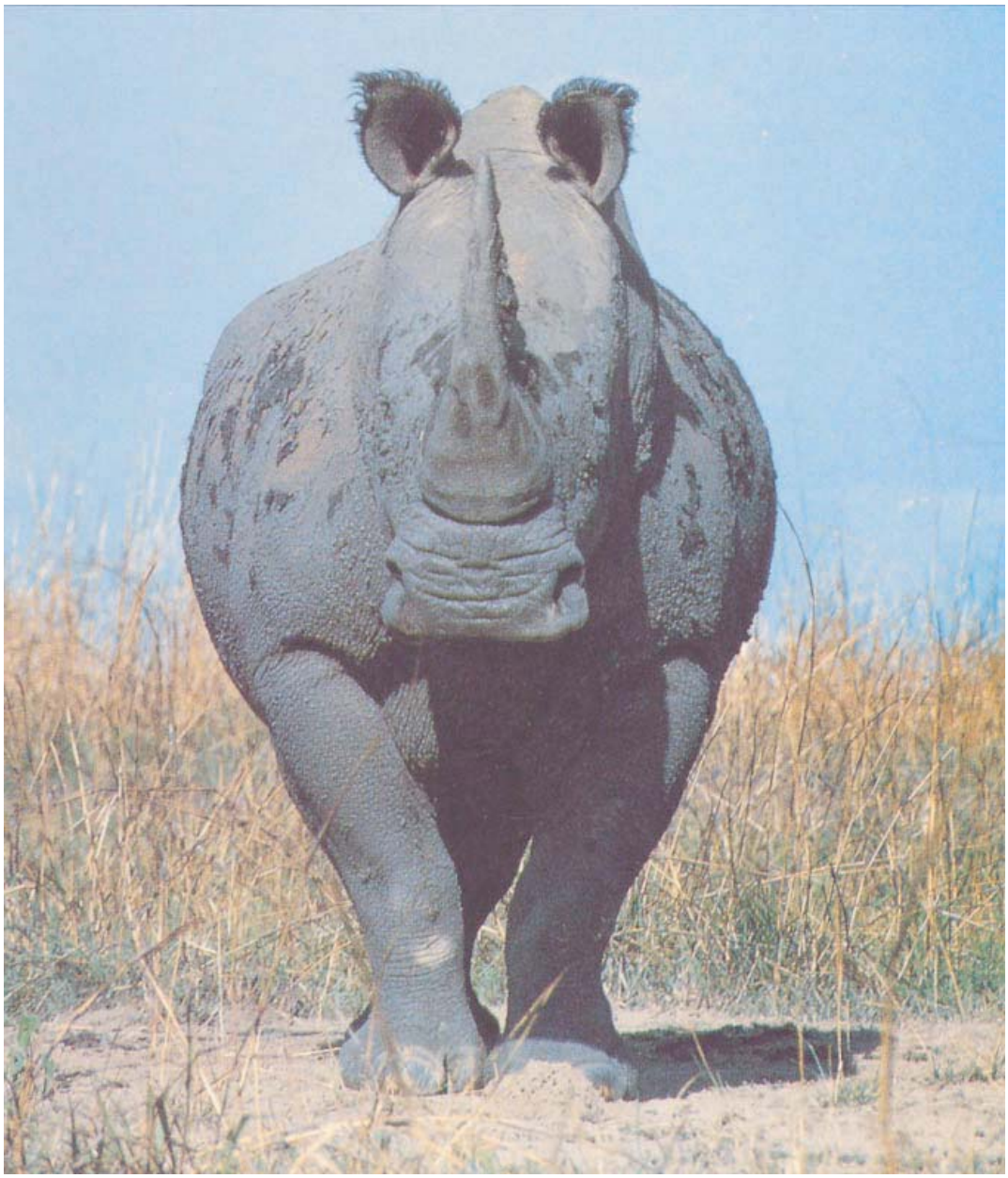
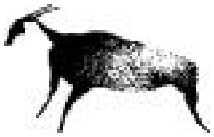
# Pachyderm

1995 Number 20





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# Pachyderm

1995 Number 20

## Contents





All correspondence, including enquiries about subscription, should be sent to:

The Editor
Pachyderm
WWF Regional Office
PO Box 62440
Nairobi, Kenya
Tel: 254-2-331543/332963
Fax: 254-2-332878

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Cover photo: A male nothern white rhinoceros *Ceratotherium simum cottoni* in Garamba National Park, Zaire. Photo credit: Kes and Fraser Smith

ERRATA

The following references were erroneously omitted from the reference list in the article by A. K. Kes Hillman smith *et al.* in *Pachyderm* 19:

Koontz, F.W. (1993) summary of results and observations on the deployment of satellite radio collars 9104 and 9105. Draft report. wcs. 32 pp.

Smith, K., Smith, F., Mbayma, A., Monungu, L., Watkin, J., de Merode, E., Amube, N. & Eza, K. (1993) Garamba National Park, General Aerial count, May 1993. Report to lZCN, WWF, FZS, IUCN, UNESCO.

# CHAIRMAN'S REPORT: ASIAN RHINO SPECIALIST GROUP

Mohd Khan bin Momin Khan[1], Chairman, With Thomas J. Foose[2]

and Nico J. Van Strien[3], Programme Officers

[1] Forestry Dept., ITTO Unit, 5th Floor, Wisma Sumber Alam, Petra Jaya, Jalan Stadium, 93600 Kuching Sarawak, Malaysia

[2] International Rhino Foundation, c/o The Wilds, 14000 International Road, Cumberland OH 43215, USA

[3] Julianaweg 2, 3941 DM Doom, Netherlands

The Global Environment Facility project to initiate the implementation of the Conservation Strategy for Rhinoceros in Indonesia and Malaysia was activated in April 1995. The project is concentrating on training and deployment of more intensive anti-poaching teams in both nations as well as improving the institutional capacity for the co-ordination of rhino conservation activities.

Progress continues on the development of managed breeding centres for the Sumatran rhino, both in its native habitat and under more natural conditions. One centre will be in Indonesia within the Way Kambas National Park, while the other will emerge in Malaysia through an expansion of the existing captive facility at Sungai Dusun into the adjacent Wildlife Reserve, where many of the animals in captivity were captured.

The first issue of the new AsRSG newsletter *Asian Rhinos* was published in January 1995 and the next issue will be published in July/August 1995.

The revised version of the Action Plan will be completed by September 1995 with publication by the end of the year.

A population and habitat viability assessment workshop for Malaysia rhinos will be conducted in Sandakan, Sabah, in late November, 1995. Immediately thereafter there will be a meeting of the AsRSG on more general matters.

Finally, the Programme Officers of the AsRSG have attempted an assessment of Asian Rhino taxa/ populations using the newly published IUCN Red List Categories. The results appear in the table below and indicate that of the seven taxa most recognised, one is probably extinct, four are critically endangered, and two are endangered. In terms of the three species, two are critically endangered and one is endangered.

*IUCN Red List Categories. assessment of Asian rhino status.*

| | JAVAN RHINO | | SUMATRAN RHINO | | | INDIAN RHINO | |
|---|---|---|---|---|---|---|---|
| IUCN CRITERIA* | *Rhinoceros sondaius sondaicus,* JAVA | *Rhinoceros sondaicus sondaicus annamanticus,* VIETNAM | *Dicerorhinus sumatrensis sumatrensis* SUMATRA, MALAISIA | *Dicerorhinus sumatrensis harrissoni;* BORNEO | *Dicerorhinus sumatrensis lasiotis* MYANMAR, THAILAND | *Rhinoceros uniornis Eastern pop.,* ASSAM, BENGALE ORIENTAL | *Rhinoceros uniornis Western pop.* NEPAL, U.PRADESH |
| A. POPULATION REDUCTION | VU | CR? | CR | CR | - | VU? | VU |
| B. EXTENT OF OCCURRENCE | EN | EN | EN | EN | - | EN | EN |
| C.&D. POPULATION ESTIMATE | CR | CR | CR? | CR | - | VU | VU |
| E. PROBABILITY OF EXTINCTION | EN? | CR? | CR? | CR? | - | VU? | VU? |
| **OVERALL RATING** | **CR** | **CR** | **CR** | **CR** | **EN?** | **EN** | **EN** |

**Revised IUCN Categories approved by the 40th meeting of the IUCN Council, 30 November1994*
*EX=Extinct CR=Critically endangered EN=Endangered VU= Vulnerable*

# RAPPORT DU PRESIDENT: GROUPE DE SPECIALISTES DU RHINOCEROS ASIATIQUE

Mohd Khan bin Momin Khan[1], Président, avec Thomas J. Foose[2] et Nico Van Strien[3], responsables de programmes

[1] Forestry Dept., ITTO Unit, 5th Floor, Wisma Sumber Alam, Petra Jaya, Jalan Stadium, 93600 Kuching Sarawak, Malaisie

[2] International Rhino Foundation, c/o The Wilds, 14000 International Road, Cumberland OH 43215, USA

[3] Julianaweg 2, 3941 DM Doorn, Pay-Bas

Le projet de Fonds pour l'Environnement Mondial pour lancer la réalisation de la Stratégie de Conservation des Rhinocéros d'Indonésie et de Malaisie a commencé en avril 1995. Le projet se concentre sur la formation et la mise en place de patrouilles antibraconnage plus intensives dans les deux pays ainsi que sur 1'amélioration du potentiel institutionnel chargé de la coordination des activités de protection des rhinocéros.

Les progrès se poursuivent dans la mise au point de centres de reproduction contrôlée des Rhinocéros de Sumatra, dans leur habitat d'origine et dans des conditions plus naturelles. Un centre se trouvera en Indonésie, dans le Parc National de Way Kambas, tandis que l'autre sera créé en Malaisie grâce à une extension dans la réserve de faune adjacente où ont d'ailleurs été capturés la plupart des animaux captifs, du dispositif actuel de maintien en captivié situé à Sungai Dusun.

Le premier numéro de *Asian Rhinos,* la nouvelle lettre du GSRAs, est sorti en janvier 1995, et le suivant sera publié en juillet-août 1995. La version révisée du Plan d'Action sera terminée en septembre 1995 et paraîtra vers la fin de l'année.

Un atelier sur l'évaluation de la viabilité des populations et des habitats pour les rhinos de Malaisie, se tiendra à Sandakan, Sabah, à la fin de novembre 1995. Il sera immédiatement suivi d'une réunion du GSRAs qui débattra de sujets plus généraux.

Enfin, les responsables de projets du GSRAs ont participé à une évaluation des taxons/populations des rhinos asiatiques en utilisant les Catégories récemment publiées dans la Liste Rouge de 1'UICN. Le tableau ci-dessous en donne les résultats et indique que parmi les sept taxons les plus généralement reconnus, un est probablement éteint, quatre sont gravement menacés et deux sont en danger. Si l'on parle des trois espèces, deux sont en situation d'extrême danger et une est en danger.

