987, the Nyeri meeting of the IUCN African Elephant and Rhino Specialist Group determined a figure of 3,832.²⁵ However, as anyone who has attempted to conduct a rhino count will readily agree, it is extremely difficult to locate these animals in the thick bush where they live and most estimates, including those above, are likely to be below the true figure.²⁶

For white rhinos it is assumed that there were about 3,900 (2,000 northern and 1,900 southern) in 1970, 3,840 in 1980,²⁷ 3,948 in 1984²⁸ and 4,600 (50 northern and 4,550 southern) in 1987.²⁹

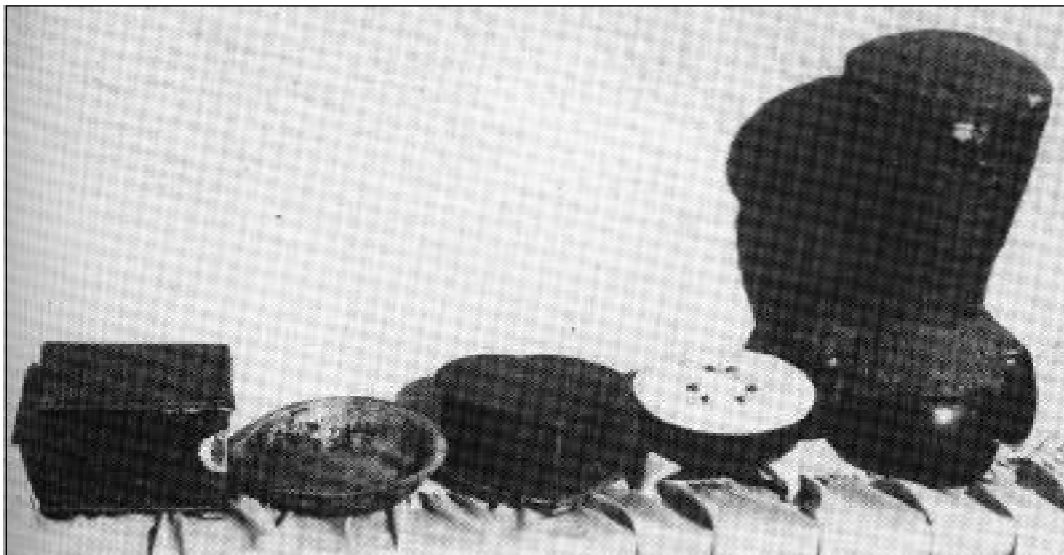
In determining the number of white rhino deaths and hence the amount of horn, it would be illogical to apply a common recruitment rate to both the northern and southern populations. The northern population has been severely reduced by poaching from some 2,000 animals in 1970 to less than 50 today and will have only a small recruitment rate. Conversely, with the exception of those animals in Mozambique³¹ where some have been poached, the southern population is youthful and will have a low natural death rate and high recruitment rate.

Using a 3% mortality rate for the southern group³² and a small recruitment rate for the northern then perhaps 4,350 white rhinos have died since 1970. If 80% of these were adults carrying an average of four kg of horn apiece³³ and assuming half of the horn was not found, then some 7,000 kg of white rhino horn came onto the market from 1970 to 1987.

It is worthy of note that although the figures as to the status of the white rhino appear very encouraging we should remember that in 1970 there were about 2,000 spread among Zaire, the Central African Republic, Sudan and Uganda and that practically all these are now dead. It is the strides in conservation management made by South Africa that have made the numbers look comparatively healthy: the population in South Africa has more than doubled in the past 18 years.

Black rhinos have been the source of the greatest weight of horn reaching the market. Our arguments on this source of horn are therefore somewhat more detailed.

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All the objects here were made from various parts of a greater one-horned rhino for General Kiran Shumsher Rana whose father was a prime minister in Nepal.

Once trade becomes illegal, dealers are naturally reluctant to disclose the amount of horn they are bringing into their countries. Nevertheless, it is possible to develop a rapport with certain traders who will then discuss their business practices and, with the advantage of having started research on the international trade in rhino products before many restrictions were imposed, Esmond Bradley Martin has been able to discover much about supply and demand. In some instances, on condition of anonymity, major traders have divulged certain facts which over the years we have been able to cross-check and confirm. These and other information confirms that the estimate EBM published for the average annual amount of rhino horn which left Africa between 1970 and 1979, a minimum of eight tonnes, is still valid. From 1980 to 1987, EBM has estimated that exports of horn fell to three tonnes a year.²² The essence of our argument is that these estimates are consistent with the death rates of rhinos over the years: that the error between the possible supply of horn and the known use or demand is negligible in terms of the uncertainty in the parameters used.

During the mid-1960s the first reasonably accurate census of rhinos in Tsavo East Park, based on stratified random samples, was made by John Goddard.³⁴ stated that the population was stable, estimated the number of rhinos in Tsavo East to be $4,200 \pm 25\%$, and calculated that the annual recruitment rate was 10.9%. Goddard's finding of a 10.9% recruitment rate on a stable population implies a death rate also of 10.9%.³⁵ The observed population was not under particular duress, so we may conclude that 10.9% is the natural death rate.

Western argues that when a population comes under heavy poaching pressure the recruitment rate is between 7% and 10.9% and Rob Brett considers that a 7% recruitment rate is more likely than 10.9%.³⁷ The lower figure would seem more plausible for a variety of reasons, ranging from the wider dispersion of individuals to the increased killing of fertile females.

It is possible to calculate the death rate which would reduce the number of animals estimated for 1970 to the estimate for 1980, and similarly for the periods 1980 to 1984 and 1984 to 1987, taking into account the annual increment for recruitment. If the initial population is P_s , the final population P_f , the death rate $d\%$, the recruitment rate $b\%$ and the period of years is n then $P_f = P_s \cdot R^{nb} \cdot R^{nd}$ where $R^d = 1 + d/100$ and $R^b = 1 + b/100$.

The figures given in the Appendix were obtained by adding the births to each year-start number and then subtracting the deaths. Then summing the deaths each year gives the approximate number of dead rhinos since 1970.³⁸ (If deaths are subtracted from the year-start figure before births are added then the total number of rhinos dying over the period would reduce by more than 15%. We will take the higher figure in conformity with our policy of maximizing supply and minimizing demand estimates.)

The calculations yield a total of some 93,800 dead rhinos at the 7.5% recruitment rate. Of these, 20% would be juveniles carrying little or no horn, and the remaining 75,100 would have horns weighing on average 2.88 kg.³⁹ The maximum amount of black rhino horn which could have been produced would thus be some 216,100 kg.

A lot of this horn never would have reached the international market. It is made of keratin fibres which rapidly deteriorate under wet conditions and also is destroyed quickly by insects. In areas of high rainfall such as Zambia, the Central African Republic, southern Tanzania and parts of Kenya, it is unlikely that rhino horn on a carcass would last more than a few weeks during the rainy season. Thus a considerable quantity of horn from rhinos dying of natural causes would never be recovered. Partially damaged horn is difficult to sell and only in South Korea is there a demand for that which has been riddled by insects. During the 1970s the main market for African rhino horn was North Yemen; it was the easiest and closest market to supply, but buyers there would accept only good quality horn; they could not use damaged horn to carve dagger handles. Consequently, even when poor quality horn was found, it would not usually be collected. Moreover, few people lived in the places where large numbers of rhinos existed in the 1970s, such as the vast wildlife sanctuaries of Luangwa Valley, Zambezi Valley and the Selous, and so chance discovery of horn was uncommon.

A recovery rate is the percentage of a total product that is found by chance and/or search. Regrettably, no investigation has been made

of such rates for rhino horn in Africa. However, Ian Parker in his major report, "The Ivory Trade", reviewed the recovery rates for elephant ivory over the period 1950 to 1978. The tusks picked up by the authorities in various parks included those from wounded animals which escaped illicit hunters as well as those from animals dying naturally. According to Parker, official recovery rates for ivory varied from 84% of the mortality in a small, well-patrolled park such as Manyara to 8% in Tsavo which is vast and understaffed. Given the predisposition of rhinos to live in thick vegetation which reduces the visibility of both live and dead animals, and the fact that their horns perish quicker than ivory, it is doubtful that the recovery rate for rhino horn could ever be as high as that for ivory. According to Ian Parker, within the large parks and game reserves where the majority of Africa's rhinos lived in the 1970s the recovery rate would have been lower than the 8% figure estimated for ivory in Tsavo.⁴¹

The records kept by the authorities in Tsavo East Park show that the recovery of rhino horn by the park's staff and other officials has always been extremely low, even when Tsavo was well-managed in the 1960s. From 1962 until 1967 between 42 and 75 rhino horns were officially collected each year, the annual average being 62, representing 31 dead rhinos.⁴² On the basis of Goddard's findings, each year of the mid-1960s an average 458 rhinos (10.9% of 4,200) should have died, but the authorities picked up horns from only 31 rhinos or 7% of the estimated number of dead animals. We do not know how many horns were collected by poachers nor, more importantly, do we know what percentage of the horn was never found or was in such poor condition it was simply left in the bush.

In 1976, 56 horns were officially collected from the many hundreds of rhinos remaining in Tsavo East but then poaching escalated and the standard of management declined and in 1977 only 16 horns were found. From 1978 to 1987 not a single one was handed into Park headquarters.⁴³ The story was practically the same for Kenya's other parks: Tsavo West's park staff collected a total of only 14 horns between 1978 and 1985,⁴⁴ in



During the 1970s Japan was one of the world's largest importers of rhino horn; shown on a book here are small pieces of sliced rhino horn which were later sold as medicine to lower fever, cure measles, stop nosebleeds and alleviate blood poisoning.



An official of Nepal's Royal Chit wan National Park displays some rhino horns, hooves and a piece of hide collected from dead rhinos, which were later sent to the King's Palace in Kathmandu.

Aberdare Park from 1977 until 1986 only 22 horns were officially recovered,⁴⁵ although that park's rhino population was estimated to be 600 in 1978.⁴⁶ What happened in Kenya's parks from 1976 onwards was that illicit hunters took more horns and some officials misappropriated those that were found.

The low official recovery rate of 7% for rhino horn in Tsavo East in the mid-1960s is not typical of all parks. In Meru National Park from 1969 to 1974 there were an estimated 200 black rhinos⁴⁷, and heavy poaching had not yet begun. Taking the usual 10.9% mortality rate, 22 rhinos would be expected to die per year in Meru. Over the six-year period 55 horns were officially found⁴⁸, representing an average annual recovery rate of 21%. For Nairobi National Park, a small reserve which has had little rhino poaching since the major translocation of rhinos into it between 1966 and 1968,⁴⁹ the official recovery rate is probably the highest of all East Africa's parks. Using Goddard's mortality rate on a population of 30 to 35 during the 1970s and the 14 horns known to have been handed to the authorities between 1979 and 1981⁵⁰, the recovery rate is in excess of 75%.

We will assume that Tsavo East's and Meru's recovery rates are closer to reality for most areas containing large rhino populations than that for Nairobi Park because in the 1960s and 1970s most black rhinos in Africa lived in reserves similar to Tsavo East and Meru. We therefore estimate 14% at most (i.e. the un-weighted average of the recovery rates for Tsavo East and Meru)

as the recovery rate of horn from animals dying a natural death. We also assume that poachers would generally be successful in collecting the horn from their victims.

Sport hunting for rhinos accounts for a small but quantifiable amount of horn. Until the mid-1970s, and until 1979 in Zambia,⁵¹ most countries with rhino populations allowed licensed hunting. Mozambique, Tanzania, Zambia, Kenya, the Central African Republic and Sudan attracted many foreigners from Europe, North and South America by offering them the opportunity to shoot one of the "Big Five". It was expensive to hunt a rhino for sport because licences had to be purchased from the government and the safari firms which organized the hunts charged high fees. The horns from a minimum of 600 rhinos shot on licence between 1970 and 1979 were usually exported by the visiting sportsmen who would normally retain them as trophies and so the horn did not enter the market.

Other African rhino horn unavailable to the market would be that from animals exported live to safari parks and zoos throughout the world. Over 1,500 rhinos have left Africa since 1970 to go to new homes, most of these animals being white rhinos from southern Africa.

Since the mid-1970s and early 1980s, when most of the official bans on export of rhino horn were established in African countries, various government departments have stockpiled horn confiscated from traders and poachers and that recovered from the bush. Several of these stockpiles are now substantial amounts. The largest is held by the Natal Parks Board which in April, 1987, had 1,692 kg. Zimbabwe officially has over 750 kg, Kenya 247 kg (as of October, 1986), 53 Namibia 173 kg (as of May, 1987), and the South African National Parks had 100 kg in their strongrooms in 1987.⁵⁵ The Zambian government has a small quantity (55 kg in January, 1985)⁵⁶ and so does Tanzania (31 kg in September, 1987).⁵⁷ A few other African countries have some as well. Therefore, by the end of 1987 there was a minimum of 3,100 kg (in southern Africa mostly from white rhino) which had not been exported. Aside from that held officially, some traders and collectors in Africa retain rhino horn which must amount to at least half a tonne in total.

Some rhino horn kept in government storehouses has deteriorated. In 1987, when EBM last visited the Ivory Room in Mombasa where the Kenya Wildlife Conservation and Management Department traditionally keeps game trophies, the majority of the horns he saw were in appalling condition, and some even fell apart in his hands. Insects and high humidity are responsible for the damage and these have taken toll also of government-owned stocks held in Dar es Salaam.

At the first meeting of the African Rhino Specialist Group, in Kenya during 1980, a programme to try to end trade in rhino horn was initiated and one of the recommendations made was that governments should destroy the stocks of rhino horn they held to prevent them from ever going onto markets. As far as we know, only Pilanesburg Game Reserve in Bophuthatswana did this: officials burned 35 kg in early 1981.⁵⁸

One more reduction in the weight of horn available to the market should be made due to the perishable nature of the commodity and consideration of the fact that it is smuggled between countries. There is no way of telling what this amount would be, but perhaps a couple of percent of the horn destined for Asia

from Africa is lost or damaged *en route*.

Lastly, some would be found and given neither to the authorities nor the trade. The rhino horns displayed for tourists in ledges and hotels are examples. Additionally a number of African peoples have their own uses for rhino horn. For example Zulu men burn rhino horn when they find it and daub the ash on their eyebrows to attract beautiful women,⁵⁹ Zimbabweans in the 1970s purchased rhino horn from traditional doctors in Harare's Pedzanhama market for use as a talisman to give them strength and power and to protect their homes from evil spirits⁶⁰ and Sudanese in Khartoum made boxes out of rhino horn until quite recently.⁶¹

As was earlier remarked, those who have studied the black rhino populations have come up with accepted numbers for four years: 1970, 1980, 1984 and 1987. These numbers were computed in various ways and do not relate to any particular time of the year. Since we need base numbers to make our calculations of rhino disappearance and not wishing to imply a greater accuracy than, perhaps, the data warrant, we have chosen to round the numbers to the nearest hundred and assume that they relate to the beginning of the year of observation i.e. 65,000 (1970), 14,800(1980), 8,800 (1984) and 3,800 (1987). These are the numbers used in the computations in the Appendix where a variety of recruitment rates (7.5%, 5%, 4%, 3%) have been applied to calculate the implicit death rates necessary to achieve these population changes.

The death rates vary in the three time periods and show the expected very large increase in 1984 -1986 (inclusive) during which time poaching was thought to have increased in response to the very large rise in the price of rhino horn.

The annual sales to identified markets have been presented. These, of necessity, are annual averages over spans of years: 8,000 kg per annum between 1970 and 1979 and 3,000 kg per annum from 1980 to 1986, all data inclusive. Since the average black rhino produces 2.88 kg of horn, these figures account for 2,780 rhinos annually over the decade of the 1970s, giving 27,800 rhinos; and 1,040 rhinos annually up to 1987, giving 7,280 rhinos. These compare with the dead rhinos of the 1970s — using a 7.5% recruitment rate — of 77,572 and 16,230 in the recorded years of the 1980s. That there is no major discrepancy between these figures is shown in the following analysis which considers a variety of corrections which must be made to both the supply and demand figures.

