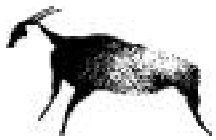
Pachyderm

1992 Number 15



SPECIES
SURVIVAL
COMMISSION

Pachyderm

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Contents

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Notice to Contributors

Pachyderm welcomes original manuscripts (not published elsewhere) dealing with the conservation and management of elephants and rhinos. All submissions are reviewed by at least two referees. Manuscripts should preferably not exceed 4,000 words; shorter ones have a greater chance of being published. Contributions may be written in English or French and should be typed on one side of A4 paper, double-spaced with ample margins. Al manuscripts must have an abstract or summary. Final versions of manuscripts should be submitted on IBM-compatible 3.5" diskettes in WordPerfect or Microsoft Word (preferred) format if possible. The full postal address of the first author should be included as well as the address of any other author.

Tables and figures should be submitted on separate sheets along with the captions to illustrations typed out on another sheet. Figures should be black-and-white high quality graphics, suitable for reduction. Photographs should be unmounted, glossy prints of good quality. Abbreviations and references should be made using the same format provided by the African Journal of Ecology.

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Cover Photo: *Radio-collared elephant in Laikipia District, Kenya.*

Chairmen's Report: African Elephant Specialist Group

Holly T Dublin and Bihini won wa Musiti

Like many of us who are fully experiencing the effects of the aging process, the African Elephant Specialist Group needs a facelift. The years of strain and struggle have taken their toll and it is now time to rebuild and restructure the foundations of the Group. This is not a trivial challenge, and we face it with a great deal of thought and an even greater degree of caution. We firmly believe that the AESG continues to have a vital role to play. That seems more obvious now than ever before, but we are keenly aware of the great many difficulties that stand in the way of this role being fulfilled.

We are also aware that to get the most out of our members we must gain and maintain their confidence during the period of our tenure. We are constantly reminded that this confidence has been lost over the years of divisiveness and discord. The task of pulling the AESG back together appears onerous, but we have accepted the challenge, a challenge that was given to the two of us by many of our colleagues and friends. While not an enviable task, it is one that we firmly believe needs doing and therefore demands devotion of our time and energy over the years to come.

The division and disunity brought about by the issue of the ivory trade will not disappear. We must accept that different opinions exist, and move forward. We believe the AESG should direct and concentrate its attention towards consolidating the theory and practice of conservation of the African elephant throughout its range. We do not believe that debating the merits of sovereign range states' differing management policies falls within our mandate. In so structuring the role of the AESG we hope to help unite range states in technical co-operation, rather than divide them even further through continued rhetorical dialogue.

From this perspective, we see many technical *issues* and tonics that can benefit greatly from the diverse membership we have invited. Our new membership will embody years of solid fieldwork in all aspects of elephant ecology and conservation in a range of habitats across the continent. These include ground and aerial census techniques, population biology, elephant-habitat interactions, behavioral ecology, and the role of the species in community dynamics in the forests, savannahs and grasslands of Africa.

We already have had a good beginning at our meeting in Gaborone in July 1991. With the help of the SSC Secretariat, the meeting accomplished its goals and objectives with the minimum of controversy or contention. Although some of our more highly-spirited members appeared disappointed that the expected pre-CITES 'jousting match' did not take place, we did, in fact, make several major strides at the meeting. Most importantly, new terms of reference were discussed at length, drafted and presented to the AESG membership. The membership voiced its strong support for the idea of the African Elephant Database (a compilation of data on numbers and distributions) belonging to AESG. They therefore committed the AESG membership to being accountable for the data contained therein and its timely updating. The Group also debated and supported the plan for all future updating of the database to remain on the African continent at the UNEP/GEMS facility. Another major outcome of the meeting was a decision that population estimates for nine range states not be included in the database due to poor quality or outdated information. This move alone stimulated at least four states to secure immediate donor funding to conduct or plan country-wide surveys over the next year or two.

We must build on these small successes, and continue to provide all concerned parties with technical expertise and advice to the best of our combined abilities. We hope we can count on everyone to participate actively in this mission. We will neither accept nor think it appropriate to have members who are 'just along for the ride'. There is now too much at stake to allow things

to follow a course of laissez-faire. The AESG must become much more active over the coming years. Both members and non-members are encouraged to participate actively in meeting the goals set out in our new terms of reference.

As many of you know, we were both 'recruited' to this co-Chairmanship through some powerful collegiate coercion (perhaps 'dragged in kicking and screaming' would be overstating the case). However, we would like to assure you that despite our own trepidation about the rather awesome task before us we are committed to working with the membership and all our colleagues to make the AESG a more cohesive, more productive and all-round more positive group in the years to come.

Rapport des Presidents du GSEA

Holly T Dublin et Bihini won wa Musiti

Comme tous ceux qui subissent les effets du vieillissement, le Groupe des Spécialistes de l'Eléphant d'Afrique a besoin d'un lifting. Les années de tension et de lutte finissent par se faire sentir et le moment est venu de restructurer les principaux fondements du Groupe. Il s'agit là d'une tâche considérable et nous nous y employons avec d'intenses efforts de réflexion et encore plus de prudence. Bien que conscients des nombreux obstacles, nous sommes convaincus que le GSEA a toujours un rôle essentiel à jouer et cela apparaot plus que jamais de façon évidente.

Nous savons aussi que pour obtenir le maximum de Ia part de nos membres, nous devons garder leur confiance tout au long de notre mandat. Nous nous rappelons sans cesse que cette confiance a été perdue par des années de division et de discorde. Les efforts qui permettront de rassembler de nouveau le GSEA seront pénibles mais nous avons accepté de relever le défi qui a été lancé à deux d'entre nous par de nombreux collègues et amis. Bien que cela n'ait rien d'une tâche agréable, nous sommes convaincus qu'elle est nécessaire. Il faudra par conséquent y consacrer notre énergie et notre temps dans les années qui viennent.

La division et la désunion entraîées par la question du commerce de l'iviore ne va pas disparaître. Nous devons accepter que différentes opinions puissent exister et aller de l'avant. A notre avis, le GSEA doit orienter, voire centrer son attention sur la consolidation de la théorie et de la pratique de la conservation de l'éléphant d'Afrique quel que soit le pays d'origine. Nous ne pensons pas que le débat des mérites des différentes politiques de gestion des pays membres fasse partie de notre mandat. En définissant ainsi le rôle du GSEA, nous espérons contribuer à réunir les pays membres pour mener une coopération technique plutôt que d'entretenir des divisions permanentes sur des questions de forme.

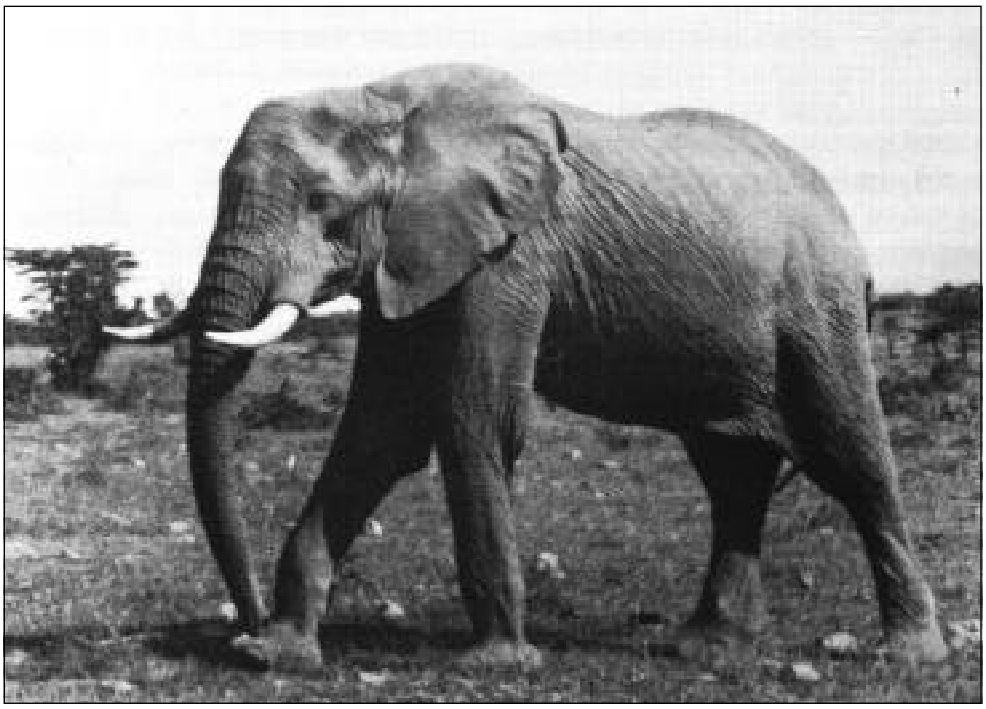
Partant de ce point de vue, nous avons identifié un certain nombre de questions et de sujets techniques pouvant bénéficier aux divers membres que nous sollicitons. Seront ainsi concrétisées des années de travail de terrain dans tous les aspects de l'Ècologie et de la conservation de l'éléphant, dans plusieurs types d'habitat du continent. Ces aspects recouvrent notamment différentes techniques de recensement au sol et aérien; la biologie démographique; les interactions entre l'éléphant et son habitat; l'écologie comportementale; et le rôle des espèces dans la dynamique communautaire dans les forêts, les savanes et les herbages en Afrique.

Un bon démarrage a déjà été assuré par notre réunion organisée à Gaborone, en juillet 1991. Gr,ce au Secrétariat de la CSE, la réunion a pu atteindre ses buts et ses objectifs, avec un minimum d'opposition et de contestation. Bien que certains de nos members, plus

fougueux, aient été déçus que le “jeu de joutes” prÈ-CITES qu’ils prévoyaient n’ait pas eu lieu, Ia réunion nous a permis d’avancer de plusieurs grands pas. En premier lieu, on notera avec satisfaction que les nouveaux termes de référence out été étudés en détail, rédigés et présentés aux membres du GSEA. Ceux-ci ont exprimé leur appui total au principe d’une base de données sur l’éléphant d’Afrique (rassemblement de données sur les populations et leur répartition) appartenant au GSEA. Les membres du GSEA se sont donc engagés à assumer la responsabilité des informations contenues dans cette base de données et à en assurer la mise à jour. Le Groupe a également discuté et appuyé le principe selon lequel toutes les mises à jour futures de la base de données seraient effectuées sur le continent africain, dans les bureaux du GEMS, au PNUE (GEMS/UNEP). Une autre décision importante a été prise lors de la réunion afin que les estimations démographiques de neufs pays membres ne soient pas intégrées à la base de données du fait de la mauvaise qualité des informations, souvent périmées. Cette seule décision a conduit au moins quatre pays membres à lancer immédiatement une recherche de financements après des bailleurs de fonds ou à prévoir des enquêtes nationales pour l’année ou les deux années qui viennent.

Partant de ces petits succès, nous devons continuer à apporter à tous les interlocuteurs concernés les connaissances et les conseils techniques, du mieux que nous le permettent nos différentes compétences. Nous espérons pouvoir compter sur la participation active de chacun à cette mission. Nous n’accepterons jamais et nous ne pensons pas possible d’intégrer des membres venus “juste pour voir”. Les enjeux sont maintenant trop importants pour permettre un quelconque laisser-aller et le GSEA doit devenir encore plus actif au cours des années à venir. Les membres et les non-membres sont encouragés à participer pleinement à la poursuite des objectifs fixés dans nos nouveaux termes de référence.

Comme beaucoup d’entre vous le savent, nous avons tous deux été “recrutés” pour cette co-Présidence par une forte pression collective (dire que nous avons été “traînés de force” serait cependant exagéré). Nous tenons néanmoins à vous assurer qu’en dépit de notre inquiétude face à la t,che particulièrement difficile qui nous est confiée, nous nous engageons à travailler avec les adhérents et avec tous nos collègues pour faire du GSEA un groupe plus cohérent, plus productif et en général plus positif pour les années à venir.



Elephant in Kenya’s Masai Mara

Chairman's Report: African Rhino Specialist Group

Martin Brooks

The decision, taken at the African Elephant and Rhino Specialist Group (AERSG) meeting in Gaborone in July 1991 to split into separate groups for rhinos and elephants should provide new momentum to the efforts to conserve these marvellous mega-herbivores of Africa. Certainly, the re-emergence of the African Rhino Specialist Group (AR SG) after a ten-year period of coalition will allow more time for formulating conservation strategies for the endangered black rhinoceros *Diceros bicornis* and northern white rhinoceros *Cerarotherium simum cottoni,* and for addressing other key issues.

Before giving an overview of the current state of rhino conservation and some of the challenges that lie ahead, I believe that it would be useful to summarise the role of the Group; its mission is to promote the long-term conservation of Africa's rhinos and, where necessary, the recovery of their populations to viable levels.

As the next decade probably will decide the future of rhinos, this mission needs to be translated into effective conservation management action. To achieve this, increased efforts will be made not only to design appropriate management guidelines and strategies, but to integrate these into existing conservation programmes. Active participation in the Group's activities by conservation managers from the various countries will therefore be crucial. The membership of the Group will be finalised by mid-1992, so detailed discussions on these initiatives will only be possible in the latter half of the year.

The current numerical status of African rhinos was one topic discussed at the Gaborone meeting, and the detailed estimates by species and country for 1991 are presented later. The results are particularly encouraging for white rhinos. The northern subspecies has increased from 18 to 30 since 1987 and the southern subspecies from 4,630 to *5,590* over the same four-year period, the latter representing a growth rate of approximately 5% per year. South Africa conserved over 5,050 of these, by far the largest population. Yet black rhino numbers continued to decline, from an estimated 3,830 in 1987 to 3,450 in 1991, albeit at a slower rate than experienced earlier in the 1980s. The most significant populations were found in Zimbabwe (1,400), South Africa (771), Namibia (479) and Kenya (398).

Poaching continues, with at least 100 black rhinos killed in Zimbabwe during 1991 and the white rhino populations in Swaziland being decimated. Law enforcement programmes appear to be holding the situation in South Africa, Namibia and Kenya. Several conclusions may be drawn, namely that trade measures have proved inadequate to protect rhino populations, poaching pressure remains a very serious threat, and that intensive field management efforts can be effective. Recent measures taken include the formation of a special unit to combat illegal trade in endangered species in South Africa, the de-horning of rhinos in Namibia, Zimbabwe and Swaziland, and the creation of the Tanzania Rhino Project. In addition, regional or national conservation strategies are being, or have been, designed for Zimbabwe, Namibia, South Africa and Kenya; and rhino working groups formed in a number of countries in an attempt to co-ordinate activities. The trend is towards small, well-protected and managed 'sanctuaries' as found in South Africa and Kenya, and which are now being adopted elsewhere. Such areas provide sound investment opportunities for funding agencies.

The slowing in the rate of decline in the black rhinoceros can be explained simply by there being fewer soft targets, but the populations in many countries have been depleted to dangerously low levels. Less than half the 14 countries with black rhino populations have more than 50 rhinos, and only one of the three subspecies, namely *D.b. minor,* numbers more than, or anything close to, the minimum recommended figure of 2,000 animals required for genetic viability. There may be only 50 of the West African sub-species *D.b. longipes* remaining and these are scattered throughout Cameroon. In addition, the northern white rhino is restricted to a single population in Zaire.

The ARSG clearly faces many challenges, but it has a firm foundation from which to build. Currently we are involved in a resurvey of the Cameroon black rhino population and this will be followed by an assessment of the available conservation management options. As for the future, the Rhino Action Plan needs to be reviewed and updated, a centralised database and reporting system designed, and issues related to resource utilisation addressed.

The new ARSG will meet for the first time near the end of 1992, and until then activities are likely to be limited. With the wealth of expertise and experience available within the Group, I am confident that several important initiatives will be identified and put into effect.

Table: Population Estimates for Black Rhinoceros *Diceros bicornis* and White Rhinoceros *Ceratotherium simum* in Africa in 1991

	Black Rhino				White Rhino				
Country	Population estimate: size and reliability		Populations: no. of and trend		Population estimate: size and reliability		Populations: no. of and trend		Source
Angola	±50	(4)	S	?	0				Hall-Martin
Botswana	10+	(4)	S	?	56	(3)	S	?	Gavor
Cameroon	±50	(4)	4	Down	0				Alers
CAR	±5	(4)	S	Down	0				Doungoube
Chad	0?			Down					Daboulaye
Ethiopia	0?		S	Down	0				Allen-Rowlandson
Kenya	398	(1/2)	19	Up	57	(1)	5	Up	Wanjohi
Malawi	5	(3)	1	Stable	0				Hall-Martin
Mozambique	50+	(4)	S	Down	0?				Hall-Martin
Namibia	479	(2)	4	Up	80	(2)	5	Up	Joubert
Rwanda					0				Gakahu
Somalia					0				Gakahu
South Africa	771	(2)	14	Up	5,057	(2)	171	Up	Brooks
Sudan					0				E. Martin
Swaziland	6	(1)	1	Stable	60	(2)	3	Stable	Hall-Martin
Tanzania	185?	(4)	S	?	0				Gakahu
Uganda	3	(2)	?	Stable	0				Edroma
Zaire	0				30#	(1)	1	Up	Smith
Zambia	407	(4)1+	Down	0				Down	Mvima
Zimbabwe	1,400	(3/4)	± 20	Down	250	(3)	10	?	du Toit
TOTALS	3,452		Down		5,590		Up		

Key: S : populations scattered
: population size unknown but very small
: population of northern sub-species *C.s. cottoni*

Reliability of census:
(1) Total count
(2) Estimate based on rhino survey within last two years
(3) Estimate based on rhino survey more than 2 years ago, or recent non- specific survey
(4) Guess or recent non-specific survey

Rapport du Président du GSRA

Martin Brooks

La décision prise lors de la réunion du Groupe des Spécialistes de l'éléphant et du Rhinocéros d'Afrique, tenue à Gaborone en juillet 1991, de séparer les groupes du rhinocéros et de l'éléphant devrait permettre un nouvel élan dans les efforts de protection de ces fantastiques herbivores. Il est évident que la ré-émergence du Groupe des Spécialistes du Rhinocéros d'Afrique (GSRA), après dix ans de collaboration, permettra de consacrer davantage de temps à la formulation de stratégies de protection des rhinocéros menacés, le rhinocéros noir (Diceros bicornis) et le rhinocéros blanc du nord (Ceratotherium simum cottoni), et à la recherche de solutions à différents autres problèmes.

Avant d'aborder la situation actuelle de la protection du rhinocéros et des défis qui sont présentés, j'estime nécessaire de résumer le rÙle du Groupe dont la mission est de promouvoir la protection à long terme et, le cas échéant, de rétablir un niveau viable pour les populations de rhinocéros d'Afrique.

Comme l'avenir des rhinocéros sera probablement décidé au cours de la prochaine décennie, il est essentiel que cette mission se traduise par des actions efficaces dans la protection de ces populations. Pour cela, des efforts de plus en plus importants devront Ítre consacrés, non seulement à définir des orientations et des stratégies de gestion appropriées mais aussi à intégrer celles-ci aux programmes de protection existants. La participation active des responsables de la protection des différents pays concernés aux activités du Groupe sera par conséquent déterminante. L'adhésion au Groupe sera finaiisée vers la mi -1992, les discussions approfondies sur ces initiatives ne pourront donc avoir lieu que dans la deuxième moitié de l'année.

La situation actuelle du nombre de rhinocéros d'Afrique a constitué l'un des sujets de discussion de la réunion de Gaborone. Les estimations détaillées par espèce et par pays pour l'année 1991 sont présentés plus loin. Les résultats sont particulièrement encourageants en ce qui concerne le rhinocéros blanc. La sous-espèce du nord est passée de 18 à 30 depuis 1987 et celle du sud de 4.630 à 5.590 pendant la mÍme période de quatre ans, ce qui représente pour cette dernière un taux de croissance d'environ 5 pour cent par an. L'Afrique du Sud en possède plus de 5.050, ce qui constitue de très loin la population la plus importante. Le nombre de rhinocéros noirs cependant continue de chuter, mais moins vite que pendant les années 1980. Selon les estimations, en effet, elle est passée de 3.830 en 1987 à 3.450 en 1991. Les populations les plus importantes sont celles du Zimbabwe (1.400), d'Afrique du Sud (771), de Namibie (479) et du Kenya (398).

Le braconnage se poursuit : au moins 100 rhinocéros noirs ont été tués au Zimbabwe en 1991 et les rhinocéros blancs du Swaziland ont été décimés. Les programmes de renforcement des réglementations semblent avoir permis le contrˆole de la situation en Afrique du Sud, en Namibie et au Kenya. Plusieurs conclusions peuvent Ítre tirées. On peut dire, par exemple, que les mesures liées au commerce se sont révélées inappropriées pour protéger les populations de rhinocéros, que la pression du braconnage constitue toujours une menace très grave et que des efforts intensifs de gestion sur le terrain peuvent s'avérer efficaces. Des mesures récentes ont été prises en ce qui concerne notamment la formation d'une unité spéciale de lutte contre le commerce illégal des espèces menacées d'Afrique du Sud, l'arrachage des cornes des rhinocéros de Namibie, du Zimbabwe et du Swaziland et du création du Projet Rhinocéros de Tanzanie. Des stratégies de protection régionales ou nationales ont en outre été élaborées, ou sont en cours d'élaboration, pour le Zimbabwe, la Namibie, l'Afrique du Sud et le Kenya. Par ailleurs, des groupes de travail sur le rhinocéros ont été constitués dans différents pays afin de coordonner les activités. La tendance est maintenant aux "sanctuaires" de petite taille, bien protégés et bien gérés, comme en Afrique du Sud et au Kenya et comme bientôt dans d'autres pays. Ces secteurs représentent d'intéressantes possibilités d'investissements pour les bailleurs de fonds.

Le ralentissement du déclin du rhinocéros noir peut s'expliquer simplement par le fait qu'ils représentent des cibles moins faciles, mais les populations de nombreux pays ont été réduites à des niveaux dangereusement faibles. Moins de la moitié des 14 pays

possédant des populations de rhinocéros noirs comptent plus de 50 têtes et une seule des trois sous-espèces, le "D.B. minor", se situe autour du seuil minimum de 2.000 têtes permettant la viabilité génétique. On estime qu'il reste environ 50 rhinocéros de la sous-espèce ouest-africaine, "D.B. longipes", répartis sur l'ensemble du Cameroun. On ne compte plus qu'une seule population de rhinocéros blanc du Nord, elle se trouve au Zaïre.

De nombreux défis doivent donc Ítre relevés par le GSRA, mais l'excellente qualité de sa structure lui permettra de faire face. Nous sommes actuellement engagés dans une nouvelle enquête sur la population des rhinocéros noirs du Cameroun. Cette enquête sera suivie d'une évaluation des options existantes de gestion de la protection. A terme, le Plan d'Action Rhinocéros devra être revu et mis à jour, une base de données centralisée ainsi qu'un système de compte-rendu seront mis en place et il est prévu d'examiner les questions liées à l'utilisation des ressources.

Le nouveau GSRA se réunira pour la première fois vers la fin de l'année 1992. D'ici là, les activités seront vraisemblablement limitées. Cependant, connaissant 1'important réservoir de compétences et d'expériences du Groupe, je suis certain qu'un certain nombre d'initiatives importantes seront préparées et mises en oeuvre.

Tableau : Estimation des populations de rhinocéros noirs "Diceros bicornis" et de rhinocéros blancs "Cerathotherium simum" sur le continent africain, en 1991.