*Catégories de la Liste Rouge de l'UICN: évaluation du statut des rhinos asiatiques.*

| | JAVAN RHINO | | SUMATRAN RHINO | | | INDIAN RHINO | |
|---|---|---|---|---|---|---|---|
| CRITERES de l'UICN* | *Rhinoceros sondaius sondaicus,* JAVA | *Rhninoceros sondaicus sondaicus annamanticus,* VIETNAM | *Dicerorhinus sumatrensis sumatrensis* SUMATRA, MALAISIE | *Dicerorhinus sumatrensis harrissoni;* BORNEO | *Dicerorhinus sumatrensis lasiotis* MYANMAR, THAILAND | *Rhinoceros uniornis Eastern pop.,* ASSAM, BENGALE ORIENTAL | *Rhninoceros uniornis Western pop.* NEPAL, U.PRADESH |
| A. Réduction de la population | VU | CR? | CR | CR | - | VU? | VU |
| B. Fréquence | EN | EN | EN | EN | - | EN | EN |
| C.&D. Estimation de la population | CR | CR | CR? | CR | - | VU | VU |
| E. Probabilité d'extinction | EN? | CR? | CR? | CR? | - | VU? | VU? |
| QUOTATION GEGERALE | CR | CR | CR | CR | EN? | EN | EN |

**Catégorias et Critères révisés de l'UlCN, approuvés lors de la 40ème réunion du Conseil de l'UICN, le 3 novembre 1994. EX=Eteint; CR=En exréme danger; EN=En danger; VU= Vulnérable*

# CHAIRMAN'S REPORT: AFRICAN RHINO SPECIALIST GROUP

Martin Brooks

Natal Parks Board, PO Box 662, Pietermaritzburg 3200, South Africa

## Northern White Rhino Conservation Workshop

The meeting to debate and review the conservation management options to enhance the survival of the northern white rhino will take place at White Oak Conservation Centre in Florida, USA, from 18 to 20 October 1995. Apart from organising the meeting, African Rhino Specialist Group (AfRSG) members are responsible for putting together background documentation for the workshop.

This meeting will bring all the key stakeholders together to debate alternative strategies. It is hoped that the product of these discussions will be a conservation strategy and a plan of action for the subspecies. The participation of a high-level delegation from the Government of Zaire, together with key players from the captive community, will facilitate the implementation of any plan to come from the meeting.

I look forward to reporting on further progress on this issue in my next Chairman's report.

## 1996 AIRSG meeting

The third meeting of the AfRSG is scheduled to take place at Itala Game Reserve in KwaZulu, Natal, South Africa, from 12 to 17 February 1996. I look forward to seeing all members of the AfRSG at the meeting. The holding of the meeting, as usual, will be contingent on obtaining sufficient funding. These meetings, which are held about every 18 months, are critically important for reviewing the status of rhino conservation in Africa and for developing appropriate strategies and action plans to ensure the rhino's long-term survival. Any interested donors are requested to contact the AfRSG Chairman as soon as possible.

Apart from collating data on poaching statistics and numbers and distribution of rhinos in Africa, the meeting will identify priority projects that need funding.

The results of recent international studies of the costs and benefits of different approaches to rhino conservation, and the economics of rhino conservation and trade, are awaited with particular interest and will be subjected to rigorous debate.

## Poaching

It appears that in the first half of 1995, levels of poaching stabilised in a number of countries. This largely reflects the fact that most rhinos now occur in small, well protected and managed "sanctuaries". Sadly, the rhinos occupying the vast, unfenced expanses of land where they once roamed in large numbers, but where it was not possible to deploy sufficient manpower, have now either been poached out or reduced to low numbers. The stabilisation of poaching levels in South Africa in part reflects that some conservation agencies have increased their anti-poaching and intelligence efforts in the face of increasing threats. There is no room for complacency. As long as there is an illegal demand for horn, *in situ* populations will continue to be threatened.

The real challenge facing managers of *in situ* populations is to obtain adequate funding to ensure that good security and intelligence are maintained. The lack of funding is becoming a major challenge facing rhino conservation agencies, which in recent months have continued to suffer budget cuts in real terms as government grants have either been cut or have failed to keep pace with inflation. This trend is of great concern considering that successful rhino conservation and protection is expensive. For example, it has been estimated that to conserve rhinos *in situ* successfully may cost as much as $1,000 - $1,200 per km$^2$ per year. Indeed, history shows that successful rhino protection measures in Africa have been strongly correlated with expenditure.

Reduced funding for *in situ* conservation programmes threatens much of the progress achieved to date. The funding of *in situ* conservation programmes therefore should become a priority for interested NGOs and foreign governments.

## UNEP Elephant and Rhino Conservation Facility

At a meeting between the IUCN Elephant and Rhino Specialist Groups and the Facility in October 1994 agreement was reached on the relative roles and responsibilities of the two organisations. One of the major roles of the Facility was to provide funding for priority projects and activities of the Specialist Groups and to acquire information and to develop plans, which, for the AfRSG, is done at our "annual" meetings. Unfortunately no such support has been forthcoming, but we remain committed to the liaison in the hope that the Facility will soon complement our efforts by providing funds.

## Action Plans

Funding has been obtained by the IUCN/SSC to print an updated African Rhino Action Plan. We are working to meet deadlines for production and publication by the end of September, 1995.

Members of the AfRSG played a major role in drafting the revised black rhino conservation plan for South Africa and Namibia. This plan was developed under the auspices of the Rhino Management Group.

## Newsletter

The format of the newsletter has been designed and the necessary software and hardware has been obtained for its production. Requests for material and country reports from members have been sent out and some material for the first edition has been received. Members of both the AfRSG and AsRSG will be sent copies. Anyone else wishing to be put on the mailing list for the newsletter, or to contribute to it, is asked to contact the Scientific Officer, Richard Emslie, at Box 662, Pietermaritzburg, 3200, South Africa, Fax ++27 331 473278,
e-mail "remslie%npb.natalparks@ahub.csir.co.za" .

## AfRSG key issue report No. 1

In the last few months the AfRSG produced a key issue report on the subject of the controversial media allegations that numbers of rhino had crashed in Hluhluwe-Umfolozi Park and 800 had been "lost". The report concluded that the population had not crashed and that the population was likely to be nearer to the official Natal Parks Board's estimate of 1,800 rather than the 1,214 counted during a helicopter count. The report pointed out the problems inherent in unreplicated helicopter counts, emphasising that many animals are missed from the air. Raw helicopter count totals need to be adjusted to account for under-count biases to produce estimates of the actual population size, but the use of such correction factors is fraught with problems. The review supported the Natal Parks Board's use of Line Transect Distance Estimation as the method best able to estimate population size.

Following distribution of this report, the Scientific Officer was requested to participate in a workshop on population estimation in Hluhluwe-Umfolozi Park convened by the Natal Parks Board, and was able to present the strengths and weaknesses of the various techniques for estimating population sizes of rhinos.

The Scientific Officer also visited Kruger National Park to give a seminar to senior Park management and research staff, and to discuss the use and relative merits of various black rhino monitoring techniques, and their suitability to Kruger National Park conditions.

## Strategy for range states with small populations

A number of countries with very small populations, often of indeterminate size, have been contacted and encouraged to undertake baseline surveys to assess rhino numbers and distribution. Such information is essential for the drawing up of action plans that are generally required before external donors will consider funding. The AfRSG has offered to assist by providing technical support and advice.

## Zimbabwe conservancy review

Earlier this year, the Scientific Officer visited Zimbabwe at the request of the Rhino Custodians Committee to undertake an independent assessment of the relative demographic success and habitat suitability of the Midlands rhino conservancy compared to the lowveld conservancies (using Save Valley as an example). A report has been sent to the Zimbabwean Department of National Parks and Wild Life Management (DNPWLM), and the Custodians Committee, for their attention.

There are exciting developments in the Zimbabwean lowveld where the introduction of black rhinos on a custodianship basis has catalysed the development of a game and ecotourism industry. Economic studies suggest that the development of the wildlife industry will achieve superior economic returns to cattle farming, create more higher paying jobs and generate

much valuable foreign exchange for Zimbabwe. Thus it appears the rhinos are playing an important role in providing benefits for people.

## Scientific Officer

Apart from assistance with the day-to-day running of the AfRSG office, advising the Chairman on issues, helping to set up meetings, and undertaking projects, the Scientific Officer is being regularly called upon to:

- Review rhino project applications (eg, for Universities, WWF, IRF, and Zimbabwe DNPWLM.
- Give technical assistance to those in the field regarding population estimation of rhino numbers, and in particular in the use of Bayesian Mark-Recapture techniques.
- Comment on rhino habitat suitability and the effects of management actions on potential black rhino carrying capacities.

# RAPPORT DU PRESIDENT: GROUPE DE SPECIALISTES DU RHINOCEROS AFRICAIN

Martin Brooks

Natal Parks Board, PO Box 662, Pietematzburg 3200, South Africa

## Atelier sur la préservation du rhino blanc du Nord

La réunion devant discuter et réviser les différentes options de gestion de préservation en vue d'améliorer la survie du rhino blanc du Nord aura lieu au Centre de Conservation de White Oak, en Floride, USA, du 18 au 20 octobre 1995. Les membres du Groupe de spécialistes de rhinocéros africain (GSRAf) sont chargés d'organiser la réunion mais aussi de rassembler toute la documentation nécessaire à la réunion.

Cette réunion rassemblera toutes les personnes clefs pour débattre des alternatives stratégiques. On espère que le produit de ces discussions amènera une stratégie de conservation pour la sous-espèce et un plan d' action. La participation d'une délégation de haut rang venant du Gouvernement du Zaïre, avec des agents importants de la population vivant en captivité, facilitera la réalisation de tout plan issu de la réunion.

Je me réjouis de vous faire part des progrès de cette question dans mon prochain rapport de président.

## Réunion du GSRAf en 1996

La troisième réunion du GSRAf doit se tenir dans la Réserve de Faune d'Itala, au Kwazulu Natal, en Afrique du Sud, du 12 au 17 février 1996, et je me réjouis de retrouver tous les membres du GSRAf à cette occasion. La tenue de la réunion dépendra comme d'habitude de l'obtention de fonds suffisants. Dois-je encore dire que ces réunions qui ont lieu environ tous les 18 mois sont d'une importance vitale pour réviser le statut de la conservation des rhinocéros en Afrique et pour la mise au point de stratégies et de plans d'action appropriés pour garantir leur survie à long terme. Tous les donateurs qui sont intéressés sont priés de contacter le président du GSRAf le plus vite possible.

La réunion va rassembler des données sur les statistiques de braconnage, le nombre et la répartition des rhinos en Afrique, mais elle va aussi identifier les projets prioritaires qui nécessitent un financement.

Nous attendons avec un intérêt tout particulier les résultats des récentes recherches internationales sur les coûts et les avantages des différentes approches de la conservation des rhinos et sur leur aspect économique; ils feront l'objet d'un débat très rigoureux.