There has always been a demand for rhino horn within Africa, ranging from Sudanese box-making to talismans; this is estimated at some 15 rhinos per year throughout the period. Until sport hunting was comprehensively banned in 1979, a minimum of 63 rhinos were killed annually on licence. On average, about 29 black rhinos per year have been exported live to zoos and safari parks. Legal stockpiles have grown to about 3,600kg since 1978 and this figure would have been say 20% greater if the horn was stored efficiently. Stockpiles of 4,200 kg would represent 170 rhinos annually. These four items would increase the demand figures by approximately 1,240 in the 1970s and 1,500 in the 1980s to totals of 29,040 and 8,780 respectively.

Considering the supply figures, if we accept Western's 20% of deaths as juveniles which do not contribute horn, the numbers to be accounted for in the market are significantly reduced to 62,057 in the 1970s and 12,984 in the 1980s and of these animals approximately half died natural deaths. Taking the Goddard death

Appendix

Numbers of dead black rhinos from 1970 . 1987 using recruitment rates of 5%, 4% and 3%, and base black rhino populations for 1970(65,000), 1980(14,800), 1984(8,800) and 1987(3,800)

Year	7.5%	5.0%	4.0%	3.0%
1970	13,816	12,191	11,541	10,891
1971	11,915	10,514	9,953	9,393
1972	10,276	9,068	8,584	8,101
1973	8,863	7,820	7,403	6,986
1974	7,644	6,745	6,385	6,025
1975	6,592	5,817	5,507	5,197
1976	5,686	5,017	4,749	4,482
1977	4,904	4,327	4,096	3,865
1978	4,229	3,732	3,533	3,334
1979	3,647	3,218	3,047	2,875
(70s totals	77,572	68,449	64,798	61,149)
1980	2,914	2,544	2,396	2,248
1981	2,559	2,234	2,104	1,974
1982	2,247	1,962	1,847	1,733
1983	1,973	1,722	1,622	1,522
(80s subtotals	9,693	8,462	7,969	7,477)
1984	2,809	2,589	2,501	2,413
1985	2,123	1,957	1,890	1,824
1986	1,605	1,479	1,429	1,378
(80s subtotals	6,537	6,025	5,820	5,615)
Total dead rhinos	93,800	82,934	78,587	74,240

(All numbers rounded to the nearest whole integer)

Deaths per 1,000 rhinos per year given various recruitment rates

Period	Recruitment rates			
	7.5%	5%	4%	3%
1970-1979	198	179	171	163
1980-1983	183	164	156	147
1984-1987	297	280	273	266

(All numbers rounded to the nearest whole integer)

rate of 10.9% of the population, natural deaths would account for 42,764 in the 1970s and 8,947 in the 1980s or, ignoring juveniles, 34,211 and 7,157 respectively. Earlier in this paper we have argued that the empirical evidence indicates a low recovery rate of 14% of horn from rhinos which die naturally. Of the 42,764 natural deaths this would mean some 5,987 found and for the 1980s figure of 7,157 natural deaths 1,002.

The supply of horn would then be obtained from total adult deaths less natural deaths plus the 14% of natural deaths recovered. This represents a total of $62,057 - 34,211 + 5,987 = 33,833$ for the 1970s and $12,984 - 7,157 + 1,002 = 6,829$ in the 1980s.

Comparison of the 33,833 supply for the 1970s with the known demand of 29,040 implies that poachers were successful in getting the horn from 85% (29,040/33,833) of the animals killed or that some 1,380kg of horn are unaccounted for annually. For the 1980s, the demand appears to exceed the supply.

In view of these calculations and their conclusions, it seems that little rhino horn is unaccounted for. Finer analysis of the demand side might clarify whether there were occasional bumps which would explain the disappearance of the surpluses in the 1970s and mid-1980s if poacher recovery truly was about 100%. Nevertheless a fairly small decrease in the population estimate for 1970 would remove completely the unaccounted surplus.

Acknowledgement

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These black rhino skulls were photographed in South Luangwa National Park, Zambia, in 1983. During the 1970s and 1980s thousands of rhinos succumbed to poachers in the Luangwa Valley, and today probably less than 200 rhinos survive in Zambia.

Elephants in Tarangire

Cynthia Moss

Tarangire Park

Tarangire National Park, Tanzania, which covers an area of 2,600 sq km, currently contains an estimated 2,319 elephants,¹ and the whole 20,500 sq km ecosystem of which the Park is a part is estimated to contain 6,110 ($\pm 51\%$).² Elephants are thought to have moved into the Park and the surrounding Lolikisale Game Controlled Area and Simanjaro Plains as a result of poaching and harassment in other areas. Poaching of the Tarangire population was severe in the 1970s with a carcass ratio of 32% reported for 1977.³ The 1988 census estimated the overall carcass ratio at 6.7%, which suggests that poaching has decreased in intensity.⁴ Before the study reported here, little was known about the age and sex structure of the elephant population using the Tarangire ecosystem and yet it is one of the largest in the Tanzania National Parks system.

The Survey

In September 1989, a survey was made of the group size, composition and age structure of the Tarangire elephants, using the 17-year-long Amboseli Elephant Research Project as a basis for methodology and comparison. The primary purpose of the survey was to provide information on elephant biomass for incorporation in the Tarangire land-use study being conducted by Robert Davison for the African Wildlife Foundation. Other data collected have made possible an assessment of the overall status of the population. The results indicate a young and growing population which appears to be recovering from a period of intensive poaching in the past.

One week was spent in Tarangire National Park from September 11-18 of which six full days were used for conducting the survey. Observations were made from a vehicle, and mostly from the available road system, in areas suggested by Robert Davison, Director of the Tarangire Land-Use Study, Frank Silkiluwasha, Park Ecologist, and Issac Muro, Park Warden. The northern part of the Park was covered more intensively because elephants are known to concentrate there in September, but three excursions were made to the south-central area.

Whenever a group of elephants was sighted the date, time and location was recorded, the group counted and classified as either cow/calf or bull. In most instances an estimate was made of each animal's age and, if the elephant was considered to be over 10 years old, a note made of its sex. An assessment of the family

structure, detailed drawings and notes of any distinguishing features, the animals' reaction to the vehicle and other relevant ecological and behavioural observations were also recorded.

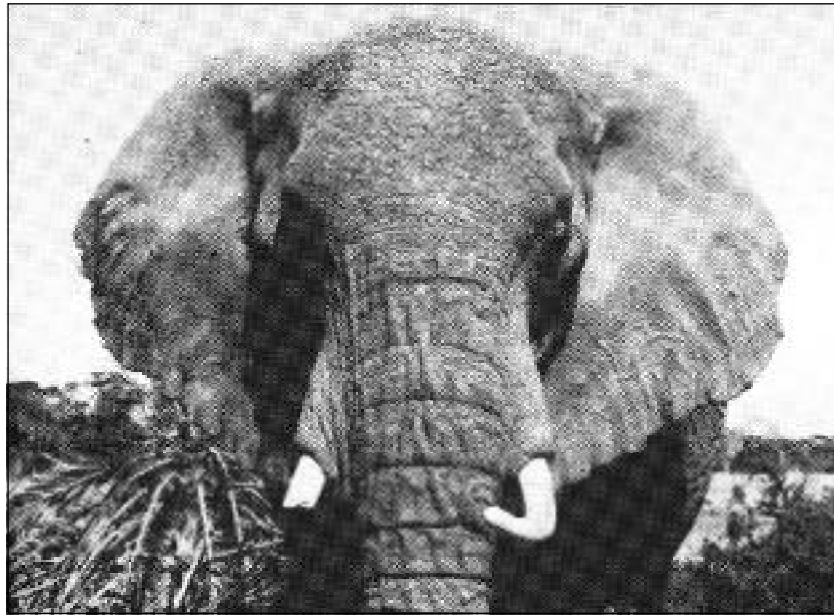
Estimating Ages

The age estimates were based on 21 year's experience studying animals of known age, first in Lake Manyara National Park from 1968-70 and then in Amboseli National Park from 1972 to the present. The author started the Amboseli

Elephant Research Project in September 1972 and since that time the births of all calves have been recorded to within plus or minus one month; the ages of calves under three years old in 1972 were estimated to within six months by comparison with the Manyara observations. Thus, in Amboseli, year of birth records extend back to the beginning of 1970 and today there are 449 elephants of known age, ranging from newborn calves to animals 20 years old.

The experience gained by observing the growth and development of Amboseli elephants together with knowledge of the age when tusks erupt and the relationship of tusk length and circumference to age make it possible to estimate the ages of elephants up to 10 years old with an accuracy of \pm one year, and elephants 10-19 years old to within \pm two years.⁵

The ages of individuals of 20 years and older are more difficult to gauge, particularly for females. Males continue to grow in weight, shoulder height and tusk circumference throughout their lifetime and, with experience, it is not difficult to distinguish a 25 year old from a 35 year old or a 35 year old from a 50 year old. In addition, not only do bulls continue to grow but their head shape changes significantly by widening across the forehead and at the base of the tusks to give a more hour-glass appearance when viewed from the front.⁶ Other characteristics such as the size of the head in relation to the body and the thickness of the neck and trunk are also of use.



Tess', a 23 year-old female

Copyright Cynthia Moss

Female growth levels off at about 25 years of age and the subsequent slight increase in shoulder height is barely perceptible. However, females continue to grow in back length and this dimension has been used as a guide to judging age.^{7,8,9} As with males, tusk length and circumference increase throughout the lifespan but overall appearance is characterized by an increasingly bony look around the shoulders, a lower ear carriage and a tendency to deepening depressions above the eye. In Amboseli the author's estimates of age using all these characteristics have proved remarkably accurate when checked against tooth eruption and wear of elephants who have died.¹⁰

Survey Results

Table I
Groups Observed and their Distribution

Type of Group	No. of Groups	Median Group Size	Group Range	Group Interquartile Range	% of Total Groups
Cow/Calf	63	10	2—120	7—18	82
Bull	10	3	1—12	1—3	13
Single Bull	4				5
All Groups	77	10	1—120	4—17	100

The 77 groups seen totalled 1,046 animals with an average number of 13.6 elephants per group. The full distribution by group size is given in Figure 1. Age estimates were made for 56 groups containing a total of 629 animals. The careful drawings made of the ears of at least two animals in each group and the notes of any other individual characteristics such as damaged ears or missing tusks led to eight groups being eliminated from the age structure analysis because they were known or suspected to have been surveyed twice. The final sample was of 48 groups containing a total of 536 individuals all with assigned ages and representing 23% of the estimated Park population.

Age Structure

The overall age structure of the Tarangire sample is shown in Figure 2 and compared with that of Amboseli elephants in Figure 3. All 262 calves under 10 years old were aged to the year and are displayed in Figure 4.

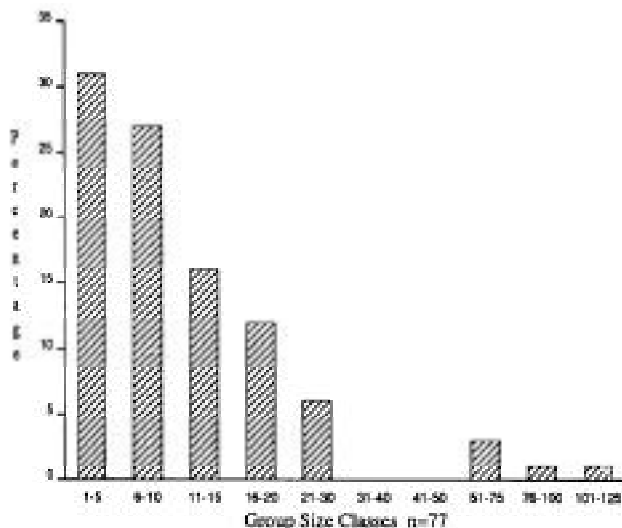


Figure 1. Elephant Group Size Distribution: Tarangire. September 1989

Table II presents the age and sex structure of both the Tarangire sample and the total Amboseli population. The sex of animals under 10 years was not determined in Tarangire. However, in Amboseli the female to male sex ratio for calves under five years old was 1:1 and for five to ten year-olds was 1.4:1. Assuming these ratios were valid for Tarangire, the under ten-year-olds divide into 73 females and 73 males under five and 68 females and 48 males over five. On this basis, the overall sex structure in the sample was 311 females and 225 males, or 1.4:1. The comparable figure for Amboseli in 1989 was 1.3:1.

To conform with Poole's results in other East African populations,¹² an adult sex ratio of all animals 15 years and older was calculated as 2.3:1 (female to male) as opposed to 1.5:1 in Amboseli.

Table II
Age and Sex Structure: Tarangire and Amboseli

	Age classes [#]									Total
	0A	0B	1A	1B	2	3A	3B	4	S	
Tarangire										
Female	73*	68*	48	42	32	24	16	8	0	311
Male	73*	48*	52	29	17	6	0	0	0	225
Amboseli										
Female	87	88	32	39	67	42	13	35	10	413
Male	84	62	26	31	35	35	16	22	3	314

*Interpolated

[#]To conform with the surveys already conducted by J. Poole in Tsavo, Mikumi and Queen Elizabeth National Parks¹¹, the following age classes were assigned to the animals surveyed in Tarangire:

Age Class	Age	Age Class	Age	Age Class	Age
0A	0—4.9	1B	15—19.9	3B	30—34.9
0B	5—9.9	2	20—24.9	4	35—49.9
1A	10—14.9	3A	25—29.9	5	50—64.9

Based on Amboseli data of age of first oestrus in females and age of onset of musth in males, a third sex ratio was computed using the number of females 10 or over to that of males 25 or over.¹³ Under this definition the sex ratio of breeding females to breeding males in Tarangire was 28:1 or 97% females and 3% males. Only six males over 25 were seen during the Tarangire survey and none of these was over 30. In Amboseli the corresponding sex ratio of breeding adults was 3.1:1 or 75% females and 25% males.

Males in several populations in East Africa have been shown to be sexually mature with viable quantities of sperm in a range from a mean of 10 to a mean of 17 years old and thus males in this age range are physically capable of impregnating females even though socially they may meet with difficulty.^{14,15,16} For Tarangire an analysis was carried out using a lower age for breeding males. Taking all males of 15 years or older and keeping all females of 10 and over, the breeding adult sex ratio in Tarangire becomes 3.3:1, or 77% females and 23% males.

Although it was strikingly obvious that there were very few adult females in the older age classes, the family groups in Tarangire did not appear to contain many orphans. All of the groups included one or more adult females, but simply had very young matriarchs by Amboseli standards. The oldest females seen were 35 to 40 years old and there were only eight of these: no elephant cows were over 40. Orphans were defined as calves under 10 with no mother, and in an effort to determine how

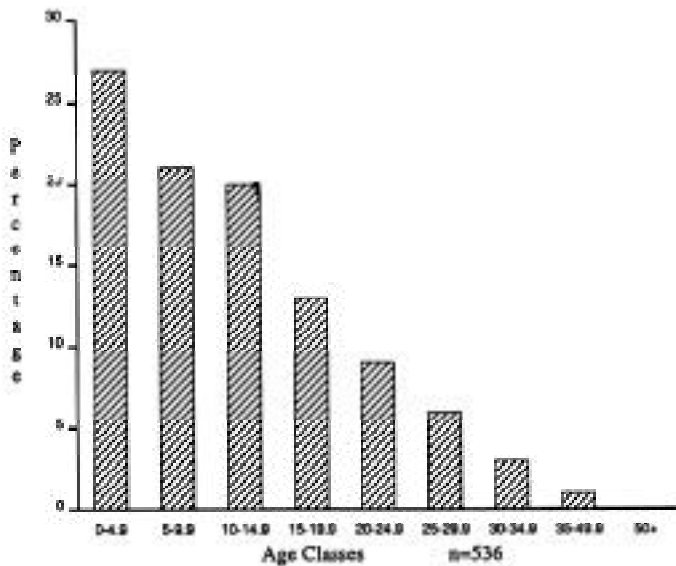


Figure 2. Age Structure for Tarangire Elephants, September 1989

many there were in the Tarangire families, the proportion of calves under 10 to adult females of 10 and over was calculated. For Tarangire this ratio was 1.5:1 while in Amboseli there were 1.3 calves for every adult female.