	Rhinoceros Noirs				Rhinoceros Blancs				
Pays	Taille estimée		Nbre de groupe	Ten-dance	Taille estimée		Nbre de groupe	Ten-dance	Source
Afrique du Sud	771	(2)	14	hausse	5.057	(2)	171	hausse	Brooks
Angola	±50	(4)	S	?	0				Hall-Martin
Botswana	10+	(4)	S	?	56	(3)	S	?	Gavor
Cameroun	±50	(4)	4	baisse	0				Alers
Ethiopie	0?		S	baisse	0				Allen-Rowlandson
Kenya	398	(1/2)	19	hausse	57	(1)	5	hausse	Wanjohi
Malawi	±5	(3)	1	stable	0				Hall-Martin
Mozambique	50+	(4)	S	baisse	0?				Hall-Martin
Namibie	479	(2)	4	hausse	80	(2)	5	hausse	Joubert
Ouganda	3	(2)	?	stable	0				Edrom
RCA	5	(4)	S	baisse	0				Doungoube
Rwanda					0				Gakahu
Somalie					0				Gakahu
Soudan					0				E. Martin
Swaziland	6	(1)	1	stable	60	(2)	3	stable	Hall-Martin
Tanzanie	185?	(4)	S	?	0				Gakahu
Tchad	0?		S	baisse					Daboulaye
Zaïre	0				30#	(1)	1	hausse	Smith
Zambie	407	(4)	1+	baisse	0			baisse	Mvima
Zimbabwe	1.400	(3 14)	±20	baisse	250	(3)	10	?	du Toit
TOTAL	**3.452**		**baisse**		**5.590**		**hausse**		

S : Populations disperses
: Taille de la population inconnue, mais très petite
: Populations d'espèces du Nord "C.s. cottoni"

Fiabilité du recen-
(1) dénombrement intégral
(2) estimation à partir d'enquêtes sur sement les 2 dernières années
(3) enquêtes vieilles de plus de 2 ans ou récentes mais non spécifiques
(4)approximation ou résultat d'enquêtes récente non spécifique

The Distribution and Number of Forest Dwelling Elephants in Extreme Southeastern Cameroon

Karl A K Stromayer and Atanga Ekobo

Introduction

The forests of southeastern Camerooon, although poorly studied, contain some of the largest and least disturbed populations of rainforest mammals in Central Africa. A reconnaissance survey by Wildlife Conservation International (WCI) in 1989 estimated an elephant density of 1.8 per km^2 for extreme southeastern Cameroon; our recent and more extensive survey suggests 4.5 elephants per km^2 is a better figure. Similar surveys in contiguous parts of the Central African Republic and the People's Republic of Congo reported elephant densities of 0.86 and 0.9 respectively (Carroll, 1988; Fay and Agnagna, 1991). Within this ecosystem the Central African Republic has established the Dzangha-Ndoki National Park with its associated Dzangha-Sangha Dense Forest Special Reserve and the Nouabale-Ndoki park/reserve system is proposed in the Congolese portion (Fay and Agnagna, 1989). None of the Cameroonian sector has any effective protected status and, increasingly, the wildlife of the area is threatened by poorly conceived logging practices and over-hunting. Sponsored by the Cameroon Government's Institute of Animal Research, Wildlife Conservation International, the World Wildlife Fund (US) and the European Community, our survey team conducted a series of biological surveys in the region during October - December 1990 and March - May 1991. Two of our objectives were to propose boundaries for a series of regional reserves, and to provide data on the number and distribution of elephants that later could be used to plan a more comprehensive elephant survey.

Study Area

The Republic of Cameroon covers an area of 475,442 km^2 and in 1988 had a population of 11.2 million (Horta, 1991). Tropical rainforest covers the southern two-fifths of the country, about 200,000 km^2 (Fig 1) (Gartlan, 1988).

The three sites surveyed in southeastern Cameroon are very similar biologically and share a common climate and geological history. The vegetation is of the

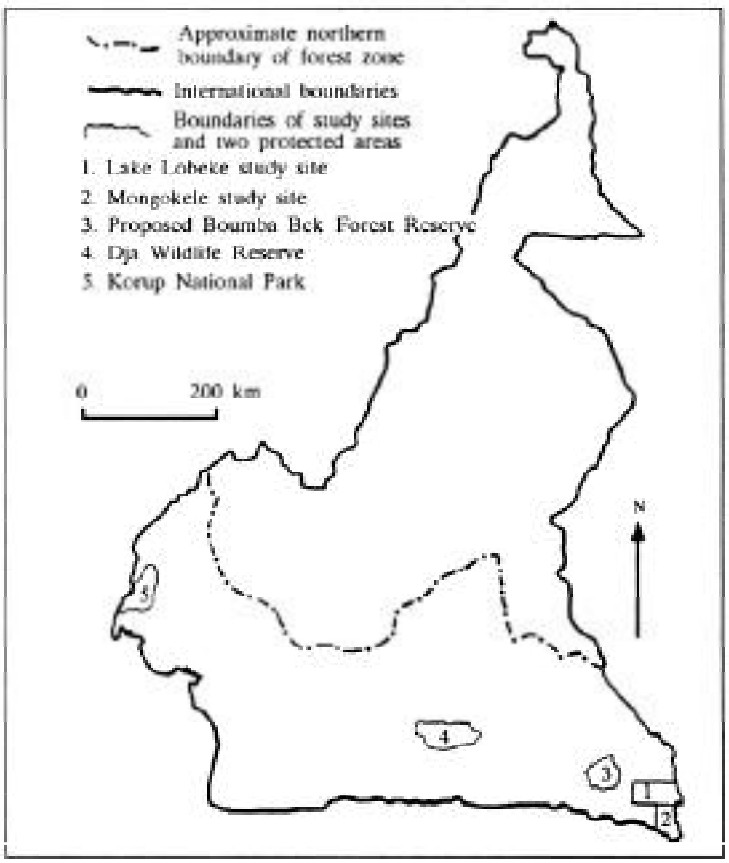


***Figure 1**: Map of Cameroon showing the forest zone, the three study sites in extreme SE Cameroon and the locations of Korup National Park and Dja Wildlife Reserve*

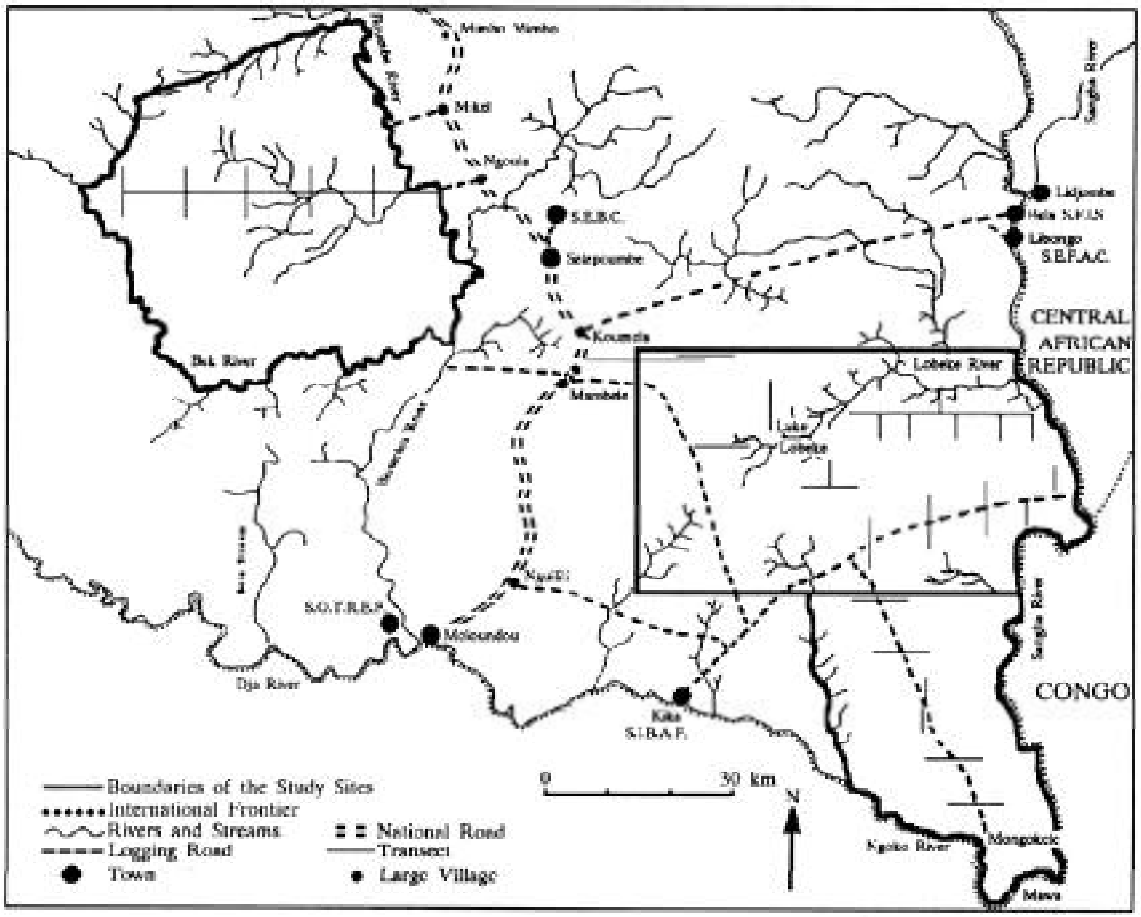


***Figure 2** : Map of the study sites in southeast Cameroon showing the locations of the transects*

Congolese forest type. Seventy to eighty percent of the Lake Lobeke and Mongokele sites has been selectively logged over the last 30 years, but the proposed Boumba Bek Forest Reserve is still in a natural state. The climate is equatorial with two wet and two dry seasons. Precipitation is about 1,600 mm a year with an average annual temperature of 25 The terrain is a series of plateaus traversed by shallow valleys and lies between 400-720 m in altitude, with occasional depressions. The Lake Lobeke and Mongokele study sites and 80% of the proposed Boumba Bek Forest Reserve lie within Moloundou Subdivision, the southeastern-most subdivision of Boumba and Ngoko Division, in Cameroon's East Province. The area of the subdivision is 15,567 km^2 of which the study sites occupy 5,594 km^2 or 36% of the total area.

The human population of the subdivision is 24,000. This represents 1.54 inhabitants per km^2, which is lower than the average of 4.0 inhabitants per km^2 for the Eastern Province as a whole. The population is concentrated in five logging towns and in villages along the national road that runs due south to the subdivisional capital of Moloundou on the Ngoko river. Although the study sites include some of the more remote and sparsely populated forest regions in Cameroon, no part is over 30 km from a motorable road or navigable river. Despite this apparent accessibility, large blocks of the forest are seldom visited by man.

Methods

Surveys were made on foot along transects in each of the three study sites (Fig 2). An effort was made to distribute the transects uniformly over the areas surveyed. Transect lines were run on compass bearings directed perpendicularly to watersheds in order to sample varied habitats. Each observer recorded distances along transects at the Lake Lobeke study site with two pedometers. These were calibrated daily using a topofil over half the total transect distance. For the surveys of the Mongokele and Boumba Bek study

Sites the length of transects was recorded using topofils over the entire measured distance. Abandoned logging roads and hunting trails were surveyed on foot while moving between transects. All elephant dung piles seen by the principal observers within two metres of either side of the transect baseline were recorded. For analysis only continuous segments of transect, logging road or hunting trail 5.0 km or longer in length were considered. Five kilometres is considered the optimum length (Barnes *et al*, 1988).

To obtain the numbers in appearance classes A-D, as defined by Barnes and Jensen (1987), we multiplied the number of dung-piles by 0.74.

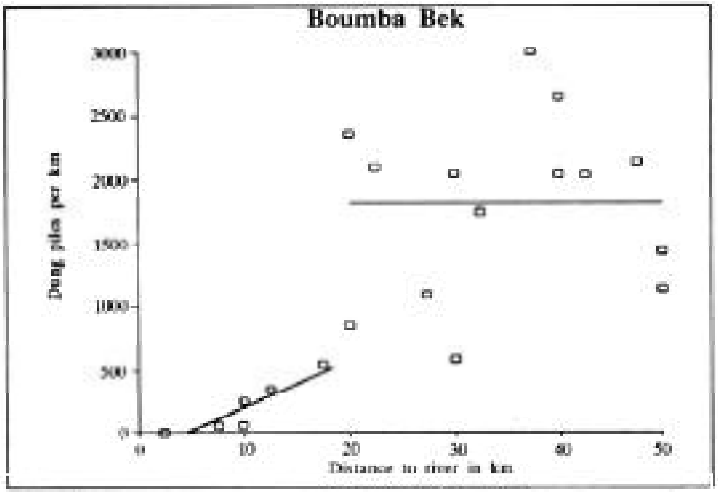


Figure 3: *The variation of dung-pile density with distance from the Boumba river (the eastern boundary of the proposed Boumba Bek Forest Reserve*

A rough estimate of elephant density was obtained using figures developed by Barnes and Jensen (1987) and revised by Barnes and Barnes (1991).

$$\textit{Elephant density} = \frac{\textit{dropping density x decay rate}}{\textit{defecation rate}}$$

With a decay rate of 0.0233 and a defecation rate of 17/day the conversion factor is 0.0233/17=0.0014 (Barnes and Barnes, 1991; Wing and Buss, 1970).

Results

Dung Density

A total of 326.50 km of transects were surveyed. This included 58 line transects each 5.0 km long, or 290.0 km in all, 117.0 km of logging roads and 23.50 km of hunting trails. Table 1 presents a summary of results from the transect data gathered in the three study sites. Table 2 compares dung densities recorded on transects with those recorded on abandoned logging roads in the same areas. In Lake Lobeke dung densities were significantly greater on abandoned logging roads (t=3.30, df=36, P). For Mongokele, Table 2 shows a similar increased dung density on abandoned logging roads, but here the difference is not significant (t=0.91, df=20, N.S.). Due to the small sample size, the data from hunting trails were not analyzed.

Elephant Distribution in Relation to Human Disturbance

Our results support the findings reported by Barnes *et al* (1991) in Gabon, which show a positive correlation between elephant dung density and distance from zones of human activity such as villages and roads.

Figure 3 shows how elephant dung-pile densities in an area of the proposed Boumba Bek Forest Reserve vary with distance from the nearest source of human disturbance. It demonstrates that the sampled area can be divided into two zones. From the Boumba river, where there are very few elephants, the density increases with distance from the river up to 20 kin; this is shown by the regression line. From 20.0 to 50.0 km from the river there is no change in dropping density; the mean density is shown by the horizontal line. This result supports our subjective impression

Table **1: Estimated elephant dung density (D) and elephant density (E) for the three study sites in SE Cameroon**

Location	km sampled	km²	D	E	Area of site km²	Number of elephants
Lake Lobeke	140	2.8	4,479	4.64	2,414	11,202
Mongokele	50	1.0	4,225	4.38	850	3,723
Boumba Bek	100	2.0	1,372	1.42	2,330	3,312

that human influence extends only a short distance from the river into the eastern part of the reserve.

If the logging road that runs due south to the village of Mongokele is divided into segments of 20 km each, a very steeply decreasing gradient of elephant dung density is noted as Mongokele is approached (Table 3). A 20.0 km transect cut perpendicularly to the single national road in the subdivision (Table 4) also shows that human activities have a profound impact on elephant distribution.

Table 3: Average elephant dung density for three 20km Intervals of abandoned logging road, in the Mongokele study area

Distance from Mongokele village -	Dung densities/km2
0 - 20km	0
20 - 40km	4,600
40 - 60 km	13,908

Table 4: Average elephant dung density for four 5km Intervals of transect from a roadside band in Moloundou subdivision

Distance from highway	Dung density/km2
0-5km	0
5-10km	0
10 - 15km	0
15 - 20km	2050

Discussion

Elephant Density in the Lake Lobeke Mon gokele Area
Our findings support earlier data suggesting that the Lake Lobeke area holds the highest density of forest dwelling elephants yet surveyed in Africa (Table 5) (WCI, 1989). This very high density is found over all the Lake Lobeke study site and the northern two-thirds of the Mongokele study site. We estimate the total elephant population in this area is 14,688 (3,264 km^2 x 4.5 elephants/km^2). Based on our results and known distances from human population centres, the same density may exist in up to 5,000 km^2 of extreme SE Cameroon. A warning that this robust elephant population faces possible compression and destruction is suggested by the small number of elephants in the southern third of the Mongokele study site (Stromayer and Ekobo, 1991). It would appear that elephants have been driven out of this area by persistent human hunting pressure.

Table 5: Estimated forest dwelling elephant densities reported from different parts of central Africa

Location	Density	Reference
Korup National Park	0.2	WCI 1989
Salonga National Park	0.2	WCI 1989
NE Gabon	0.4	WCI 1989
SE CAR	0.48	Fay 1991
SW CAR	0.86	Carroll 1986
NE Congo (Ndoki area)	0.9	Fay and Agnagna 1990
Extreme SE Cameroon	1.8	WCI 1989
Lake Lobeke study site	4.64	Ths study

Possible Habitat Preferences of Forest Dwelling Elephants in SE Cameroon
The extremely high elephant densities we encountered in the Lake Lobeke - Mongokele areas as opposed to those in the area of the proposed Boumba Bek Forest Reserve probably can be attributed to the preference displayed by forest dwelling elephants for secondary forest (Barnes *et al,* 1991). If compression of the elephant population due to human pressures was the driving force, one would expect higher elephant densities in the proposed Boumba Bek Forest Reserve. Boumba Bek is undisturbed primary forest with no logging roads and difficult for humans to penetrate while the Lake Lobeke - Mongokele site has a dense network of logging roads and a recent history of intensive elephant hunting. Regardless of the true explanation for the distribution of the extremely high densities of elephants found in SE Cameroon, these populations still appear both large and healthy, and promise excellent and perhaps unparalleled conservation potential.

Methodology
In both the Lake Lobeke and Mongokele study sites, elephant dung pile densities on transects were very much lower than those on abandoned logging roads. This is because elephants are attracted to the food provided by the secondary vegetation that grows along the latter (Barnes *et al,* 1991). Table 2 shows that roadside densities have a higher variance than those on transects. The results clearly show that elephant dung pile counts made on abandoned logging roads are misleading measures of elephant density.

Our estimates of the numbers of elephants are based on dung counts, an indirect way of assessing a population. We were unable to determine elephant defecation or dung decay rates for the SE Cameroon study sites and were forced to rely on values for these

variables taken from other forests in Africa. For these reasons the final estimates of elephant numbers should be viewed with caution. We emphasize that ours was a preliminary survey of the elephant population that shows the order of magnitude of its size. It should be followed by a more detailed survey to give an accurate estimate of the number of elephants.

Current Threats to the SE Cameroon Elephants and some Recommendations for their Protection

Interviews with government officials, local villagers and expatriates residing in the subdivision suggest that elephant hunting has been proceeding on a large scale for at least the last ten years. This ten-year period closely correlates with the building of a logging road infrastructure that provides easy access to previously remote areas of the region. Among expatriate senior staff of logging companies the consensus is that the elephant population has been halved since the roads were built, and that at least one elephant was killed per day in Boumba and Nyoko Division throughout the decade. Several of our sources indicated that the current international ban on the transport and sale of ivory has had a slight but perceptible 'braking' effect on elephant hunting in the region.

This accident, which befell us in November, 1990, illustrates the dangers of traveling on abandoned logging roads. Large tree trunks spanning a stream bed had rotted through, leaving a 'trap' concealed by vegetation. The vehicle came to rest on its axles, half suspended over a 12 foot drop to the river bed below.

Currently there is no effective anti-poaching programme in the area. Teams of hunters, some of whom specialize in hunting elephants year-round, operate almost freely. They are often armed with semi-automatic weapons for which ammunition is readily available in nearby Congo. Less well-equipped hunters simplify their task by first incapacitating the elephants with large snares made of thick cable and attached to heavy toggles. Local traders are said to be instrumental in supplying weapons and ammunition to hunters, in buying tusks and in transporting ivory out of the subdivision. It is also rumoured that certain government officials play a significant role in this illegal trafficking.

Due to the high biodiversity and great densities of elephants, leopards, gorillas and other endangered mammals present in Cameroon's southeastern-most forests, the area has an extremely good potential for conservation efforts. Although Korup National Park already exists in southwestern Cameroon and Dja Wildlife Reserve in central Cameroon, no measures have been taken to safeguard representative portions of Cameroon's Congolian forests in the southeast. We recommend the establishment of a minimum of two protected areas in Moloundou subdivision. One encompassing the general areas of the Lake Lobeke and Mongokele study sites and another consisting of, at a minimum, the western two-thirds of the proposed Boumba Bek Forest Reserve. The creation of these reserves would be complementary, as much of the Lake Lobeke and Mongokele sites have been logged in the last 30 years, whereas the proposed Boumba Bek Forest Reserve has not. Additionally, the conservation potential of the Lake Lobeke — Mongokele unit will be considerably enhanced by its adjoining both the Dzangha-Sangha protected area in the CAR and the proposed Nouabale-Ndoki protected area in the Congo.

The three Cameroon sites embrace a total of 5,594 km2. which is about 2.8% of Cameroon's total forested area, and 1.2% of the total national area. Granting these areas protected status would be consistent with Cameroon's stated national policy of conserving at least 20% of the country as National Parks and Forest Reserves. Serious land-use management conflicts are not anticipated in the region because there is only a small human population, the potential for plantation agriculture is poor and exploitable trees are few in number.

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Bali: Business as Usual

Chryssee and Esmond Bradley Martin

Almost all elephant ivory carving industries have significantly declined since the international bans on ivory trading were introduced, and overall retail sales of worked ivory are estimated to have fallen by at least *75%* since June, 1989. However, in Indonesia, on the island of Bali, there is a small ivory carving industry which is thriving. Although Bali is a major tourist resort, it is not the tourists who are buying the carved tusks, figurines and jewellery made there. Neither is the raw ivory coming from recently-poached elephants.

Elephant ivory carving in Indonesia is only carried out in any quantity on the island of Bali.

Historically, Bali has been a place of refuge for artists, intellectuals and nobles from Java. It is one of the parts of the Indonesian archipelago that is non-Islamic, and Bali's Hindu religious practices are much less strict than in India. The society is communal and based on agriculture. Because the land is very fertile, life is not hard; even now, despite the crowded population of more than 2.6 million people, there is time to spare to do everyday tasks artistically. Balinese art seems to be a natural pursuit, whether it is the simple arrangement of offerings set out for Hindu gods or decorating with sculpture the entrance to one's house.

Bali's art museum in the capital, Denpasar, consists of a group of buildings reminiscent of traditional temple and palace architecture. Inside, there are paintings, sculptures and many more commonplace items, such as baskets — even these show an artistic flair. Among the ivory treasures are handles for kris knives, sculptures of gods and goddesses, intricately designed fans and one particularly large carved ball. None is marked with a date or the artist's name, but most could have been made 50 or a 100 years ago on Bali.

Until droves of western tourists began flooding the island, there was not much trade in Balinese arts and crafts, but soon shops sprang up, selling all kinds. When we first went to Bali, in January, 1981, we wanted to find out if there was an ivory industry. We were directed to a village north of Denpasar and within walking distance of the town

The Bali ivory carvers specialize in carving large old tusks which originate from elephants frsom India and Sumatra and were brought to the island of Flores east of Bali as a form of currency many years ago.

of Ubud. It was Tampaksiring, and there we watched craftsmen copying Japanese netsukes and German animal figurines from photographs and drawings. When carving these small items, they usually sat out on verandahs, the piece of ivory they were working held by their toes against a block of wood. Their hand tools were numerous; practically every one had 12 or more chisels. We learned that there were around 25 ivory carvers in the village, some working at their own homes, others coming to the houses of the three ivory businesses, which were all cottage industries.

Most of the carvers had learned how to carve on cow horn before embarking on ivory. Being paid for the work they produced, rather than regular wages, they earned around 75,000 rupiah a month (then the equivalent of $120), which favourably compared with the lowest monthly minimum salary of $32 in Bali.

They were not making a great variety of items, and when copying pictures of netsukes and animal figurines, the craftsmen rarely modified any of the designs. Jewellery was mostly limited to bangle-type bracelets with silver clasps. However, when the craftsmen were given whole tusks to carve, their work was spectacular and imaginative. Often they depicted Balinese versions of Hindu mythology on them. They also paid much attention to detail, such as showing the folds on a goddess' gown rippled by a breeze. Some of the tusks being carved weighed 15 kg or more, very large for Asian ivory.

Finished pieces were usually placed in display cabinets inside the proprietor's parlour, where sales to tourists were carried out. In one, we saw a very ornately carved small tusk priced at $400. It weighed about a kilo, but we were told that the tusk had been

1.5 kg raw. Narrow bracelets with the silver clasps cost $33 retail.

We heard complaints about raw ivory becoming expensive; the owner of Kenaka Centre of Ivory Carving told us that he paid $130 per kg for small tusks and $160 for large ones. We were surprised to learn that all the ivory used for carving in Bali came from the island of Flores, some 500 km away. Flores probably never has had any elephants at all.

When we made our plans to return to Bali in December, 1990, we contacted a friend of ours, Kalman Muller whom we first met when we were students together at the University of Arizona in the 1960s. Since then, Dr Muller has spent much of his life in Southeast Asia, writing anthropological articles and books about the people and photographing them. One of his specialties is the customs of Indonesians. He explained to us that before Europeans went to the archipelago, Bugis traders, originally from Sulawesi, established entrepots all over Indonesia. Among the items they brought to Flores were porcelain, gold and elephant tusks. The latter were used by the people of Flores as money. The Bugis obtained the ivory mostly from Sumatran elephants, but some probably originated in other Southeast Asian countries and India. Dr Muller knows a descendent of a Flores rajah who owns a good number of large tusks given to the family generations ago by a Portuguese. On Flores, a bride price is sometimes still paid in raw ivory, but this tradition is fading with the demand for cash. Local Chinese merchants are known to buy up old ivory stocks and the Tampaksiring businessmen from Bali barter with them or the families who remain with some of the old 'money'.