## Braconnage

Il semble qu'au course de la première moitié de 1995, le braconnage se soit stabilisé dans un certain nombre de pays. Ceci est principalement la conséquence du fait que la plupart des rhinos se trouvent maintenant

dans des “sanctuaires” restreints, bien protégés et bien gérés.

Il faut hélas reconnaître que les grands espaces non clôturés où les rhinos avaient l’habitude de vivre, mais qu’il n’était pas possible de faire protéger par un personnel assez nombreux, ont été soit complètement braconnés soit considérablement réduits. La stabilisation du braconnage en Afrique du Sud reflète en partie le fait que certains organismes de conservation ont accru leurs efforts contre le braconnage et pour les investigations face à des menaces croissantes. Il n’ya a pas lieu d’être conciliant. Tant qu’il y aura une demande illégale pour de la corne, les populations sauvages resteront menacées.

Le vrai défi à relever pars les gestionnaires des populations en liberté, c’est de trouver des financements suffisants pour s’assurer qu’une bonne sécurité et un bon service policier sont maintenus. Le manque de fonds devient un problème majeur pour les organismes responsables de la protections des rhinos; elles ont ces derniers mois continué à subir des réductions réelles de leur budget, soit parce que les allocations du gouvernement avaient été coupées, soit parce qu’elles n’avaient pas suivi le cours de l’inflation. Ces tendances sont très inquiétantes dans la mesure où la conservation et la protection des rhinos sont coûteuses. On a par exemple estimé que la protection efficace de rhinos *in situ* pouvait coûter jusqu’a 1.000 ou 1.200 dollars par $km^2$ par an. En effet, le passé nous apprend que l’efficacité des mesures de protection des rhinos en Afrique est étroitement liée à leur coût.

La réduction du financement des programmes de conservation *in situ* menace sérieusement les progrès réalisés à ce jour. C’est pourquoi le financement de programmes de conservation *in situ* devrait rester ou devenir une priorité pour les ONG ou les gouvernements étrangers intéressés.

## Dispositif de protection du pnue pour l’éléphant et le rhino

Lors d’une rencontre entre les Groupes de spécialistes des éléphants et des rhinos de l’UICN et le Dispositif en octobre 1994, on s’était mis d’accord sur les rôles et les responsabilités respectifs des deux organizations. Une des rôles principaux du Dispositif était de faciliter le financement des rojects prioritairs et les activités des Groupes de spécialistes qui doivent rassembler des informations et préparer des plans d’action, ce qui, dans notre cas, se fait lors de nos réunions “annuelles”. Malheureusement, nous n’avons pas reçu ce support mais nous maintenons notre association dans l’espoir que le Dispositif deviendra bientôt complètement opérationnel et pourra assister nos efforts par un financement.

## Plans d’action

Nous avons obtenu un financement de la CSE/UICN pour imprimer un Plan d’action pour le Rhino Africain. Nous travaillons pour respecter les délais de production et de publication, à la fin de septembre 1995.

Les membres du GSRAf ont été très utiles en rédigeant 1’avant-projet du plan de conservation du rhino noir pour l’Afrique du Sud et la Namibie. Ce plan a été mis au point sous les auspices du Groupe de Gestion des Rhinos.

## Périodique

Le format du périodique a été choisi et on a acquis le matériel software et hardware nécessaire pour le produire. On a envoyé aux membres les demandes pour de la matière et des rapports nationaux et on a reçu quelques documents pour la première édition. Les membres du GSRAf et du GSRAs en recevront des exemplaires. Toute personne désireuse de figurer sur le mailing pour le périodique ou pour y participer est priée de contacter le responsable scientifique, Richard Emslie à la Box 662, Pietermantzburg, 3200 South Africa, Fax ++ 27331 473278, e-mail” remslie%npb.natalparks@ahub.csir.co.za” .

## Rapport-clef N⁰1 du GSRAf

Ces derniers mois, le GSRAf a produit un rapport-clef au sujet des allégations controversées de média selon lesquelles le nombre des rhinos s’était effondré au Parc de Hluhluwe-Umfolozi et que 800 d’entre eux avaient été “perdus”. Le rapport concluait que la population ne s’était pas effondrée et qu’elle était probablement plus près de l’estimation officielle de 1.800 donnée par le Conseil d’administration des parcs du Natal que des 1.214 recensés lors d’un comptage par hélicoptère. Le rapport soulignait les problèmes inhérents à tout comptage par hélicoptère non répété, insistant sur le fait que beaucoup d’animaux passent inaperçus d’en haut. Les totaux bruts des comptages par hélicoptère doivent être ajustés pour tenir compte des dénombrements insuffisants afin de donner des estimations de la taille réelle de la population, mais l’utilisation même de tels facteurs de correction est une

source de problème. L'examen encourageait le Conseil des Parcs du Natal à utiliser l'estimation par transects, comme étant la méthode la plus à même d'estimer la taille d'une population.

Suite à la distribution de ce rapport, le responsable scientifique fut prié de participer à un séminaire sur les estimations de populations au Parc de Hluhluwe-Umfolozi, organisé par le Conseil des parcs du Natal et put rendre compte des avantages et des faiblesses des différentes techniques pour l'estimation de la taille des populations de rhinos.

Le responsable scientifique rendit aussi visite au Parc national Kruger où il dirigea un atelier pour le personnel d'encadrement de la gestion et de la recherche dans le parc, et où il discuta de l'utilisation et des mérites respectifs de diverses techniques de surveillance de rhinos noirs et de leur adéquation aux conditions du Parc Kruger.

## Stratégie pour les états de l'aire de répartition avant de petites populations

On a contacté un certain nombre de pays qui ont de très petites populations, de taille souvent inconnue, et on les a encouragés à entreprendre des évaluations élémentaires du nombre et de la répartition de leurs rhinos. De telles informations sont très importantes pour la conception de plans d'action qui sont généralement nécessaires avant que des donateurs étrangers n'envisagent une contribution financière. Le GSRAf a proposé d'apporter son aide au niveau technique ou scientifique.

## Analyse de la conservation au Zimbabwe

Au début de cette année, le responsable scientifique a visité la Zimbabwe à la demande du Rhino Custodians Committee pour entreprendre une évaluation indépendante respectivement de la réussite démographique et de l'adéquation de l'habitat dans la stratégie de protection des rhinos dans les Midlands, comparées à celles des basses terres (la Save Valley servant d'exemple). Un rapport a été envoyé pour être sournis à l'attention du Département zimbabwéen des Parcs Nationaux et de la Gestion de la Faune sauvage et du Custodians Committee.

On a observé des développements fascinants dans les basses terres zimbabwéennes, où l'introduction de rhinos nours qui doivent rester sous bonne garde a catalysé le développement d'une industrie d'écotourisme. Des analyses économiques laissent entendre que le développement d'une telle industrie suscitera des retombées économiques intéressantes sur l'élevage, créera un nombre supplémentaire d'emplois mieux payés et génèrera des rentrées de devises au Zimbabwe. Il apparaît donc que les rhinos jouent un rôle important et procurent des avantages aux populations locales.

## Responsable scientifique

Mis à part son aide à la gestion quotidienne du bureau du GSRAf, les conseils qu'il peut donner au président sur les différents sujets, sa collaboration à l'organisation des réunions et le démarrage de projets, on fait souvent appel au responsable scientifique pour:

- Analyser les demandes de projets pour les rhinos (par ex. pour les universités, le WWF, l'IRF ou le Département des Parcs du Zimbabwe).

- Apporter une assistance technique à ceux qui sont sur le terrain pour les estimations du nombre de rhinos et en particulier pour l'utilisation de la Bayesian Mark-Recapture Techniques.

- Donner son avis sur l'opportunité d'un habitat et sur les effets des activités de gestion sur le nombre de rhinos noirs que peut éventuellement accueillir un endroit.

# CHAIRMAN'S REPORT: AFRICAN ELEPHANT SPECIALIST GROUP

Holly T. Dublin

WWF Regional Office, PO Box 62440, Nairobi, Kenya

The last issue *of Pachyderm,* released in March 1995, generated much positive comment from the readership and helped to highlight the main issues surrounding the problem of human-elephant conflict on the continent. Recognising the priority of conflict, the AfESG is currently supporting two research projects, one in Cameroon and one in Zaire, which are examining aspects of elephant crop-raiding. Thanks to generous donor funding the AfESG is in a position to offer small grants to additional projects which, for example, seek solutions to conflict problems, or implement and evaluate innovative methods of management.

In February 1995, several AfESG members were invited to attend a workshop in northern Cameroon to discuss strategies for approaching the human elephant-conflict situation in Kaelé (see *Pachyderm* 19). One presentation which was received enthusiastically was Clem Coetsee's summary of family elephant translocation methodology, which he pioneered in Zimbabwe. The comparison of the Cameroon situation to that of Zimbabwe pointed out the numerous practical aspects which have to be considered for a successful translocation. There has been a dramatic increase in public interest for this option of elephant management, but careful thought needs to go into the long-term effects of translocation, in relation to both the source and the translocated populations.

This is a subject which may be discussed at our next AfESG meeting, which is scheduled to take place in February 1996 in South Africa. AfESG members will shortly be receiving invitation letters, but meanwhile, I would encourage members to send in suggestions for working group topics. As usual, the meeting will form a venue for technical discussion and for updating information on range and population size estimates of the African elephant. In this context, we are hopeful that the update of the African Elephant Database, which is now in its final stages of completion, will be made available to the membership before the meeting.

In my last report, I noted that the AfESG was making a concerted effort to support elephant work in West and Central Africa. We have moved ahead with plans to open a small office, with a Programme Officer, to serve better the membership in these regions. The office is tentatively going to be located in the Cameroon and although we have experienced some delays with the recruitment process we hope that the office will be functional soon.

# RAPPORT DE LA PRESIDENTE: GROUPE DE SPECIALISTES DE L'ELEPHANT AFRICAIN

Holly T. Dublin

WWF Regional Office, PO Box 62440, Nairobi, Kenya

Le dernier numéro de *Pachyderm,* paru en mars 1995, a suscité chez ses lecteurs de nombreux commentaires positifs et a fait ressortir les principales questions que pose le problème des relations hommes-éléphants, à l'échelle du continent. Conscient de la priorité du conflit, le GSEAf soutient actuellement deux projets de recherche, un au Cameroun et un au Zaïre, qui étudient les différents aspects des récoltes dévastées par les éléphants. Grâce au généreux fiuiancement de donateurs, le GSEAf est en mesure d'attributer quelques subsides à des projets supplémentaires qui chercheraient par exemple des solutions aux problèmes de conflits, ou qui amélioreraient et feraient le bilan de nouvelles méthodes de gestion.