Behaviour

The behaviour of the Tarangire elephants to the approach of the research vehicle was greatly dependent on their location in the Park. None of the cow/calf groups was as calm as a typical

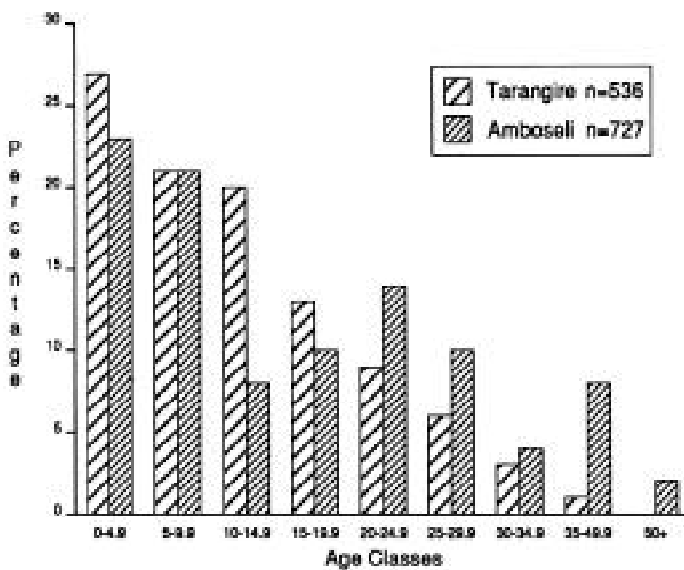


Figure 3. Elephant Age Structure Comparison: Tarangire & Amboseli, September 1989

Amboseli group but the elephants in the northern part of the Park were far more habituated to vehicles than expected. Most groups were wary of us at first sighting but calmed down once the engine was turned off. A few females made mock charges or shook their heads. The bulls, especially those that fed around the lodge, were even more accustomed to cars than the cows. In the central and southern parts of the Park the elephants were much less tolerant of intrusion. At the approach of a vehicle or upon detecting its presence by odour they ran away or charged or lifted their trunks and smelled the wind and then moved away at a walk. Even so they did not go far, only attempting to keep a distance of about 200 metres between themselves and the vehicle. No groups showed intense fear behaviour.

Conclusions

The survey indicated that elephants in large numbers are concentrated around the Tarangire River in the north and the Silale Swamp in the central part of the Park with a daily movement pattern of travelling towards the river or swamp in the morning and away in the evening. By midmorning there were always numerous groups of elephants along the Tarangire River in the north.

The Warden, Issac Muro, reported that there was little evidence of poaching in the Park (pers. com.) and the behaviour of the elephants using the northern part of the Park support this view. In addition, group size and dynamics in the Tarangire sample indicate a relatively undisturbed population. It has been suggested that elephants gather into large groups when they are harassed, by poachers or otherwise, and/or have lost many adults. Elephants also congregate when environmental conditions allow and they then move and feed in social aggregations.¹⁷ These two types of large groupings can be distinguished by the dynamics of the herd. Disturbed elephants move in tight formation, bunched together to present a wall of elephants; social aggregations usually form in and after the wet season and are much looser with greater inter-individual distance.¹⁸ In the Tarangire sample the groups encountered were generally small and discrete with a median size of 10. There were only four groups of over 30 and these appeared to be loose aggregations made up of families and a few bulls. The largest herd, numbering 120, was exceptionally relaxed when approached and was strung out in a long column moving away from the river. There was no indication that it was in any way disturbed.

The age structure and sex ratios derived from the Tarangire sample indicate that the population experienced relatively severe poaching sometime in the past, together with some evidence that illegal hunting continues today. The great majority, 68%, of the population was under 15 years old and only 4% were 30 or more; all the older animals were females. In contrast, 52% of the Amboseli population was under 15 and of the 14% aged 30 years and over 41% were males. In the Tarangire sample there were only eight females over 35 and none over 40; in Amboseli there were 58 females over 30 including 10 of over 50.

Poachers tend to kill adult males first since they have the largest tusks. When the males are greatly reduced in number and become difficult to find, poachers turn to the adult females and kill the larger and thus older ones, before finally turning to young males and females.

The age and sex structure of the Tarangire sample suggest that most of the large adults in the population have been killed but that poachers have not yet reached the stage of killing younger animals. As mentioned earlier, many deaths occurred in the 1970s when carcasses of freshly killed elephants were frequently observed: during the 1980s ground and aerial observations suggest less intensive poaching. At the same time the age structure of the sample indicates that the population has been breeding and successfully rearing calves for the last 10 years. Calves were well represented in every year except 1988, and the low birth rate that year may simply have resulted from a lack of availability of females who were neither pregnant nor in lactation anoestrus.¹⁹



A three to four year-old calf

The puzzling aspect of the relatively high reproductive rate of the Tarangire elephants was the lack of breeding bulls. It has been suggested that in populations with no or few males over 25 lowered fertility may occur because females prefer older males and young males are inexperienced.²⁰ The Tarangire data are not conclusive in regard to available males but calves are

being produced. It is possible that there are older males present that were not found during the survey. However, the northern part of Tarangire, which is thought to be favoured by bulls,²¹ was well covered during the survey and, indeed, was where most of the bulls were found. Additional information was provided on the Tarangire elephants by a panoramic sequence of photographs taken by John Sutton in May 1989 of a large herd of 300 animals. While in Amboseli a herd of this size would usually have at least one or two large males present, none was revealed by examination of the photographs.

It may be that younger males in Tarangire have been able to mate successfully with females in the absence of competition from older bulls. Under conditions where there is little male-male competition, either musth may not play as important a role in mating success as it does in a population with an abundance of males or males may come into musth at a much earlier age.

The key to the reproductive success of the Tarangire elephants probably lies primarily with the structure and composition of the families together with the lessening of poaching pressure during the last decade. Most of the families appeared to be intact in the sense that there were one or more adult females present in each. The Amboseli records show that calf survivorship is affected by many factors including among others: age of the mother, size of the family, number of allomothers (older female calves who take care of young calves), environmental conditions, sex of the calf and deaths and disturbance in the family.^{22,23,24} In many cases after a matriarch died in Amboseli the cohesion of the family broke down and there was splintering into subgroups for periods of up to two years and more. During these periods other calves died as well as the matriarch's. In most of these incidents the family eventually reformed and leadership was taken over by the next oldest female.²⁵ It is possible that the Tarangire females experienced similar periods of disruption in

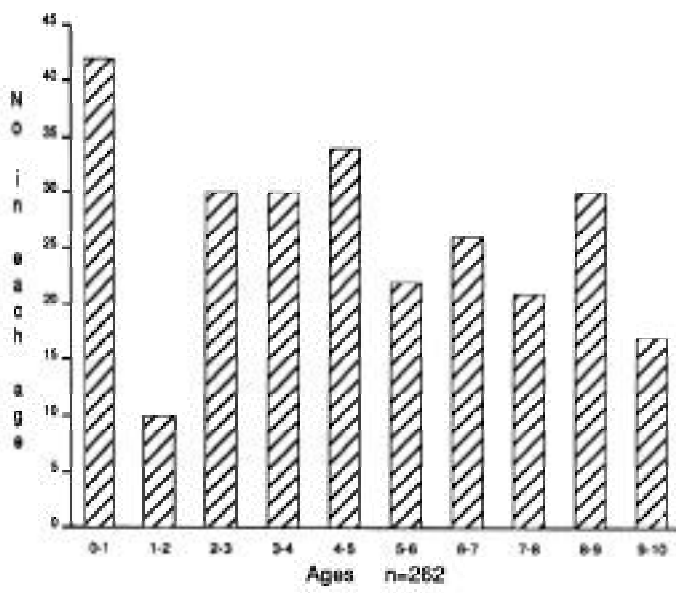
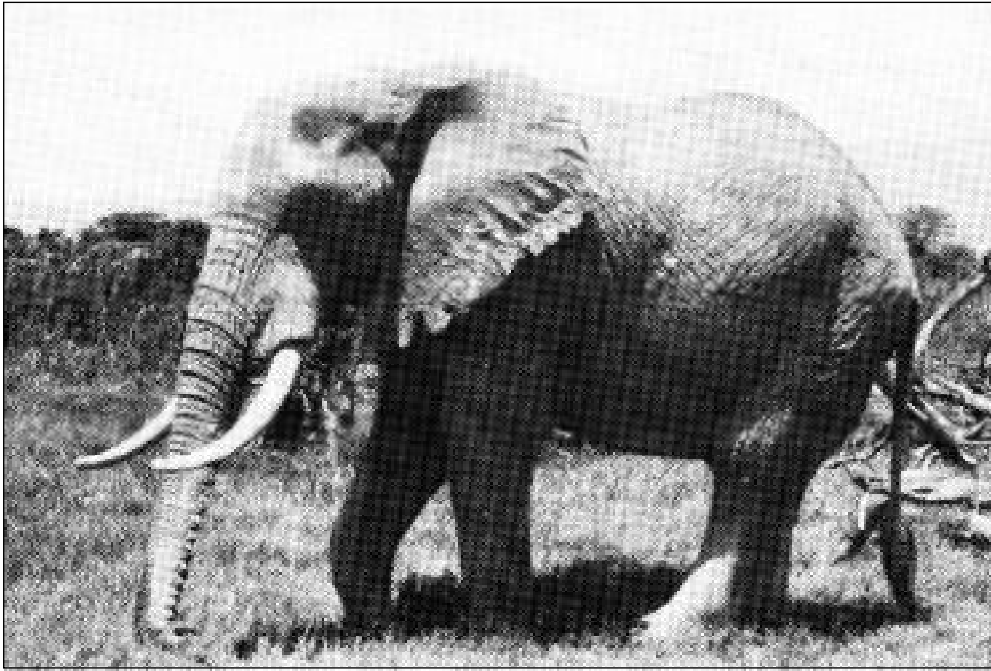


Figure 4. Age Structure: Tarangire Calves, September 1989



A 21 year-old male

the 1970s but have now regrouped and bonded under the leadership of younger matriarchs. At the same time environmental conditions have been relatively favourable in terms of rainfall in northern Tanzania in the 1980s.

The Tarangire elephants appear to be thriving despite the serious losses they experienced in the 1970s. There is reason to be optimistic that other populations that have been reduced by

poaching can also recover; although it would be dangerous to assume that any population can resume breeding in the way that the Tarangire elephants have. One such as reported in Mikumi, with 39% of families lacking adults and another 33% mainly composed of orphans, may take many years to recover because the social environment for the successful rearing of calves has been seriously disrupted.²⁶

Assessing the demographic structure of elephant populations throughout Africa should be an essential part of elephant conservation strategies in order to know where efforts can be best placed. It must be stated that overall numbers should not be the only consideration in determining the status of a population.

The elephants in the northern part of Tarangire provide a spectacular and very pleasurable viewing experience for visitors to the Park. The Tarangire elephants are an asset important to the Tanzania National Parks system because they are easily visible in the dry season and habituated to tourists. At the present time Tarangire is the best place in Tanzania to view elephants and every effort should be made to maintain the successful conservation and anti-poaching measures taken in the area.

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The Black Rhino Sanctuaries of Kenya

R.A. Brett

The purpose of this article is to show that the policy adopted by Kenya in 1984 of creating rhino sanctuaries has been a success over the last four years. This is qualified by the fact that the areas showing the largest increases in rhino numbers, Nairobi National Park and Solio Ranch Game Reserve, were stocked in the late 1960s and early 1970s long before the term 'rhino sanctuary' had been coined. As mentioned in a previous *Pachyderm*, the established rhino sanctuaries are now beginning to show the population growth which it was hoped they would promote, in addition to providing security from poaching either by fencing, alarms, armed patrols or a combination of these.¹

Sanctuaries and Rhinos

The total number of black rhinos remaining in Kenya is between 370 and 400 animals. The majority of these animals are located in 11 well protected areas which come under the general heading of rhino sanctuaries. None of these areas has more than 60 rhinos and of the areas concerned, six are ring fenced, three are partly fenced and two are open. Data from these 11 major protected rhino populations are shown in Table I. Two sanctuaries are at an early stage of stocking and development; the completed 93 km² OI Pejeta Ranch Game Reserve has received only 4 males so far and the Tsavo Ngulia sanctuary, being extended this year to 73 km², has been stocked with six females and one male. Each of these sanctuaries eventually should be stocked with at least 20 rhinos in more balanced sex ratios.

In addition to the total of 285 black rhino in sanctuaries, a WWF-funded census has produced an estimated number of 85-100 rhinos living outside these areas. There still exist significant breeding populations of 20 in the Ngeng Valley and 12 in the Loita Hills. Other animals are widely separated and include rhinos still remaining in areas which have been heavily poached, such as Tsavo National Park outside the Ngulia sanctuary. Many of these 'outlier' rhinos are isolated and non-breeding individuals living in remote and largely unprotected areas. Although several have been captured since 1984, in particular to stock the Lewa Downs and Tsavo Ngulia rhino sanctuaries, the remaining outliers, almost by definition, are very difficult to locate and capture and hence costly to translocate.

Management of Sanctuaries

Apart from protection, the aim of the sanctuaries is to build up the number of rhinos as quickly as possible. In the absence of an adaptive management system which would maintain a defined balance of age structure and sex ratio, a fixed stocking rate approach is appropriate, particularly in the relatively small ring-fenced sanctuaries which range in area from 40 to 142 km² with an average of 55 km².² Initial estimates of the carrying capacities of the rhino sanctuaries have been calculated and are shown in Table 2. For each of the ring-fenced sanctuaries and Nairobi National Park the Ecological Carrying Capacity (ECC) was estimated and three-quarters of this figure was taken as the

Table I
The Black Rhinoceros in Kenya: Population Statistics as at the End of 1988

SANCTUARY: TYPE and Name	Males				Females				Unknown sex				TOTAL
	Adults >6yr	Sub- adult 4-6yr	Calves <4yr	Sub- Total	Adults >6yr	Sub- Adult 4-6yr	Calves <4yr	Sub- Total	Adults >6yr	Sub- Adult 4-6yr	Calves <4yr	Sub total ?	
RING-FENCED													
Nakuru NP	8	3	0	11	5	2	0	7	0	0	2	2	20
Ngulia RS	1	0	0	1	5	1	0	6	0	0	2	2	9
Solio GR*	16	2	8	26	19	5	6	30	0	0	2	2	58
Lewa Downs RS*	1	1	1	3	5	1	4	10	0	0	0	0	13
OI Jogi GR*	1	3	1	5	3	1	0	4	0	0	1	1	10
OI Pejeta GR*	2	2	0	4	0	0	0	0	0	0	0	0	4
	29	11	10	50	37	10	10	57	0	0	7	7	114
PART-FENCED													
Nairobi NP	15	9	3	27	18	6	5	29	0	0	1	1	57
Aberdare NP ^s	7	1	2	10	9	3	31	5	?	?	?	12	37
Laikipia R	19	3	1	23	10	4	1	15	3	0	2	5	43
	41	13	6	60	39	13	9	59	3	0	3	18	137
UNFENCED													
Masai Mara GR	5	1	3	9	11	1	2	14	1	0	1	2	25
Amboseli NP	4	1	0	5	2	1	0	31	0	0	1	1	9
	9	2	3	14	13	2	2	17	1	0	2	3	34
TOTALS	79	26	19	124	89	25	21	33	4	0	12	28	285

NP = National Park GR = Game Reserve RS= Rhino Sanctuary R = Ranch * = Private Land ^s=Aberdares National Park Salient

number of rhinos the area should normally support, i.e. a management level of 75% of ECC. Rhinos surplus to this number would have to be removed to maintain maximum breeding output and adequate food supply. Calculation of such management levels is at present inappropriate for the Aberdares Salient, Laikipia Ranch, Masai Mara Game Reserve and Amboseli National Park, where, in each case, rhinos exist in a small and relatively secure but open area contained within a much larger potential distribution range. Carrying capacity in these open areas is primarily determined by the limits of the zone of security rather than ecological bounds.