Competition for the ivory has increased the price. In 1986 tusks from Flores cost $167 per kg; by 1990 $265. Although the rise from 1981 to 1986 is little in dollars, in rupiah it is much greater, due to devaluation. By 1990, the official exchange was 1,880 rupiah to the dollar, compared to 620 in 1981. On our recent visit to Tampaksiring, we found that the ivory business owners were continuing to buy all their stocks from Flores. They said they never used African ivory because they believed its softness rendered it inferior. We looked at most of the tusks in the three ivory carving establishments and saw that they were all from the Asian species and quite old, with deep dark brown stains. Many were large, weighing between 20 and 30 kg. The proprietor of an ivory business proudly showed us a 40 kg tusk, which in halting English was described as"gigantic".

Indeed, that is huge for an Asian elephant. There were 24 other tusks in a storeroom at the house. Although we were unable to estimate how much ivory is presently being carved in Bali, we had the impression that it is considerably more than the amount we calculated in 1980, at which time the largest business used 120 kg a year.

We noticed two important changes in the Tampaksiring ivory industry, both of which may account for the higher ivory consumption. While the carvers are still only about 25 in number, they now use electric tools to speed up their rough work, dentist drills having been purchased for them by the business owners in late 1989. Power lines only reached the town of Ubud in the mid-1970s, and the craftsmen are a little wary of electricity; several said that they prefer using their old hand tools. None the less, they are being encouraged to change their ways, as the proprietors realise that the quicker the work is done, the sooner they can make a return on their ivory investments. We noticed that the craftsmen worked more steadily than they formerly did. Gone were the long afternoon card-playing games; they kept working from 8 o'clock in the morning until around 4 o'clock, with breaks only for food and drink. Payment received was still for output, and the craftsmen in 1990 were earning on average $110 a month, compared to $40 for a shopgirl's salary. All the craftsmen we watched were carving large tusks. It may take as long as two years for a 24 kg tusk to be completed. One or two craftsmen may work on it. Reduced to about 18 kg when finished, it will have cost the proprietor just over $10,000, of which $7,000 would have been paid for the raw ivory, $2,500 for the labour and $560 for food, electricity, maintenance of the tools used, etc. For such a tusk, the proprietor would ask $18,600.

There is a new market for the ivory carvings of Bali, and that is the major change that has taken place. Having started business by selling ivory bric-à-brac and jewellery to foreign tourists in the 1960s, then specializing in figurines and netsukes for Germans and Japanese in the 1970s, one woman proprietor began producing whole carved tusks for wealthy Indonesian officials in Jakarta in the 1980s. Today, they are her main clientele, and she is delighted that she began cultivating their interest in fine ivory pieces when she

did. As a result, her business did not suffer in the least when tourists began avoiding ivory purchases.

When we visited her showroom, admiring several exquisite carvings, she assumed we were ivory collectors but warned us against buying anything because of the illegality of moving ivory from one country to another. We asked her if she ever sold items to tourists now, and later in the course of conversation, she admitted that she did. She pointed out a few carvings on ivory plates, 15 cm long and 6cm high, but quite thin. Those, she said, Japanese and Taiwanese do occasionally buy and smuggle out. Each one was exquisite, depicting animals in their natural habitat, such as otters in water, bear cubs playing in a forest and mice in a field.

As for the whole carved tusks, she herself takes them to Java to show prospective buyers. Occasionally, senior government officials come to Bali to choose ivory pieces; however, most sales are made in Jakarta by all three of the ivory businesses. Interestingly, the buyers rarely commission orders, they prefer seeing finished work and making their choices then.

What has happened to the ivory industry in Bali could occur in other countries with stocks of raw ivory. Conservationists who are actively attempting to close down all trade in ivory would then need to re-direct their efforts to prevent the emergence of local markets for ivory carvings among the elite.

Table:Retail Prices for Ivory Items In Bali in December1990

Commodity		**Price in US$**
Cigarette holder	11 cm	34
Bracelet (small, partly carved)	1.25 cm thick	66
Buddha figure	5 cm tall	93
Mouse sculpture	5 cm long	160
Masked Dancers sculpture	5 cm tall	250
Ghanesh sculpture	9 cm tall	700
Komodo dragon sculpture	20 cm tall	1 ,000
Carved tusk	1.25 kg	1,064
Hindu god	19 cm tall	1,200
Carved tusk	5kg	3,190
Carved tusk	18 kg	18,600

Source: Survey taken by the authors

David Harland

Almost 20 years after the signing of the convention, CITES is still struggling to find a role for itself. The debate between strict preservation and consumptive use continues to generate a great deal of acrimony, as the ongoing debate over the status of the African elephant witnesses. If the debate is not resolved soon, CITES might find itself bypassed by a new convention — much broader in scope, and potentially much better funded.

Kyoto Meeting

CITES' biannual Conference of Parties was held in Kyoto from 2-13 March 1992. Again the African elephant took centre stage, though not'— as was the case in Lausanne in 1989—to the exclusion of everything else. Debate in the substantive Committee I was divided between about 100 proposals for amendments to the Appendices and a sheaf of resolutions on the structure of the convention itself.

The best that can be said for the debate on amendments to the Appendices was that it was refreshingly broad in its coverage. Attention was rightly turned to several bird species (the value of the international trade in tropical birds dwarfs the trade in all other wildlife products combined) (Fitzgerald, 1989). And for the first time serious attention was paid to a number of plant taxa. (CITES, Doc.8.46)

Nevertheless, as usual, it was the African mammals that dominated the proceedings. The quality of debate was not particularly high. The basic problem was that the debate was much less an interactive process than a declarative one. There was a great deal of sermonising and self-righteousness on all sides. This process reached its most absurd during the debate on the elephant that included a ringing statement from Burundi on the moral imperative for banning the ivory trade and for protecting the noble animal (CITES, Com.I 8.9).

As in the past the basic pattern was to put more and more species on Appendix I. Efforts to down-list various species — including the elephant, both species of African rhinoceros, the cheetah, the leopard and various others—were all roundly rejected (CITES, Com.I 8.9).

Interestingly a few species were down-listed. These included the North American bobcat *(Felis rufa escuinapae)* (CITES, Doc.8.44). It was left for Rowan Martin of Zimbabwe to note that barely half an hour before the bobcat was down-listed without any trade or population data at all, a similar proposal for the leopard was rejected for lack of information despite several hundred pages of supporting studies. Martin claimed to be "bewildered", but he was being disingenuous: it was apparent to everyone present that no high-profile species — no species that might have a 'constituency' in the donation-giving countries — could possibly be down-listed (CITES, Doc.8.45). The decisions were political, not biological.

CITES Visibility: Pluses and Minuses

The accelerating tendency to push species onto Appendix I and its converse, the difficulty of down-listing species, points to a basic contradiction within CITES.

CITES is a success because it is a spectacle. It is one of the most visible instruments of international law

in any field. Governments that know that they are in the public eye are highly responsive to the perceived wishes of their constituents, and highly responsive to lobbying (Lyster, 1985).

That is positive, for in the absence of public pressure it is altogether likely that governments would simply ignore CITES completely.

But there are problems, too.

The first is that it gives a massively disproportionate weight to the voice of rich countries and the non-governmental lobbyists in those countries. It is the Western European and North American publics that stump up the money for wildlife lobbyists, and it is therefore, naturally, the rich man's philosophy of wildlife management that prevails. The views of the poorer countries'—which, ironically, are guardians of most of the world's endangered species'— are marginalised (Harland, 1992).

Further, because the whole process is so driven by NGO lobbies, debate must be pitched at a level meaningful to the constituencies from which these lobbies draw their support. That means two things. First, there is a hugely disproportionate interest in the—'charismatic megafauna', to the detriment, unfortunately, of less glamorous but equally important species (Tolba, 1992).

Secondly, complicated solutions, however effective, must be abandoned in favour of simpler ones — ones that will have appeal at the bumper-sticker level. Thus it is very much easier to say "Save the Elephant: Ban the Ivory Trade" than it is to say "Save the Elephant: Support a Programme to Make Elephant Habitat Viable Against Human Encroachment" (Harland, 1990).

NGO Dilemma

The elephant debate at Kyoto illustrated this problem nicely. Those non-governmental groups that do elephant conservation work in Africa — most notably WWF — found themselves in an awkward position, caught between a need to support a policy that actually does some good, and a policy that appeals to a constituency that largely receives its information as sound bites on the evening news. To their credit — but to the detriment of their funding base — WWF, as well as a number of Africa based experts such as lain Douglas-Hamilton, refused to take the expedient course of supporting the Appendix I listing (WWF, 1992; Douglas-Hamilton, 1992).

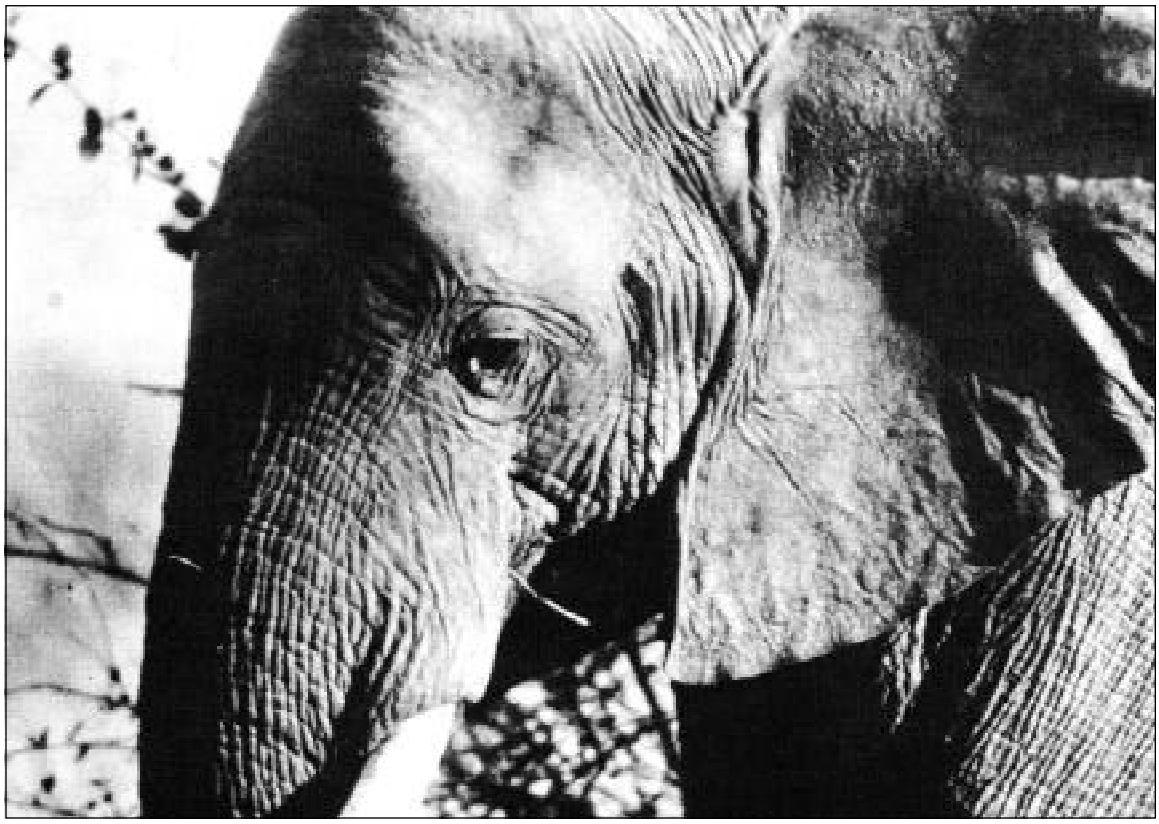
On the other hand, groups with no commitments in Africa found it simpler to stake out positions that, even if they advanced the cause of the elephant not at all, played well at home. There were, unfortunately, several in this category, the most extreme of which was the Environmental Investigation Agency. The EIA produced a very handsome, and no doubt expensive, report that made a powerful case and was widely reported in the press (EIA, 1992). It seemed not to concern EIA supporters that information in the report was misleading, and in important respects just plain wrong. Apparently the truth was not so important as the funding base. Where the elephant featured in all this was unclear.

Overloading on Appendix I

Another problem with CITES comes from the same source, though it affects governments rather than lobbyists. That is the incessant urge to list species on Appendix I. At each biannual meeting, the Parties agree that Appendix I is overcrowded, and that customs officers simply cannot enforce a list that includes thousands of discrete items. And then, often in almost the same breath, governments vote whole rafts of species onto Appendix I.

There arc two reasons for this. The first is that gov≠ernments like to be seen to be 'doing something'. Listing a species on Appendix I is the cheapest, most visible option open to a government that wants to placate voters without going too far out of its way. No matter if the number of species on Appendix I dilutes its effectiveness. That is a subtlety, it is assumed, that is lost on the voting public. Thus, "listing itself is considered more important than the subsequent enforcement" (CITES, Doc.8.14).

The second reason for over-loading Appendix I is less cynical, and points to a serious structural flaw in the convention. It is the fact that Appendices II and III in their present form are largely ineffec≠tive. They do not suppress demand and they rely entirely on the (often absent) goodwill of the exporting state to control supply (Swanson and Barbier, 1992). The main reason the elephant ended up on Appendix I was the total failure of the Appendix II machinery to stop the poaching that had halved population numbers in



a decade (Barbier *et al,* 1990). Likewise, one of the main reasons that a down-listing for the rhino was rejected was that it was felt, probably correctly, that however ineffective Appendix I controls might be, Appendix II controls would likely be worse (CITES, Com.I 8.10).

The Role of the Public

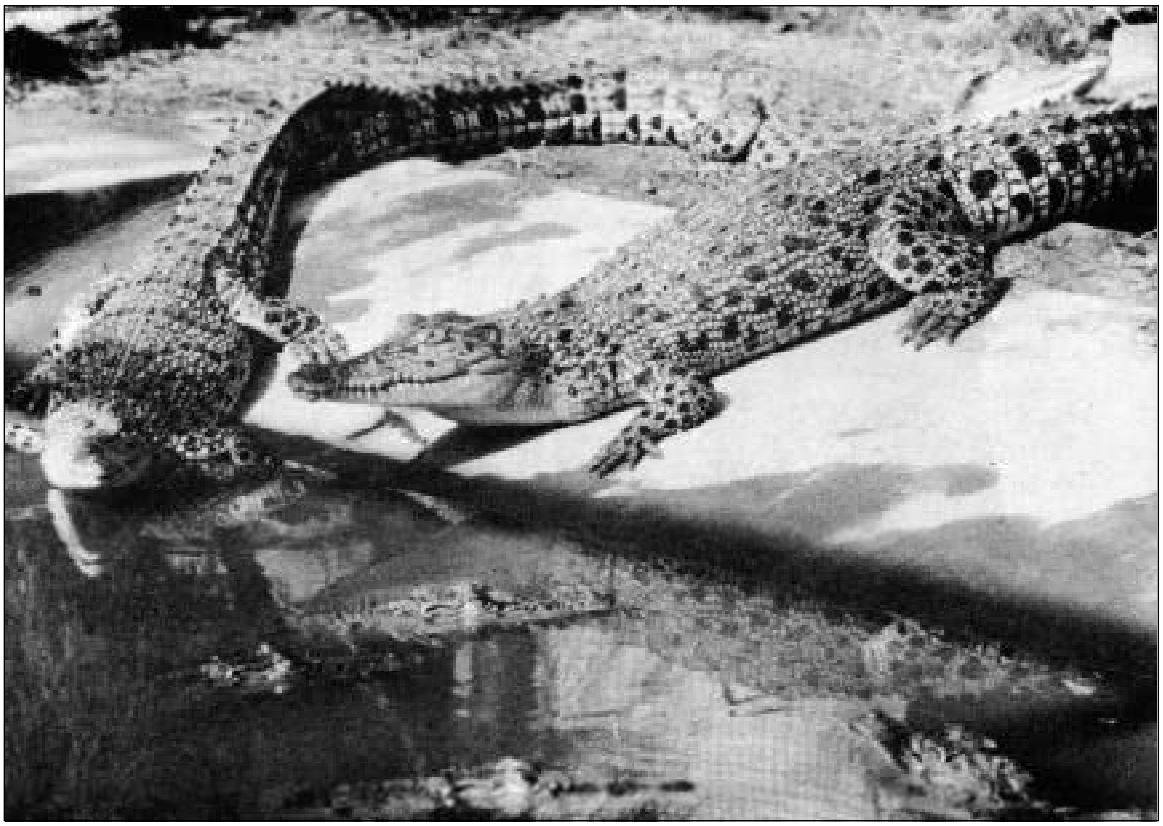
CITES' problems can be thus roughly divided into two areas: those that grow out of its extreme malleability in the face of public opinion that is not always very well informed, and those that are internal to the convention itself.

The first group are the more intractable. So long as CITES is so open to public influence (which it must remain if governments are to take it seriously), its agenda and its decisions will largely reflect the concern of the rich countries. That is one reason developing countries are talking increasingly of by-passing CITES altogether, and focusing on the recently-negotiated Convention on Biological Diversity.

On the other hand, there is some hope. So far govern≠ments and NGOs seem to be adhering to Mencken's adage that'"nobody ever went broke underestimating the intelligence of the American public." It is widely assumed that the public in Europe and North America is somehow incapable of seeing wildlife conservation as more than a black-and-white struggle between poachers and conservationists.

Judging from the press reports that came Out of the Kyoto meeting, that assumption is wrong. A large part of the press corps gave over considerable space to discussing the needs and aspirations of African farmers, and to discussing the threat to wildlife in more than just the lexicon of a morality play (AWF, 1992). It was encouraging stuff, and should be pursued.

The CITES Secretariat, however, is not good at cultivating the press. The new Secretary-General, aware perhaps of his predecessor's fate, gives the press as wide a berth as possible. He may be right to keep a low profile while he finds his feet, but a little bit of co-operation with a press corps that is making an intelligent effort to raise the level of public debate on the subject might not be amiss (Paul Ress, pers comm).



Structure of the Convention

On the second problem, that of the structure of the convention, things are looking hopeful. The original premise of CITES is that international trade in endangered species is bad. The more in danger a species is, the less it should be traded. Thus Appendix I, which effectively bans all trade, is reserved for the most endangered species; Appendix II affords a lower (and largely ineffective) level of protection, and is for species in less immediate danger, and so on.

For over a decade several countries have been trying to turn that premise around. Their belief is that a well regulated trade should be a positive asset in conservation.

Their first substantial initiative was the resolution on ranching, adopted in 1981 (CITES, Conf.3.15). The crocodile ranching schemes that grew out of that resolution have been an unreserved success, and Zimbabwe's contention that trade has helped to boost crocodile numbers is certainly true. Indeed, one of the most time-consuming issues at Kyoto was dealing with the long list of countries that wanted approval for ranching proposals of their own.

The other notable success has been with the vicuna. The down-listing of the vicuna onto Appendix II to allow the sale of hair from live-shorn animals has worked well, and the vicuna's prospects have improved considerably since its introduction. It is an imaginative use of Appendix II, and one that a number of countries would like to see developed.

Zimbabwe and a group of southern African supporters presented five resolutions designed to push the inchoate willingness to accept trade as beneficial still further. Some less-than-coherent opposition from Kenya notwithstanding, the standard of debate on these resolutions was good and represented the high-point of the meeting.

Three of the southern African resolutions passed, in amended form, and were adopted by consensus. Two others were rightly rejected (CITES, Doc.8.49; CITES, Doc.8.52). The first of those adopted was a general recognition of the potential benefits of trade in wildlife,

and the ease with which it passed showed just how far CITES has evolved in ten years of prodding from southern Africa. From a convention committed to taking endangered species out of trade, CITES is now equally committed to examining conservation measures that involve encouraging trade in endangered species. For developing countries, keen to find ways of marrying conservation and economic development, the trend is an encouraging one (CITES, Doc.8.48).

The second resolution passed was possibly the most far-reaching. It recommended overhauling the Berne Criteria (the rules that determine onto which Appendix a given species should be put), replacing the existing, difficult-to-apply and somewhat arbitrary rules with new 'objective criteria' (CITES, Doc.8.50).

It has long been acknowledged that the Berne Criteria are flawed, but until now the difficulty of producing anything better has let them stand (CITES, Doc.8.12). The southern African proposal, for establishing 'objective criteria', may have been noble in intent, but the draft criteria they proposed gave very little room for optimism that they had come up with anything better than the Berne Criteria. The daunting task of drafting something that is, a) more objective, b) workable and c) does not require huge amounts of information that simply are not available, has been left to IUCN and others to sort out in the inter-sessional period.

The third resolution passed concerned the need to consult with range states when submitting a proposal for the amendment of the Appendices (CITES, Doc.8.51). The point here seemed to be that the southern Africans—and many other Third World states—feel that the fate of their wildlife is determined by Europeans and North Americans with almost no regard to the views of range states themselves. To reinforce the point, land-locked Zimbabwe submitted (and later withdrew) a proposal to put the North Sea herring on Appendix I (CITES, Doc.8.46).

As originally formulated, the resolution on consultation would have given range states the ability to kill any proposal that two-thirds of them did not like. That was amended out of the final text, as demand control in *importing* states is one of the few weapons that makes CITES really effective. The obligation to consult, however, was retained, and the mechanism put in place goes some way to making sure that rich Westerners do not push through amendments oblivious to the needs, wishes and interests of those who actually have to live with the species concerned.

More than was probably realised at the meeting itself, the three resolutions passed went a long way towards changing the very philosophy and direction of CITES —or at least they formalized a decade-long shift away from the original intent of CITES as a mechanism for turning parts of the Third World into an open-air zoo (Tolba, 1992).

CITES: An Endangered Species?

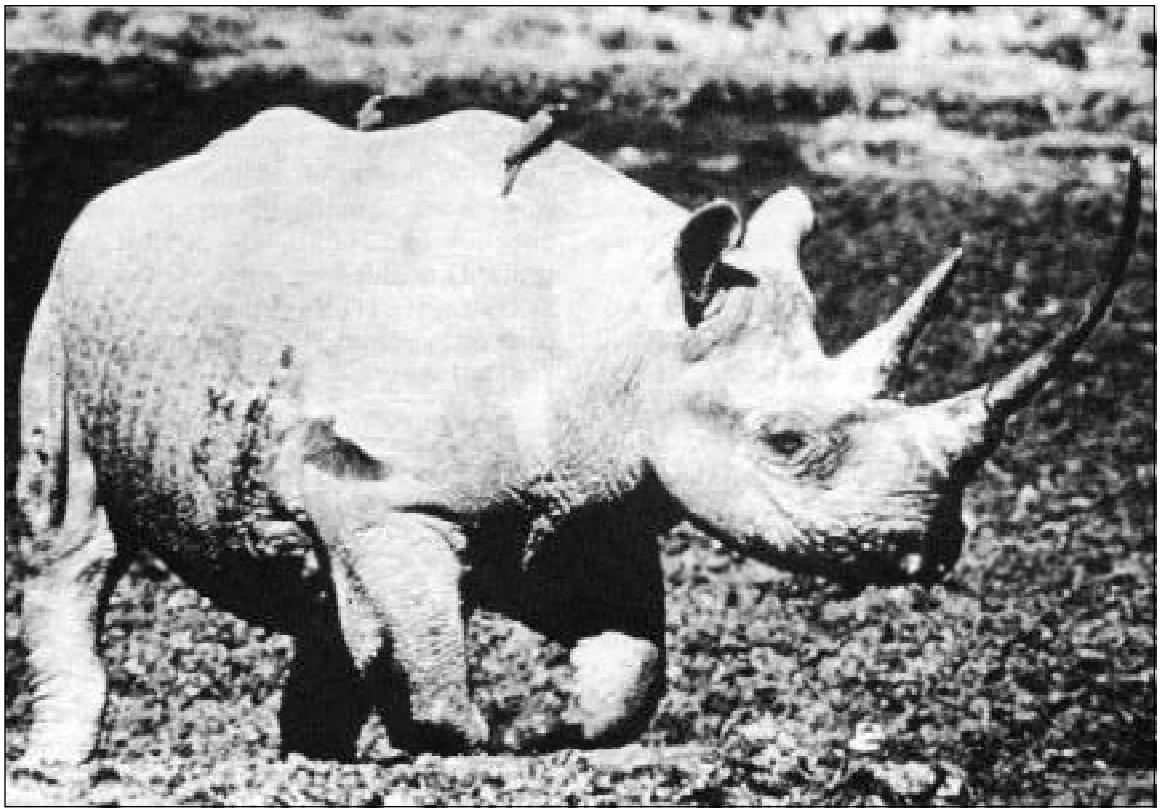
Whether the moves to accommodate the developing countries were sure enough to secure a strong future for CITES remains to be seen.