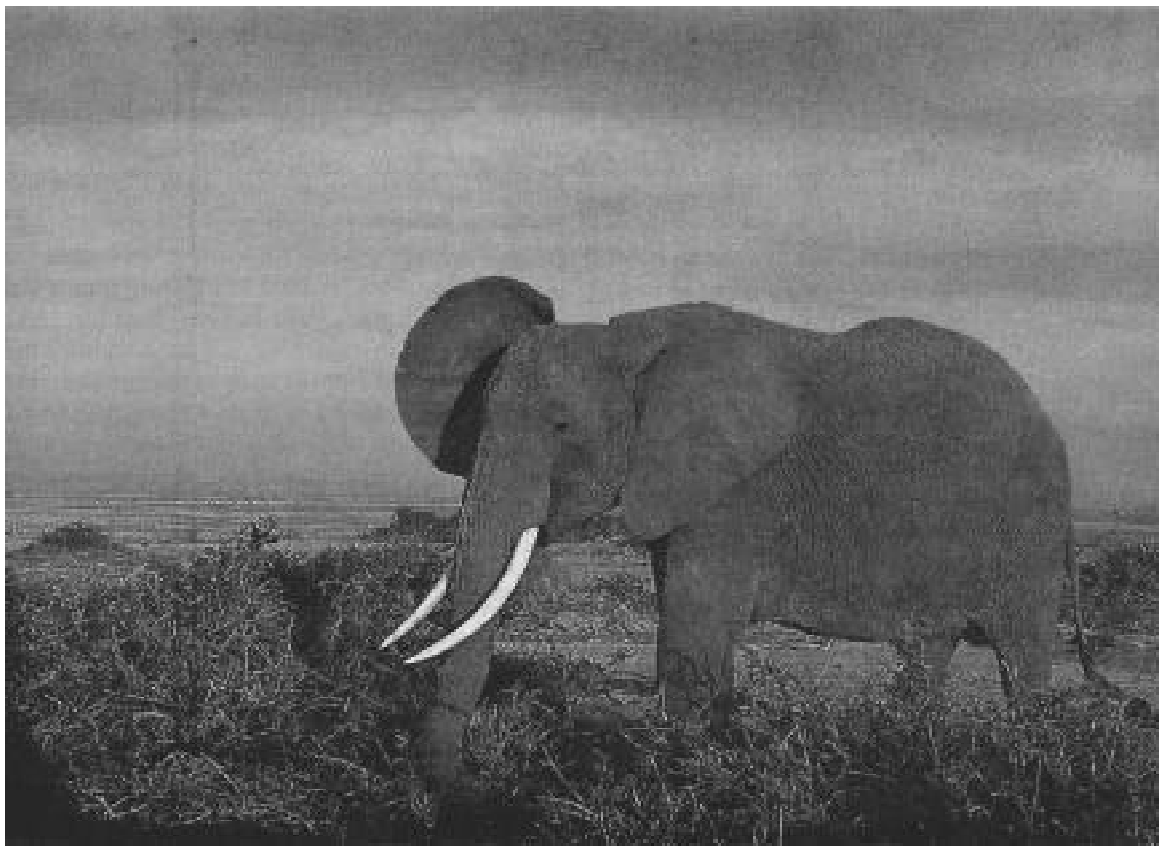
En février 1995, plusieurs membres du GSEAf furent invités à participer à un séminaire au nord du Cameroun pour discuter les différentes stratégies d'approche de la situation conflictuelle qui oppose les hommes aux éléphants à Kaélé (voir *Pachyderm*

n$^0$ 19). Une des présentations qui a suscité le plus d'enthousiasme fut le résumé donné par Clem Coetsee de la méthodologie de translocation d'une famille d'éléphants qu'il a inaugurée au Zimbabwe. La comparaison entre la situation prévalant au Cameroun avec celle du Zimbabwe a pu souligner de nombreux aspects pratiques qu'il faudra considérer pour réussir une translocation. L'intérêt général pour cette option de gestion des éléphants s'est considérablement accru, mais il faut étudier soigneusement les effets à long terme d'une translocation, tant en fonction de la population d'origine que de celle qui est déplacée.

C'est un des sujets dont nous devrons discuter lors de la prochaine réunion du GSEAf, qui est prévue pour février 1996, en Afrique du Sud. Les membres du GSEAf recevoir incessamment leur invitation mais en attendant, je voudrais déjà demander aux membres d'envoyer des suggestions pour les sujets à débattre par les différents groupes de travail. Comme d'habitude, la réunion sera l'occasion de discuter d' aspects techniques et aussi de remettre à jour les informations sur la répartition et les estimations des éléphants africans. Dans ce contexte, nous espérons que la remise à jour de la Banque de Données sur l'Eléphant Africain, qui est maintenant très près d'être complète, sera accessible aux membres avant la réunion.

Dans mon dernier rapport, j'avais signalé que le GSEAf faisait un effort certain pour soutenir les travaux sur les éléphants en Afrique occidentale et centrale. Nous avons progressé et prévoyons d'ouvrir un petit bureau, avec un responsable de programme, pour mieux s'occuper des membres de ces régions. Ce bureau devrait se trouver au Cameroun et, même si nous avons dû subir des retards dans le processus de recrutement, nous espérons qu'il sera bientôt fonctionnel.

Photo credit: John Matkin



*An elephant in Amboseli National Park, Kenya.*

# NEPAL'S RHINOS — ONE OF THE GREATEST CONSERVATION SUCCESS STORIES

Esmond B. Martin and Lucy Vigne

c/o WWF Regional Office, PO Box 62440, Nairobi, Kenya

Photographs by Esmond B. Martin

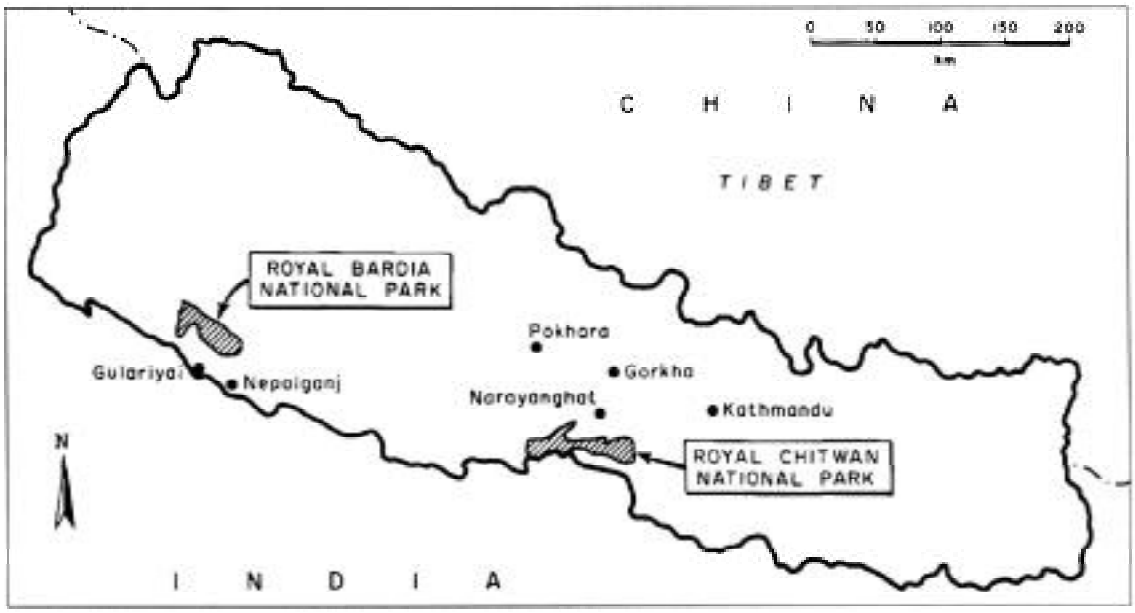



*Figure 1: Map of Nepal showing the location of Royal Bardia and Royal Chitwan National Parks.*

## INTRODUCTION

Nepal has two national parks inhabited by the greater one-horned rhino, *Rhinoceros unicornis* (see maps in Figures 1-3). Within the Chitwan valley, the Royal Chitwan National Park was gazetted in 1973 and made a World Heritage Site in 1984. Now covering an area of 932km$^2$, its rhino population has grown in number from around 100 in the mid-1960s to 450 in 1994. This achievement has been due primarily to His Majesty the King of Nepal's commitment in protecting the rhinos, and since 1990, to His Majesty's new government's efforts. This is one of the greatest conservation success stories in the world for the rhinoceros. From 1986 to 1991 38 rhinos were translocated from the Chitwan area to Royal Bardia National Park to form another population. Bardia had been gazetted as a wildlife reserve in 1976, and was expanded to cover 968km$^2$ in 1984, and then made into a national park in 1988 due its large numbers of ungulates and tigers (Upreti, 1994).

Despite Nepal's gradual increase in rhino numbers since the late 1960s, in 1992 18 Chitwan rhinos were illegally killed, the highest number since the 1 960s, and poaching increased in Royal Bardia National Park also. Reasons for Nepal's success in curtailing rhino poaching and opinions as to why rhino poaching in Nepal increased in 1992 will be discussed in this paper, as well as recommendations for further improvements to Nepal's excellent rhino conservation efforts.

## ROYAL CHITWAN NATIONAL PARK

### A general history of rhino poaching and protection in the Chitwan area

In 1950 Chitwan's rhino population numbered about 800 animals (see Table 1). In 1951, the Rana ruling family, Nepal's hereditary prime ministers, was overthrown and many of the rhinos were shot dead illegally in that decade by Nepalese and Indians. The horns were sold in India. There was also massive human settlement at that time due to a malaria

*Table 1. Number of rhinos in the Chitwan valley, and from 1973 in Royal Chitwan National Park*

| Year | Number | Comment | Source |
|---|---|---|---|
| 1950 | 800 | Estimate | Willan (1965), in Laurie (1978) |
| 1957 | 400 | Estimate | Stracey (1957) |
| 1959 | 300 | Estimate | Gee (1959) |
| 1961 | 165 | Estimate | Spillett (1966) |
| 1966 | 100+ | Estimate | Spillett & Tamang (1966) |
| 1968 | 81-108 | Helicopter census | Caughley (1969) |
| 1972 | 120-147 | " " | "Pelinck & Upreti (1972) |
| 1978 | 270-310 | Estimate | Laurie (1978) |
| 1988 | 358-376 | Census by photos | Dinerstein & Price (1991) |
| 1994 | 440-460 | Ground census | Yonzon (1994) |

eradication scheme and over half the area became agricultural land. Then, realising that the numbers of rhinos had declined to about 300 in the late 1950s and that there had been a 70% reduction in forest and grassland areas, His Majesty's Government of Nepal created a deer park in part of the Chitwan valley. Due to lack of law and order, however, poaching and habitat loss continued. By 1968, there were estimated to be only around 100 rhinos remaining.