Breeding and Possible Problems

Indicators of breeding performance over the last four years are also given in Table II. Known births and deaths show that there have been 3½ times more births than deaths over the period and an approximate 5% annual increase in numbers overall.

The limitations on breeding output in high density rhino populations require much further study: the relationship between the effect of a given density of rhino and other browsers on vegetation and the rate of population increase may be complex. For example, a very marked over-browsing of a favoured species (*Acacia drepanolobium*) by rhinos in a high density of 1-11/2 per km² on Solio Ranch Game Reserve, a small 56 km² area, as yet has had little or no deleterious influence on their very high breeding output. However, rhino populations exceeding the ECC

of large areas have clearly suffered detrimental effects. Reduced calving as density increased has been recorded in the Central Complex Reserves in Zululand.³ During the late 1960s, for areas of Tsavo National Park where rhinos were in a very high density of 0.9-1.4 rhino per km², Goddard noted reduced cow-calf ratios and lower percentages of calves compared to the values for animals living in low density areas.⁴

Recruitment rates recorded in the sanctuaries in recent years have varied considerably. An exceptionally high annual birthrate of 15% from 1980-1986 at Solio Ranch, where virtually every adult female had a calf at foot, compares with a low recruitment of 21/2% from 1986-89 at Laikipia Ranch, where there have been twice as many adult males as adult females and poor breeding performance from the latter. Solio Ranch has achieved a 12% net annual rate of increase while Nairobi National Park rhino population has grown at an annual rate of only 3% since stocking ceased in 1968.5 rates of recruitment for other parks and reserves and at various dates are shown in Table III.

Under present conditions the total capacity of the Kenya rhino sanctuaries is about 680 rhinos and, at a high 10% rate of recruitment, this figure could be easily bred from the present nucleus of 285 rhinos within the next ten years. By the turn of the century and certainly thereafter, the emphasis must be on restocking the large areas of former rhino distribution that remain in both highland and lowland areas of Kenya such as the Aberdares and Tsavo National Parks. Ngulia sanctuary provides

Table II
The Black Rhinoceros in Kenya: Management and Overall Breeding Performance from 1986 to 1989

SANCTUARY: TYPE and Name RING-FENCED	Management	Breeding	Births & Deaths	Census	Rating	7
Nakuru NP						
Ngulia RS						
Solio GR*						
Lewa Downs RS*						
OI Jogi GR*						
OI Pejeta GR* 2095813104114	14273564073931135	0.130.121.040.330.140.040.10 71	5373 5556 4226	2020	1593	
70337 253 111600016	1.570.170.870.301.25-0.88	40408410067-73	10.022.227.638.520.00.024.7	221743028	0	
12 15 10 01 10	08 4 0	12 10 10 11 10 13				
PART-FENCED						
Nairobi NP						
Aberdare NPS						
Laikipia R*						
UNFENCED						
Masai Mara GR						
Amboseli NPT						
TOTALS			57374313725934285			
11770397584169039020803410	0.490.530.110.230.010.020.020.08	60 45 50	(50) 100 (100)210	19580		
(80) 50	(50) 130	130 679	580	12001200028	0.930.671.531.020.641.670.820.93	
5056404655505458	15.828.09.313.124.011.120.618.2	12552272959 2	50 01 23	70	12	12
213 13 1	10 11 120 10 105					
NP = National Park	GR = Game Reserve	RS = Rhino Sanctuary	R = Ranch	*	= Private Land	S = Aberdares National
Park Salient						

Table III
Annual Recruitment Rates of Black Rhinoceros Populations

Area	Recruitment rate %	Authority
Olduvai Gorge	7.2	Goddard ⁸
Ngorongoro Crater	7.0	Goddard ⁸
Tsavo National Park	10.9	Goddard ⁹
	8.2	Western and Sindiyo ¹⁰ (from Goddard ⁹ data)
Amboseli National Park	6.8	Western and Sindiyo ¹⁰
Kruger National Park	9.0	Hall-Martin ¹¹
Hluhluwe Game Reserve	5.3	Hitchins and Anderson ¹²
Umfolozi Game Reserve	11.0	Hitchins and Anderson ¹²
Addo Elephant National Park	9.6	Hall-Martin ¹³
Ndumu Game Reserve	8-9	Conway and Goodman ¹⁴
Solio Ranch Game Reserve	15.0	Brett ¹⁵

an example of a possible management approach. It is located deep inside Tsavo and has a fence designed purely to contain rhino for breeding while anti-poaching patrols maintain a zone of security extending far beyond the sanctuary area: surplus rhinos can simply be released to restock the surrounds and breed with the 'wild' population.

Managing a Metapopulation

Apart from the necessities of continuing to protect rhinos within sanctuaries and ensuring the integrity and security of future dispersal areas, other long-term management guidelines have already been recommended for maintaining demographic stability and genetic variability in rhino populations. These recommendations include ensuring that 15-20 unrelated breeding animals are gathered together to found a new population, that the habitat is capable of carrying at least 200 rhinos, and that one or two unrelated adults are moved into each population every generation or 6 to 15 years. The latter will involve the movement of animals between the Kenya sanctuaries as well as the capture and translocation of outliers.

However, there are a number of practical difficulties involved with moving rhinos between populations and some are enumerated below: the list should not be considered exhaustive:

1. In an area with a high rhino density there is often aggression between introduced rhinos and residents. When confined in small, ring-fenced sanctuaries, dominant males may be very aggressive and this behaviour is not confined only to males.¹⁶ In Nakuru National Park a sub-adult female introduced from Solio Ranch in 1987 was so repeatedly attacked by an unknown rhino assailant that she had to be

translocated. High levels of aggression, predominantly between adult males, has been recorded in artificially high density populations such as that in Addo Elephant National Park where there were 2 to 5 rhinos per km².¹⁷

2. The degree of success in breeding to be expected of rhinos brought into an area is unknown, particularly for males introduced to confined areas where mating is exclusive to one or a few dominant males.
3. The suitability of a particular rhino for immobilization varies and often relates to age and sex: females may be heavily pregnant or have small calves at foot. The home range of the animal is also a factor in deciding whether to capture: areas close to rivers or swamps make successful darting problematic.
4. The availability of animals of the required sex is limited: females are in great demand for improving breeding in all rhino areas.

5. There will be differences in habitat between donor and recipient areas: the browse species available, diseases such as trypanosomiasis, minerals, heat, disturbance, etc. all can influence the success of a translocation.¹⁸

6. There are many difficulties with the 'rescue'-type capture of outlier rhinos. The remoteness and inaccessibility of the animals and the typically unsuitable terrain make capture operations very expensive, if they are feasible at all.

7. There is risk of mortality during immobilization and translocation. Capture related death rates have been close to 5% in Kenya since 1984.

8. After release, the rhino may wander or stray into unprotected areas.

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A 3rd generation three year-old female black rhino born in Solio Ranch Game Reserve

9. Owners of sanctuaries on private land have personal preferences and often form an attachment to particular animals.

The first three of these difficulties might be overcome by appropriate 'predictive' management, for example by moving young animals between sanctuaries in the hope they will eventually breed, or introducing rhinos only into low density populations. Young animals, particularly sub-adults, are the 'easiest' animals for translocation in any case. 'Swops' of breeding males between small sanctuaries where single males dominate and breed may also be feasible, but have not been attempted yet in Kenya. When stocking rhino sanctuaries, choosing unoccupied ranges as release points for new inhabitants may also relieve subsequent conflict. Solio Ranch Game Reserve was stocked with 23 rhinos over a ten year period, with animals released in many locations; only one sub-adult male was subsequently killed in fighting.

It has become clear that in the short term, demographic problems of age and sex bias in small populations can quickly limit their breeding performance. The pronounced preponderance of males in the indigenous Laikipia Ranch population has severely limited the number of calves born in recent years and, as part of a 'swop' of breeding males with Ol Jogi, the removal of the dominant male from Lewa Downs has resulted in there being no matings in this sanctuary for at least two years through lack of a capable successor.

Information and Research

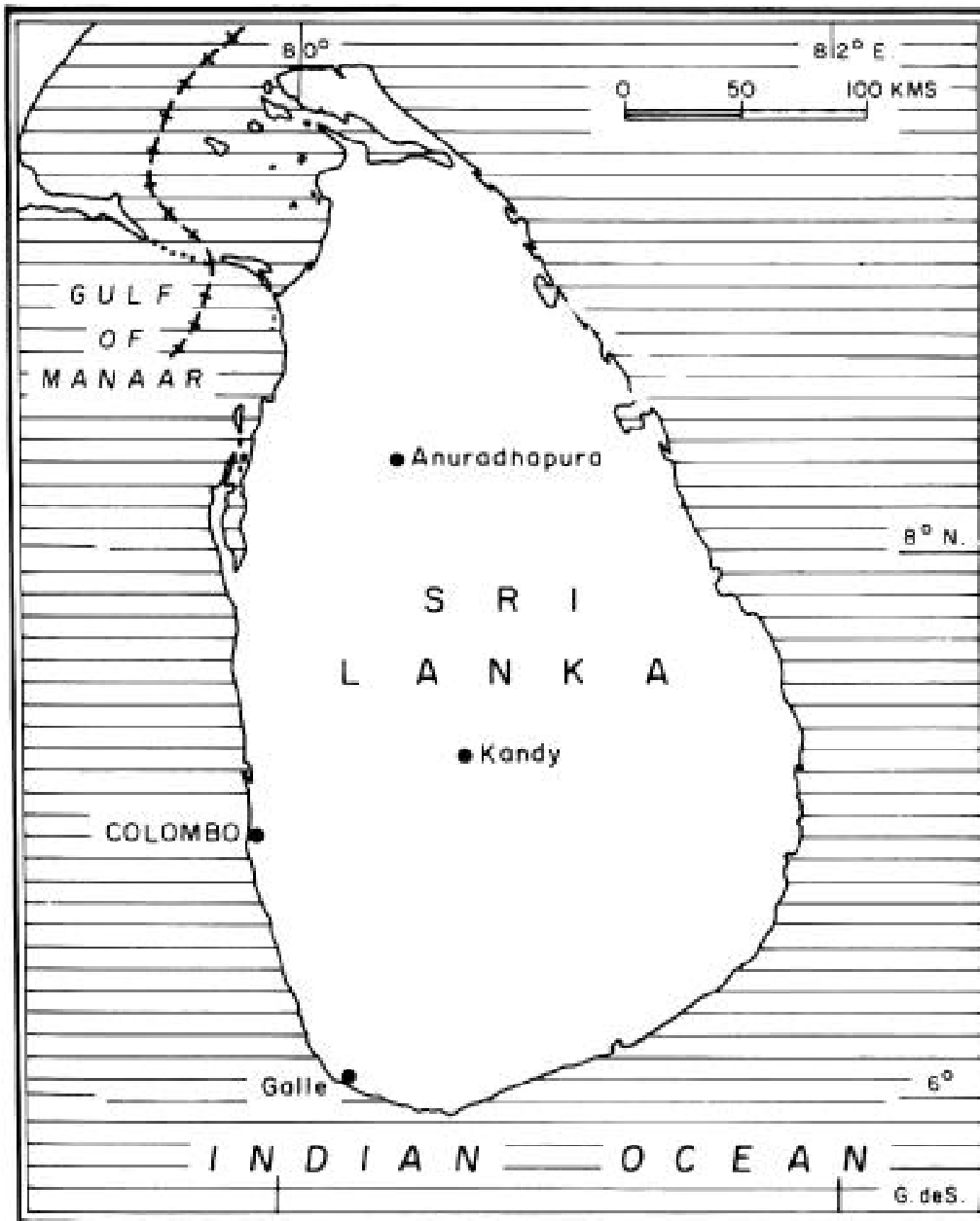
With the largely anecdotal nature of many of the important past events in different rhino sanctuaries, it could be rewarding if the AERSG would serve as a focus for such limited information as is available since it strongly influences management decisions. The data would provide a basis for decision rules in management and, in addition, criteria for the selection of sanctuary areas. Given limited funds, sound assessment of the genetic value of translocations, which each cost approximately US\$ 10,000 in Kenya in 1989, will become increasingly important as will a dispassionate appraisal of the effectiveness, in breeding terms, of rescuing outliers as opposed to moving others between sanctuaries.

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Sri Lankan Ivory Sculpture in Retrospect

Chryssee Perry Martin and Esmond Bradley Martin



CENTRES OF IVORY CARVING IN SRI LANKA IN 1979

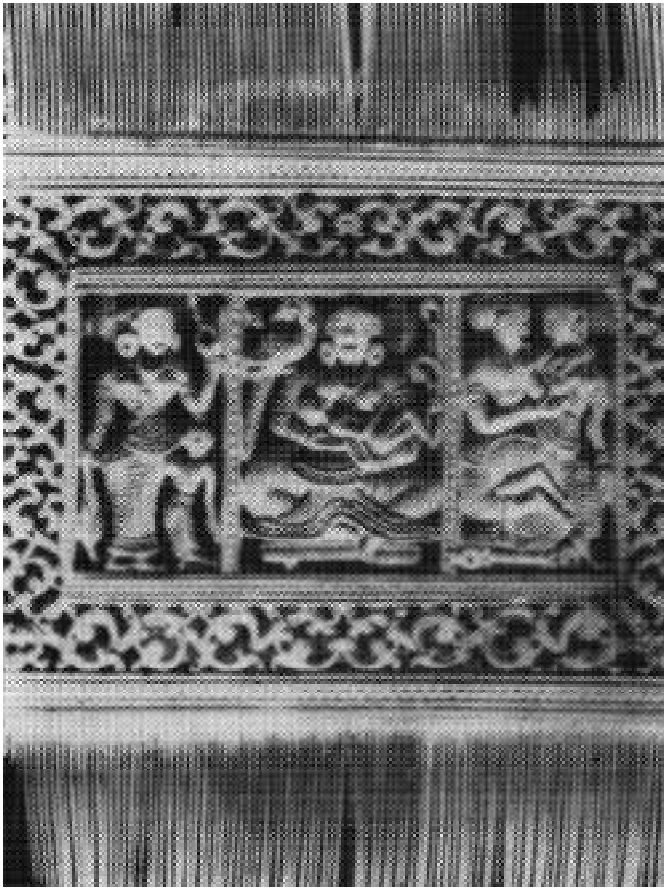
Compared with the main ivory carving centres in Asia—China, Japan and India—relatively little is known about the ivory masterpieces produced in Sri Lanka (formerly Ceylon). During the Kandy period (1597-1815) and for some time afterwards Sinhalese craftsmen executed some of the highest quality ivory carvings, albeit in limited quantities. The Colombo Museum displays many fine examples: statues, fan handles, panels, jewellery and relic caskets, pill boxes, scent sprayers, bullock carts, gem scales, rings, fly whisks and book covers. Among the more unusual pieces are a syringe and a pair of spectacle frames. Possibly unique are the ivory combs which are ornately carved either in low relief or with lace-like perforations.¹ Some are erotic in style, illustrating human lovers, and combs were

probably given by a bridegroom to his bride as a marriage present.² Also of special interest are the exquisitely carved ear picks called *kan-handa*. Shaped like sea-horses these have rings on top and a tiny spoon at the bottom for removing ear wax. The jewellery casket carvings were influenced by Dutch and Portuguese settlers while the relic caskets are of Sinhalese-inspired design and inlaid with rubies and sapphires. Before the middle of the 19th century most of the ivory pieces were made for the Sinhalese aristocracy and other wealthy people living on the island. In the first six decades of the 20th century, however, the market demand changed considerably and most items were made for foreigners, especially British residents.