At the meeting Botswana and Zimbabwe threatened again (they have done so twice before) to leave CITES altogether (Kedikilwe, 1992). They probably will stay, though it is likely that they will be working vigorously to trade in wildlife products outside the CITES system. They may already be planning to move a certain amount of ivory and rhino horn (Reuter, 1992).

Meanwhile many countries in Latin America and southeast Asia have been looking to a new convention that would be more responsive to their needs. This is the Convention on Biological Diversity, recently signed in Rio de Janeiro. That convention —which also will be administered by UNEP—would give final say on every conservation project to the government of the country concerned. The involvement of the rich countries would be circumscribed by a series of articles upholding the 'sovereignty' of poor nations rich in biological diversity (UNEP, 1992).

The biodiversity convention is as yet untried, and the United States is sceptical enough of it not to have signed in Rio, but with interim financial support coming from the 1.3 billion dollar Global Environmental Facility it is altogether possible that it could quickly eclipse the North-dominated forum that is CITES.

How viable CITES remains will depend heavily on the extent to which recent efforts to make it more responsive to the needs of species-rich, economically-poor countries succeed.



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Javan Rhinoceros in Vietnam

Charles Santiapillai

A Remarkable Ability to Survive

The Javan rhino *Rhinoceros sondaicus* was once widely distributed in northern and southern parts of Vietnam. Although even as early as 1969 there was scepticism as to whether Javan rhinos occurred in Vietnam, there were sporadic reports of their presence in the south from hunters and tribal people. Then, in 1988, one animal was killed by a Stieng tribesman and the skeleton taken to Hanoi, where it rests today at the Ministry of Forestry. That the animal outlived the war and the destruction wrought on its habitat by bombardment and defoliation is proof of a remarkable ability to survive.

Lam Dong province is about 150 km northeast of Ho Chi Minh City, once Saigon. In March 1991, a survey was made there along the Dong Nai river in the area where the four provinces of Lam Dong, Dong Nai, Song Be and Dac Lac meet. This area of 35,000 ha of lowland forest represents the last stronghold of the Javan rhino in Vietnam and it is estimated that between eight and twelve animals may still survive there.

It is a shy animal that often retreats to dense forests to avoid disturbance and escape poachers. While this characteristic is of survival value and therefore to be welcomed by conservationists, it also makes it an extremely difficult species to study. Much of the information about the number, range and food habits of the rhinos is derived indirectly from footprints, trails, wallows and dung. What is known of its biology is mainly gleaned from incidental observations by tribal people and poachers.

The altitude range of the mountains of southern Vietnam is such that most of the area in Lam Dong province along the Don Nai river is a rich habitat for rhinos. Among the plants eaten by the Javan rhino in Vietnam, and identified from undigested material found in their dung, were *Acacia pennata, Calamus poilanei, Calamus tetredactylus, Combretum* sp, *Barnbusa procera, Bambusa bluemeana, Plectocoia elongata* and *Daemonorop nigro-ciliata.* In addition rhinos may be feeding on

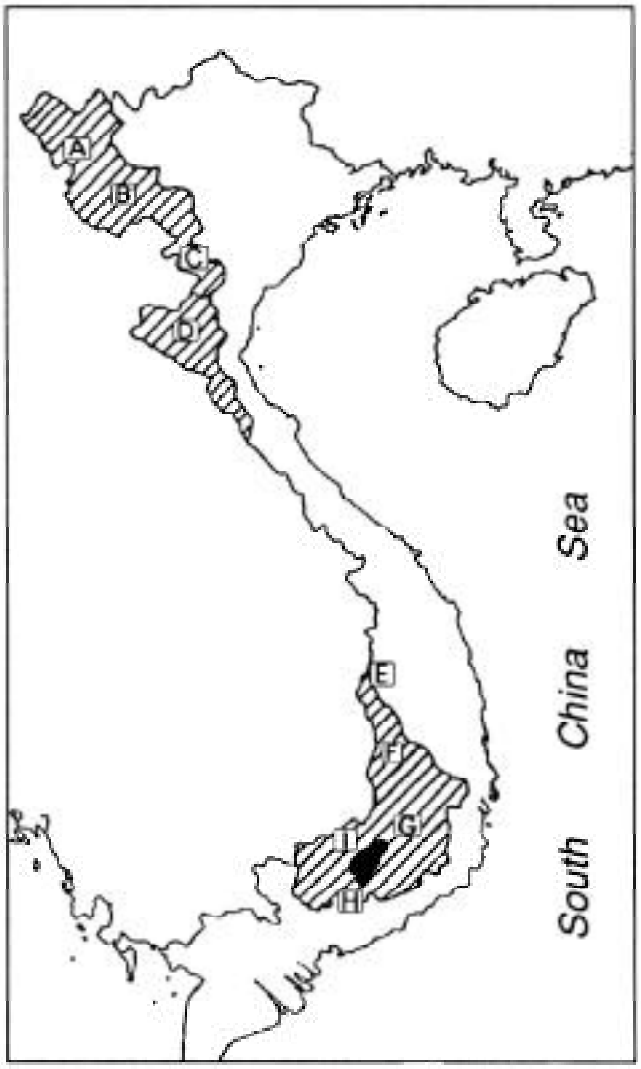


***Figure 1** : Map of Vietnam showing the extent of the past (cross hatching) and present (so/id shading) distribution of the Javan rhino. A: Lai Chau; B: Son La; C: Thanh Hoa; D: Nghe Tinh; E: Gia Lai-Con Tun; F: Dac Lac; G: Lam Dong; H: Dong nai; and I: Song Be provinces*

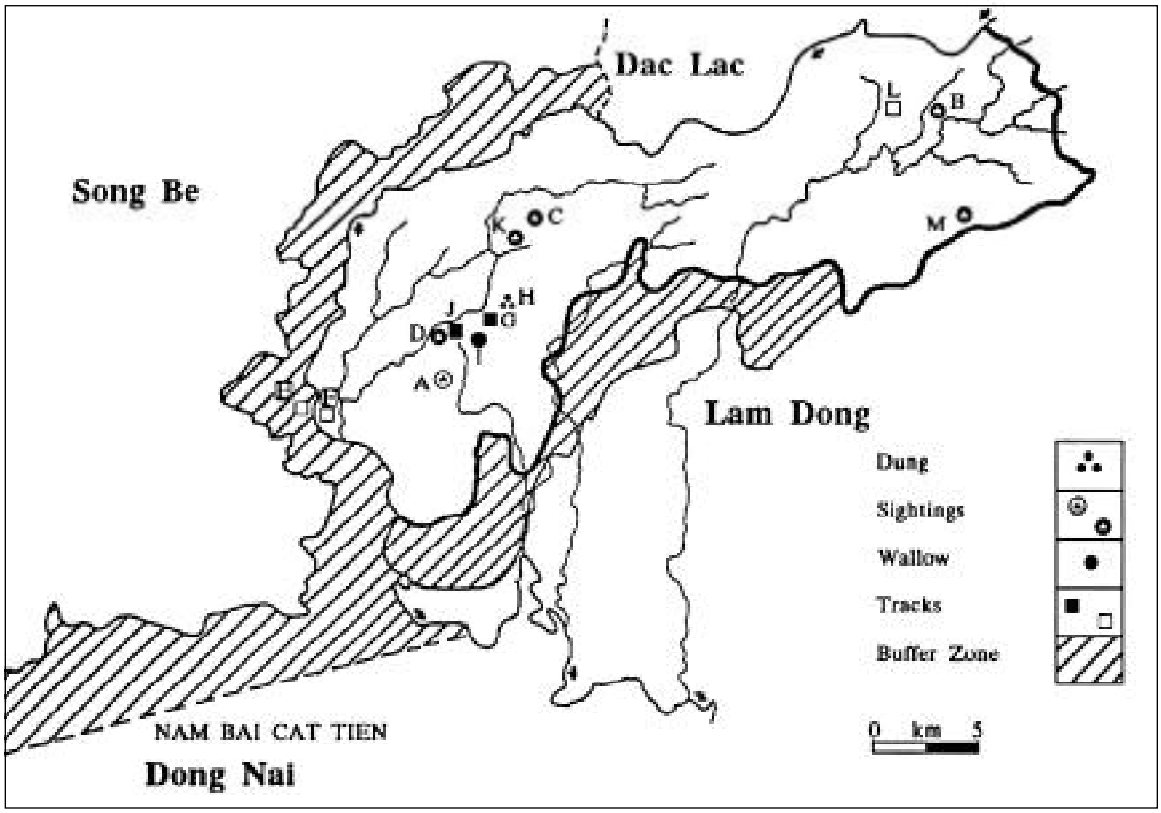


Figure 2: *Map of the area where the four provinces of Lam Dong, Dong Nai Song Be and Dac Lac meet, showing the 35,000 ha of lowland forest where an estimated 8-12 Javan rhinos may still survive*

wood fern *(Cyathea* sp). Rhinos can breakdown toxic plant material in their stomachs and so it was not surprising to find also a highly poisonous species, *Strychnos nux-vomica.*

Unpleasant Legacy of War

The most serious threat facing the Javan rhino population of Vietnam is poaching. An unpleasant legacy of the prolonged war with the USA is the ready availability of guns and rifles. Many minority tribal people carry guns to hunt wildlife for meat. Given the high price rhino horn fetches in the international market, the Javan rhino in Vietnam is worth more dead than alive to those Chinese middlemen in Ho Chi Minh City who trade in rhino horn.

Logging in itself is not a serious direct threat to Javan rhinos although their territory is rich in commercially important timber species of the Dipterocarpaceae family. The Vietnamese system of timber extraction stipulates the removal of only those trees that are over 80 cm in diameter at breast height, and a cutting cycle of 35-40 years. Logged areas actually offer some of the best habitats for rhinos and other large herbivores. The threat to rhinos from logging is indirect, and is attributable to logging roads providing people and poachers with easy access to hitherto inaccessible places.

Another threat comes from the slash and bum agriculture practised by almost all the tribal people resident in the area. The fires set by the farmers could easily spread into the core area of the rhinos, especially during the dry season when there is so much combustible plant material around. Shifting cultivation is identified as a prime agent of forest destruction.

Not All Small Populations are Doomed

Much emphasis is placed on inbreeding depression in small populations. While the effects of inbreeding—depression are real, they are often transitory in nature and not all small populations are doomed, contrary to what some zoos would have us believe. The effects of inbreeding depression can be minimised if numbers

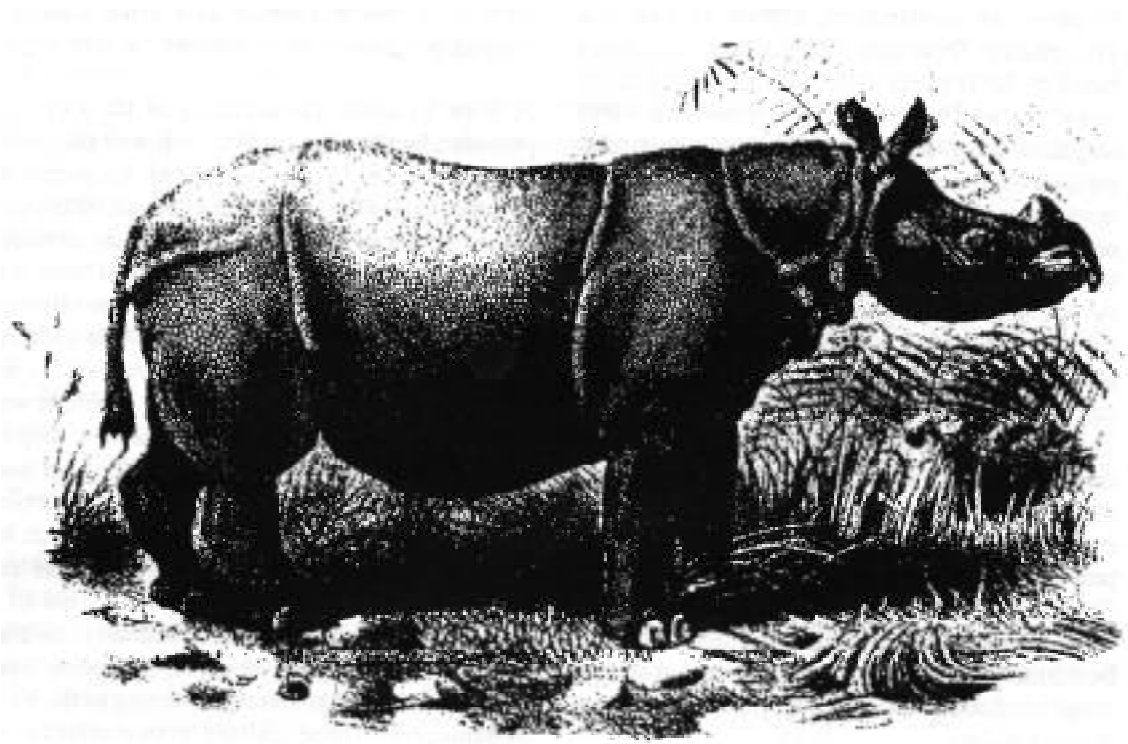
recover quickly from bottlenecks. The population of about 40 wild cattle at Chillingham in northern England is fit and thriving after some 800 years (about 120 generations) of continuous inbreeding, which has included bottlenecks of one female and one male in 1760 following an epidemic, and eight females and five males in 1947 following an arctic winter. Equally striking is the case of the collared lizards of the Ozarks where colonies of about 40 animals have experienced 4,000 years (about 2,000 generations) of inbreeding.

Protection and Punishment

The priorities for conservation of Javan rhinos in Vietnam are to protect the habitat and to eliminate the threat of poaching, It is proposed to link the 35,000 ha rhino area with the adjoining 45,000 ha Nam Bai Cat Tien National Park, provide a buffer zone around the rhino area to increase the total area to about 100,000 ha, and declare the entire unit a 'Man and Biosphere Reserve'.

More detailed surveys of adjoining areas are planned, which should determine the range and number of Javan rhinos in Vietnam. Stricter penalties need to be imposed on persons killing rhinos or trading in their products. The conservation of the Javan rhino, if it is to succeed, must have the support of the local people, especially those who live along the fringes of the rhino habitat and whose livelihood depends on the rational use of forest resources.

The Javan rhino in Vietnam is well adapted to respond to a 'Sanctuary Strategy'. The small rhino population in Lan Dong province can remain viable, and so must be protected and not abandoned on the hypothesis that genetic degeneration will set in and automatically eliminate it.



Satellite Tracking of Elephants in Laikipia District, Kenya

Chris Thouless, Richard Hoare and Martin Mulama

Introduction

Most studies of elephant movements have been carried out using conventional (VHF) radio transmitters but in recent years considerable interest has been shown in the use of transmitters which transmit to orbiting satellites, Satellite tracking has been successfully carried out on polar bears, caribou, musk oxen, wandering albatrosses and a variety of other species (see review in Harris, 1990). It is not easy to design a suitable satellite collar for an elephant. The most crucial constraint is the need for high radiated power output —which conflicts with the requirements for robustness, low weight and long life span.

Satellites move overhead on a near polar orbit. Positions of transmitters, known as Platform Transmitter Terminals (PTTs), are calculated based on the Doppler shift in the frequency of the signal received at the satellite as it moves towards and then away from the PTT. For a particular satellite overpass the chance that a position can be resolved is determined by how many signals are received from the PTT during the time that the satellite is overhead. This in turn is determined by the strength of the signal, the pulse repetition rate (usually every 60 to 200 seconds) and the angular attitude of the satellite. Both high power output and low signal repetition rate reduce battery life. This can be increased by incorporating a mechanism for switching the transmitter on and off on a regular basis, resulting in, for example, a 'duty cycle' of 22 hours on/26 hours off. Radiated power output can be enhanced by aerial design. However, efficient aerials are likely to be the most fragile, and equipment suitable for elephants must be robust. The search for an efficient, but strong, aerial has dominated the development of elephant satellite collars.

The purpose of this study was to develop satellite transmitters suitable for elephants, to test their effectiveness in the field and to assess how valuable and cost-effective the results are, compared with those from conventional radio-tracking. It was carried out as part of the Kenya Wildlife Service Laikipia Elephant Project, which has simultaneously been doing conventional tracking of elephants. The work was conducted on 01 Ari Nyiro Ranch in western Laikipia District.

Methods

Three types of transmitters were tested, Data from the Argos (satellite) system were transmitted from the satellites to the Toulouse ground station and thence to London Zoo by modem, and a printed output sent to Kenya by fax, Poor telephone links to Kenya and lack of direct communications with the study site meant that there was often a considerable delay in the receipt of this information. Data were also displayed on a screen in the elephant house at London Zoo using Elsa, the plotting programme developed by Service Argos.

In order to assess the accuracy of the locations provided by the satellite system it was necessary to find the true positions of the elephants at approximately the same time as the satellite over-passes occurred. This was done using the auxiliary VHF transmitters on the collars. In most cases true positions were confirmed by visual observation of the animal with the satellite collar. The location was found using a 1:50,000 scale map and, with the dense network of roads on the ranch, it was possible to obtain a location with an accuracy of better than 200 m. The accuracy of the map base has been confirmed using Global Positioning Systems. The ground-truthing proved difficult for a number of reasons, particularly because the proportion of overpasses which resulted in a location being calculated was extremely low and, on the first two collar designs, problems were encountered with the range and tuning of the VHF transmitters. Three collars manufactured by Mariner Radar of Lowestoft, England, with external vertical aerials (Figure 1) were put on cow elephants in May 1990. The transmitters worked for 5, 2 and 18 days respectively. During the time that they were operational a good number of fixes was obtained each day.

The loss of signal from the PTTs was thought to be a result of the vertical aerials being bent and then broken off. However, at the time that the signals failed, the aerials still seemed to be intact and were actually lost later. One of the elephants was re-darted and the collar removed on 19 October 1990. Signs of corrosion were found inside the transmitter box, indicating that poor waterproofing may have also contributed to the failure.

The Mariner Mk III transmitter consisted of a PT'T' with a folded monopole antenna inside a low profile fibreglass dome (Figure 2), The PT'T' and auxiliary VHF unit were both inside the fibreglass dome but electrically separated. A bull elephant was fitted with the Mk III collar in October 1990 and the transmitter was removed in early January 1991, although still working, because of the low number of accurate locations being received.

The final model tested was constructed by Telonics Inc. This had transmitting units totally imbedded in acrylic, with bipolar aerials sewn into the collars (Figure 3). One was put on an adult bull in February 1991. Ground-truthing was carried out from March to May 1991. The collar was still functioning after eight months.

Results

Frequency of locations

Table 1 shows two measures of the frequency with which locations were calculated. The message index for each PTT was defined as the number of times at least one message was received from that PTT, divided by the total number of transmission hours; the location index for each PTT was the total number of unique location estimates divided by the total number of Transmission hours. The later index was a rough estimate of probability of obtaining a location during each hour of transmission time (Harris *et al*, 1990). From this table it can be seen that the elephant collars gave poorer results than have been recorded from other studies.

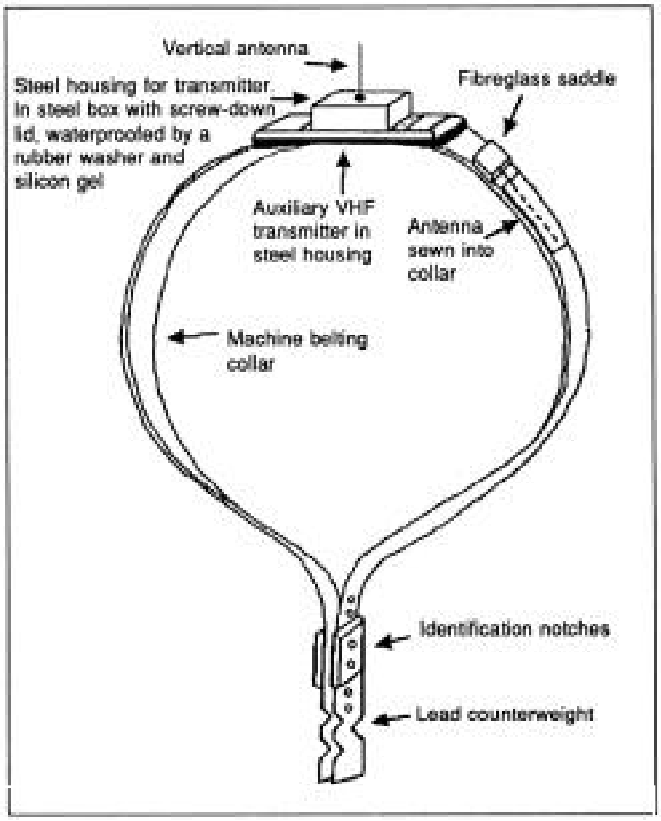


Figure 1: *Mariner Radar Mk 1 satellite collar for elephant*

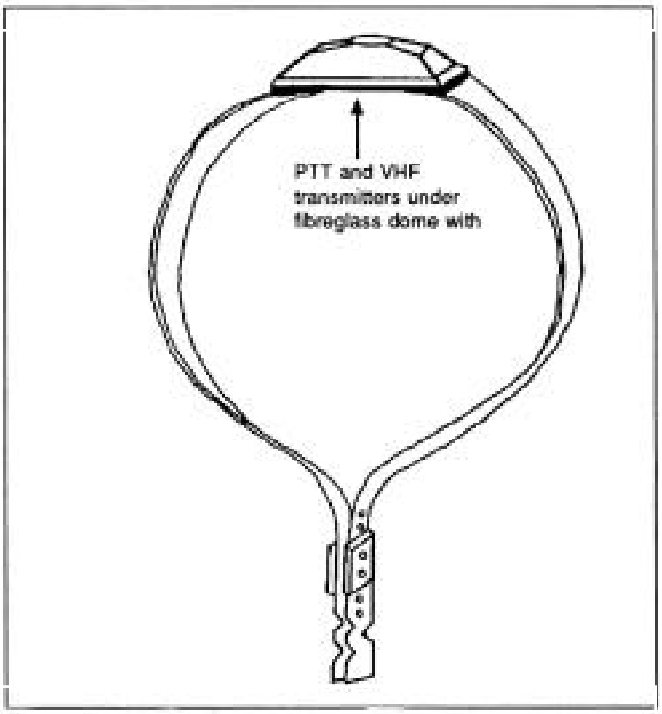


Figure 2: *Mariner Radar Mk III satellite collar for elephant*

Quality of locations

Table 2 shows the percentage of calculated locations which were placed in the different categories of accuracy, as determined by the satellite. Location class I (LCl) is the least accurate, and LC3 the most precise. The elephant collars produced a small proportion of accurate locations. It is worth noting how much the quality of locations declines when the transmitter is actually on a live elephant rather than being ground-tested, and thus ground tests in a particular place are not necessarily a good guide to field performance.

Ground-truthing

Table 3 shows the results from the ground-truthing. Argos output gives two possible locations, and in all cases the nearest to the true location was taken, Mean errors were considerably larger on the east/west (longitudinal) axis. According to Argos, 68% of results from LCl fixes should be within one kilometre of the true longitude and latitude. However, from our results, only 46% of latitudinal errors and 38% of longitudinal errors for combined LC1 and LC2 were within this figure. Out of 11 LCl fixes ground-truthed, four were more than five kilometres out, and one was displaced by nearly ten kilometres. One of the two LC2 fixes ground-truthed was 5.3 km in error, despite the fact that Argos claims an accuracy of 68% of LC2 locations within 350 m. Ground-truthing of the poorer quality Location Class 0 fixes indicated that these were too inaccurate to use. For instance, of 20 fixes in April-May 1991, 15 were more than 20 km in error.