Traditionally, each head of State has had to perform a sacred ceremony offering rhino blood from a newly killed animal to the Hindu gods; this is called the Blood Tarpan ceremony (Martin, 1985). This has meant that the rhinos have had to be strictly protected for future generations. So, when His Majesty's Government finally gained control of the country, it gazetted Chitwan as a National Park, and a special "Rhino Patrol" or Gainda Gasti was established under the

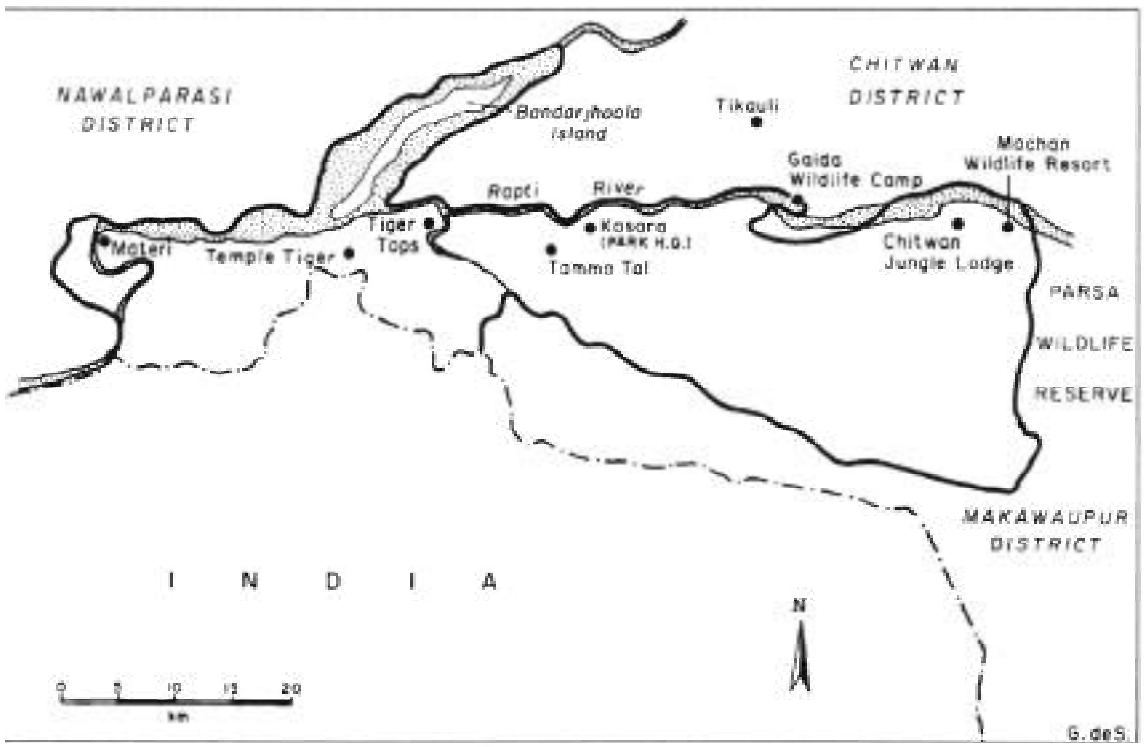



*Figure2: Map of Royal Chitwan National Park*

*Table 2. Number of known rhinos poached in the Chitwan valley before 1973, and from 1973 in Royal Chitwan National Park.*

| Year | No. | Comment | Source |
|---|---|---|---|
| 1954 | 72 | min. no. poached | Talbot (1960) |
| *1958* | *60* | " " | *Gee(1959)* |
| 1973 | 5 | | D.N.R.W.C* |
| 1974 | 2 | | " |
| 1975 | 0 | | " |
| 1976 | 2 | | " |
| 1977 | 0 | | " |
| 1978 | 0 | | " |
| 1979 | 0 | | " |
| 1980 | 0 | | " |
| 1981 | 0 | | " |
| 1982 | 0 | | " |
| 1983 | 0 | | " |
| 1984 | 2 | | " |
| 1985 | 0 | | " |
| 1986 | 3 | | " |
| 1987 | 0 | | " |
| 1988 | 3 | | " |
| 1989 | 1 | | " |
| 1990 | 3 | | " |
| 1991 | 1 | | " |
| 1992 | 17 | | " |
| 1993** | 4 | | " |

**Dept. of National Parks and wildlife conservation*
** * January to November*

*Table 3. Number of known rhinos poached from 1973 outside Royal Chit wan National Park*

| Year | No. | Source | Year | No. | Source |
|---|---|---|---|---|---|
| 1973 | 2 | D.N.P.W.C. | 1984 | 4 | D.N.P.W.C. |
| 1974 | 2 | " | 1985 | 2 | " |
| 1975 | 1 | " | 1986 | 0 | " |
| 1976 | 0 | " | 1987 | 0 | " |
| 1977 | 0 | " | 1988 | 0 | " |
| 1978 | 0 | " | 1989 | 0 | " |
| 1979 | 0 | " | 1990 | 1 | " |
| 1980 | 0 | " | 1991 | 1 | " |
| 1981 | 0 | " | 1992 | 1 | " |
| 1982 | 0 | " | 1993* | 4 | " |
| 1983 | 0 | " | * January to November | | |

Forest Department in the same year (1973) to protect rhinos that wandered outside the Park. Three years later His Majesty the King stationed units of the Nepali Royal Army inside the Park, enabling the National Parks staff to concentrate their efforts on Park management. There was originally one company, and poachers initially feared the army; no rhino poaching is known to have occurred from 1977 to the end of 1983. Poachers then learned that the army did not patrol very effectively. At least 19 rhinos were illegally killed from 1984 to 1990 in the Chitwan area, although in 1987, three companies had been sent to guard Royal Chitwan National Park, and by 1988 there was a whole battalion; poaching pressure continues into the 1990s, despite this large security force within the Park.

Until 1990, the horns and nails from dead rhinos were taken to His Majesty the King's Palace in Kathmandu. These included horns from the occasional rhino shot by His Majesty the King's party from 1951 to 1990 on Royal hunting expeditions to the Chitwan area (Martin, 1985). Since then, with the election of the new democratic government, all rhino horns and nails and some skin, collected from rhino carcasses or taken from poachers, are kept locked up in Kasara in the centre of the Park, or in Tikauli if they are found outside the Park. On 1 January 1994 the storeroom at Kasara held 30 horns, while the one in Tikauli had 18 weighing 15kg in total.

## Recent rhino poaching in the Chitwan area

Unlike most other countries with rhino populations, Nepal's rhino numbers have been steadily increasing in recent years from around 100 in 1966 to 270-310 in 1978, reaching 358-376 in 1988, and according to the latest census carried out on elephant back from 2 March to 19 April 1994, a total of 440-460 rhinos were counted. The population has increased by an estimated 5.6% a year on average from 1966 to early 1994 (Leader-Williams, pers. comm.). These figures show that rhino poaching has been under control since the I970s and continues to be negligible. Poachers

*These Forest Department officials are responsible for protecting rhinos that wander out of Royal chitwan National Park into the Tikauli area.*

have killed an average of only 4.7 rhinos per year from 1984 to November 1993 in and around the Park (see Tables 2 and 3). Most poachers are from the Tharu and Tamang tribes. Sometimes they are organised by a local leader who will provide them with guns and ammunition. The size of a gang varies from two or three for shooting or snaring a rhino, to five or six for pit-digging, but gangs of more than ten are known. Most poaching pressure is in the grassland areas where rhinos occur in highest density, especially along the floodplain of the Rapti River, the Tamma Tal and on Bandarjhoola island. An estimated 23% of Royal Chitwan National Park is grassland as opposed to 70% sal *(Shorea robusta)* forest and 7% riverine forest (Yonzon, 1994).

Several methods are used to kill rhinos. Pit-diggers make large rectangular pits at night on a rhino's path into which the animal may fall, but this can be a slow way of catching a rhino. In 1992 over 50 pits were known to be dug, but only 14 rhinos were caught in this manner in the Park. The poisoning of rhinos has been attempted several times through placing poison in maize and pumpkins near the Park in an area commonly visited by a rhino (Martin, 1992). After eating the poisoned food, the rhino takes up to five hours to die, and often the animal cannot be found by the poachers. Wire nooses and heavy spears suspended in trees are other techniques used to kill rhinos. These methods usually are not very effective as it may take three days or more to catch a rhino and in the meantime the army are likely to have found the traps. Rifles are by far the most effective weapons, and automatic ones have been commonly used since 1992. Occasionally, however, rhinos are wounded by a bullet and take several days to die. For example, in December 1993 one such rhino was found injured; for four days 20,000 visitors came to see the animal, many of whom annointed its skin with vermilion powder, burnt incense sticks and offered fruit for the animal's well-being. Some spectators cursed the poacher, while many prayed for the rhino's recovery. There were eight guards and 70 to 80 local volunteers who protected the wounded animal. When the rhino eventually died, the Forest Department staff cut off the horn, skin and hooves, while the villagers took the rest of the carcass except the bones (Santosh Nepal, DFO Nawalparasi, pers. comm.).

When a poaching operation is successful, the poachers take the animal's single horn and sometimes its hooves. In 1993 a gang was paid about 50,000 to 100,000 rupees ($1,087 to $2,174) for an average 700gm horn (about $1,553 to $3,106 per kg), and 4,000 rupees ($87) for the animal's 12 nails. In 1992 the first middleman in the chain (who bought from

the poachers) sold the horn for 300,000 to 400,000 rupees ($7,042 to $9,390) per kg, but by late 1993 these middlemen were able to sell a horn for around 550,000 rupees ($11,224) per kg (Tika Ram Adhikari, Assistant Warden, Royal Chitwan National Park, pers. comm.). The buyers are usually from Narayanghat, Pokhara and Kathmandu, and they export the horn from Nepal usually by aeroplane to eastern Asia.

Fake rhino horns are occasionally put on the market. In 1993 five such horns made of buffalo and cow horn were intercepted in Chitwan and Nawalparasi districts, along with their maker who lived in Gorkha district. He had sold them to five people for 1,000 rupees ($22) each; all the people involved were arrested as it is illegal to buy and sell fake rhino horns because of fraud (Adhikari, pers. comm.).

## Rhino anti-poaching units in the Chitwan area

In recent years, the Department of National Parks and Wildlife Conservation, the Forest Department (including the Gainda Gasti) and the army have all continued to be involved in anti-poaching work in and around Royal Chitwan National Park, sometimes with financial assistance from NGOs.

In 1993 the National Parks Department consisted of 256 staff in the Park (including 150 workers for 50 domestic elephants), with a warden and three assistant wardens, 10 rangers, 12 senior game scouts and 60 game scouts. Morale is good: as well as a salary, the staff receive a uniform each year, free rations, housing and medical assistance. Park staff carry no guns, however, as anti-poaching patrols inside the Park are supposedly the job of the army only. In mid-1993, following the sudden 1992 poaching increase, however, two anti-poaching units were created by the National Parks Department: one in the east of the Park and one in the west, including Bandarjhoola island. Each unit has six men: a senior game scout, two other Department staff and three local villagers. The units are proving a success in collecting information on poachers, but they do not yet have any guns so the units cannot combat poachers actively.