Following the wide-scale nationalization of private businesses, the wholesale trade and almost all foreign-owned plantations during the period 1970-1977, most of the British and other European residents left the country. But at the same time the government was encouraging foreign tourists to visit the island in order to earn foreign exchange. Many hotels were built on the beaches and in the cities of Colombo and Kandy to cater for the visitors who became the principal buyers of the ivory items produced by Sri Lankan craftsmen in the late 1970s.³

In October, 1979, when we went to Sri Lanka to study the ivory carving industry, the main items being made were bangles, Buddhist sculptures, small elephant figurines, carved tusks, necklaces, ear rings, bracelets, rings and the famous Perahera elephant sculptures studded with local gemstones. This latter ornament is modelled on the large caparisoned tusker carrying the relic casket containing a reputed original tooth of Buddha, seen in the fabulous evening procession held during the annual Esala Perahera pageant in Kandy.

The extremely fine and intricate carving which distinguished Sri Lankan ivory work prior to the 20th century was rarely made in the 1970s. Although the ivory craftsmen were still carving



The affectionate couple on the right-hand side of this eighteenth century ivory comb is a typical motif

some items in a local Sri Lankan style, their output was based mainly on the demand of European tourists, not the traditional, more sophisticated tastes of the Sri Lankan aristocracy. The fan handles made for Buddhist priests were no longer produced because the last craftsman doing this work had died leaving no successor.

Prior to the 19th century, there had been a relatively large elephant population in Sri Lanka, perhaps numbering 1 2,000⁴ which had easily supported the local craftsmen's demand for raw ivory. From the middle of the 19th century up to 1937 thousands of elephants were killed in order to open areas for human settlement and for coffee, tea and rubber plantations.⁵ The worst slaughter occurred in a three-year period ending in 1848 after 3,500 had been shot in the Northern Province and from 1851 to 1855 when 2,000 were killed in the Southern Province.⁶ In 1937, finally, elephants were given full protection. By 1979 only an estimated 2,500 wild elephants remained in the country, and more importantly for the ivory trade only 7% of the males had tusks (the tushes from females are too small for most ivory carving).^{7,8}

From 1915 to 1919 very little African ivory was imported but during the 1920s an annual average

of 472 kg was legally brought in mostly from East Africa, South Africa and the United Kingdom. From the time of the World Depression until the end of World War II very small quantities were imported; from 1945 to 1955, there was an average annual import of 103 kg mostly from South and East Africa. The period 1956-1964 saw relatively large quantities of African ivory imported: 621 kg on average each year, mostly from East Africa. From 1964 to 1979 less than 20 kg was legally imported, per year. There must have been some smuggling as well, but the quantities were not significant in the 1970s. Curiously, during the 1920s and early 1930s, small amounts of raw ivory were exported from Sri Lanka, especially to Japan; these tusks were probably from Sri Lankan elephants as the Japanese artisans have traditionally preferred Asian ivory.⁹

Until 1965 the government held public auctions to sell ivory which the Department of Wildlife Conservation collected from dead elephants or confiscated from poachers and traders. In 1965 the government ceased to hold auctions and began to stockpile the ivory. By 1979 the Department held 84 tusks weighing approximately 455 kg; no policy on what to do with this ivory had been decided.¹⁰

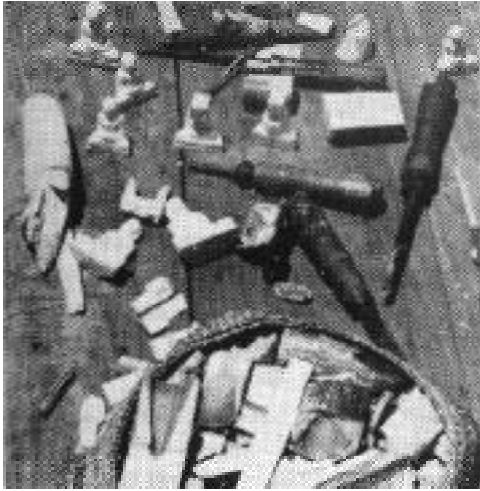
In 1979 the traders in Sri Lanka obtained almost all their ivory from illegal sources or from the owners of domesticated elephants. Poachers shot some of the 60 or so elephants killed illicitly each year in the 1970s but most were despatched by farmers and plantation owners protecting their crops.¹¹ The latter did not, however, usually kill tuskers but just chased them away.

The 575 domesticated elephants¹² provided the major portion of the ivory available to the Sri Lankan market.¹³ Their owners pruned tushes and tusks and removed the ivory from carcasses. In 1979 craftsmen paid between US\$ 142 and US\$ 171 a kg for raw ivory. This high price, twice as much as the world market figure, was due to the shortage of tuskers on the island, the limited amount of legally or illegally imported ivory and the fact that the government was not selling from its stockpile.

There were then approximately 107 artisans working ivory in Sri Lanka. The largest group, comprised of 45 men, worked in and



In the Kandy area domesticated elephants are regularly taken to rivers to be bathed and washed.



Raw ivory, Buddha statues and tools used by an ivory craftsman living near Kandy in 1979

best known for making elephant sculptures, many of which are encrusted with gemstones by jewellers who are mostly Muslims. It is not known for how long these elephant figures have been made in Galle but at the St. Louis (USA) Exposition in 1904 several of these ivory elephants, some adorned with elaborate mountings of gold and gemstones, were exhibited.¹⁴ The ivory historian, George Kunz, writing in the early part of the 20th century praised highly the workmanship at Galle:

The finest Cinghalese ivory carving is done at Point de Galle ... and here many highly artistic ivories have been produced, the designs being in some cases derived from specimens of old Buddhist art and others inspired by scenes of the life of to-day in Ceylon.¹⁵

Although the workmanship in Galle was not as superb as it had been, when we were in Sri Lanka the carving of the Perahera elephant sculptures was probably still the best work done on the island.¹⁶ In the late 1970s, a typical carver would take about five days to make an elephant 12.5 cm long by 10 cm high, using files, rasps and chisels. Normally he would sell it to a Muslim jeweller who would adorn it with gold. A local shortage of this metal often meant that the jeweller had to purchase US dollars on the black market and then, by fishing boat, seek a rendezvous with a steamer on which the hard currency could be exchanged for the gold necessary for his work.

After gold was applied to the elephant sculpture, a variety of local gemstones would be added: blue and pink sapphires, rubies and cat's-eyes. Finally, a fine wooden box upholstered in velvet and satin as made to hold the jewelled elephant. When we were on island, Perahera elephant sculptures were being offered

around the old town of Galle which has a long history of making jewellery and carving ivory. During the Portuguese era (1505-c.1640) this was the island's main port and during Dutch rule up to 1656 Galle was the capital. The ivory carvers of Galle are

retail sale in Galle, Kandy and Colombo for between US\$ 325 and US\$ 6,400, depending upon their size and the value of the gemstones.

Elephant bone, mostly from the leg and distinguishable from ivory by its yellowish colour, was also used by Galle craftsmen.¹⁷ As it cost only some US\$ 11 a kg there was a huge price difference between carvings in bone and those made of ivory. An undecorated model of an elephant 5 cm high sold for US\$ 13 if bone, some US\$ 65 if fashioned from ivory.

Carvers of genuine ivory earned in 1979 an average of about US\$ 40-50 a month, which was higher than the wage of a shop-girl in Colombo or a stenographer working for the government, but less than the salary of a Class II civil engineer employed by a state-owned enterprise. The ivory artisans, however, supplemented their income by selling ivory shavings waste to traditional medicine shops at US\$ 1 a kg and, on occasion, they or ivory traders would also sell elephant jaws bought from poachers. Local practitioners of medicine would prescribe the former for a customer suffering from skin disease, the latter provided a nostrum to alleviate the sufferings of mumps.¹⁸

The second major ivory carving centre on the island was Kandy, again a former capital of the country. As in Galle, most of the ivory craftsmen worked in the suburbs or outlying villages. One such village was Kalapura where the government built new houses and let them at subsidized rents to carvers and handicraft workers in order to encourage production in ivory, silver, copper and brass. We talked to one artisan who was working full time at carving ivory which he bought from a jeweller in Kandy at US\$ 170 a kg; he generally made small Buddha figures. A 5 cm high sculpture would take him about three days to carve and polish, the final lustre being obtained by burnishing with scouring powder and water applied with a fine sandpaper. Such a sculpture of Buddha would earn him US\$ 32 when sold to the government handicraft shop called Laksala in Kandy.



A Perahera elephant carving in ivory and encrusted with jewels Copyright



The manager of Laksala told us that he dealt with four artisans, three in the Kandy area and one in Colombo. He bought mostly Buddha figures and elephant sculptures because these were the items most in demand by his customers, 95% of whom were foreigners; all good quality pieces were purchased and he would buy more if they were available. The manager said that usually the shop put only a 25% mark-up on ivory items but was selling no more in 1979 than in 1974.

In the area of Kandy near the Queen's Hotel most of the jewellery shops sold ivory items. Perahera elephants were costly but the highest-priced modern piece we saw was a single tusk carved partly with elephants and encrusted with fine gemstones at US\$ 20,000. Some antique ivory pieces, such as a balance (US\$ 1,935) ear plugs, fan handles, combs, boxes and elephant figurines were also on offer and the quality of craftsmanship was high. In contrast, at the cheap end of the market in Kandy, the majority of the so-called ivory items displayed, such as animals and women's rings and bracelets, was not made out of genuine elephant ivory but from a variety of bones.

In addition to the concentrations in Galle and Kandy, craftsmen were to be found elsewhere on the island. Near Anuradhapura there was an ivory 'factory' which employed a few carvers

although most were working ebony due to the shortage of raw ivory. The workers had been recruited from Galle and were paid a monthly salary of US\$32 to US\$39 to make animal figurines, rings, bracelets and bangles. The 'factory' owner used these items as stock for his shop in one of the principal Anuradhapura hotels catering mainly for the foreign tourists visiting the magnificent and impressive ruins of this 2,000-year-old Buddhist ancient city.

Despite its long history by 1979 the Sri Lankan ivory industry was one of the smallest in Asia, the decline exacerbated from the middle 1960s by the shortage of raw material. Although the craftsmen in ivory, who were all men, still did most of their work with traditional tools instead of the electric dentist drills commonly used in northern India, Singapore, Hong Kong, Macao and China, the quality of workmanship had deteriorated. The decline in excellence over the past 80 years was undoubtedly due to the lack of patronage by the aristocrats and wealthy of Sri Lanka, and their replacement as clients by tourists from North America, Europe and Japan, amateur customers commonly possessing little knowledge of fine ivory carvings. However, Sri Lankan craftsmen still managed to produce one item carved from ivory which was both unique and of high quality: the jewel-encrusted Perahera elephant.

Table I
SRI Lankan Ivory Carving Centres in 1979

Place	Number of Artisans
Galle	45
Kandy	30
Anuradhapura	12
Colombo	10
(Elsewhere)	10
Total	107

Source: Survey taken by the authors

Table II
Retail Prices for Various Ivory Items in Sri Lanka In 1979

Item	Price in US\$
Ring (small)	1
Ear rings (pair)	3
Beaded necklace	18
Carved bangle (thin)	34
Buddhist sculpture	40
Elephant sculpture (without jewels)	65
Carved tusk, called an elephant bridge, 40 cms long	209
Ghanesh (elephant-headed Hindu god). 10cm tall on wooden stand	430
Jewelled ivory elephant sculptures	325 – 6,400
Elaborately carved tusk, encrusted with jewels	20,000

Source: Survey taken by the authors

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- Occasionally, some wealthy Sri Lankans obtained a pair of ivory tusks to put into their house for decoration.
- Robert Olivier, "Distribution and Status of the Asian Elephant". *Oryx*, Vol XIV, No 4 (November 1978), p 415.
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- Interview with A.S.A. Packeer, Senior Deputy Director, Department of Wildlife Conservation, Colombo, 12 October 1979. This figure of approximately 2,500 elephants in Sri Lanka is the same given by Ainsley Fernando, Assistant Director, Elephant Conservation, Department of Wildlife Conservation (interviewed by EBM in Lausanne, Switzerland, 17 October 1989) and by Olivier (p 416).
- At a government ivory auction held 28 March 1951 59 kg from three pairs of tusks fetched 108 rupees a kg, compared with just 17 rupees a kg for tushes (B.W.M. Gooneratne, "The Ceylon Elephant: Elephas Maximus Zeylanicus. Its Decimation and Fight for Survival", *Loris*, Vol XIV, No 5, June 1978, p 269).
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- Interviews with Robert Olivier and A.S.A. Packeer.
- The figure of 575 domesticated elephants for 1979 was given in the interview with A.S.A. Packeer and is close to the number Olivier quotes for 1969 (Olivier, p 414).
- A large tusker in 1979 was worth between US\$ 6,500 and US\$ 9,500 and could be hired for US\$ 10 to US\$20 per day, of which the owner received from a third to a half with the balance going to the mahout. (interviews with mahouts in Sri Lanka, October 1979). The larger the tusker, the more valuable he was for ceremonial occasions, and for this reason the biggest ones usually did not have their ivory trimmed.
- George Frederick Kunz, *Ivory and the Elephant in Art, in Archaeology, and in Science*, Garden City, New York, 1916, pp 117-118.
- Kunz, p 117.
- Sir Emerson Tennent wrote that the Muslims of Galle in the middle of the 19th century cut the raw tusks from local elephants into plates from which they made knife handles, card racks and 'presse-papiers' (Tennent, p 89).
- Bones from fish, dogs and cows were also carved in Sri Lanka during the late 1970s.
- The powder from the jaw is mixed with lemon juice and applied externally to the swollen areas.

Rhino Conservation in Garamba National Park

Kes Hiliman Smith

In 1963 there were estimated to be 1,300 white rhinos (*Ceratotherium simum cottoni*) in Zaire's Garamba National Park. In 1976 there were 490±270. By 1983 there were some 13 to 20.¹ Retrospectively, by individual recognition, the 1984 total was put at 15, little more than one percent of the figure of 20 years ago. Similar statements could be made about most populations of rhinos in Africa. What is less common is that we can go on to say that there are now 26 white rhinos in Garamba. If they continue to increase at the same rate, the population could have doubled in seven years from 1984.

The results of aerial counts and monitoring also indicate a major reduction in elephant poaching since 1984. From a general aerial census in 1983 the overall live:dead ratio of elephants was 8:1. Using the same counting method in 1986 the ratio was 118:1 with no fresh carcasses seen.²

The current significant reduction in poaching of rhinos and elephants at Garamba has been largely due to the co-operative efforts of an international aid project and the Institut Zairois pour la Conservation de la Nature (IZCN, the Wildlife Department of Zaire). The project, known as the Garamba Rehabilitation Project (GRP), comes under the auspices of IUCN and is funded by WWF, Frankfurt Zoological Society and UNESCO. The latter organization is involved because the Park was designated a World Heritage Site in 1980.

The increase in the rhino population is particularly heartening since so much was in question at the beginning of the project. In 1983, following the precipitous declines in numbers of northern white rhinos in Sudan, Uganda and Garamba itself, a recommendation had been made that all the rhinos remaining in the Park should be captured and held in zoos pending possible release at a later date. This was unacceptable to Zaire. Further, as Stanley Price points out, re-introduction of animals is not simple.³ Susceptibility to disease has often been a problem with animals being moved to and from zoos, and disruption of patterns of social behaviour has led to loss of or injury to individuals in other rhino relocations. So, in 1984, a project to rehabilitate the general functioning of the Park with the rhinos as an integral part of the ecosystem became a reality. Since that time 11 northern white rhinos have been born in Garamba, while the last one born in captivity was in 1982.