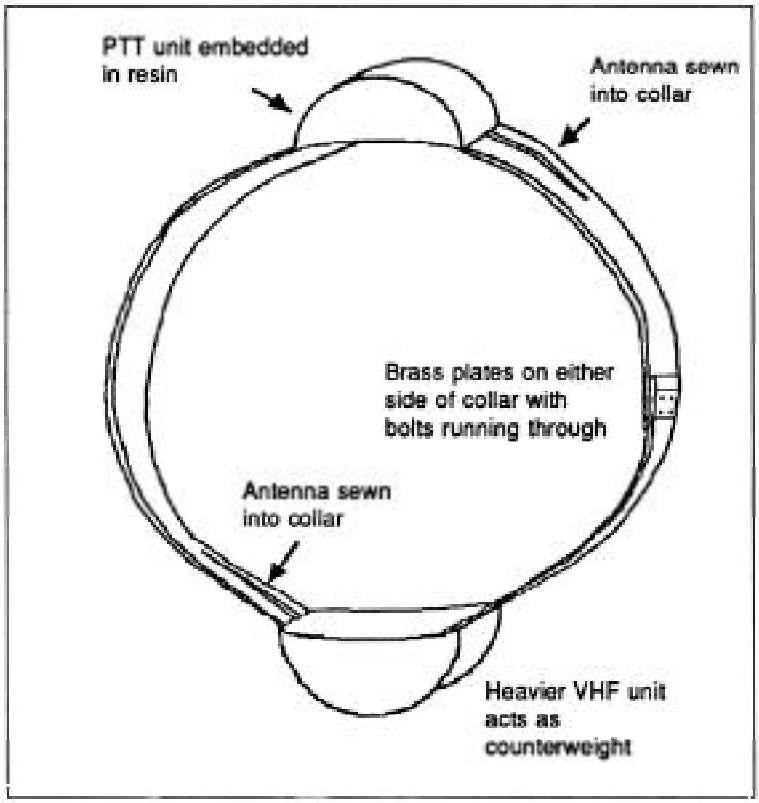


Figure 3: *Telonics satellite collar for elephan*

Discussion

Value of Results

The quality of locative results has been disappointing, with the exception of those from the short-lived Mariner Mk I. In the case of the Telonics collar, there were few days of transmission when more than one acceptable location was received. The Mariner Mk III was slightly better, but even so,

Table 1: Performance Indices and study locations for platform transmitter terminals (PTTs) on various species for comparison with Laikipia elephant PTTs.

Species and general location	Approximate latitude (degrees)	Location index	Message index	n
Caribou, Alaska and Yukon	70N	0.61	0.96	256
Musk ox, northern Greenland	82N	0.55	1.16	19
Polar bear, Beaufort Sea	70N	0.21	0.90	393
Elephant, Laikipia (Mk III)	0	0.19	-	3
(Mk III ground test	0	0.26	0.10	2
Brown bear, Kodiak Island	58N	0.08	0.56	4
Elephant, Laikipia (Telonics)	0	0.04	0.13	7
Telonics collar ground test	0	0.12	-	2
Elephant, Namibia (Telonics)	19S	0.05	-	40

Sample sizes are the number of PIT-months used in calculations. Additional values from Harris *et al,* 1990 and calculated from Lindeque & Lindeque, unpub. PTTs used in other studies were all manufactured by Telonics

Table 2: Percentage of locations in each of the 3 location quality index (LQ) categories for platform transmitter terminals (PTTs) on various species. LQ3 locations are the best quality

Species and general location	LO1	LQ2	LQ3	n
Caribou, Alaska & Yukon	59	37	4	*45538*
Musk ox, northern Greenland	61	27	12	966
Polar bear, Beaufort Sea	68	27	5	11078
Elephant, Laikipia (Mk III)	79	21	0	174
Mk III ground test	84	13	3	39
Mule deer, Idaho	81	16	2	630
Brown bear, Kodiak Island	92	3	*5*	80
Elephant, Laikipia (Telonics)	92	*5*	3	80
Telonics collar ground test	63	18	18	60

its performance compared poorly with satellite collars used in other studies.

There are probably three reasons for the small number of locations per day. The most important is that the polar orbit of the Tiros satellites means that there are fewer overpasses per day on the equator than in temperate or polar latitudes. With two satellites receiving data there are typically 28 daily overpasses at high latitudes, compared with eight at the equator (Fancy *et al*, 1986). With eight overpasses, the highest potential location index is 0.3, compared with observed figures of less than 0.2 for Mk III and less than 0.1 for the Telonics collar. It is also clear that putting the transmitter on an elephant greatly reduces the effective radiated power. There is some evidence that the large body mass of elephants is a contributory factor (Harris *et a!*, 1990). Except for those on bears, most other studies have used partially protruding aerials, which give more efficient signal radiation than internal ones.

Sources of error

The errors found from the ground-truthing were surprisingly large. The principal sources of error that would affect Argos' calculations are errors in actual versus predicted altitude, displacement of the PTT during the satellite overpass and oscillator instability.

Altitudinal errors are primarily longitudinal because the satellites travel in near north-south orbits. When signals come from PTTs that are higher than the assumed elevation, Argos interprets them as coming from locations that are closer than they actually are to the satellite (Harris *et al*, 1990). This was unlikely to have been a major source of error in this case because the altitude range of collared animals was less than 200 m.

Displacement errors that are caused by a PTT moving during the course of a satellite overpass are also unlikely to exceed more than a few hundred metres.

Table 3 : Results of ground truthing from Mariner Mk III and Telonics satellite transmitters.

Transmitter type	Location class	North/south error (km)	East/west error (km)	Time difference (mins)
Mariner Mk III	1	0.1	0.6	0
	1	1.0	2.5	16
	1	3.5	8.2	20
	2	1.7	5.0	26
	1	1.3	5.0	24
Telonics	1	0.5	0.5	19
	1	0.4	4.5	0
	1	1.7	0.1	0
	1	0.2	2.5	30
	1	0.5	0.0	7
	2	0.2	0.4	24
	1	6.4	6.5	30
	1	2.0	6.4	4
Mean		1.5	3.2	

If the frequency of signal output by the PTT changes during the course of a satellite overpass then inaccurate locations may be obtained, particularly in the longitudinal axis. The oscillators used for wildlife PTTs are sensitive to steep temperature gradients. Argos investigated some of the overpasses made while Mk I PTTs were operational and found that a number of fixes were rejected on the basis of excessive instability although, on the basis of the number of messages received and the geometry of the overpass, high quality locations could have been expected. It is possible that direct sunlight falling on a PTT on a stationary elephant in the open could make it hot enough to affect oscillator stability. In any

Table 4 : PTTs used during the course of the study.

	Duty cycle: hrs on/off	Date put on	Date failed	Date removed	Sex	Reprate
Mariner Mk I						
10014	cont	08/04/90	24/04/90	-	F	90
10015	cont	06/04/90	07/04/90	-	F	90
10017	cont	05/04/90	09/04/90	19/10/90	F	90
Marnier Mk III	22/26	19/10/90	-	10/01/91	M	70
Telonics	24/48	28/02/91	-	-	M	70

Rep rate — signal repetition rate (seconds).

future studies where this is likely to be a problem it might be worth including a temperature sensor in the PTT. Satellite locative errors are caused by inaccuracies in the orbital path of the satellite, but they are claimed by Argos never to exceed 300 m.

Lindeque and Lindeque (in prep) working in Namibia, used reference beacons to calibrate their locations. However, this would only be effective in eliminating the error caused by orbital inaccuracies, and since no systematic ground-truthing was carried out in their study, it is not clear how valuable this is in reducing total error.

Comparison with VHF tracking

Quality of results

Because of the locative errors from satellite tracking, it is not be able to provide this. Satellite tracking under these circumstances is only useful for looking at the broad pattern of movements, where errors in the order of ten kilometres do not lead to faulty biological interpretations.

We have compared the cost of satellite tracking with VHF tracking using figures derived from this study (Figure 4). Figures for VHF tracking using aircraft are derived from the true costs of the study described in Thouless and Dyer (see pp 34-39). Basic running costs for satellite tracking are given as the concessionary rate of FF80 per day plus LC0 information at FF15 per day. It should be noted that the standard rate is more than double this. We have excluded salaries and the costs of data transmission and analysis. Capital costs are calculated on the basis of a two-year study. VHF collars are expected to last for at least two years, so the cost of two capture operations, one to deploy, and one to remove the collars is included. The cost of darting operations is estimated at $500, which covers the cost of a spotter aircraft, drugs and a fee to the vet performing the immobilization. Two figures are given for satellite

possible to use this technique for detailed analysis of habitat use, as has been planned in a project in the Ivory Coast (Lavenue *et al*, 1990). Nor would it be possible to look at short term movements, such as those during a 24-hour period. Techniques have been developed in high latitudes to improve the quantity of data by eliminating erroneous locations. However, these are dependent on comparing several fixes during the course of a day. Any study of eleohants close to the equator is unlikely to tracking. In one, it is assumed that the collar needs to be

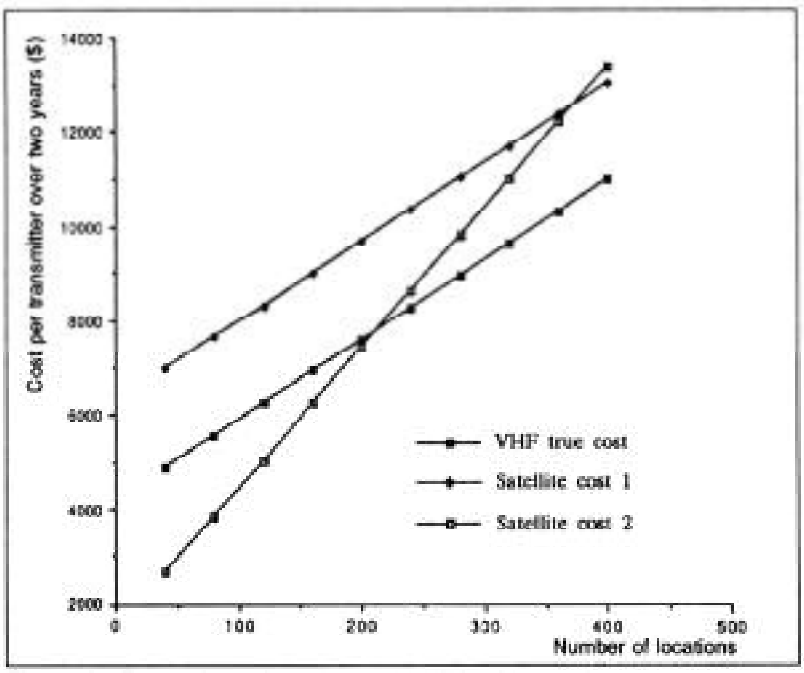


Figure 4 : *Comparison of satellite and VHF tracking costs*

replaced after six months, so that five darting operations are required; in the other it is assumed that the satellite collar lasts for one year. Equipment costs are $450 for a Telonics VHF collar, $3,800 for a Telonics satellite collar, and the lower figure for satellite tracking also assumes that one is using a Mariner Radar collar costing $2,720. No figure for VHF receiving equipment is included, since this would also be needed for satellite tracking to locate the animals for ground-truthing and relocation for immobilization.

These figures show that for the present project involving 16 elephants the cost per location would be the same for satellite and VHF tracking if locations were required every four days for the cheaper satellite costs or every two days for the more expensive estimate. It should be pointed out that, with such low sampling intervals, the total cost of radio-tracking over the two-year period would be extremely high. In reality one would have to compromise, by using either a small number of satellite collars with frequent locations, or a larger number of VHF transmitters with relatively infrequent locations. Our study population consists of 2,500-3,000 elephants. All 16 animals collared have shown independent movements, so a reduction in the number of collars would have resulted in a poorer understanding of the movement patterns.

Future of satellite tracking

Our work shows that, with the current state of technology, satellite tracking of elephants has some serious limitations: it is expensive; location information is inaccurate; it does not provide information on habitat use and group sizes; there is a lack of flexibility in the sampling procedures; and transmitters last for a shorter time than VHF ones. The level of error may be substantially greater than we have found, if elephants are moving over a large altitudinal range.

Despite its problems, satellite tracking may be of value under circumstances where VHF tracking using aircraft is not a viable alternative. Aircraft may not be available on a regular basis, and they may be very expensive because of need for commercial hire or because they are based a distance from the study site. Conventional tracking may be impossible if elephants are crossing international boundaries.

Although the value of satellite tracking could be enhanced if effective radiated signal strength were increased, it is unlikely that a sufficient improvement could be made to existing designs. The technology exists for much more accurate location systems using passive positional satellite locative systems (GPS) and it is likely that future satellite tracking will be based on this, rather than the Argos system.

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Acknowledgements

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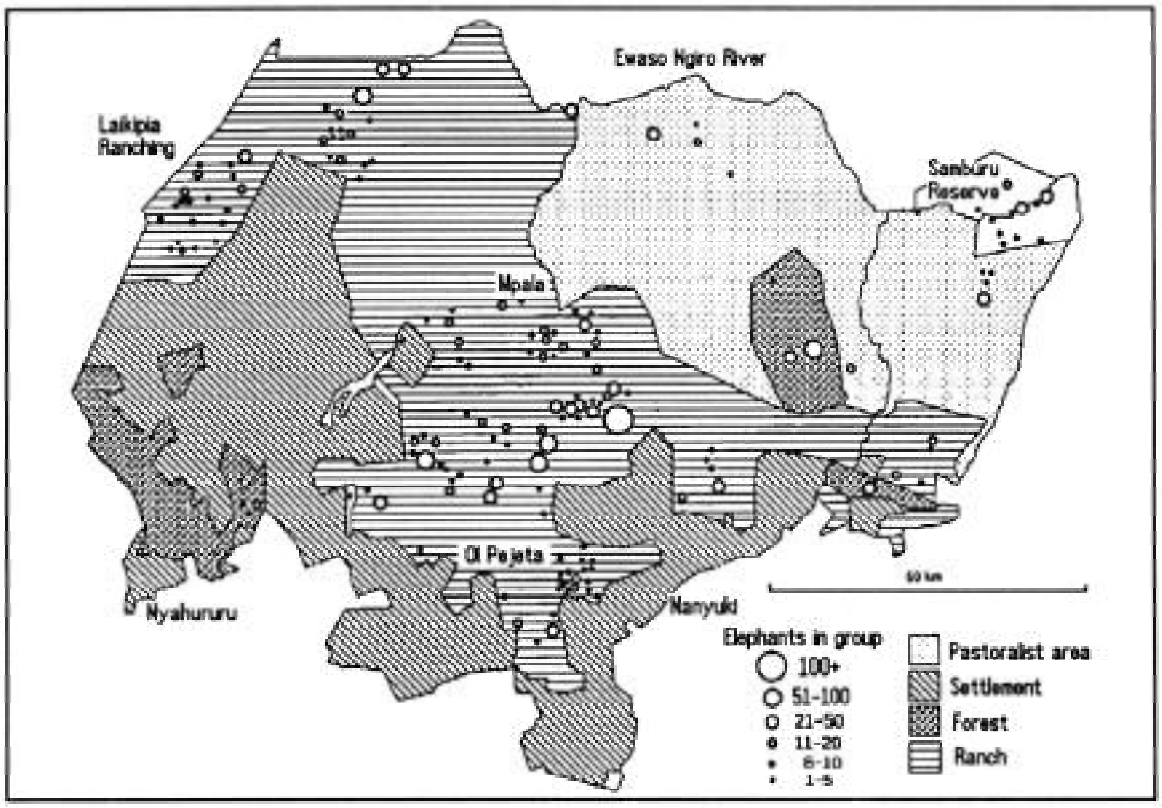

Distribution of elephants seen during an aerial survey of Laikipia on 15-16 September 1990.

Radio-tracking of Elephants in Laikipia District, Kenya

Chris Thouless and Anthony Dyer

Introduction

One of Kenya's largest elephant populations lives for much of the year on private land in Laikipia District. Few elephants were found here before the increase in poaching in Samburu District, and it is believed that they moved south to Laikipia because of the greater security found on ranches. However, because these ranches are being sold for small-scale farming settlement schemes, the elephants are coming into increasing conflict with people. Elephants leave the ranches at night and raid crops on adjoining farmland. The Laikipia Elephant Project was established to study and to find ways of reducing this conflict.

The Laikipia elephants were known to move away from the ranches at certain times of year and an essential first step towards the conservation of this population was to gain information on their movements. Both satellite and conventional VHF collars have been used. Satellite tracking has not proved satisfactory (see Thouless *et al*, pp 28-33). This paper describes technical aspects of the conventional tracking programme and presents some initial results.

Methods

Selection of animals

The total aerial count conducted in September 1990 (Thouless, 1991) was taken as an initial basis for the selection of animals to be immobilised and collared. As far as possible one collar was put on for every group, or groups, totalling more than one hundred animals. Only females were collared, since their movements are

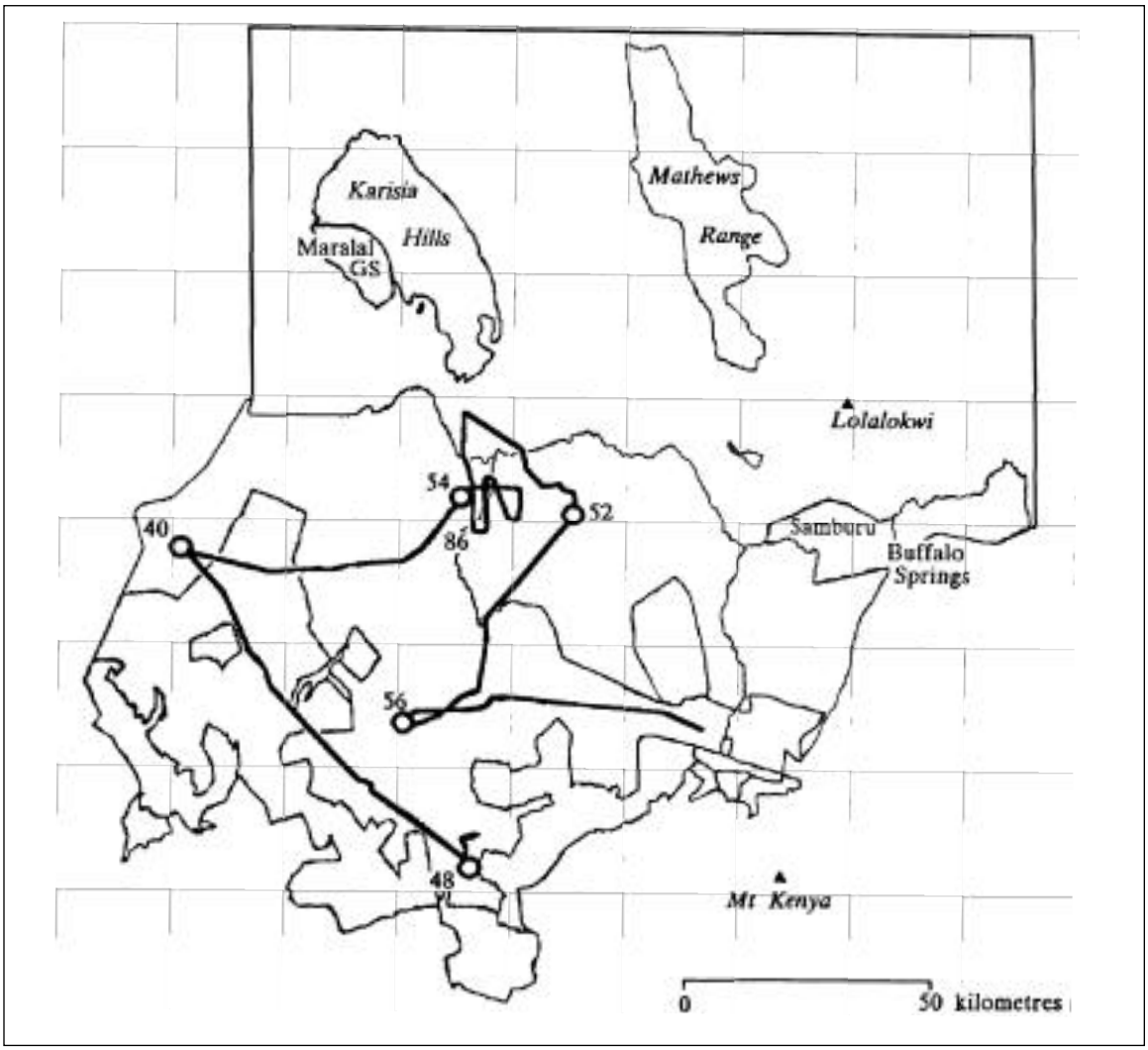

Figure 1 :*Path of radio-tracking flight recorded using Trimble GPS directly onto digitised maps. Numbers indicate identities of located elephants.*

more likely than those of bulls to be representative of the population. Matriarchs and females with young calves were rejected, because such animals are more likely to be defended by their family once they were immobilised. Sixteen cow elephants had been collared by the end of 1991, from a total population of approximately 2,500.

During the initial immobilisation operations, elephants were collared on Mpala, O1 Pejeta and 01 Ari Nyiro Ranches in central, south and west Laikipia respectively. By the time the first seven animals were collared, the main herds seen during the count had moved away, and later darting operations took place when these herds returned to places where they were accessible. Additional elephants were collared near Isiolo in January 1991, in the Mathews Range in April, and in northwestern Laikipia in September.

Most darting operations were carried out on *foot*, using a light aircraft for spotting, and with the immobilising dart fired from a range of about 20 m. Six elephants have been immobilised by darts shot from a helicopter, either a Gazelle provided by the British Army Air Corps, or a Hughes 500 from the Eden Wildlife Trust.

Collars

The radio collars were produced by Telonics Inc. A brass plate with four stud-bolts protruding outwards

is placed against the elephant's hide. Both ends of the collar, which is made of machine belting, have holes cut to match the bolt pattern. After each end of the collar is fitted over the bolts, a second brass plate is fitted, sandwiching the collar ends. Four nuts are tightened down onto this plate to secure the assembly. The transmitters are totally imbedded in acrylic and hang at the bottom of the collar. Aerials about 20 cm long project from each side of the transmitter and are sewn into the collar.

Tracking

Most of the radio tracking was carried out from the air, using a De Havilland Beaver, Helio Courier, Piper Supercub, Cessna 207 or Cessna 185. The Supercub and Beaver were found to be most satisfactory, because of their ability to perform well at low speeds. Although fuel consumption was higher in the Beaver, this was compensated for by better climbing performance and greater power reserves, which made low speed flying in mountainous areas safer.

The aeroplanes were fitted on each wing strut with H-Adcock aerials pointing forwards and downwards at an angle of approximately 30 Coaxial cables connected the two to a switching box which allowed the observer to listen either to the signals from both aerials simultaneously or to switch between left and right. The receiver was a Telonics TR2 with a scanner attachment TS-1.

Pattern of flight

On taking off, a course was steered towards the last known position of an elephant, at an altitude of more than 1,000 ft above ground, and by comparing the signals received from the aerials mounted on each wing, the animal could be approached almost directly. One problem with the outward-pointing aerial configuration is that weak signals from animals immediately ahead are difficult to pick up, and it was sometimes necessary to fly in S-shaped bends until one of the aerials was pointing directly towards the transmitter. Once nearby, the aircraft was taken to a lower altitude and the elephant group located visually. If there were several groups in the area, the aircraft circled each group until the one was found for which the strongest signal always came from inside that circle. This process was repeated until all animals were located, although to reduce flying time those elephants that hardly moved after being collared were not located on every flight. When animals could not be located, the aircraft was taken to 4,000 ft or more above ground level, and this was usually sufficient for a signal to be picked up. Figure 1 shows a typical flight pattern.

Information recording

The position of collared elephants was found by reference to a 1:50,000 map and was recorded as a four-figure grid reference. Usually the location could be determined to within one kilometre, but in some areas where there were few ground features the accuracy dropped to two kilometres. For some flights a Trimble Pathfinder GPS receiver was used to get a precise location.

The size of the group of the collared animal was recorded. Small groups were counted exactly, larger ones were photographed using a 35 mm camera with 105 mm lens and 400 ASA colour print film, and counted later. Groups were considered to be separate if they were divided by more than 500 m. Also recorded were habitat type, distance from the nearest surface water and type (eg, dam, river, temporary rain-pool) and the distance from human activity (eg, houses, manyattas, herds).

Frequency of flights

Radio-tracking from aircraft has continued since November 1990, with flights taking place at intervals of from one to just over two weeks (Figure 2). In most cases the interval was 8-10 days. A total of six flights took place in 1990 and 40 in 1991. CRT was observer on all but five flights and AD pilot on all but 12.