The Forest Department has three District Forest Officers (DFOs) around the Park whose main job is tree protection outside the Park. Rhino anti-poaching work is considered only a minor duty. Nevertheless, the DFO in Chitwan district at Tikauli to the north of Royal Chitwan National Park has forest guards who are conscientious and patrol their area at night. There is also a DFO in Nawalparasi district, to the west of the Park, with 98 forest guards. These men carry 50 to 60.303 rifles, and 15 of the guards patrol for rhinos. There are 25 resident rhinos within 60 km$^2$ of this district plus 10 to 15 migrants in the season. None was poached in 1991 or 1992, but two were killed in 1993. There is a third DFO in Makawaupur district, near Parsa Wildlife Reserve to the east of the Park, but there are seldom rhinos in the district so poaching pressure is not a problem there.

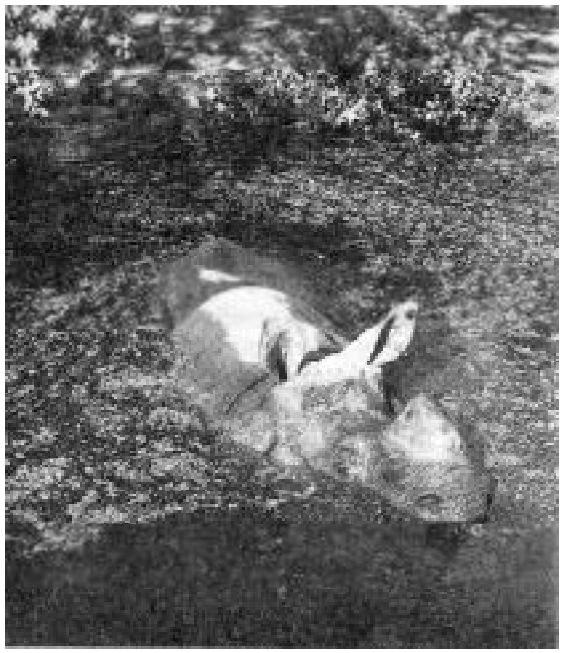
The Gainda Gasti has worked under the DFOs around the Park for 20 years, continuing to patrol just outside the Park's borders in order to protect any straying rhinos. They are knowledgeable about rhinos, with much experience. There were about 150 guards until December 1993 when the special unit was amalgamated with the Forest Guards. They are now called Armed Forest Guards and their primary work is to protect the trees outside the Park; rhinos have thus had to become a lesser concern. The 150 guards patrol on foot and have 70 to 80 .303 rifles and 10 pistols.

In charge of the army is a Lieutenant Colonel who has 800 men in one battalion. Due to leave and training time, there are about 550 men working on any one day; they are divided into five companies stationed at 30 posts inside the Park. Soldiers have a one-month training period and spend two years working in the Park before being transferred elsewhere in the country. Most of Nepal's parks and reserves are still guarded by the army, a heritage of His Majesty the King's former government. The soldiers are supposed to patrol day and night inside the Park to stop all forms of poaching. They carry .762 self-loading rifles. They are not involved in information-gathering in the villages as they operate only inside the Park, unlike the National Parks and Forest Departments who have informers in the villages and in the small towns along the highway.

## The intelligence system in the Chitwan area

As well as good patrol work, one of the best deterrents to poaching is a good intelligence system. Until rhino poaching was stopped in the late 1970s, His Majesty the King gave rewards of up to $400 for information leading to the arrest of poachers (Martin, 1985). When poaching restarted in 1984, an intelligence system was set up until 1988 when it was terminated because of government budget cut-backs, and due to the difficulty of accountability for cash funds spent on rewards for information (Adhikari, pers. comm.). The UK-based

*In January 1994 the Forest Department at Tikauli recorded 18 rhino horns weighing about 15kg; these horns had been collected from animals that died outside Royal Chitwan National Park or had been confiscated from, illicit traders.*



*The greater one-horned rhino, along with the Javan or lesser, one -homed rhino, has a single horn. I-loin from the greater one -horned rhino is ten times more valuable than horn from Africa's rhinos.*

International Trust for Nature Conservation took over as the providers for informant money, as unlike the Department, the Trust could provide ready cash. Since January 1991, 1TNC has given 2,000 rupees (about $45) a month for informers. This small amount has been extremely effective in catching poachers. As a direct result of ITNC support, eight rhino poachers and eight tiger poachers were caught in 1991, three tiger poachers in 1992, and in 1993, with additional funds of at least 138,000 rupees ($3,000), 37 rhino poachers and three tiger poachers were apprehended (Adhikari, pers. comm.) (see Table 4). Most of these were local villagers; they were all caught with evidence. In early 1994 these poachers were still in jail awaiting trial.

*Table 4. Number of poachers arrested in and around Royal Chitwan National Park*

| Year | Rhino poachers | Tiger poachers | Total |
|---|---|---|---|
| **1991** | 8 | 8 | 16 |
| 1992 | 0 | 3 | 3 |
| 1993 | 37 | 3 | 40 |

*Source: Royal Chitwan National Park*

When a poacher is caught, pressure is sometimes used to extract evidence. At other times, a member of the Department of National Parks and Wildlife Conservation may pose as a buyer to catch poachers and confiscate the horns, and often he works in conjunction with the two DFOs. Tika Ram Adhikari believes that giving rewards for information is the most cost-effective anti-poaching system, and that if he were given 200,000 rupees (worth $4,348 in 1993) each year, he could catch almost all the poachers.

In April 1993, punishment for rhino poachers was increased from five years in jail and/or a 15,000 rupee ($326) fine to a maximum 15 years in jail and a 100,000 rupee ($2,174) fine, a further deterrent to poachers.

## Attitudes of the villagers around Royal Chitwan National Park towards rhinos

With an increasing human population around the Park, and increasing rhino numbers, negative feelings towards rhinos have risen; perhaps 75% of the local villagers now dislike the animals (Ganga Thapa, the King Mahendra Trust for Nature Conservation, pers. comm.). This is because about 7% of the rhino population live outside the Park, disturbing the people and their livelihood. Old rhinos, especially, tend to wander out of the Park to eat rice as they cannot compete for grass inside; these old rhinos either die of natural causes or get speared. Generally, villagers chase the rhinos away rather than kill them, despite damage to crops being very severe in certain areas. For example, over 60% of the paddy lost to wild animals is caused by rhinos which often trample the paddy at night. Recent research has shown that wild animals, especially rhinos, boars and spotted deer, destroy 13.2% of the crops around Royal Chitwan National Park each year (Nepal & Weber, 1993). No compensation is paid. It is probable, however, that villagers equalise their losses by illegally entering the Park to obtain firewood, grasses, fodder, fish and medicinal or edible plants.

Rhinos are also dangerous to people. In 1993 one person was killed outside the Park, while five illegal grass cutters were injured inside the Park as well as one member of Parks staff (Adhikari, pers. comm. and Ram Prit Yadav, Warden, pers. comm.). No fixed compensation is paid for death.

Villagers have other reasons for complaint. The soldiers sometimes treat them badly, beating those they catch for stealing thatch or wood instead of reporting them to the National Parks headquarters. Technically, villagers are fined 60 rupees for trespassing in the Park, and 20 rupees for each of their domestic animals found in the Park. Despite fines having been doubled since 1988/9, there has been no decrease in trespassing (Sharma, 1993). The army arrested about 11,000 people inside the Park (mainly women) from March to December 1993, and about 25,000 cattle were impounded (Lt. Col S.R. Pradhan, Commanding Officer of the army battalion in Chitwan, pers. comm.); these figures are probably the highest in Asia for any protected area with rhinos. The villagers dislike the sometimes arrogant soldiers and they feel deprived by them of their former rights to Royal Chitwan National Park. Lack of firewood and fodder are the villagers' main grievances over the Park.

It is very important to have the full co-operation and support of the villagers. Park officials realise the importance of benefits to the locals, and some valuable measures exist. Since 1976, grass and reed cutting has been permitted for a certain period each year. In recent years, for 15 days every January, villagers pay five rupees each for a permit to enter the Park as often as they wish, in order to collect thatch grass, reeds and binding materials, mainly for house construction; this is a significant benefit to the villagers, worth $500,000 a year (Sharma & Shaw, 1993a). In 1993, 65,254 permits were issued.

Another practical benefit for the local villagers is that when a rhino is found dead - after officials have removed the horn, hooves and skin - the villagers are permitted to help themselves to blood (which is thought to regulate menstruation), urine (which is consumed to alleviate respiratory disorders) and meat (which is eaten either dried or as a stew to give extra energy). The blood and urine are particularly popular in Nepal.

Some villagers in addition benefit from work in tourist lodges and camps which employ over 650 people during the tourist season from October to May (although many jobs are also given to outsiders as the local tribal Tharus are not as well trained to deal with foreign tourists). The tourist industry has expanded greatly from 836 foreign visitors to Royal Chitwan National Park in 1974 to 55,335 in 1992 (see Table 5). There are at least 46 lodges and hotels around the Park with six more under construction, and there are seven establishments inside the Park. Over 80% of the visitors are foreigners who pay 650 rupees ($14) to enter the Park and another 650 rupees per hour for a ride on a National Parks elephant. Foreign tourism is the second largest earner of foreign exchange in Nepal *a*nd significantly helps the local villagers in employment.

*Men of the Royal Nepal Army check vehicles traveling in Royal Chitwan National Park in order to make sure that the entrance fees have been paid and that wildlife products are not being smuggled out of the Park.*

Tourism may become an even more important benefit to the local villagers, as an Act was passed in 1993 stating that 30% to 50% of Chitwan's revenue would go to the local community, rather than the Central Treasury, for development projects and in order to create an impact zone around the Park. The impact zone would be managed by villagers and Park staff. Trees would be planted in the zone, enabling the villagers to collect legal firewood; the impact zone would also create a buffer for the rhinos and other wildlife while allowing cattle grazing, thus lowering pressure on the Park's resources and reducing the problem of the villagers' lack of firewood and fodder (U.R. Sharma, Director General, Department of National Parks and Wildlife Conservation, pers. comm.).