If this is a measure of success so far, what factors have influenced it? Cumming *et al* showed a direct relationship between financial resources per unit area and the success of conservation.⁴ They found the average of annual budgets for different conservation areas in 1980 was US\$ 558/km², with a range from US\$ 5 to US\$ 6,000/km². Leader-Williams and Albon extrapolated for

Luangwa Valley that spending needed to be US\$ 230/km²/year to arrest rhino declines.⁵ However, the budget of the Garamba Park and Project together is only US\$ 55/km². Financial input is not therefore the only key factor which determines success.

There have been two major declines in rhino numbers since the inception of the Park in 1938. It is difficult to make precise comparisons between previous population estimates since counting methods have varied, but the somewhat exaggerated-looking graph shown in the Figure is at least indicative of the dramatic fluctuations.

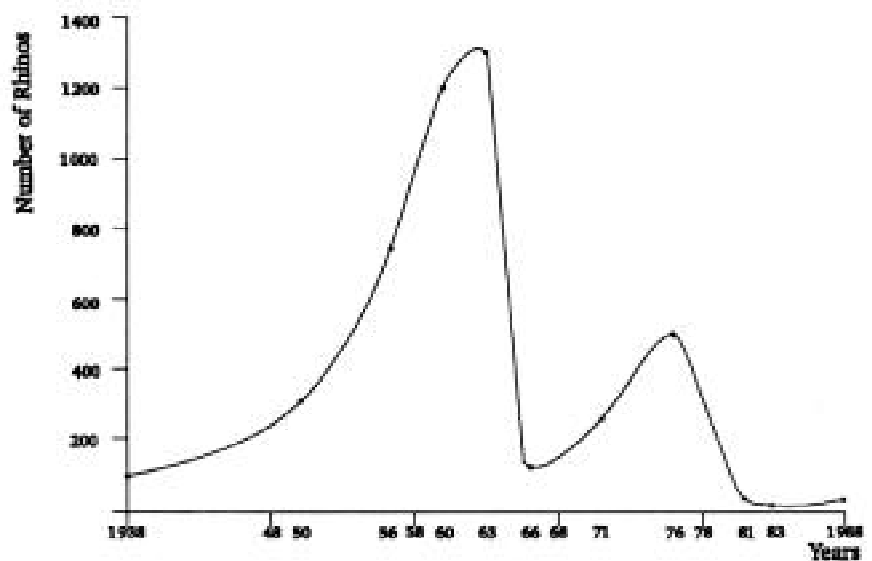


Figure: Estimates of the northern white rhino population of Garamba National Park since its inception in 1938.

Between the 1,300 in 1963 and the 490 in 1976 there was no steady decline but a rapid drop until a rough estimate of 100 remained in 1966.⁶ The poaching in 1963 and 1964 resulted from civil war and was carried out by both rebels and the mercenaries employed to subdue them. After the Wildlife Department regained control of the Park the rhino population increased. If the figure of 100 was correct, the rate of increase must have been of the order of 14% per annum. Since the current rate is 11%, even if the 100 was somewhat an under-estimate it was probably not far out.

The second wave of poaching started around 1978 in line with increased poaching throughout eastern and central Africa and the rising value of rhino horn. In Garamba the problem was exacerbated by poor communications, lack of resources and personnel problems; and also by its position on the borders of Zaire, Sudan and Uganda, where arms and ammunition were available after recent civil wars.

Zaire is the second largest and most heavily forested country in Africa. At the best of times communications are difficult, and the Park is about as far from the IZCN headquarters as it can be. Resources were particularly limited in 1978. When salaries were meagre, late in arriving or non-existent, and no vehicles nor radios worked because there was no fuel nor spare parts, it was a natural consequence that some



Guards of Garamba National Park. Uniforms and equipment were supplied by the Garamba Rehabilitation Project.

Before the GRP began, the IZCN responded to the seriousness of the situation by posting a Rhino Protection Officer and a vehicle to the Park. With the project came a major input of vehicles, spares, fuel, equipment, an aircraft, rations for guards and expert assistance. Roads were opened, river crossings made, patrol posts constructed, a radio network established and workshops set up. The patrol system was re-established and a monitoring programme was started.

But equipment alone is ineffective without good leadership. The previous Director of the Wildlife Department was replaced for involvement in ivory trading. The excellence of the current Director has permeated the IZCN with better principles and motivation. He has increased significantly the guards' salaries and ensured that they receive their payments regularly. After a series of different Conservators at the Park, we now have one who is strong and principled. He has enforced his control over most of the Park and extended the anti-poaching ethos outside the Park through contacts with local administrators and chiefs.

The over 400% increase in resources together with the management changes have probably been the main factors



Adult female northern white rhino FS, 'Mama Giningamba', with calf Sa, 'Giningamba', aged less than one month, March 1985.

responsible for the improvement in Garamba's rhino conservation. However, these might not have been sufficient if the poachers had been organized, well-armed men with highly-placed backers rather than local people. In addition, the war in Sudan may have helped by disrupting a trade route.

The distribution of the vulnerable animals, which has resulted primarily from the effects of the poaching, has allowed a concentration of effort in the most important areas. The 4,900 km² Park is over 100 km long north to south, but in many places less than 50 km wide. The north abuts the Sudan frontier, while the headquarters are on the southern border. Control of the north is therefore more difficult and there is still some poaching, largely of buffaloes (*Synceros brachyceros*) for meat. But the elephants (*Loxodonta africana*) and

rhinos are concentrated in the south. During an elephant census we carried out in 1989, the density of the 4,000-4,500 strong elephant population was 3.1/km² in the central southern section and 0.3/km² overall in the region north of the Garamba river.⁷ The rhinos have been observed within a 900km² range, but the more regularly used area is of the order of 500 km². It has thus been possible to have a higher intensity of patrolling and monitoring within the section where the elephants have tended to concentrate and the rhinos remain. If one were to consider that roughly 2/3 of the resources were concentrated in the southern 1/4 of the Park the spending would be more of the order of US \$ 145/km².

The conservation of so small a rhino population is fraught with risks. The rhinos' future in the wild depends upon the continuation of at least the same level of resources, the right personnel, political stability and no increase in poaching pressure.

The present population structure is: 7 adult males, 5 adult females, 3 sub-adult males, 4 sub-adult females, 3 juvenile males, 3 juvenile females and 1 infant of as yet unconfirmed sex. Of the sub-adult females, one six year-old, has been in oestrus and observed as the recipient of courtship behaviour. If she is considered part of the potential female breeding cohort, there is a near equal sex ratio among the effective population (N_e).

The current 11% rate of increase compares favourably with that of 10% found for the southern sub-species (*C.s.simum*) by Owen-Smith,⁸ and shows no sign of inbreeding depression at this stage. The average interval between surviving calves is 2.75 years, but one female has had four calves in six years. I also suspect that another female may have had a calf and lost it, which, if true, would reduce the mean overall inter-calf interval.

It has been postulated that populations of less than 50 are not worth consideration. Yet with



Northern white rhinos, Garamba National Park, February 1989. Female FS, 'Mama Giningamba', with female calf 5b. 'Grizmek'. born in October 1987.

many populations reduced to less than this number, efforts must be made to conserve them. The Garamba population has probably only been under 50 for less than ten years and, theoretically, rapid passage through a bottleneck minimizes loss of genetic heterozygosity.⁹ Changes in the management of captive northern white rhinos may also encourage a build-up of their numbers which could lead to the possibility of using them as a

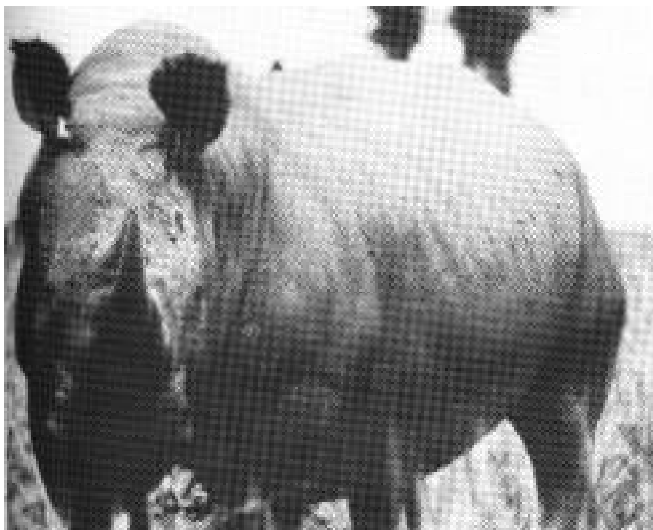
reservoir to supplement the gene pool of those in the wild. The potential for increase is therefore favourable and the Garamba population could well be over 50 in six years from now. The first increase in the number of rhinos after the creation of the Park was probably partly due to immigration. Nevertheless, its past record of rapid build-up and the example of the southern sub-species also bode well for the rhinos' ability to increase when protected.

Adequate protection, however, is going to involve international as well as national commitment for some time to come. It could be argued that conservation of a sub-species is not worth the investment. Happily though, we are not just talking of the conservation of a sub-species, but of a whole ecosystem, which includes 4,000 – 4,500 elephants, over 30,000 buffaloes, the

only population of giraffe in Zaire, 14 other species of Ungulata, 16 Carnivora, ten primates and 93 other small or medium-sized mammals, not to mention a unique habitat and a valuable National Park. Now the GRP is also moving into more extension work and conservation education, with a view to improving the lot of the local people and their attitudes towards wildlife. Within these broader contexts I believe the investment is worthwhile.

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Adult male rhino M9. Individual recognition is by horn shape, damage to ears, tail, and nose crinkle pattern.



Guards on patrol, Garamba National Park.

The Effects of Poaching Disturbance on Elephant Behaviour

Richard Ruggiero

Elephants and the Central African Republic

The drastic decline in elephant numbers across much of Africa has been well documented. Nowhere on the continent are the effects of ivory poaching more obvious than in the Central African Republic (CAR). A landlocked nation of just under 3,000,000 people, the CAR covers some 620,000 km², ranging from dense equatorial forest in the south, through extensive riverine wooded savanna, to near desert conditions along the Chadian and Sudanese borders to the north.

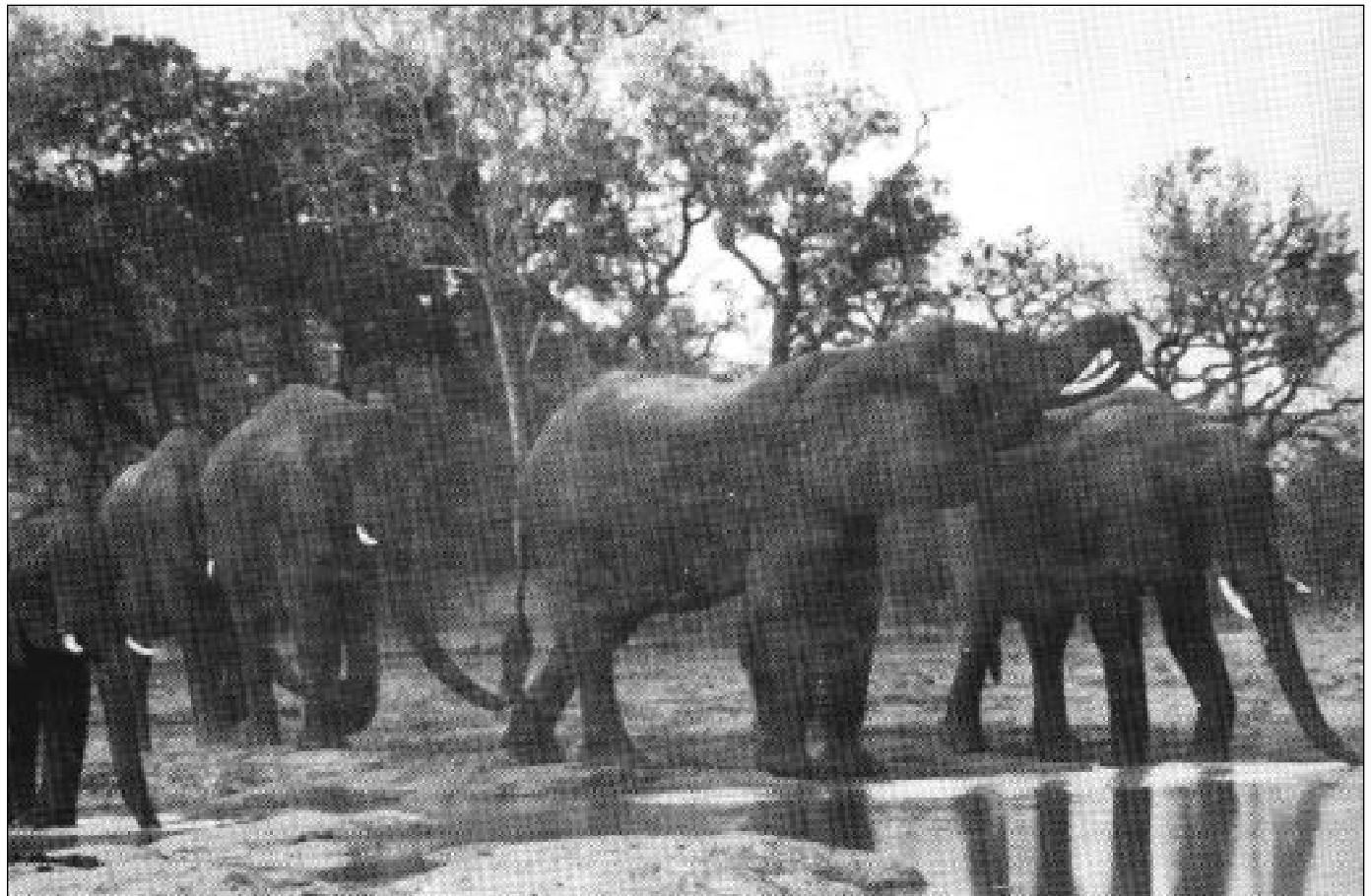
Despite a favourable habitat and with little pressure on land from the low density human population, the number of elephants has suffered a dramatic decrease over the past ten years. As a result of a decade of uncontrolled poaching and little or no government action, the CAR's estimated population of 63,000 elephants had been reduced to 19,000 by 1989.¹ According to some sources, as few as 10,000 elephants remain now,² about half of which inhabit the forested regions in the southwest of the country. The vast road-less eastern CAR has been virtually un-monitored and surrendered to large bands of poachers while, despite the efforts of a small but dedicated anti-poaching team, the sprawling Gounda-St Floris National Park in the north of the country has seen many animals from its herds fall under a wave of Sudanese horsemen.

Mounted Hunters

In the Gounda-St Floris National Park poachers never hunt at night. Elephants are killed during day-time attacks by mounted men who use thrusting spears to sever the sciatic nerve of the victim. Working in teams, they repeatedly chase and spear the panicked elephant until it eventually falls from blood loss. The coup-de-grace is usually a thrust through the heart, delivered after the elephant falls. During a single day, as many as ten elephants have been killed and an equal number wounded by one party of horsemen.³ Among these organized marauders professional ivory traders are reported to have set up mobile camps from which they send large numbers of tusks to Khartoum for trans-shipment to the Orient. However, the tradition of hunting elephants by expert horsemen using spears is being replaced by shooting whole herds with automatic weapons.⁴ AK-47 assault rifles have proliferated as a result of the Chadian and Sudanese civil wars: it has become the weapon of choice of elephant poachers across the continent.