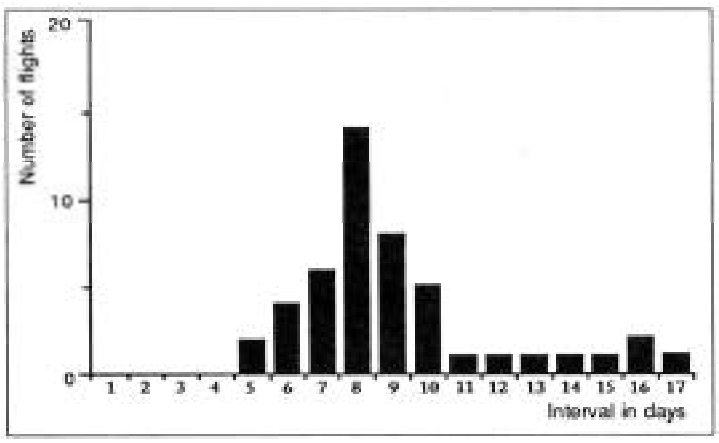

***Figure 2** : Interval in days between radio-tracking flights, 1990-1991*

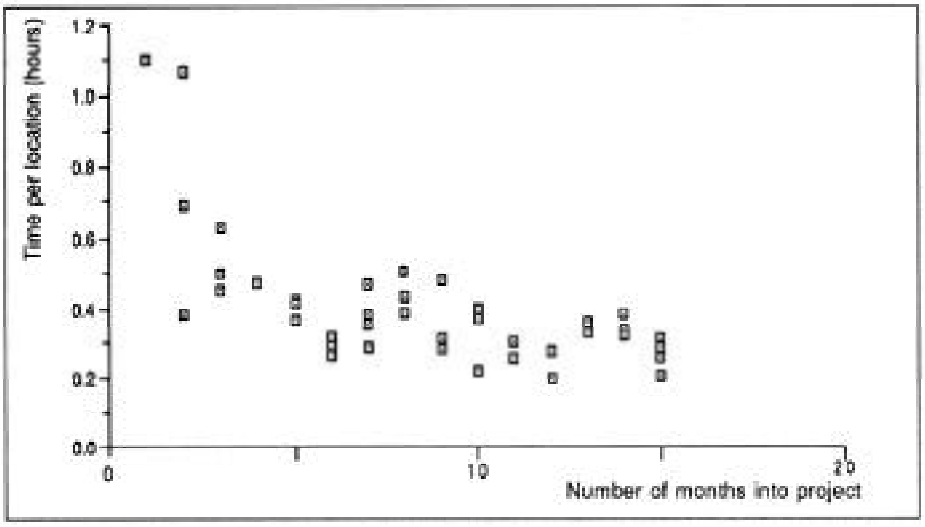

Figure 3 : *Times taken per location*

Analysis
Maps of the study area were digitised at a scale of 1:250,000. Additional digitised maps of land-use within Laikipia District were provided by the Laikipia Research Programme. Information on movements was printed out using Arc/info. Analysis of ranging patterns was carried out using an experimental Macintosh programme, Wildtrack, developed by Oxford University's Wildlife Conservation Research Unit.

Results

Performance of collars
None of the collars failed during the study. In December 1991, one of the collared elephants was shot by game rangers during an attempt to move her herd out of a ranch, and the collar was removed. Apart from some splitting along the edge of the collar, there were no serious signs of wear. Another collar from a sedentary animal was removed in January 1992, and no marks of rubbing were visible on the animal's neck.

From the air elephants have been detected from a distance of 100 km, and from over 15 km on the ground. However, when animals are in steep-sided valleys the range is considerably reduced.

Ease of finding
In the course of six tracking flights in 1990 collars were located 39 times, each location taking an average of 33 minutes of flying time. During 1991, 442 locations were found during 40 flights, each collar taking an average of 16 minutes. The improvement in efficiency is shown in Figure 3. Not every collar was searched for on every flight. Two elephants were extremely sedentary, and these were located once per month. During the dry season, when most of the elephants were far south, the fairly sedentary elephants in the northern Mathews Range were only located every second flight in order to conserve flying time.

On only two occasions (0.4%) did we fail to detect a radio signal from an elephant that we were attempting to locate. On two other occasions a signal was picked up for which we only established the general direction because location would have meant flying within a Restricted Area or operational zone. Twenty four times (5% of all locations) we were unable to see the group that the collared elephant was in or to get a location more accurate than to within about five kilometres; we were certain about the general area. This was usually because the animal was in difficult terrain, such as forest or a steep-sided valley where the radio signal bounced, or we were starting to run out of flying time, or else because of the need to avoid flying low over an operational anti-poaching zone. Occasionally we were unable to see a herd, although by circling we knew the exact location, because the elephants were in thick forest.

Home Ranges
The tracking operation has produced one of the most complete records available of the movements of a migratory elephant population in Africa. This is a result of the success of the collars and our cability to carry out regular monitoring flights.

Five of the elephants had home ranges (minimum convex polygon) of more than 2,000 km^2. They had

small dry season (June to October) ranges on the Laikipia ranches, but once the rains started they moved north into Samburu District, up to the plains to the south and east of the Mathews Range. These movements took place in a short time, with distances of over 100 km covered in a week. Although the animals formed large groups of several hundred individuals in these areas, they moved in much smaller family units, with the different collared animals moving north over the course of several weeks. As temporary water supplies in these areas dried up, the elephants drifted south to the Laikipia ranches, where there were abundant dams, but spent time in intervening areas, which they had passed through without stopping on the way north. A second rainy season in April was followed by a shorter return to the northern areas. Figure 4 shows the movements of one of these elephants.

A second group of animals had home ranges of 500-2,000 km^2. This included three elephants collared near Isiolo, one collared in central Laikipia and two collared from the northern Mathews Range. The latter were clearly remnants of a larger population that had been heavily poached. There were few adult females, with a

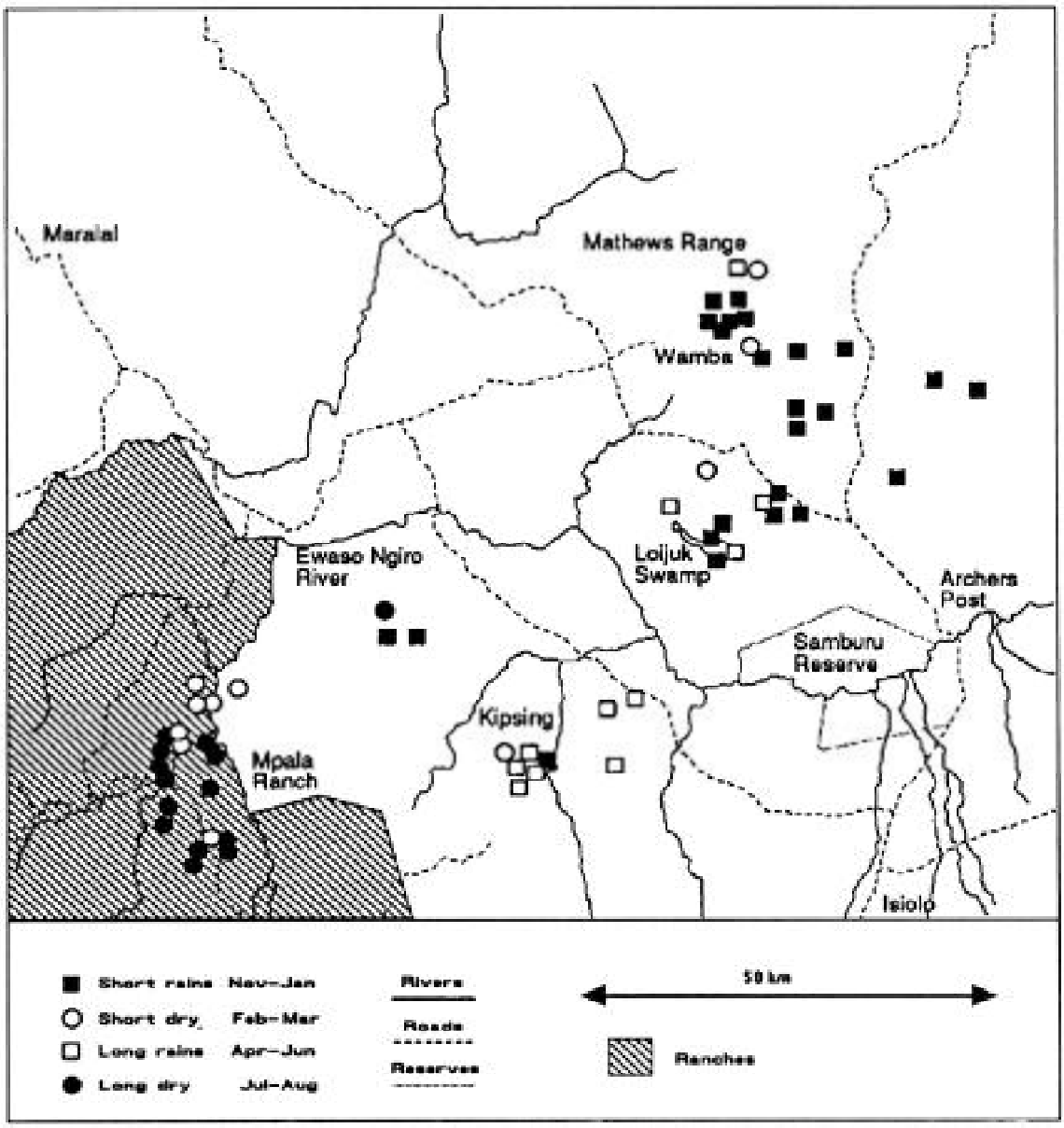

Figure 4 : *Movements of elephant number 46 in Laikipia and Samburu Districts in northern Kenya.*

large population of five-to-ten-year-olds, and they were much more nervous than any of the other animals we followed. Two elephants moved hardly at all after being collared, and had home ranges of less than 500 km^2 on 01 Ari Nyiro and 01 Pejeta Ranches.

Three additional elephants were collared in western Laikipia in September 1991. There is insufficient information to calculate home sizes for these individuals.

Table : Home ranges for radio-collared female elephants in Laikipia and Samburu Districts. Figures given are for 100% and *95%* minimum convex polygons in sq km.

Elenhant#	100%	95%	N
40	100	100	22
42	1,310	1,060	38
46	4,800	4,510	50
48	140	140	23
50	600	530	37
52	3,470	2,960	50
54	2,180	1,800	34
56	2,010	1,710	48
58	3,470	3,330	50
66	4,390	3,850	49
78	3,940	3,280	28
82	2,460	2,440	14
84	840	580	20
86	1,000	850	14
92	710	710	20

Conclusions

For the purposes of the present study conventional radio tracking using aircraft has proved very successful even though the elephants are moving over large distances and using hilly areas where signal reception is difficult. It has usually been possible to find 15 elephants spread over 15,000 km^2 in less than five hours of flying time. This success is partly due to the performance of the equipment and to the availability of suitable aircraft at low cost (typically $100 per hour) within the study area. Radio tracking has given much information of value for management that could not have been obtained in any other way. One striking feature of the results is the variation between individual elephants and the importance of tracking a sufficiently large sample size of animals. If the project had relied upon satellite tracking it would have been possible to get more detailed (but less reliable) movement data on a much smaller sample of animals, and inappropriate biological conclusions might have been drawn. In fact, for management purposes conventional tracking with less frequent locations of an even larger sample would have been useful. It is clear from reports of elephant movements in the district that even with 16 collared animals in a population of about 2,500 we are missing important movements. However, this may be because most of the elephants that are crop-raiding or killing people are bulls or small and elusive cow-calf groups. Selecting a suitable sample for collaring is extremely difficult, since animals with very different movement patterns will often be found in the same area.

In the past, population estimates for Samburu and Laikipia were considered separately, but it is clear from the radio tracking that, depending on the time of year that counts are conducted, this may either result in a considerable under- or over-estimate of the number of elephants in the two dis-tricts. There are many elephant populations in Kenya whose status is to a large extent unknown because of the lack of information about their movements. In regions such as the borders with Uganda and Ethiopia, conventional radio tracking is unlikely to be feasible, but it may have considerable value in the areas surrounding Mt Kenya, the Aberdares, Shimba Hills, Meru and the Ndotos Ranges, for obtaining more accurate population estimates and for ascertaining the effects of proposed management such as fencing and of land-use changes.

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Acknowledgements

The Laikipia Elephant Project was originally conceived by the Gallmann Memorial Foundation (GMF), working closely with the Zoological Society of London (ZSL) and work started in May 1990, with the project coordinated by the Kenya Wildlife Service (KWS). Funding for the radio-tracking has been provided by the World Wide Fund for Nature (WWF) and Lonrho East Africa. Computerised mapping by Fran Mitchelmore, using the facilities of UNEP in Nairobi, has been funded by the EEC African Elephant Programme and Bunzl Plc through ZSL Particular thanks are due to the pilots who have provided their services for the tracking operation: Martin, Francis and Michael Dyer and Mike Webley, arid to those who have helped with ele≠phant darting especially Dieter Rottcher, Ian Craig, Colin Francombe Jo Ugi, John Wreford Smith. Ted Goss and Pilots of he British Army Air Corps.

Boma Management, Construction and Techniques for a Founder Population of Black Rhinos (Diceros bicornis minor) as Applied in Lapalala Wilderness, South Africa

Clive H Walker

Introduction

The construction of six bomas to hold five black rhinoceros transferred from the capture pens in Umfolozi Game Reserve, Zululand, to Lapalala Wilderness, Waterberg Mountains, Transvaal, is described. Data are provided on site, location, equipment, construction techniques, feeding and release procedures. In addition, various problem areas are highlighted and emphasis is laid on the lack of available literature to assist the private landowner in the introduction of a species such as the black rhinoceros.

On 18 June 1990, a founder population of five black rhinoceros were auctioned by the Natal Parks Board. The two bulls and three cows were bought by Lapalala Wilderness for the sum of R2.2 million. This was the highest price per head ever paid for the species.

Lapalala Wilderness is one of eight private game reserves that applied to the Natal Parks Board for classification as suitable habitat for the introduction of black rhinoceros. Lapalala Wilderness is a 24,400 ha sanctuary with an area of approximately 10,000 ha selected as a black rhino sanctuary. The latter area is encircled by an 18 strand game-proof fence some 45 km long. The sanctuary has four permanent game scouts, i.e. one scout per 25 km^2.

The topography consists of densely bushed slopes, hills, plateaus and valleys, with the Block-land River, which is a tributary of the Lephalala River, running from south to north. In addition to this permanent supply of water, there are two mountain streams, four boreholes that connect to five water troughs, and one dam capable of holding water throughout the year.

The entire area is surrounded by some 75,000 ha of wild country devoted entirely to conservation. For obvious reasons, Lapalala Wilderness did not construct pens suitable for holding rhinos before the auction. The day after the sale, talks were held between Natal Parks Board officials and Mr Peter Hitchins, an advisor to Lapalala Wilderness on boma management and construction techniques. Natal Parks Board had anticipated the problem and were prepared to hold the five rhinoceros for six weeks in order to give Lapalala Wilderness time to complete construction.

It soon became apparent that there were wide and diverse opinions between one conservation agency and another, and between individual rhino specialists, on boma construction, feeding and release techniques for black rhino. The only literature available was a paper written by J P Raath and A J Hall-Martin (Koedoe, 32 (2) pp 69-76. Pretoria ISSN 0075 6458). One must bear in mind that this was the first disposal of black rhinoceros to the private sector, but certainly will not be the last in South Africa.

Numerous people, however, were consulted. They are acknowledged at the end of this paper and we are extremely grateful for their advice and assistance.

The first steps taken prior to the commencement of construction, were to consider the following:

a) Suitability of the site for construction
b) Availability of water
c) Ease of access
d) Availability of electric power
e) Proximity to game-scouts' quarters and reserve management headquarters.
f) Good terrain for release.

A rock-free plateau area on the eastern side of the reserve in relatively open country that has a gentle

west slope to the Blockland River was chosen for pens. As matters turned out, the rhino were successfully held in the bomas for some 18 weeks, which was not foreseen, but proved that the location was a good choice, apart from being too close (300m) to a provincial dirt road.

C B Ravenhill, Reserve Manager of Lapalala Wilderness, was appointed supervisor of construction and K Matshaba, a local builder, together with four of his staff, were engaged to carry out construction, assisted by various additional Lapalala Wilderness personnel. A total of 10 people were engaged in construction, which took four weeks to complete.

Bomas

The holding pens, or bomas, at Lapalala Wilderness are constructed from chemically treated poles (tannerlith). They consist of six pens, each measuring 6 m by 7 m, back to back in two rows of three to form a rectangle 18 m by 14 m. An off-loading ramp is at the western end, extending 8 metres out and with two individual entrance gates. At the eastern end there is a pair of emergency exit gates. The south-western pen, the one nearest the off-loading ramp, has another exit gate. All gates are 1.5 m wide and their design is the same as that used at Umfolozi Game Reserve, consisting of upright double poles cemented into the ground, with loose poles across the opening. To facilitate movement of each rhino during daily cleaning and eventual release, there are interconnecting gates between each enclosure. Eleven gates in all were constructed.

All the main corner poles and main support poles of the gates are cemented into the ground up to a depth of 500 mm. In addition, two vertical poles are cemented into the ground every two metres. Horizontal cross poles are bolted top and bottom to the verticals; dropper poles are bolted to these in an upright position, with a gap of 15 cm between each dropper. All poles measure 150 mm in diameter except the four outer corner poles, which are 400 mm thick. The height of the boma sides measures 2 m. The spacing between each pole was not strictly adhered to and resulted in certain problems, which will be elaborated on later.

The following is a detailed list of all materials used in the construction and costs incurred:

Poles for boma and off-ramp construction

	Size	Number of poles
Front end of off-	150mm x 2.5 m	22
loading ramp:	150 mm x 4.5 m	64
Main dropper poles for bomas:	150 mm x 2 m	280
Main support poles:	150mm x 2.5 m	142
Cross poles supporting droppers:	150mm x 4 m	54
Main corner poles:	200 mm x 2.5 m	4
Gates: (11 in total)	100mm x 2.5 m	150
Total number of poles:		716

The following costs exclude the salaries of the permanent Lapalala staff:

	Rand
Builder's quote	2,500.00
Poles	11,852.15
Delivery charges	1,650.00
Bolts, nuts & washers	1,720.87
Rope/wire	467.62
Drill/bits	785.76
100 pockets of cement	1,186.50
Hosepipe	52.88
54 metres of shade cloth	1,050.00
580 metres of bolt rods 12 mm @ R 2.00 per metre	1,160.00
Total cost for construction:	22,425.78

Water troughs

These measure 70 cm x 70 cm x 45 cm deep and were constructed below ground level. A concrete lip of 15 cm was added. The water troughs are located in each outer corner in the case of three of the corner bomas and in the case of the fourth boma, which was to be the release boma, the water trough is located in the centre on the west side between the entrance and exit gates. In the case of the two centre bomas, the water troughs are located in the centre of the outer wall. Water is laid on by means of hosepipes from two central points on either side of the off-ramp and the supply is obtained from a large reservoir 100 m away. A 50 mm (2 inch) pipe with release valve is built into the bottom of each trough, thus enabling a rapid release of water into a large drain located outside the boma.

Shade

This was achieved by attaching 80% shade cloth down the length of the centre of the entire boma extending four metres from the centre line into each of the six bomas. Additional strips measuring four metres wide were later added at right angles and attached to the outer walls. Shade cloth was found to be perfectly adequate, providing there is no intention of holding the rhino for longer than four to six weeks. However, it did not prove satisfactory in our case, due to the rhinos being confined for a lengthy period and, with the onset of increasingly high temperatures, might very well have led to the complications experienced with three of the rhinos, as will be described later.

Feeding - daily cleaning

The four game scouts selected to patrol the rhino sanctuary were allocated the daily cleaning of the bomas and were assisted over weekends by general reserve staff, under the supervision of the Reserve Manager. Water troughs were drained every morning at 5.00 a.m. and cleaning commenced at 7.30 a.m. It took approximately two hours to complete all five pens; the sixth pen, which had been cleaned the previous day, was used for the first changeover. When a pen was clean, fresh lucerne and game cubes were added and the interconnecting gate poles pulled out. When they first arrived, it took some coaxing to persuade the rhinos to move, but later they waited impatiently and banged the poles in their desire to go through to reach the lucerne and cubes. The poles were rapidly replaced and secured and the process repeated until all five rhino pens had been cleaned.

During the cleaning every vestige of vegetation was removed as well as all traces of dung. The holes frequently dug by the rhinos were filled in and a regular supply of river sand added. Water was allowed to run into slight depressions to let the rhinos take mud baths, a ritual they all practised regularly. Care, however, is needed not to overdo this. As in fact did happen on occasion, resulting in the site being turned into a mud-house, with stagnant water and decaying faeces that in turn created a fly problem and unpleasant odours. Due to the relatively narrow confinement (6 m by 7 m), and the rhinos' habit of prancing and dashing about, wet and muddy conditions coupled with fairly deep holes could have resulted in injury. Nevertheless, I regard a mud-hole as most important in boma management, for an animal would seek this out in the wild. As the months grew hotter, the rhinos became more desirous of the cool and soothing effects of the mud.

Care was taken to clear all the surrounding areas outside the boma and special attention was paid to the cleaning of water troughs. Dung that collected under the boma poles and in the bolted ends of poles from being shovelled over the walls was checked daily. A fly trap proved most useful in keeping flies under control.

Feed

Four men attended to the day's food supply every morning and this took upwards of three hours depending on availability and distance traveled. August, the month the rhinos arrived, is not the best in terms of available browse and resulted in an increase in the amount of lucerne provided. Each rhino consumed one-and-a-half bales of lucerne a day and four kilograms of game cubes. Considerable effort went into browse collection; it was freshly cut twice a day. The afternoon browse collection was made by the crew who did the daily cleaning, allowing the morning browse crew to continue with general reserve work. The rhino were eventually in the pens for more than 18 weeks and had been held in Zululand for approximately 13 weeks. All five were fairly aggressive upon arrival, but settled down very quickly. No difficulties were experienced with feeding. Browse was mixed and varied and was increased in quantity as summer approached, with the lucerne being reduced to two bales per day between the five rhinos, The browse was thrown directly into the boma and whilst wire support lines had been erected, particularly for acacia, these were abandoned, for the animals readily took their feed from the ground. Constant lifting up of the browse by the rhinos took place as did the placing of browse on the horns and heads and scattering around the boma. Browse was frequently dumped in the water troughs. At no stage did any of the rhinos lose condition; they steadily gained weight during the day and night, with no noticeable difference in the volume that was consumed.

The afternoon feed usually took place after 4.00 p.m. and the morning feed commenced as soon as each rhino was moved from one pen to the next. Firstly

they were fed on lucerne and cubes, and later browse when the vehicle carrying the latest collection arrived.

Release

Release of the rhinos finally commenced on 3 December 1990, after 18 weeks in the bomas. After consulting a number of colleagues, I had decided to hold the rhino back, regardless of cost. The delay was necessitated by the poor veld conditions resulting from extremely late rains. By this time, the rhino had been almost totally weaned off any artificial food, such as lucerne and game cubes.

The release order was:

1. Bull
2. Cow
3. Cow
4. Bull
5. Cow

This was accomplished over a period of ten days, one rhino every 48 hours approximately. Two animals were released after dark and three at dawn. No plastic funnel was used, although recommended. This decision was taken in the light of the length of time the animals had spent in the bomas and the calming effect it had upon them. Release in the early evenings presented no problems, with only four people in attendance. The release animal was positioned in the boma next to the southwest release boma with the outer exit gate's poles having been removed earlier in the day. Feed had been reduced and no lucerne given at 4.00 pm. Whilst absolutely calm, the animal was given a small portion of lucerne, whilst the fourth person directed the extraction of the poles. A vehicle was parked some 50 m down the exit road and after the last pole was out, all four people quietly retreated and drove away. The animals came out undisturbed, after our departure. The dawn releases were the same, only this time all staff remained inside the off-ramp. Once the animals had finished eating the lucerne, they did not take long to realise the poles were out and came out very quickly. No problems were experienced.

One bull ran off twice and came back, before finally running off some 70 m, dropping to a trot and then walking away. In each case, the rhino fed on various types of vegetation and showed a high degree of curiosity. Only one rhino returned to the bomas and that was No 2, a cow, seeking water. Unfortunately, in spite of Dr. Anthony Hall-Martin advising that both food and water should be available, this was overlooked and the rhino in her search for water damaged two of the outer drains. Dung had been collected prior to release and laid out leading to the river and also placed in numerous areas, as suggested by three specialists. No problems whatsoever were encountered after the final release and the two bulls are in fairly separate locations. Two of the cows have since been seen together and one cow is very settled in the presence of people in vehicles. The other four have reverted to type and are extremely shy.

General

The original assessment of the 10,000 ha rhino sanctuary was not, in my opinion, sufficiently detailed to determine the outcome. I firmly believe that a more specialised study should be done in future on any private property that is to receive rhino. I am also concerned about the 'long-term' in relation to carrying capacity. I would question the timing of any introduction in the dry months, without a detailed feeding analysis coupled with a close examination of the habitat. The introduction of black rhino to a new area is not a task to be lightly undertaken.

Unlike Government Conservation Agencies who employ veterinarians and technicians, the private sector does not normally demand such expertise. For this exercise every precaution was taken and a full medical kit was on hand, together with immobilising equipment drugs and a dart gun. A list of veterinarians who had offered their assistance was drawn up, together with their telephone numbers, and a light aircraft was always available in the event of an emergency arising. For the releases, a helicopter was put on standby and a rhino crate was provided by the Natal Parks Board, who also very kindly agreed to come to our assistance if any of the rhino broke out after release. In addition, we had the benefit of our next door neighbour, Mr. Rodney Henwood, who was once Natal Parks Board Capture Officer and who was prepared to assist with any eventuality that might arise. Constant contact was maintained with various rhino specialists and veterinarians were called in twice for general checks.