## Royal Chitwan National Park's budget

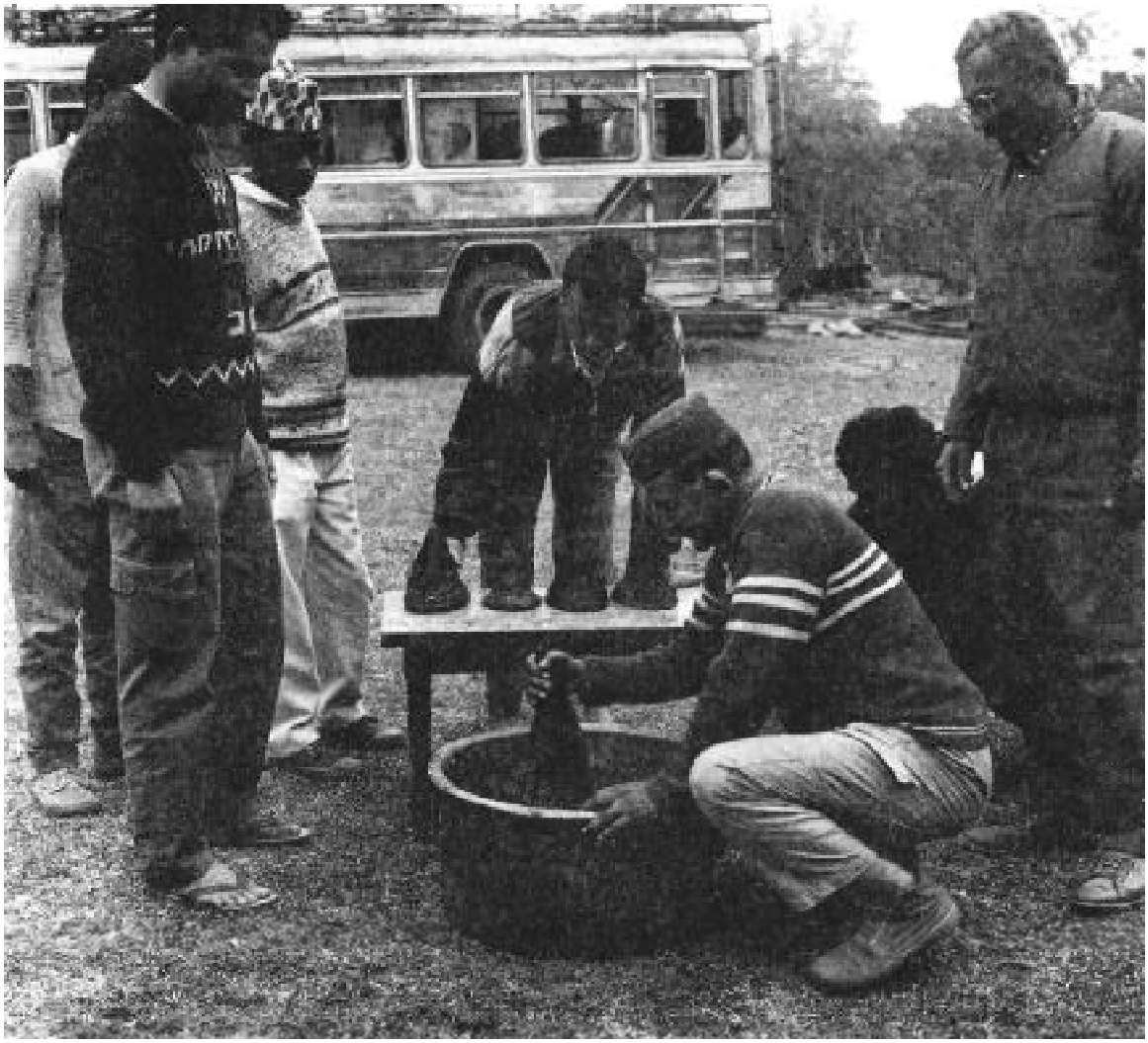
In 1993/4 the total government budget of Royal Chitwan National Park, which included maintaining an elephant breeding centre and 50 domestic elephants

*Table 5. Number of foreign tourists to Royal Chitwan National Park*

| Year | Number | Year | Number |
|---|---|---|---|
| 1974 | 836 | 1984 | 14,166 |
| 1975 | 2,206 | 1985 | 14,156 |
| 1976 | 5,021 | 1986 | 25,156 |
| 1977 | 5,547 | 1987 | 33,225 |
| 1978 | 8,325 | 1988 | 34,606 |
| 1979 | 6,290 | 1989 | 36,275 |
| 1980 | 8,116 | 1990 | 36,072 |
| 1981 | 8,464 | 1991 | 43,750 |
| 1982 | 11,570 | 1992 | 55,335* |
| 1983 | 11,763 | | |

** This includes not more than 10,000 Nepalese visitors a year but no exact figures are available.*

*Tourist fees (late 1993): Entry fee for foreigners 650 rupees for 2 days. Entry fee for Nepalese 1O rupees for2 days. Elephant ride per person 650 rupees per hour.*
*Source: Royal Chitwan National Park*



*At Tikauli, members of the Forest Department occasionally put rhino horns into boiling water to kill insects. in the background is a confiscated bus which was used to carry illegal supplies of wood.*

for patrolling and tourism, was 38,613,940 rupees ($804,457) of which the army received 65%. The total budget for the Park for the same financial year, which included the government's contribution and assistance from non-government sources of at least another $3,375, amounted to $867 per km$^2$, a very large sum, especially for such a poor country. The Park's revenue, mainly from tourism, but also from penalties and grass and reed cutting, was 39,600,000 rupees ($893,905) in 1992/3 or $959 for each km$^2$ of the Park. For the last few years, the Park's earnings have been very similar to its expenditure, which is very unusual in Asia. Royal Chitwan National Park probably produces more income per km$^2$ than any other park in Asia with a rhino population.

## Reasons for 1992's sudden increase in rhino poaching in and around Royal Chitwan National Park

Since 1973, most rhino deaths in the Chitwan valley have been due to natural causes (see Table 6). In 1992, however, more rhinos were killed illegally than in any other year since the late 1960s - at least 18 (see Table 7) - exceeding deaths by natural causes for that year. From August 1992 to January 1993, 14 were killed in pits, two were snared with cables, one was shot and one was speared. A minimum of four were killed in the Park in 1993 (see Table 8) and four more outside the Park. Although not biologically significant, this rise in poaching has caused concern.

*Table 6. Number of rhinos killed by tigers and number that died of natural causes from 1973 to 1990 in and around Royal chitwan National Park*

| Year | Inside Park | | Outside Park | |
|---|---|---|---|---|
| | Killed by tigers | Natural deaths | Killed by tigers | Natural deaths |
| 1973* | 2 | 4 | 0 | 4 |
| 1974 | 1 | 7 | 0 | 4 |
| 1975 | 0 | 2 | 1 | 5 |
| 1976 | 0 | 1 | 1 | 1 |
| 1977 | 0 | 5 | 0 | 2 |
| 1978 | 0 | 7 | 0 | 4 |
| 1979 | 0 | 6 | 0 | 2 |
| 1980 | 0 | 8 | 1 | 2 |
| 1981 | 0 | 3 | 0 | 8 |
| 1982 | 0 | 7 | 0 | 6 |
| 1983 | 1 | 2 | 0 | 3 |
| 1984 | 0 | 2 | 0 | 8 |
| 1985 | 0 | 2 | 0 | 4 |
| 1986 | 0 | 2 | 0 | 4 |
| 1987 | 1 | 5 | 0 | 4 |
| 1988 | 1 | 0 | 0 | 2 |
| 1989 | 2 | 6 | 0 | 1 |
| 1990 | 0 | 3 | 0 | 5 |

** Park started in January1973.*
*Source. Royal Chitwan National Park, and Ministry of Forest and Soil conservation*

*The Forest Department at Tikauli collects dead rhino products including headskins with ears. These are put onto rooves to dry.*

*Table 8. Number of rhinos poached and methods used in Royal Chitwan National Park in 1993.*

| Area inside Park | Poaching type | No. of rhinos |
|---|---|---|
| Bandarjhoola island | chain noose | 1 |
| Near Temple Tiger | bullets | 2 |
| Near Materi | bullets | 1 |
| **Total** | | **4** |

*NB These are minimum numbers; rhinos die deep in the forest and cannot be found, their bodies decompose.*
*Source: Royal Chitwan National Park.*

*Table 7: Number of rhinos poached and methods used in and around Royal Chitwan Park in 1992.*

| Area | Type of poaching | Number of rhinos |
|---|---|---|
| Inside Park near Machan Wildlife Resort | pit trap | 2 |
| Inside Park near Gaida Wildlife Camp | pit trap | 4 |
| Inside Park on Bandarjhoola island | pit trap | 6 |
| | snares | 2 |
| Inside Park near Temple Tiger | rifle/shotgun | 1 |
| Inside Park near Chitwan Jungle Lodge | pit trap | 2 |
| Outside Park near Chitwan Jungle Lodge | pit trap | 1 |
| **Total** | | **18** |

**Source: Royal chitwan NatiOnal Park**

Rhino poaching Increased in 1992 for various reasons. Firstly, the prices in rupees for rhino horn rose in Nepal. Some tiger poachers thus switched to killing the more lucrative rhinos, which may also help to explain the fact that there was a decline in tiger poaching during that time (C. McDougal, tiger researcher, pers. comm.).

Secondly, with the new democratic government, it became harder to convict a poacher. The National Parks Department presently has a list of 80 identified poachers, all Nepalese, who cannot be convicted due to lack of evidence.

Thirdly, the new democracy has also led to conflicts amongst some government staff. It is now sometimes more difficult to discipline officials, and inefficiency has consequently increased. It is harder also to get rid of ineffective members of staff. A further problem has been that four different Director Generals of National Parks have been in office from 1991 to the end of 1993, which disrupts policies and continuity. In addition, government policy has been to reduce most departments' staff, and National Parks' mid-level staff were cut by 30% in the headquarters and 25% in the field in 1993.

The fourth and main reason for the increase in rhino poaching, however, was poor leadership in Royal Chitwan National Park at the time. So much depends on a good leader, and the main cause of rhino poaching decreasing or increasing unexpectedly in certain years is usually the competence or incompetence of those in charge. Before 1990, the Palace could directly order the army and other sectors of government to patrol more rigorously if leadership slackened. Now, the forest guards are fully controlled by the DFO, the Parks Department by the Park Warden, and the battalion's effectiveness depends on the commitment and strength of the Lieutenant Colonel. If these leaders are weak, ineffective or lazy, the system suffers.

The army is not obliged to patrol extensively, and this duty became even less effective than usual in the early 1990s. The army's patrol work has limitations anyway due to the regular times the men must be in camp. The presence of guard posts inside the Park is a better poaching deterrent than the limited patrolling. The worst poaching in 1992/3 was on the western side of the Park, including Bandarjhoola island where there were insufficient numbers of army posts.

Another problem is that conflict can occur between the commanding officers and the park wardens, and if the army's co-operation is lost, poaching pressure increases. This is unacceptable when one considers that 65% of the Park's budget goes to the army for Park protection.

Furthermore, soldiers generally dislike working at Royal Chitwan National Park as they fear the rhinos; their training for rhino patrol work is inadequate and two years in the Park are not long enough to gain the needed experience. If the two-year posting is lengthened, as occurred in 1992 when the same soldiers were in the Park for two and a half years, efficiency levels drop as the men so much want to leave. The soldiers consider Royal Chitwan National Park to be a hardship post.

It is interesting to note that in the bad year of 1992 there was one area with no rhino poaching: that of Nawalparasi district (see Table 9). This was directly the result of good patrolling which in turn was due to a hard-working District Forest Officer who motivated his men (Adhikari, pers. comm.).