The Effects of Hunting

Before the arrival of mounted poachers, elephants were seen frequently throughout the day, feeding and drinking in the Park's many rivers and ponds. Now, however, a WWF-sponsored study



Thirsty elephants in the Gounda-St. Floris National Park take advantage of the last woodland waterhole left during the long dry season.

has shown that poaching has affected the Park's elephants in ways not reflected in carcass counts (Table I). A profound behavioural change has taken place in reaction to the disturbance caused by poaching, resulting in a reduced ability to efficiently forage during the dry season and to undertake traditional seasonal migrations in response to rainfall and food availability.

Table I
Elephant carcass ratios expressed as a ratio of dead to dead plus live

	Live	Dead	Carcass Ratio
MGSF complex ^a	2701	5840	68.4%
Gounda-koumbala inter-river area ^b	444	823	65.0%
Gounda study area ^c	300	140	31.8%

- a. Manovo-Gounda-St Floris Complex (32,400km²) includes the Gounda-St Floris National Park (17,600km²) and surrounding reserves. These estimates are based on a 4% aerial survey.⁵
- b. Gounda-Koumbalainter-river area (4,800 km²) estimates are based on a 15% aerial survey.⁶
- c. Gounda study area (600 km²) live elephant estimate based on direct counts and photographic analysis of known herds. Carcass estimates are based on ground transects of 6% of the study area.⁷

During the rainy season, disturbance of the Gounda elephants is greatly reduced because mounted poachers are able to operate only with difficulty when tall grass makes movement arduous and tsetse flies endanger the horses. Elephants are occasionally shot at this time of the year, but the herds appear much less disturbed after about a month of heavy rainfall. With water and grass available throughout their range, the elephants can move freely and they quickly recover the condition lost during more stressful times.

In contrast, the seven-month dry season begins with annual grass fires which remove most of the dried grass, some of which exceeds three metres in height. Trees have little or no foliage at this time and fresh forage is limited to the emergent vegetation and grass growing in the low-lying areas along river courses. Most rivers in the Park have extensive, productive flood-plains containing hundreds of grass-filled ponds which gradually shrink as the dry season progresses. Elephants are therefore forced to leave the woodlands, cross several hundred metres of flood-plain and forage in open areas. During more secure times, this posed no problem and elephants could take advantage of the cooling waters of the Gounda River and the shade provided by scattered *Daniellia* trees to help pass the heat of the day. However, after repeated attacks by horsemen taking advantage of the elephants' vulnerability in the open, the herds have learnt to avoid the flood-plains during dry season days and restrict their grazing and watering there to night time.

Data Collection

Over a two-year period, 604 hours of observation were made on adult elephants near the Gounda River in the centre of the Park.⁸ These include examinations made over 24-hour periods and during rainy and dry seasons. Data were examined by analyzing feeding, resting and herd movements in relation to habitat type and the level of poaching activity.

A comparison of the total time within a 24-hour period spent browsing with that occupied in grazing shows no significant difference between seasons. However, when data from dry season nocturnal and diurnal periods are compared, (Table II), daylight browsing time was significantly longer than that in the wet season and more grazing was done by night, a fact which may be attributed to the restriction of the herds to the woodlands by day. In order to obtain sufficient nutrition through the lean months of the dry season, elephants have to spend as long as possible grazing on the flood-plain at night. The inability of elephants to move freely between the riverside and the wooded areas during the daytime in the dry season may compromise their ability to forage in an efficient manner just when their nutritional stress is highest. This situation may be particularly serious during dry years and especially in light of another effect of poaching disturbance.

Table II
Mean Percentage of Time spent by Elephants in each of Three Major Habitat Types in the Gounda Study Area

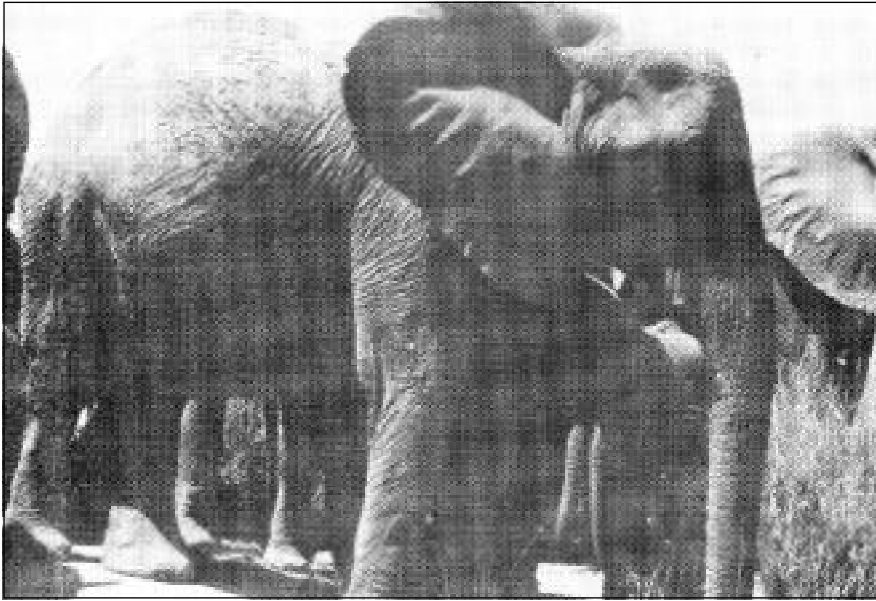
	Dry Season		Rainy Season	
	diurnal	nocturnal	diurnal	nocturnal
Flood-plain	4.0	60.8	5.9	22.4
Woodland	77.9	16.8	85.9	57.2
Ecotone	18.0	22.3	8.2	20.4

The dry season is from November to May, and the rainy season is from June to October.

Undesirable Side Effects

Until relatively recently, the elephants of the area were free to migrate over hundreds of kilometres and thereby maximize feeding efficiency throughout the year. They once could move in a long circuit between the wooded savannas of the northern CAR, where foliage and water are available at the height of the dry season, and the more arid and lightly wooded savannas of southern Chad. The rainy season begins in the south and, as it progresses, gradually moves north. It brings the regrowth of perennial grasses which can be exploited at the optimal stage of growth only by mobile herds. The migrations were an important behavioural adaptation in response to the seasonal demands of this marginal elephant habitat. But today, these migrations are no longer possible due to the resettlement in southern Chad of refugees from the recent civil war.

The concentration of resident and fugitive herds into extremely large aggregations in the Gounda area, sometimes in masses of more than 1,000 individuals, is grim testimony to the disturbance wrought by poaching and the elephants' inability to utilize the full scope of their traditional range.⁹ On more than one occasion, herds that recently experienced attacks were observed acting restlessly and breaking trees in large numbers. Likewise, because of their tendency to congregate in abnormally large herds when disturbed, the Gounda elephants caused considerable habitat degradation around natural salt licks and seasonal water-holes near the flood-plains where they lingered while awaiting nightfall to descend to the river.



'Legs and Trunks'

Social Upheavals

Although hundreds of elephants remained in the Gounda area in 1984, it became uncommon to find a bull over 25 years of age since these were the poachers' first quarry as carrying most ivory. As the killing continued, hunters turned to the adult females, frequently choosing the herd matriarchs. Groups became increasingly composed of sub-adults and young, often led by

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A young bull elephant, its trunk severed by Sudanese horsemen, lies decomposing under the African sun.

inexperienced cows. It is possible that the social system of elephants evolved in response to the species' need to utilize food and water resources which become vital during periodic droughts. The system gives an advantage to groups containing older individuals that have lived through previous droughts and are able to lead the herd to areas where food and water are available. Evidence of the exploitation of female and younger elephants is seen in the collapse of tusk weights. In March 1982, a sample of 26 tusks confiscated in the Gounda area averaged under 2.5 kg each. This is far below the 15.2 kg mean tusk weight exported from the CAR that year.¹¹

The disruption of population structure due to ivory poaching may also cause a decrease in the rate of reproduction because bulls under 24 years old rarely come into musth.¹² Increased competition may result when older bulls which have already established ranks in a dominance hierarchy are killed, leaving younger males to fight for oestrous females. The observation that bulls are more likely than cows to destroy trees led Douglas-Hamilton to consider some tree breaking as a social display.¹³ The need to establish a bull's place in a disturbed - hierarchy may result in more tree damage. This may contribute to an accelerated rate of tree destruction and the replacement of woodlands by grasslands which are a less favourable dry season elephant habitat.

DNA and the Ivory Trade: How Genetics can help Conserve Elephants

Nicholas Georgiadis, John Patton and David Western

At the recent CITES convention in Lausanne, member countries resolved to list African elephants as endangered and to outlaw commerce in elephant products, in particular ivory. However, provision was made for the resumption of an ivory trade in the future, but only by countries which could demonstrate healthy and well-protected elephant populations. Indeed, several countries with surplus elephants have already declared their intention to continue trading independently of the CITES agreement. The point is that some ivory trading will persist, and so will the problem of limiting the trade to legally exploited populations. If the trade is not to threaten the survival of African elephants, as it has in the past, effective methods of regulation are essential and a prerequisite for efficient control is the ability to discriminate between tusks

from legally and illegally exploited populations.

Two scientific techniques have been proposed to reveal the true geographic origin of ivory regardless of what is stated on the trade permit. The first, based on region-specific variation in microchemical composition of tusks looks promising but expensive.¹ The main objective of the pilot study reported here was to test the feasibility of the second method. This would use genetic markers obtained from DNA attached to tusks to identify the parent population. The first tasks were to test whether DNA can be obtained from elephant tusks and whether genetic distinctions exist between elephant populations in different regions. Both these objectives were achieved.

Genes from Tusks

While not extractable from pure ivory, DNA in varying degrees of degradation was secured from about 90% of minute tissue samples taken from 88 tusks of known origin in the ivory rooms of Nairobi and Dar es Salaam. Surprisingly, the DNA in most samples was sufficiently intact to yield genetic fingerprints, and these revealed considerable disparity between samples. Unfortunately, genetic variations between animals in a single population were as marked as the distinctions between individuals from different populations. Thus, the fingerprinting technique proved unsuitable for revealing population-specific markers. However, because each elephant had a unique genetic fingerprint, we were able to identify matched pairs of samples that had unwittingly been collected from the left and right tusks of the same individual.

Next we tried a new and elegant technique, called the Polymerase Chain Reaction (PCR), which soon gave us the population-specific markers we were seeking. In a cocktail containing the building blocks of DNA and an enzyme that strings them together, many copies of a short but specific sequence of DNA

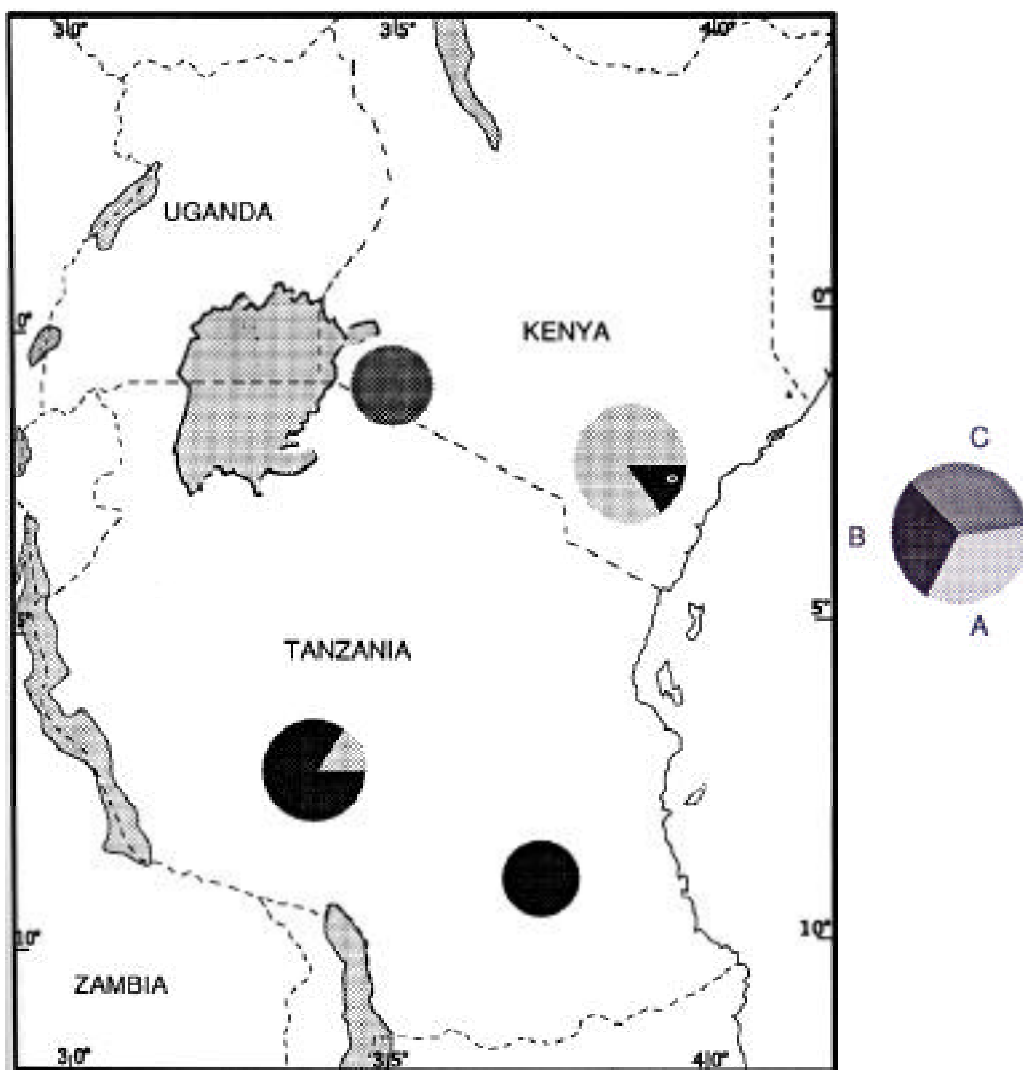


Figure. Evidence for genetic differentiation between elephant populations. Pie diagrams depict frequencies of three mtDNA types in populations around eastern Africa.

can be made from as few as a single template. For each individual animal, a unique segment of up to 3000 base pairs, chosen from more than a billion, can be 'amplified' millions of times in a reaction lasting a few hours. With so many copies to work with, genetic differences between individuals can be conveniently sought within the segment using a variety of techniques. For our purpose, the main advantage of PCR is that even highly degraded DNA from minute tissue samples of a few cells will work, and this permits us to apply the method to minuscule DNA samples taken from tusks.

We focused our attention on DNA in a cellular body, known as the mitochondrion, that is discrete from the nucleus yet contains its own DNA. Mitochondrial DNA (or mtDNA) is unique in the way it is passed from one generation to the next: most sexually reproducing animals inherit all their mtDNA only through the mother. The father contributes no mtDNA to offspring although he does, of course, contribute half of the offspring's nuclear DNA. Thus, in a species such as the elephant where females tend not to migrate far from the region in which they were born, genetic markers that characterize a given population are most likely to accumulate in mtDNA. This is exactly what we found. Although sample sizes are small, segments of mtDNA in tusks from populations in the Masai Mara (western Kenya), Tsavo (eastern Kenya) and southern Tanzania were sufficiently distinct to suggest that regulating an ivory trade using DNA markers is technically and biologically feasible (Figure).

Implications for Elephant Biology and Conservation

For other than technical reasons, we still are far from applying this method to regulating the ivory trade. However, the biological implications of this study are as important to elephant conservation as they are to the trade. For example, results suggest that elephant populations that are separated by more than 250 km constitute distinct gene pools, at least in eastern Africa. Does the same apply to populations separated by distances that are more easily traversable by elephants? That is, are genetic neighbourhoods of interbreeding individuals smaller than is suggested by the long distances that elephants are capable of travelling? An understanding of genetic patterns and processes in elephant populations has the potential to answer this and many other questions that are pertinent to effective conservation such as:

1. To what extent will effective population sizes be modified in the future by human development?
2. To what extent are the major remaining populations genetically differentiated, which of them are the most genetically divergent and why? What proportion of the total genetic variation that currently exists is likely to persist under various future conservation strategies?
3. In the past, how much gene flow was due to migration between adjacent populations and, in the future, to what extent will effective migration be interrupted by human development?
4. What were the evolutionary patterns within elephants on the African continent? When did savanna (*L. a. africana*) and forest (*L. s. cyclotis*) elephants diverge, and to what extent do they hybridize today?