A type of lesion developed on the backs of three of the rhinos and samples were obtained and sent to

Onderstepoort. This condition has never previously been recorded in captive rhinos and the results of the analysis are still awaited. One month after the release of the most seriously affected animal, she was seen to be perfectly clear of all back lesions. This particular rhino arrived from Zululand with the most developed shoulder and chest lesions, which have since decreased.

Problems encountered

Arrival
As a result of not taking the precaution of spraying water on the floors of each boma, considerable dust occurred as the rhinos left the truck and moved down and through the pens at a fairly swift pace.

Gates
It is strongly recommended that interconnecting gates should be constructed of steel and attached to sliding coasters. Whilst our staff became extremely adept at removing the poles, this obviously has certain drawbacks. Rhinos ran through the entrance before the last pole was completely removed and on more then one occasion slammed into the protruding end, which could have resulted in injury.

Water troughs
The depth of 45 cm was too great and I would recommend no more than 24 cm, with a 10 cm lip. Problems were encountered with rhino attempting to stand in the water troughs and rocks had to be placed in them to reduce the effective depth. Definitely, the water trough should be constructed above ground level to avoid contamination with dung and soil.

Cleaning
Particular attention must be paid to this aspect, as it was found on more than one occasion that shortcuts were being taken, and decaying dung left in the bomas was resulting in a fly problem. Careful checks need to made where dung is thrown over the walls during the cleaning process; it must not be allowed to collect in the bolted ends of the poles. The utmost attention should be paid to this aspect on a daily basis, and extra checks should be devised to cover everyone concerned.

Browse
It is essential to ensure that mixed browse is provided for each animal. On a number of occasions, it was found that one particular species of browse was being given, due to the ease of collecting from one tree rather than moving around over a wider area.

Dropper poles
Most of the dropper poles were simply bolted to the two cross members and flush with the ground, whereas all the main support poles were cemented in. Possibly due to the long confinement, all five rhinos were in the habit of digging on a daily basis, resulting in large holes that were often directly under these poles. It might, therefore, be advisable to have longer droppers and bury them to a depth of 300 mm.

The spacing of 15 cm between droppers was not always maintained. Over-large gaps allowed rhinos to have greater contact with one another, which resulted on one occasion in one of the females losing the top half of her ear where the identification cut had been made. This was as a result of the rhino in the next pen exerting pressure on his horn, which was pressed down on the female rhino's ear.

Visitors to the rhino bomas were cautioned constantly not to get too close to the rhinos at these particular points, as the animals were very quick to respond by thrusting their horns through the openings and upwards. In addition to this, some openings let warthogs enter the pens, which they did on a daily basis, helping themselves to horse-cubes. The rhinos generally tolerated them with the exception of one warthog who was caught by a rhino and had his right tusk broken off as he endeavoured to exit from inside the pen.

A long and protracted dry season resulted in two white rhino bulls discovering the whereabouts of the black rhino enclosure. Their subsequent daily attendance in search of lucerne spilling out of the sides of the bomas presented problems with the outer drains, which had to be protected from the weight of these animals wandering around the bomas during both day and night. The continuing availability of food resulted in these two bulls becoming extremely tame and presented a potential hazard for the staff attending to the rhinos' daily needs.

Notwithstanding these minor problems, it must be understood that, whilst the staff had experience with white rhino, no-one had ever worked with black rhino before, and in the absence of any available literature, one relied upon contacts with people within the official conservation agencies for guidance. And without the support of all these people the eighteen-week-long introduction programme would not have achieved the successful outcome that it did.

Acknowledgements

I wish **to** acknowledge the considerable support, advice and encouragement given by many individuals and organisations, whose interest in the Lapalala Black Rhino project was highly appreciated and is an example of the commitment of a dedicated group of people concerned with black rhinoceros conservation. I also wish **to** acknowledge the interest of the Natal Parks Board and their support during the entire period the rhinos were held in bomas at Lapalala Wilderness. In particular, I would like to thank the following people who rendered valuable assistance and without whose support we would have experienced considerable difficulties:

Dr. Martin Brooks, Natal Parks Board
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Mr. P M Hitchins, Songimvelo Game Reserve
Mr. R Henwood, Touchstone Game Ranch
Dr. A Hall-Martin, National Parks Board of SA
Mr. K Meiklejohn. Natal Parks Board
Dr. C Raath. National Parks Board of SA
Mr. C B Ravenhill, Lapalala Wilderness

Case History of a Nasal Polyp in a Black Rhinoceros

Dieter Rottcher and Ross Tarara

A free-ranging young adult male black rhino, about 9-10 years old and living in the Nairobi National Park, was noticed to be ill. The animal was eating, but never moved far from its territory near Masai Lodge. It gradually lost condition and was obviously unfit.

The following abnormalities were noted during a close observation: the animal appeared very thin and weak; its respiration was laboured and audible as loud wheezing and snoring noises from as far as 35 m away; after walking a short distance uphill it was short of breath and breathed through the open mouth; there was nasal discharge from both nostrils.

One week later it was seen again together with two other rhino bulls. All three were close to a cow with a large calf. The cow was possibly in season at the time. The sick bull was obviously thinner than the others. A fair amount of nasal discharge from the left nostril was present.

Ten days later the animal looked very ill and in respiratory distress. It was decided to anaesthetize it briefly in order to examine its upper respiratory tract and administer treatment if possible. A dart was prepared containing 2.5 mg Etorphine (M99) and 150 mg Azaperone. The animal was approached on foot and darted from about 15 m. The projectile injected into the muscles of the left shoulder.

Unfortunately the rhino was still in the company of the group described above. After it was darted, it ran off for about 20 m and stopped. The other rhinos stayed where they were. Six minutes later the sick bull began to stumble and shortly afterwards sat down in sternal recumbency. Some stones were thrown in the direction of the other rhinos and they moved off

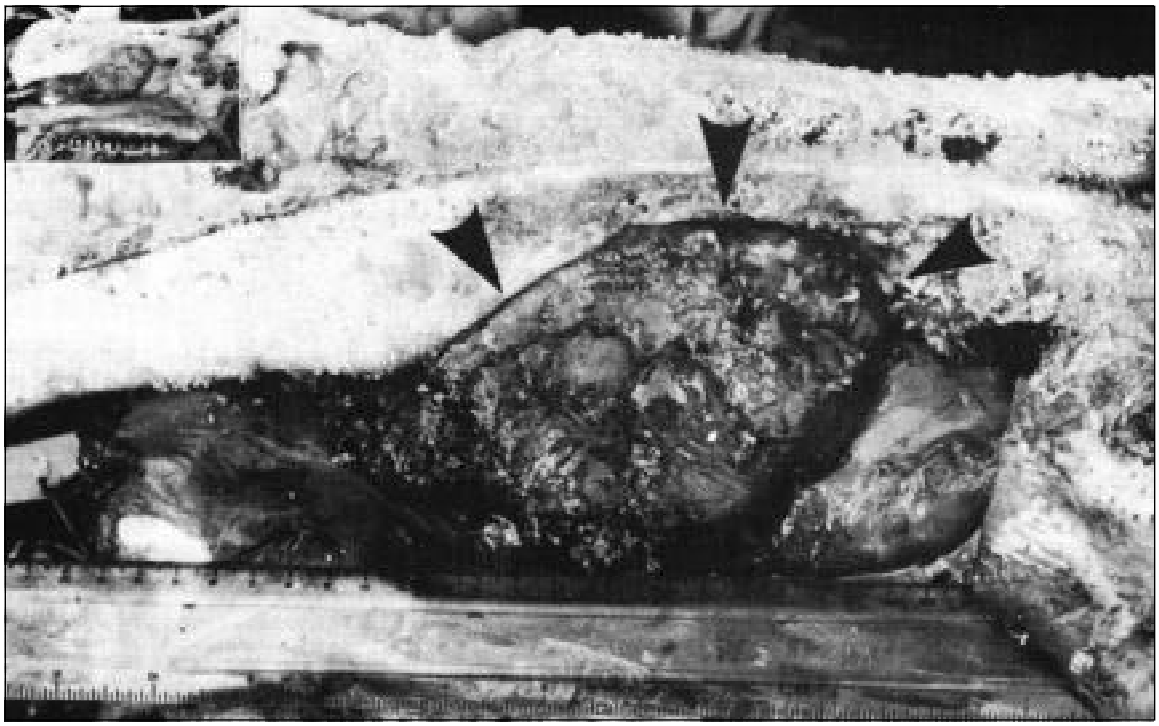

Figure 1: *A hemisection of the skull shows a large multi-lobular mass (arrows) filling the nasal cavity. The upper left inset is provided for orientation*

except for one bull. More stones were thrown at him, but he would not leave until a vehicle was brought and driven towards him. Ten to fifteen minutes were lost in the process.

When it was finally possible to examine the sick animal, it was immediately obvious that the bull was severely starved of oxygen. The head had sunk down so that the chin rested against the ground and the mouth was firmly closed by the weight of the upper skull resting on the lower jaw. About three times per minute the animal gasped for air. The antidote (Diprenorphine 3 mg) was given intravenously immediately. The next ten minutes were spent in an attempt at artificial respiration by applying pressure rhythmically to the left side of the thorax. However, spontaneous respiration did not improve, but stopped. The animal was dead about half an hour after being darted.

A post mortem examination was carried out. The animal was thin without any fat deposits. Kidney, heart and orbital fat deposits were nonexistent. There were no obvious abnormalities to the abdominal and thoracic organs. A fair number of helminths were noted in the large intestine. The air passage through larynx, trachea and bronchi was free and the lungs looked healthy. The nasal cavity, however, was blocked on both sides. A soft, multi-lobular, tumorous mass was visible in both nostrils and posteriorly above the soft palate. Once the soft and hard palate had been removed the full extent of this lesion became obvious. It filled the nasal cavity in the anterior portion on both sides and extended on the left side further posterior than on the right.

The animal had been unable to get sufficient air through the nose. Its emaciated condition may have been caused by the permanent difficulty of feeding and breathing simultaneously. Because closing the mouth to chew also closed the air intake, it probably ate less than a normal amount of food. The tumour was in an anatomical position and of such extent as to make it inoperable. The cause of death was obliviously asphyxiation due to the position adopted under anaesthesia that closed the remaining air passage through its mouth. However, it appears likely that the progressive growth of the lesion would have killed the rhino eventually.

Tissue from the nasal mass was fixed in 10% buffered formalin processed for light microscopy by standard

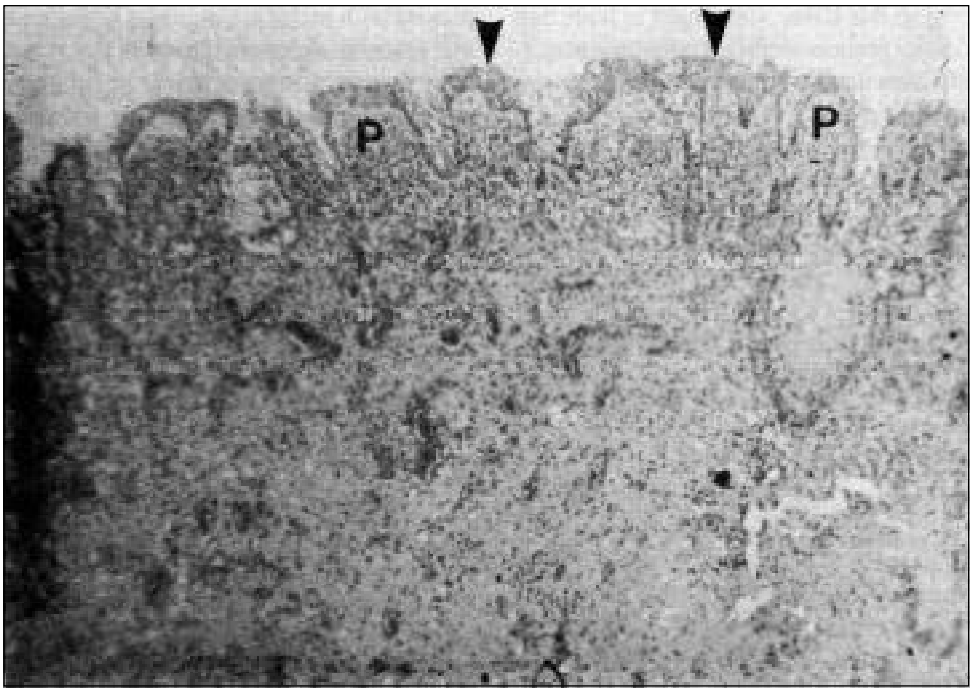

***Figure 2: The** surface of the mass was lined by pseudo-stratified columnar epithelium (arrows) which invaginated at regular intervals resulting in the formation of short, blunt papillae (P) (x 65).*

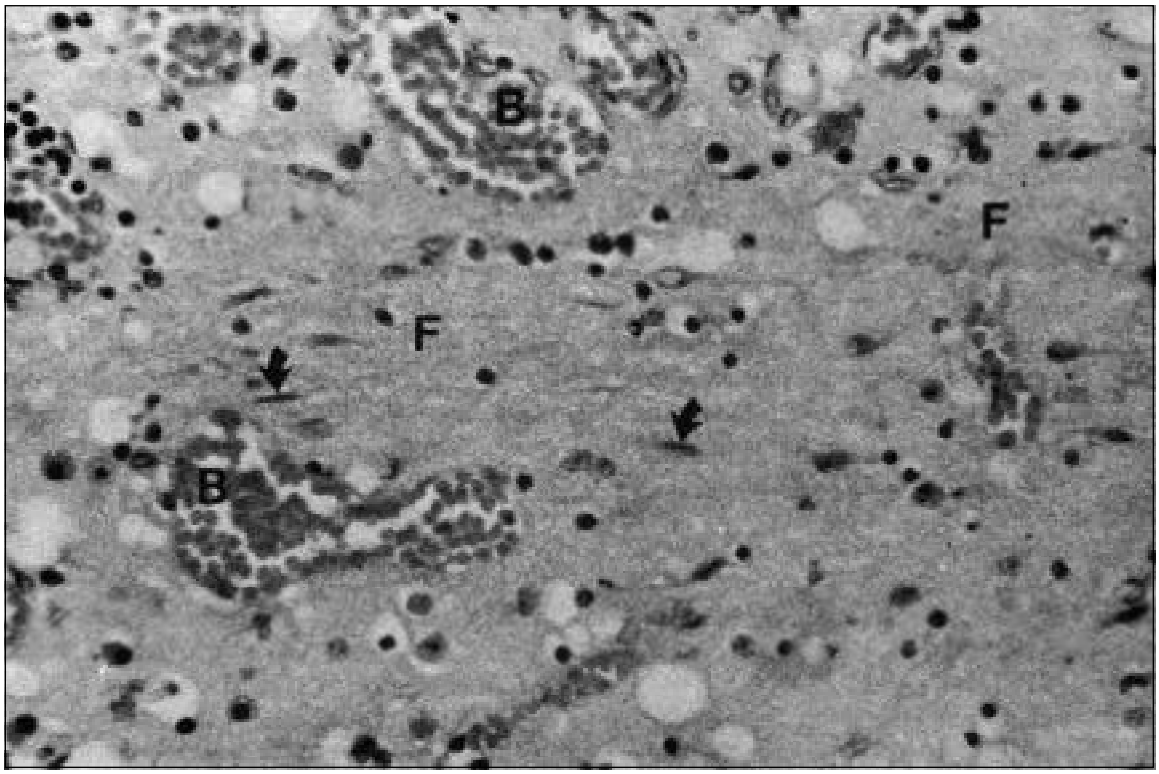

Figure 3: *The stroma contained many thin-walled blood vessels (B) and was composed of dense fibrous connective tissue (F) with widely-spaced spindle-shaped fibroblasts (arrows) (x 650).*

methods, embedded in paraffin, sectioned at 7 and stained with haematoxylin and eosin.

Histologically, this tissue was found to have one border lined by pseudo-stratified columnar respiratory epithelium that invaginated at regular intervals along the surface resulting in the formation of wide, short, blunt papillae. The lamina propria of these papillae contained an abundant, mainly lymphocytic-histiocytic, inflammatory cellular infiltrate. The stroma deep in this lamina propria contained radially arranged thin-walled blood vessels that extended to the surface. It consisted of dense, fibrous connective tissue with spindle-shaped fibroblasts. Scattered mild to moderate vacuolation was present in the stroma and a diffuse, mainly mononuclear, cellular infiltrate was present with increased numbers of cells surrounding vascular channels. Deep in the stroma there were several clusters of acinar structures lined by tall, cuboidal epithelium having pale basophilic cytoplasm. A mainly mononuclear cell infiltrate was also associated with these acini.

Based on these morphological features a diagnosis of nasal polyp was made. The deep acinar structures were interpreted to be pre-existing glandular tissue of the nasal mucosa.

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Photographs by the authors.

The Status of Elephants in Uganda: Queen Elizabeth National Park

Eve Abe

Uganda now has seven national parks with Mount Ruwenzori, Mgahinga and Bwindi Impenetrable being the most recently gazetted. At least three parks, Murchison Falls (MFNP), Kidepo Valley (KVNP) and Queen Elizabeth (QENP) contain elephants within their boundaries. The density of elephants increased in both MFNP and QENP during the 1960s (Laws *et al*, 1970; Field, 1971; Ellringham, 1977). In MFNP the increase led to severe habitat deterioration, especially south of the Nile where the elephant density was highest. The increase in QENP (then Rwenzori) was less.

In an attempt to reduce the damage done in MFNP (then Kabalega), rangers shot 2,000 elephants between 1965 and 1967, and a recommendation was made that a further 3,500 should be culled from the park and the neighbouring grasslands of Bunyoro (Laws *et al*, 1970). The Scientific Advisory Committee of the Uganda National Parks considered this recommendation, but, before agreeing to its implementation, decided that a further study was needed to find out if the situation had changed (Eltringham and Malpas, 1980). The new count showed that poaching had increased to such an extent

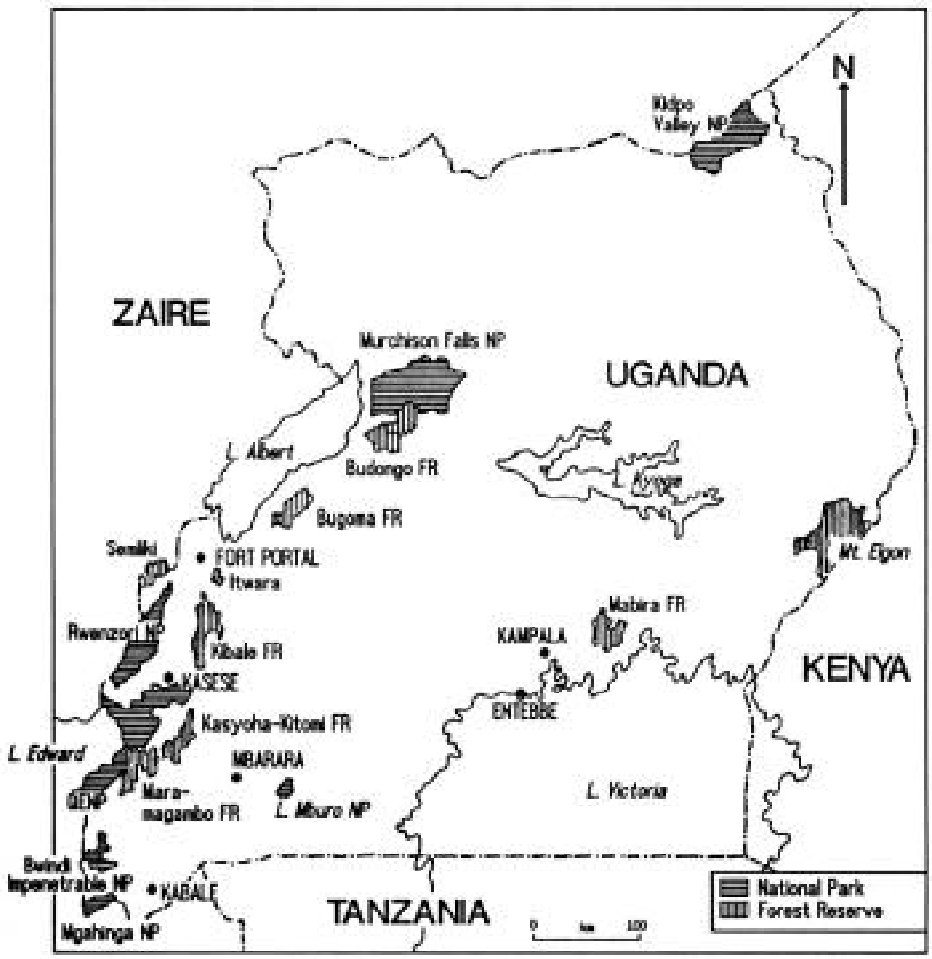


Figure 1 : *Map of Uganda showing the locations of the National Parks.*

that there had been a very large decline in elephant numbers in both parks (Malpas, 1978).

In 1971, after the military coup, the parks suffered a series of unexpected blows of catastrophic proportions. Tourism first collapsed and then was banned in 1973. Law and order steadily deteriorated. With the dramatic rise in the world value of ivory, government officials and security officers began to poach elephants from the national parks. It was impossible for park wardens and rangers to cope (Kayanja and Douglas-Hamilton, 1983). From 1973 lo 1976, the Uganda Institute of Ecology regularly made aerial surveys of the country. Over this three-year period estimates of elephant numbers in QENP declined from 2,700 to 700. Following 1976, no more surveys were allowed until after the fall of Amin's regime. When monitoring resumed in 1980, only 150 elephants were counted in QENP, although 250 were seen just across the border in Parc National Albert in Zaire (Kayanja and Douglas-Hamilton. 1983).

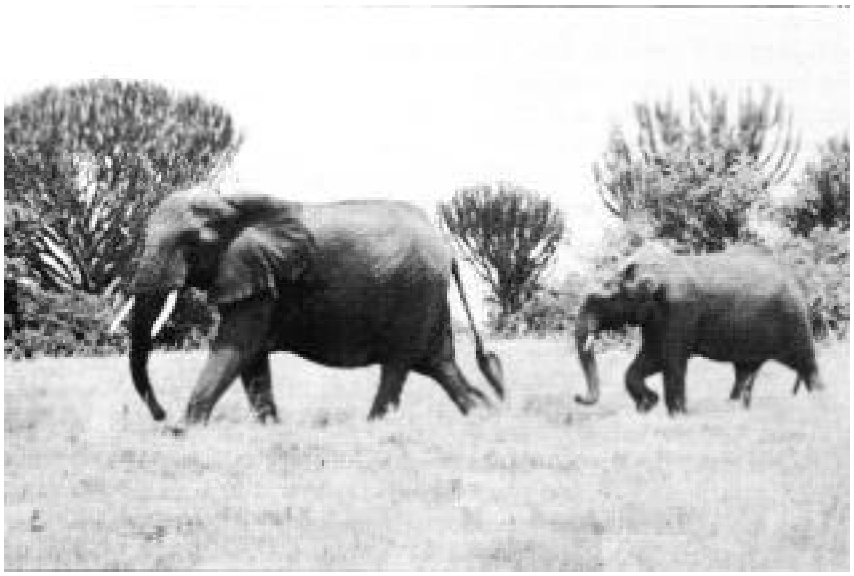
In 1989, the European Community provided a scholarship for a study of this daunting decrease in the number of elephants. This paper reports briefly on elephants in QENP, where the author is presently studying the effects poaching has had on the elephant population.

Three groups of elephants are currently in QENP, totalling about 500 individuals. There is a Northern Sector group of 250 elephants, a group in the Kazinga area of 60, and another around Ishasha of 200 animals. All the groups live in semi-permanent aggregations, which are believed to be a result of poaching activities (Eltringham, 1977). Little is known about the Ishasha elephants except that they move between QENP and Parc National Albert in Zaire. The animals living in Northern Sector are the main object of the present study.

To monitor ranging patterns in all three groups, individuals from each have been fitted with radio-

Figure 2: *Queen Elizabeth National Park*

collars. The only criterion used to choose the elephants to collar in the Ishasha and Kazinga populations was that they be adult females. This was because the two areas are so dense and thick with vegetation that it is almost impossible to select individuals; because there are few known individuals especially in the Ishasha group; and because most females stay within the aggregations and are less likely than males to wander away on their own (Moss *et al).* An advantage of the elephants in these populations continuing to live in semi-permanent aggregations is that the groups can be located easily at any time.



There is no doubt that the number of elephants in Queen Elizabeth Park is increasing
Copyright: Eve Abe

Specific individuals were chosen from the Northern Sector population. These were: Tom Ear (a matriarch—50-55 years old), Zola (an 'orphan'— 15-20 years old) and Rob (the highest ranking bull—30-35 years old).

Monitoring Techniques/Methods

The working team was Michael H Woodford, Rob Olivier, Wilhelm Moeller, Marcel Onen and the author; Woodford was the dart man. Darts did not always work as expected due to detonators failing to explode. This was discovered after retrieval of the darts. All the shots except one were made from a Land Rover. A compressed air dart gun and the drug Immobilon/Revivon were used.

So far four elephants have been fitted with radio collars. These are Torn Ear, Zola, Rob and Ursula. For animals from the Northern Sector collaring was not a very difficult task, because the area the animals were in is not thick with vegetation and the elephants are used to people and vehicles. They are approachable to within five metres or less. The situation is remarkable in that when Zola was being fitted with a radio collar, the rest of the elephants, numbering about 15, were only some ten metres away from us. Rob was collared when he was in musth. When the dart hit him, he just moved aside and looked at the vehicle. He then walked away for about five metres, stopped and, about 17 minutes after the dart hit, finally sank down to his knees. I had expected Rob to come crashing through the bush at us, as males in musth are often aggressive (Poole 1989).

For the Kazinga and Ishasha populations fitting the collars has not been so simple. Aerial support was needed to find the elephants because from a vehicle you rarely can see through the bush for much more than a metre. With the aid of hand-held radios Olivier, the pilot, guided the people on the ground to the elephants. Trying to collar animals from these populations is aggravated by the fact that the elephants flee at the sound of a vehicle. There was also a chance of losing the animal after it had been darted. Thus the pilot usually stayed in the air for about 3-4 hours directing the ground crew until they located the fallen animal.

Elephant Conservation and Implications

There are no reports of elephant poaching activities within the last five years, but death due to accident has occurred thrice in the last two years. There is no doubt that elephant numbers are building up, with the population breeding rapidly (Abe in prep).

With the radio-collars fitted it is hoped some of the mysteries of where the elephants disappear to will be solved. There remains the problem of access in rugged terrain such as the Crater area, some of which is densely forested. Elephants frequent this part of the Park especially in the wet seasons. Few motorable tracks exist and beyond the areas open to vehicles aerial monitoring will be employed whenever possible.

Due to the nature of its establishment, QENP has 12 fishing village enclaves. Some of these villages, such as Mweya, Kasenyi and Hamukungu, form important parts of the elephants' range in the Northern Sector. The elephants stay in Mweya for an average of about five days every two months. Mweya is a peninsula. The movements of elephants in this area are routine and very predictable. They ascend to the upper part of the peninsula in the evening and spend the night close to human habitations. In the mornings, they descend to the lake-side where they feed and water.

In Kasenyi the most frequented area is the salt-pan at Lake Bunyampaka. People work their salt at a distance of some *50* m from the elephants when they are in the area. There has been no report of damage caused by elephants to the worked salt piled on the edges of the pan. Hamukungu is one of the larger villages in the park and is split into upper and lower parts separated by a belt some 500 m wide that has no buildings. Elephants usually use this as a path whilst moving from south to north, or vice versa. Two baby elephants have been found abandoned at the edge of these settlements. One, which was completely blind and less than six months old, died within 48 hours of being found. The other, Nile, was found in the same area about a year ago and is now some four years old and doing well in Mweya. Initially, the people of Hamukungu looked after her for 12 days before she was transported to Mweya. In this village the elephants are remarkable, spending nights amongst the buildings. The relationship between elephants and people is amicable.

The situation is different for the village of Muhokya and Kasese town, both of which abut the QENP boundary. Agricultural activities are carried out in these areas. Twice I have gone with park rangers to chase out elephants from banana plantations in Muhokya. There are also reports of *shamba* raids by elephants in areas around Kasese.

The frequency of elephant sightings is increasing, and more tourists leave the park happier after seeing elephants. Visitors, if asked: "What did you see?", often reply, "Nothing much." If elephants were seen, they say: "We saw lots of animals."

Everything else remaining the same, the future of the elephants seems good, and it is my hope that elephants in this park will recover in numbers.

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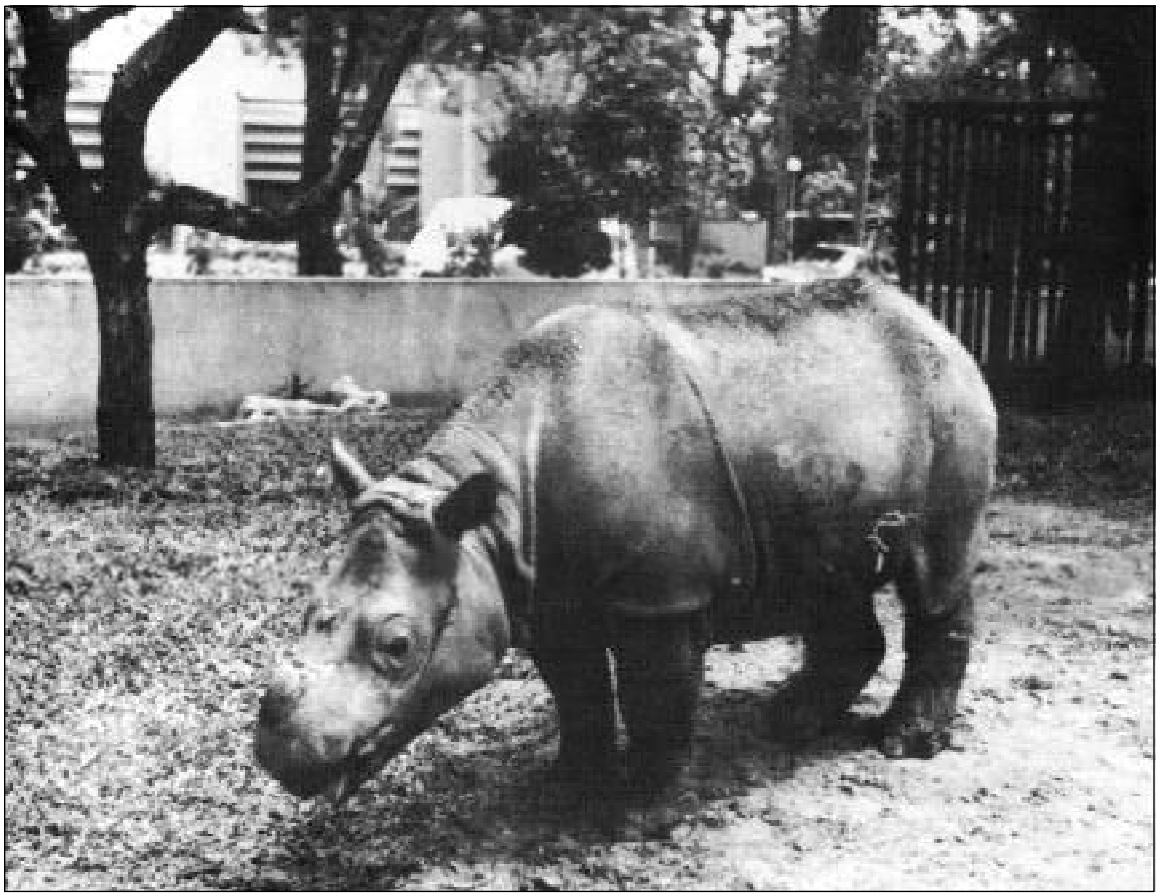
The Author

I was in Amboseli where I trained under C. Moss and J. Poole to age, sex and identify elephants in the field. Using the ageing techniques I learnt, I can age calves and juveniles to within two years; young adult males and females to within five years. This paper is from casual observations made whilst in the field. I am currently in my second year of data collection on elephant ecology in QENP, leading to a PHD.

A Survey of Rhino Products for Retail Sale in Bangkok in Early 1992

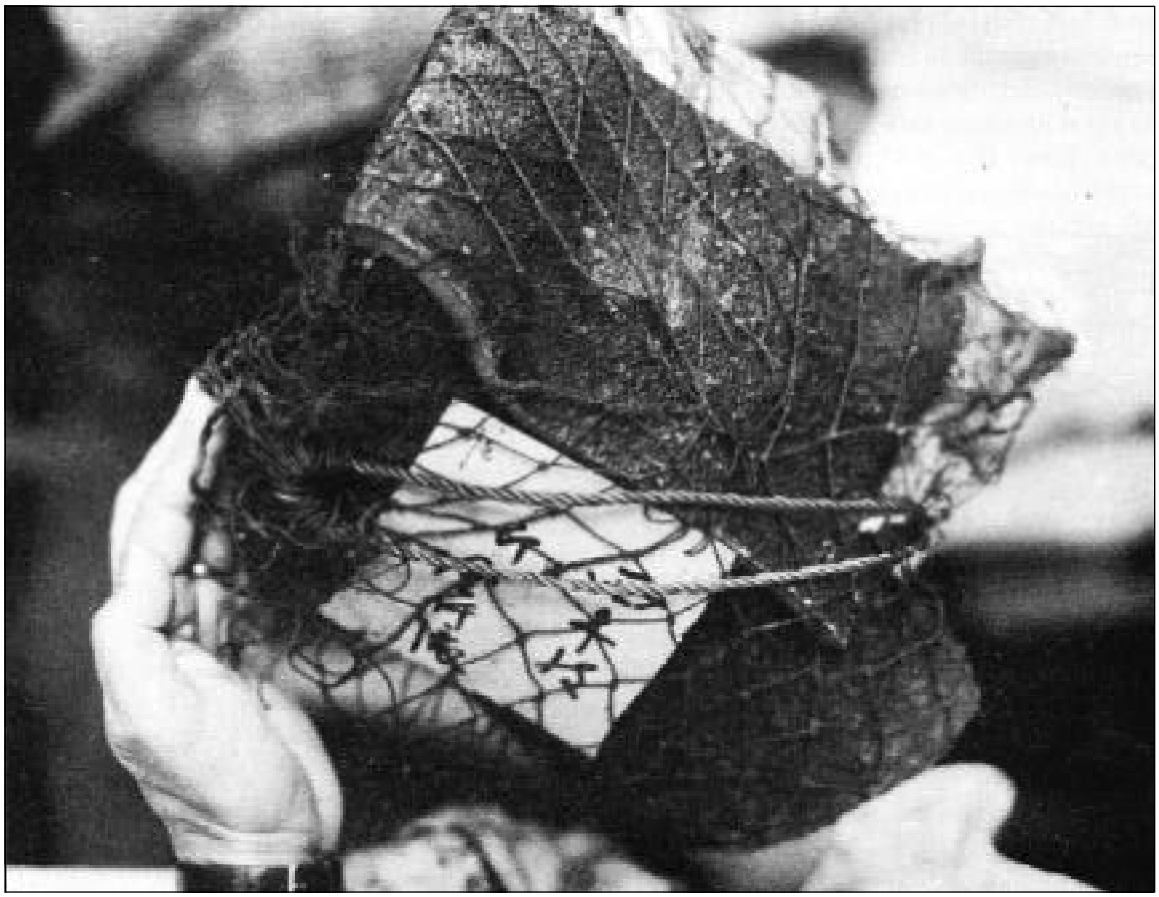
Esmond Bradley Martin



This Sumatran rhino was caught in Malaysia as part of Malaysia's captive breeding programme. However, she was given to the King of Thailand and sent to the Palace in Bangkok in January 1986. She died in the zoo a few weeks afterwards when she got her neck caught in the bars seen at the back of the picture.

Bangkok has been for many years a major market for rhino products, including the horn, skin, nails and penis. However, in March 1992, fewer pharmacies were selling rhino horn and skin compared with my 1990 survey, and the prices had increased by less than 10% per annum during that time, despite the major growth in the Thai economy. This strongly suggests that consumer demand has not risen. This is good news for the rhinoceros.

As the main dealers were not available during my 1992 survey, it was not possible to learn if new rhino products have recently been brought into Bangkok, but most of the rhino products for retail sale were the same pieces as in 1990. Some old stock has been sold; 24% of the pharmacies visited in 1990 offered rhino horn compared with only 14% in early 1992, a decline which has been continuing since the early 1980s (see Table 1). Also, less rhino horn was openly displayed due to the increasing awareness of the illegality of owning rhino horn from the Asian species, and because the medicine shop owners are worried that the government might inspect their businesses. During the period 1990 to 1992, the average price of African horn dropped from $10,286 to $5,341;



Sumatran rhino skin is still easily available in Bangkok's medicine shops. Copyright: Lucy Vigne

the average price of Asian horn rose from $21,354 to $31,275.

For rhino skin, all from the Sumatran animal, the retail prices for 1990 and 1992 are almost identical: $1,717 versus $1,721 (see Table 2). However, the percentage of medicine shops selling skin dropped from 46% to 27%. A possible reason for this apparent decline, which may also apply to rhino horn, is that some of the pharmacists were more suspicious and may not have been totally honest about telling us of their rhino products sales. Shopkeepers realized they were selling prohibited items and consequently were more scared and unco-operative with my interpreter and myself.

The big surprise was the huge increase in the price of nails. All nails for sale are from the Sumatran species. From 1986 to 1990, their retail price rose from $1,487

Table 1 :Average retail prices of rhinoceros horn in Bangkok

Year	Total number of pharmacies visited	Number & percent selling horn	Type of horn	Average price per kg in US $
1979	23 12	52%	Most African	3,654
1986	44 15	34%	Most Asian	11,629
1988	52 17	33%	Most Sumatran	13,111
1990	46 11	24%	Asian/African	15,205
1992	44 6	14%	Asian/African	18,308

Source: Surveys taken by the author

Table 2: Average retail prices of rhinoceros skin in Bangkok

Year	Total number of pharmacies visited	Number & percent selling skin	Type of skin	Average price per kg in US $
1979	- -	-	-	-
1986	44 8	18%	Sumatran	395
1988	52 7	13%	Sumatran	1,254
1990	46 21	46%	Sumatran	1,717
1992	44 12	27%	Sumatran	1,727

Source: Surveys taken by the author

Table 3 : Average retail prices of rhinoceros nails in Bangkok

Year	Total number of pharmacies visited	Number & percent selling nails	Type of nails	Average price per kg in US $
1986	44	5 11%	Sumatran	1,487
1988	52	7 13%	Sumatran	2,295
1990	-	- -	Sumatran	2,604
1992	44	7 16%	Sumatran	13,905

Source: Surveys taken by the author

a kilo to $2,604 (see Table 3). This latter figure is about the same as that for Singapore in 1990 ($2,528 a kilo). By 1992, however, the average price in Bangkok had soared to $13,905 a kilo (see Table 3) with a huge range from $1,043 to $31,287. One explanation is that Bangkok's prices rose to equal those in other Thai towns such as Hat Yai ($11,345 a kilo in 1988) and Phuket ($16,000 a kilo in 1988 also). Some of the pharmacists explained that it was becoming harder to obtain these Sumatran rhino nails, so they have recently increased the price.

It is unfortunate that members of the Forest Department, who are responsible for controlling the trade in endangered species, almost never inspect the medicine shops as they consider this to be a low priority. According to Boonlerd Angsirijinda, the Chief Law Enforcement Officer of the Wildlife Conservation Division of the Forest Department, during the past five years only one rhino horn has been confiscated. That was in 1987 when a horn from the greater one-horned or Indian rhino was seized in Bangkok's Chinatown.

Although it is encouraging that there are fewer rhino products for sale in Bangkok, conditions at any time could change, and the pharmacists would buy new products if they were available. For instance, poaching of the Sumatran rhino could increase in eastern Burma. Most of these animals are in the Tenasserim Range near the border with Thailand, where presently they are protected by the Karen military forces. The head of this rebel group, who has been fighting the Burmese government for many years, has stated on several occasions that if one of his men were to kill a rhino in the Karen area he would be punished by death. There is no doubt that rhinos still do exist in areas controlled by the Karens (Murray Watson, pers comm, April 1992).

These Sumatran rhino products were being offered for sale beneath the counter of a medicine shop in Bangkok: a penis, a horn on top of some slices of skin and two nails on either side

Another potential source for Asian rhino products is the island of Sumatra for which Singapore has been a market and entrepot. There has always been a demand for these horns in Singapore for traditional medicine, and traders have also re-exported some to dealers in South East Asia. But in December 1991, the Singapore Customs Authority intercepted a consignment of Asian horns sent from Sumatra. This was the first major seizure of horn by the government since joining CITES in 1986. Following this recent loss, it is possible that the exporters of rhino products in Indonesia might choose to send the horns to a safer place, namely Bangkok.

For rhino conservation and the protection of rare species, the new Wildlife Act of 1992 is the most promising piece of legislation to be passed in Thailand for many years. Article 54 of this Act stipulates a maximum prison term of seven years and/or a fine of up to 100,000 baht (about $3,910) for hunting endangered species such as rhinos in a specifically protected area. Concerning the trade, illegal possession and import or export of rare species and their parts, Article 47 states that a person who is found guilty of such an offence will be imprisoned for up to four years or shall be fined a maximum of 40,000 baht or both. Article 55 imposes the same penalties on accomplices who illegally obtain a protected species or its parts such as Asian rhino horn or skin.

The Act also makes it compulsory for people who possess undocumented rhino commodities to register their stocks with the appropriate government authority within ninety days from the day the Act became effective (28 February 1992). The owner can continue to keep the registered rhino products, but is not allowed to sell them. If the rhino products were legally possessed some time in the past and were recently registered with the Forest Department, a temporary trading permit may be issued to allow the trader to dispose of his commodities within three years. The trader, however, must send a monthly sales report to the Forest Department.

To make this Act effective for rhino conservation, the two African species and the greater one-horned rhino will have to be included in the endangered wildlife list. When the 1992 Act was originally promulgated, only the Sumatran and Javan species were included. However, all CITES Appendix I species will soon be covered by the Act (Boonlerd, pers. comm.). Regular inspections must be carried out to check that the pharmacies are not selling prohibited rhino products. This new Act is a major piece of legislation, but for it to be effective, it has to be enforced. Hopefully, the Forest Department, Customs and other government bodies will now give a higher priority to wildlife conservation and allocate the resources needed to enforce the new Wildlife Act. Otherwise, yet more public criticism of Thailand will have to be instigated.

Vesey's Horn

Clive A Spinage

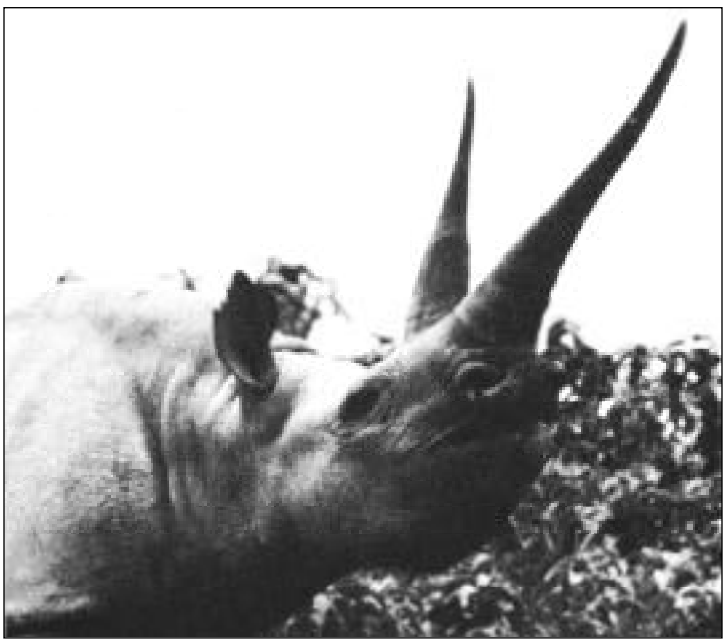
Few people are aware that Kenya's Game Department appointed a wildlife biologist as early as 1948. This was the late Desmond Vesey-Fitzgerald, universally known as 'Vesey', whose first assignment was to have been a vegetation survey of the Tsavo National Park. What a calamity that it never took place, so that we would have had quantitative baseline data against which to compare the subsequent important events that took place there! That it never did take place was because about 1949 Vesey was sent on three months' secondment to the Red Locust Survey study area in the Rukwa valley in Zambia —where he remained for 15 years until 1964 when he joined the Tanzania National Parks.

During his brief term as biologist to the Kenya Game Department one of his tasks was to prepare the Game Department's stand for the annual Nairobi Royal Show. Vesey once explained to me how he had constructed an enormous rhino horn by splicing two long horns together, which he then put on display at the stand. The idea, he stated, was not deliberately to deceive people, but simply to draw attention to the stand. What success it had was stowed away in the Game Department storeroom and forgotten about.

That is until some years later, when someone rummaging about in the store came across this jumbo-sized horn and measured it in astonishment. Even if it was not the world record, it had to be one of the longest horns ever known. Such an outstanding find was promptly submitted to Rowland Ward's Records of Big Game, where it was duly listed.

When Vesey became aware of this, much to his amusement but no doubt much to others' annoyance, either he himself or someone whom he confided in, informed the official measurer in Nairobi and it was quietly dropped from the list.

That supposedly was the end of the story. But in April, 1991, WWF issued a 'Campaign Report' entitled "Help WWF Stop the Rhino Horn Trade" that carried a photograph of Dr. Esmond Bradley Martin in the Nairobi Ivory Room, In the background of this photograph is a rhino horn of exceptional length. I brought Vesey's little trick to have a closer look at the horn. He said that it did indeed have a crack in the middle. It was in the picture because when the Game Department started to burn their rhino horn stocks he suggested that they should keep some of the best examples from destruction.



What's the point of trying to growth. longest horn, when humans cheat!
Copyright: David Western

Esmond confirmed to me later that the horn was indeed 'Vesey's Horn'—two horns glued together. So perhaps it would be best if it now was consigned to the fire, lest Vesey's Horn should raise its ugly head again at some distant, future date.

Acknowledgement

I am grateful to Esmond Bradley Martin for his assistance with the preparation of this note.

Black Rhino Monitoring in the Umfolozi/Hluhluwe Complex

TM Yule

Introduction

Since it began in 1988, the black rhino monitoring programme in the Umfolozi/Hluhluwe complex has made outstanding progress; it has provided many facts that now comprise a computer database. The information that can be derived from the data-base helps managers to be more productive and more accurate in decisions on black rhino management such as off-take figures.

A black rhino sighting return form is submitted monthly by each of the six Section Rangers in the complex. This data is then entered into the computer at the research centre in Hluhluwe Game Reserve. Master files containing the history record sheets, calving records, mortalities, re-sightings, distribution maps and data from animals captured for relocation are kept at the relevant Section Rangers' outpoints, the bases where the Section Rangers reside and from which they operate. Copies of these files are kept at the research centre and updated monthly in case of accidental destruction of a master file.

Methods

Accurate data to enter into the files and onto computer come from a number of sources, namely:

1. Opportunistic sightings - rhinos seen by chance, e.g. whilst driving in a vehicle.
2. Game guard reports - rhinos sighted by game guards out on patrol.
3. Biological patrols by a Section Ranger - a Section Ranger on patrol with his guards sights and records a rhino. (Such occasions also provide an opportunity for training and evaluating guards.)
4. Observation posts - game guards equipped with binoculars and a radios are placed on vantage points such as hills. When a rhino is sighted, the Section Ranger is guided by radio to the animal.
5. Helicopter and fixed wing monitoring - a helicopter (Bell 47) with two crew members is directed to rhinos by a fixed wing spotter aircraft (Cessna 182). The helicopter crew members alight at a distance and are then guided to the animal by the fixed wing.
6. Helicopter and fixed wing monitoring and notching - a helicopter (Bell Jet Ranger) with a Section Ranger and a veterinarian aboard are directed to rhinos by a fixed wing aircraft. After the Section Ranger has confirmed that the animal has no distinguishable marks, such as scars, ear notches, missing tail, etc., and if the animal is not on dangerous ground such as near a ravine, it is darted with M99. Once the animal is down, the helicopter crew land and notch the ears according to the national strategy numbering system. If from the air the animal is seen to be marked, it is photographed and the sex, age, group composition and location recorded.

Training

Over the past three years I have been involved with the training of game guards to monitor black rhinos accurately and effectively. APP of the Picket Indunas, the rank given to game guards in charge of a patrol area within a section, are now at a standard where their data can be entered onto the master files and the data-base. All sightings made by the Indunas are quality controlled by the Section Ranger. Through training the amount of accurate data has increased four-fold.

Results of the 1989 black rhino survey.		**Results of the 1990 black rhino monitoring/notching programme.**	
Helicopter hours: (Bell 47)	20	Helicopter hours: (Bell Jet Ranger)	30
Fixed wing hours: (Cessna 182)	40	Fixed wing hours: (Cessna 182)	37
Number of rhinos sighted	135	Number of rhinos sighted	40
Number of known animals sighted	57	Number of rhinos notched	36