5. Is social structuring in elephant populations based on genetic relatedness among individuals? Has excessive exploitation disrupted natural population genetic patterns?

The Next Step

To provide answers to these and other questions, we propose a second phase of research on a continental scale into the genetic patterns and processes of African elephant populations. Because both the trade and the biological aspects of this research are based on the same genetic information, progress can be made on both simultaneously. However, initial development will be limited by the need to collect enough samples from each of the various populations throughout Africa. What constitutes a sample? So far we have collected dried bits of tissue and bone attached to tusks, and these have worked very well. Additionally, we have sampled live animals from the Amboseli population in southern Kenya, using an ingenious new technique for collecting skin biopsies that does not require immobilization of the donor. The technique was developed by Dr Bill Karesh, a field veterinarian now at the New York Zoo, who substituted a biopsy probe for the hypodermic needle on a standard (0.5" cal) immobilization dart. Fired by a small charge, the dart bounces out of the target animal with a sample of skin sufficient for genetic analysis. While this technique does not harm the donor it most certainly does not guarantee the health of the collector! We can therefore use anything from fresh, frozen skin to dried flesh, skin or bone to obtain the genetic information we need.

Can You Help?

For future collection of samples, we need your help. If you know how we can obtain bits of dried tissue or bone, no matter how small, from elephants OF KNOWN ORIGIN, please write to Dr Nick Georgiadis, WCI, Bronx Zoo, NY, 10460. We stress that the samples must be of known origin, since without that information we would just be 'chasing our tails'. If you yourself can collect specimens, we will be most grateful. Dried samples are easily dealt with: simply place in an envelope, mark with the date, sex, tissue type, collector's name and address, and information regarding the area where the elephant lived (if you don't know exactly, indicate how inexactly). By all means keep the sample dry, and try and handle it as little as possible. We will be happy to pay for postage.

Acknowledgements

We thank the Governments of Kenya and Tanzania for permission to collect elephant samples.

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Monitor

The Black Rhino Conservation Potential in Tanzania

During the first quarter of this year I visited those National Parks in Tanzania which have been ear-marked for the establishment of black rhino sanctuaries. The purpose of the visit was to carry out preliminary surveys on the rhino status, gather baseline information on the areas and rank them according to habitat suitability. The potential sanctuaries in Tanzania are the Arusha, Lake Manyara, Tarangire and Rubondo Island National Parks; and the Ngorongoro Crater. The latter, although not a National Park, is the only place in Tanzania where one can easily see a rhino.

Using the criteria adopted during the IUCN African Elephant and Rhino Specialist Group (AERSG) meeting of September 1989 held in Nairobi, the potential rhino sanctuaries were ranked according to their habitat suitability. The results were:

National Park	Proposed sanctuary	Rank	Present rhino no
Arusha:	Ngurdoto Crater	1	0
Lake Manyara:	whole area	2	0
Tarangire:	Sirale area	3	5*
Rubondo Is land:	whole area	4	6*

*Number unreliable.

The Ngurdoto Crater in Arusha National Park ranked highest due to its natural barrier/security, small size, former high rhino density and diversity of rhino browse plants. This Crater should be used as a breeding ground for rhinos. Lake Manyara National Park can be considered as an ideal area for re-introduction once rhinos are available. A small area in the Sirale region of Tarangire Park can be developed into a sanctuary like Ngulia Rhino Sanctuary in Tsavo West National Park in Kenya.

Rubondo Island National Park was ruled out as a potential rhino sanctuary because: -

- The Park never had rhinos prior to 1965.
- To date, the rhinos introduced in 1965 have not successfully bred and the causes for this failure have not been established.
- There is lack of security due to the closeness of the Park to inhabited areas and easy access for poachers from all sides by boat.
- The vegetation type and terrain makes proper monitoring of the introduced rhinos impossible and maintenance of security very difficult.

Ten rhinos were observed on the floor of the Ngorongoro Crater. However, the total population for the whole of the Ngorongoro Conservation Area is estimated as being 10 to 30. No rhinos were sighted during the visits to potential sanctuaries although on Rubondo Island rhino dung piles and foot prints were seen. The Warden of Tarangire National Park said that five rhinos

were sighted in Sirale region late last year. The earmarked Parks have no rhinos which can be used for re-introduction and the Tanzania Government will have to acquire animals to establish a breeding stock from wherever they can.

Fred Waweru



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An employee of a traditional medicine shop in Johannesburg holds up two rhino horns: Zulu men sometimes put rhino horn ash on their eyebrows to allure women.

Further Notes on Pygmy and Forest Elephants

I would like to add some short notes that may be of interest complementary to the article by David Western, "The Pygmy Elephant: A Myth and a Mystery", *Pachyderm*, No 7, December 1986.

The elephant population of Garamba National Park appears to be an inter-grade between the savanna (*Loxodonta africana africana*) and the forest (*L. a. cyclotis*) types. Some groups show the predominately forest type characteristics of small size, small round ears and narrow straight tusks, while others are of the savanna type, larger, with thicker curved tusks, bigger ears and different body shape. The *cyclotis* type predominates although the Park is mainly long grass, open savanna in the guinea savanna belt, and the surrounding woodland is not forest but small mixed deciduous trees dominated by *Combretum* species.

Since 1927 the Elephant Domestication Centre of the previous Belgian Congo has been based here and the Belgians recognized the two types of elephants as separate sub-species: *L. a. cyclotis* and *L. a. oxyotis*. The *cyclotis* type was reputed to be much more tractable and favoured for domestication.

Offerman (1951) also talks of the small form of elephant which the Azande people called 'Abele' meaning 'those of the forest'. During extensive capture operations, Offerman observed that the small type was almost always found in dense stands of *Raphia* or swamp of difficult access. They captured a small male at Ango in 1925. He was then 1.30 m in height with tusks 0.65 m long. Thirteen years later, when estimated to be 25 years old, he was still only 1.60 metres tall with tusks of 11 m length. Normal *cyclotis* males of this age averaged 2.35 metres in height. A female captured in 1912 had also remained much smaller than her peers throughout life. The small type of 'pygmy' elephant may therefore not be exclusively juveniles of the forest type with premature tusk development, although this

phenomenon would certainly seem to account for some reports.

From his observations, Offerman concluded that large height variations exist in the *cyclotis* race of elephants and that the existence of a distinct pygmy race is not proven.

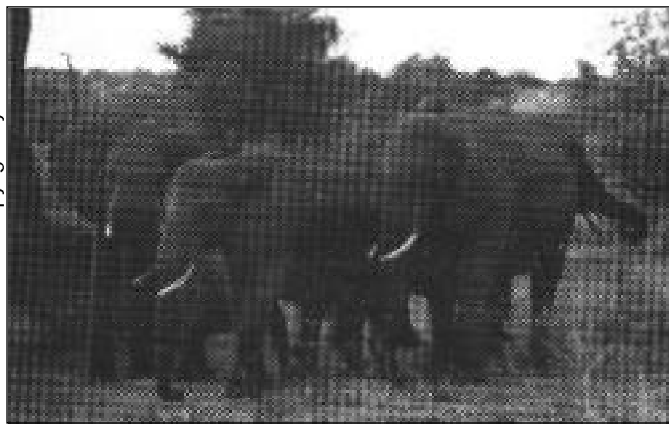
It is perhaps of interest that we have a similar situation among buffaloes in the Park. Individuals of distinctly forest characteristics (*Synceros caffer nanus*), with red coats and small thin upward-pointing horns are found mixed in herds with the normal black savanna type of buffaloes, though the horns of the latter are not usually quite as large as those of East African buffaloes, possibly due to inter-breeding.

Kes Hillman Smith

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A family group in Tarangire

Black Rhinos in Lake Nakuru National Park

Before the translocation exercise of rhinos to Lake Nakuru National Park (LNNP) started, two rhinos, a male and a female, were already in the Park. The history of these two goes back to the late 1950s when three black rhinos used to be sighted by herdsmen on the former cattle ranch which today is a part of the Park. In 1987, when monitoring studies started, only two rhinos were located, the third was assumed dead. It is something of a mystery that the two have not bred in all this time.

By October 1987, when the exercise ended, a total of 17 black rhinos had been translocated to LNNP, 15 of which came from Solio Game Reserve, one male from Nairobi Park and another from Lewa Downs. This increased the population to 8 females and 11 males, a total of 19 rhinos. All the rhinos have settled with the exception of one female which was taken to Lewa Downs Rhino Sanctuary after having been attacked and seriously wounded.

One of the rhinos, which was pregnant when captured, gave birth in late 1989. Although there is a lot of browse in LNNP, monitoring indicates that most of it is unavailable to the rhinos due to plant heights of over 2.5 m. Dietary composition results indicate that some plants are not eaten at all, while others are heavily selected. All the animals are in the southern part of the Park. This distribution can be attributed to water scarcity in the northern as compared to the southern part of the Park where several bore-holes and shallow dams have been developed. The lake water is highly alkaline. The home ranges

during the dry season are significantly larger than in the wet season.

F.K. Waweru

Unita Involved in Ivory Trafficking

Unita is involved in ivory trafficking, the South African newspaper, the *Sunday Times* reported in November last year.

The newspaper published an interview with a former officer of the South African Army, Col. Jan Breytzenzach, who confirmed that Unita is still involved in trafficking ivory and rhino horns to finance its military activities against the Angolan government.

According to the officer, all ivory and rhino horns obtained from indiscriminate killing of animals in southern Angola were transported via Namibia to South Africa, which has become an important exporter of these products.

Breytzenzach, who commanded battalion 22 of the South African Army in the invasion of Angola's Cuando-Cubango province, said he observed Unita killing elephants in that area with the use of AK-47's and other machine guns.

Agencies: Kenya Times 24 November 1989

Kenya's Rhino Man Wins the Goldman Environmental Prize

Michael Werikhe, Kenya's rhino man, was one of six recipients of the First Annual Goldman Environmental Prize. Mr Werikhe received the prize for Africa in recognition of his walks to raise funds for rhino projects in East and Central Africa, and awareness of the plight of the rhino and the state of the environment in general.

Mr Werikhe and Janet Gibson of Belize who won the prize for South/Central America for her role in helping to preserve a coral reef were two of the Wildlife Conservation International's nominees for the awards. Other prize-winners included, for North America, Lois Gibson of the United States, who first warned that toxic waste was seeping into a residential area called Love Canal; for Asia, Harrison Ngau who suffered imprisonment and house arrest for his efforts to help Borneo's indigenous people to save their rainforests; for Australia and Oceania, Bob Brown of Tasmania, who left his medical practice to campaign for environmental causes; and for Europe, Janos Vargha of Hungary, who lost his job during his fight against construction of a dam on the Danube River.

In one of his speeches Mr Werikhe said, "... What we need most is public education, and for the governments of the world to exert influence on Arabia and the Far East, where people must be made to understand that the rhino is better alive than made into dagger handles, medicines and aphrodisiacs. Just as rhino horn has become a symbol of wealth and health for many cultures, it has long been a symbol of wildlife conservation in Africa. A metallic rhino greets you at the gates of our national parks. But if we can't take care of our symbol, what hope is there for the rest of the natural habitat, and ultimately for man himself?"

Michael Werikhe now plans to walk in the United States next year to raise further funds and support for the rhino. He will once again have the support of East African Wild Life Society and Wildlife Conservation International.

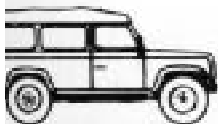
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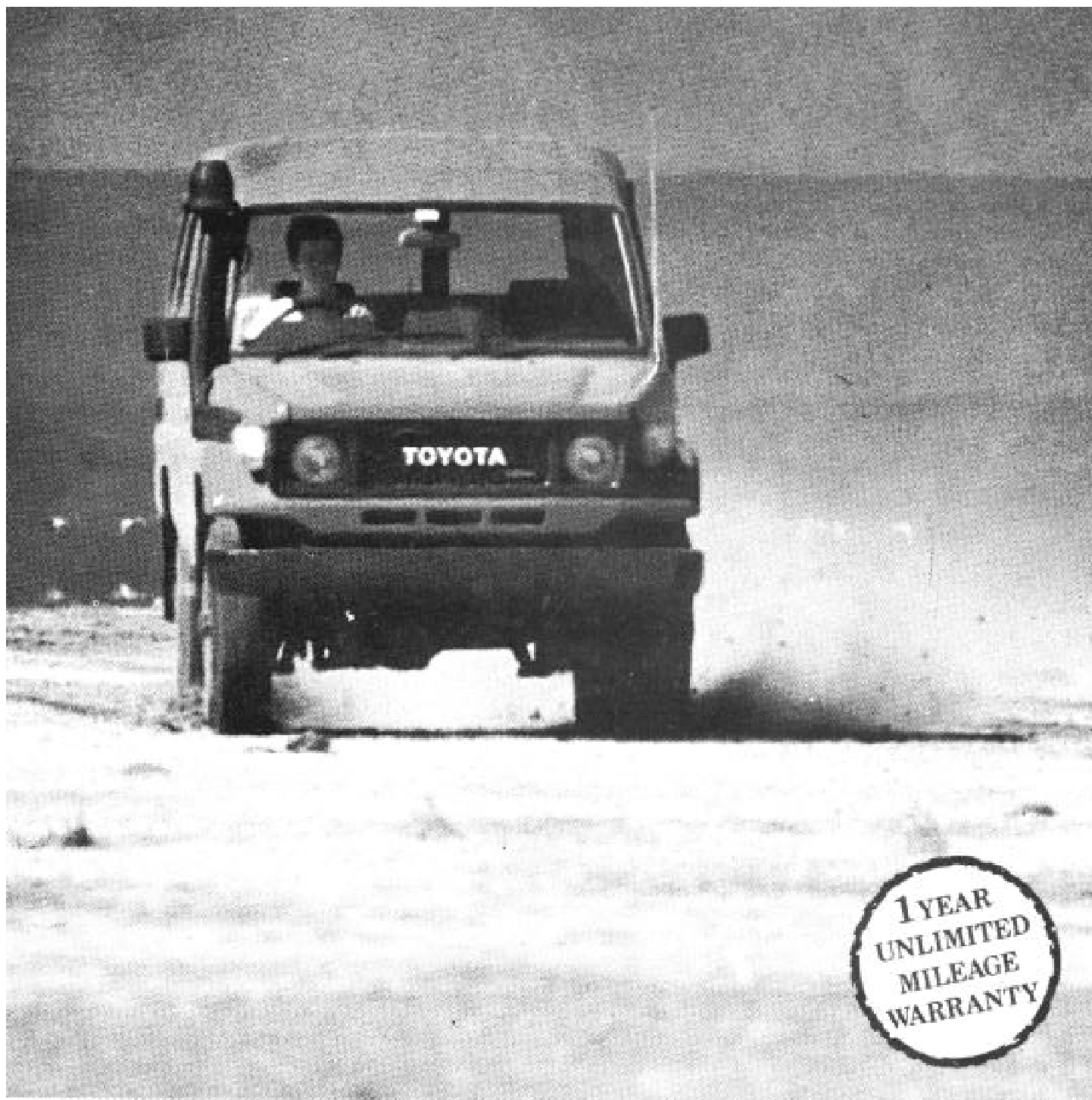
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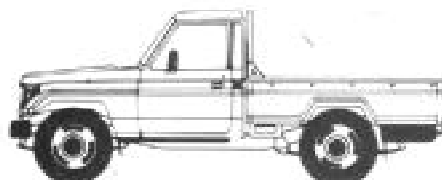


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