*Table 9. Minimum number of rhinos poached in and around Royal Chitwan National Park*

| Year | Area within Park | Chitwan district | Nawalparasi district |
|---|---|---|---|
| 1990 | 3 | 1 | 0 |
| 1991 | 1 | 1 | 0 |
| 1992 | 17 | 1 | 0 |
| 1993 | 4 | 2 | 2 |

*Source: Royal Chitwan National Park, and Ministry of Forest and Soil Conservation*

## Recommendations for improving rhino conservation in and around Royal Chitwan National Park

- A special Parks unit inside the Park and a special Forest unit outside the Park should be established to deal specifically with rhino protection.
- The new anti-poaching units of the Department of National Parks and Wildlife Conservation, although good at collecting information on poachers, need guns, walkie-talkies and camping equipment if their tasks are to include effective patrol work.
- The number of game scouts inside the Park should be increased from 60 to 100.
- More army posts should be set up in the western side of the Park, including the river areas and Bandarjhoola

*For 15 days a year local people are allowed to collect thatch grass, reeds and binding materials from Royal Chitwan National Park Much fire wood, however, is smuggled out of the Park concentrated in the grass bundles.*

island where there has recently been an increase in poaching.

- More walkie-talkies and transport should be supplied to the army posts.
- Leadership effectiveness, in all anti-poaching sectors, should be regularly checked, and incompetent leaders replaced immediately.
- The frequent changing of the Director General of Parks needs to be stopped.
- There should be a significant increase in funding for the intelligence system operated by the Park Warden and the DFOs.
- Publicity in the local newspapers is needed, stating the truth that the price of rhino horn has fallen in the Far East, in order to deter poaching.
- Conditions for the villagers need to be improved by implementing the plan for an impact zone around the Park. Villagers also need to be encouraged to plant more trees, make gas from cow dung, improve the uses of agricultural waste from rice straw and promote the use of stall feeding so the number of domestic animals illegally entering the Park would be reduced (Sharma, 1989; Sharma & Shaw, 1993b).

## ROYAL BARDIA NATIONAL PARK

### The history of Royal Bardia National Park's rhinos

Royal Bardia National Park is a large area of lowland, similar in size and habitat to Royal Chitwan National Park, in the more remote, south-west part of Nepal. In order to start a new rhino population in Nepal, rhinos were translocated there from the Chitwan area: 13 in 1986 and 25 in 1991. The first group of rhinos was

taken to the west side of the Park to the Karnali floodplain. Of these first 13 rhinos, three crossed the border into India and one was illegally killed. The second group of rhinos was released in the more remote and rugged eastern section of the Park in the Babai valley. Four of these rhinos were poached in 1992/3. From 1986 to early 1994, however, at least 17 calves were born. Of the Park's total rhino population, by early 1994 eight had been poached, four had died of natural causes, three of unknown causes and one was killed by a tiger (see Table 10). Thus Royal Bardia National Park had 39 rhinos (both adults and calves) in 1994 (R.K. Thapa, Ranger, pers. Comm.).

*Table 10. Known deaths of rhinos in Royal Bardia National Park*

| Year | Natural death | Poaching | Tiger predation | Unknown causes | Total |
|---|---|---|---|---|---|
| 1986/7 | 1 | 0 | 0 | 0 | 1 |
| 1987/8 | 0 | 0 | 0 | 0 | 0 |
| 1988/9 | 0 | 1 | 0 | 0 | 1 |
| 1989/90 | 0 | 0 | 0 | 0 | 0 |
| 1990/1 | 0 | 0 | 0 | 0 | 0 |
| 1991/2 | 1 | 2 | 1 | 2* | 6 |
| 1992/3 | 1 | 4 | 0 | 0 | 5 |
| 1993/4 | 1 | 1 | 0 | 1* | 3** |

*Source: Royal Bardia National Park*
**babies **early January*

## Rhino poaching in and around Royal Bardia National Park

Poaching is organised by people living mostly to the north of the Park. A gang with a rifle or shotgun consists of two or three local people, but gangs of five or six are common in the remote eastern side of the Park where the poachers are less likely to be spotted. It is in this region that pits are often dug, usually near a rhino track leading to a water hole; many pits are dug at one time. The third method of poaching used in the Park is snaring. A fairly thick electric wire is tied to a tree over a rhino track, and branches are put down to block other paths, so a rhino is forced to follow the route with the snare (Ram Prit Yadav, former Warden of Royal Bardia National Park, pers. comm.).

The Park lost its first rhino to poachers by gunshot in 1988/9 in the north-west part (near Khairbhatti). Two more were illegally shot dead in 1991/2 outside the Park, one west of the Karnali river and the other to the south. In 1992/3 poachers moved to the eastern side of the Park to the newly introduced rhino population in Babai valley; two were killed in wire snares, and two poached by unknown means. In 1993, one more rhino was shot dead in the south of the Park (R.K. Thapa, pers. comm.).

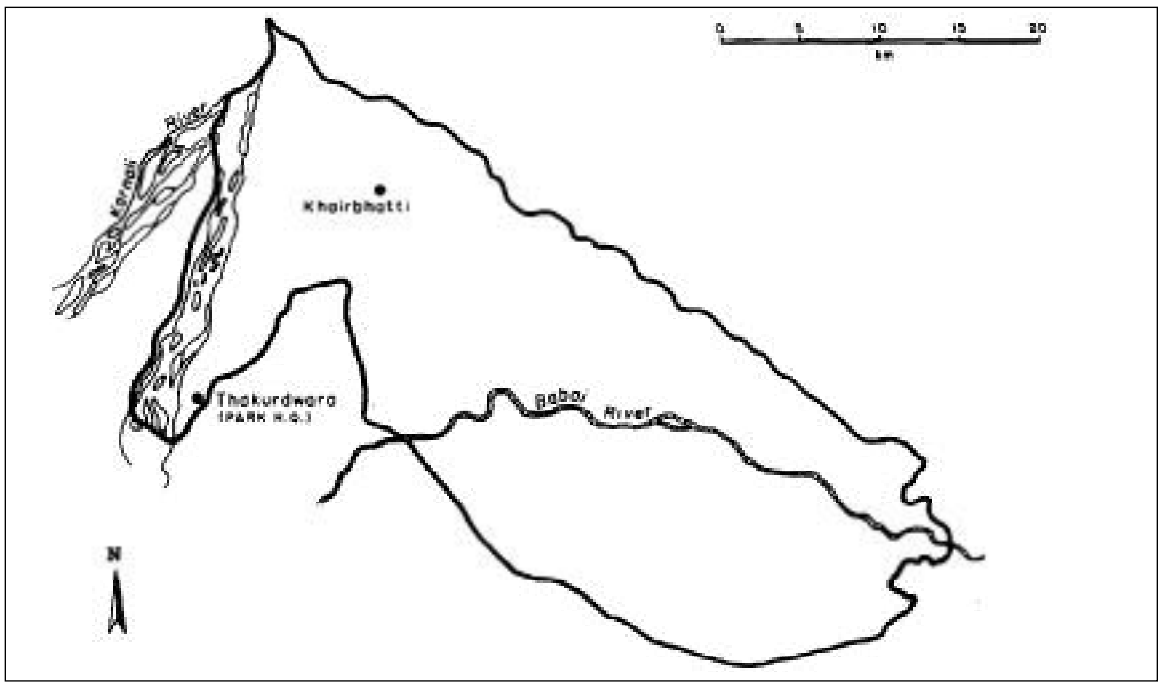



*Figure 3: Map of Royal Bardia National Park.*

Prices paid to poachers and middlemen for rhino horn are not known because information-gathering has been inadequate: But in November 1993 six poachers were caught south of the Park near Gulariyai. They admitted to having killed the rhino in 1993 and selling the horn to a person from Pokhara. Horns are bought probably by businessmen in Pokhara and Nepalganj who may sell them to merchants in Kathmandu who arrange their illegal export.

## Anti-poaching efforts for Royal Bardia National Park

Royal Bardia National Park has never had a Gainda Gasti or special rhino patrol unit; forest guards patrol outside the Park and the army work inside with some help from the Parks Department. There are two army companies of 250 men each, one in the west and one in the east, but only 175 men are available in each company at any one time: In 1992, unlike in Royal Chitwan National Park, the army did patrol Royal Bardia National Park effectively, due to good leadership: However, poaching worsened at that time in the Babai valley, due to lack of staff in the area: Since then, more army personnel have been posted to the valley and poaching has been reduced: Each company has a Major in charge: Patrolling occurs usually three times a day and occasionally at night. Patrol times differ so that the poachers do not know when a patrol is out. Soldiers in the Park think that it is a duty to patrol, unlike those in Royal Chitwan National Park. The Royal Bardia National Parks Department, which has 128 employees, maintains one anti-poaching unit of nine men (five Parks staff and four local men), but they have no firearms: In early 1994, this unit patrolled the western area where there were 13 rhinos. There are also 60 game scouts who patrol with nine domestic elephants, but neither do they have firearms.

## The effect of Royal Bardia National Park on the nearby villagers

Rhino damage is not so severe around the Park compared to Royal Chitwan National Park as there are far less rhinos (39 versus 450); there are also fewer people in this region; furthermore, part of the northern Park boundary is a forest reserve: Some rhinos in the east, however, do eat crops on the Park border, for which no compensation is paid: The re-introduced rhinos had acquired the habit of crop-raiding around Royal Chitwan National Park; they like rice and maize especially: Rhinos also wander out of the Park into the village areas in the west: A report submitted to NORAD in 1993 stated "Preliminary results show that rhinos in the Karnali floodplain (in the west) are causing serious damage to agricultural crops in certain key locations and that harassment and injuries to humans are increasing" (NORAD, 1993): From 1989 to 1992 four villagers were injured, while in 1993 two people were killed by rhinos, one inside and the other outside the Park (Yadav, pers. comm.). There is still no fixed compensation for death:

In order to maintain good relations with the villagers, especially important now with the presence of rhinos, the Parks Department allows the people to receive certain benefits from the Park. There is presently little demand in this area for rhino urine, blood or meat, although the local people do use the skin for religious purposes. Villagers are allowed to cut grass and reeds for 15 days in the winter, and 45,193 permits were issued for 12 rupees each in the 1993/4 season. The Park's tourist industry is presently small, so very little employment is possible. The one tented camp (with 26 beds) inside the Park, and a lodge (with 24 beds) plus two small rest houses outside the Park employed just 54 people in late 1993. Only about 600 foreign visitors came in that year, but this was an increase from 222 in 1988 (see Table 11).

*Table 11. Number of foreign tourists to Royal Bardia National Park.*

| Year | Number | Year | Number |
|---|---|---|---|
| 1984/5 | 212 | 1989/90 | 556 |
| 1985/6 | 20 | 1990/1 | 360 |
| 1986/7 | 115 | 1991/2 | 670 |
| 1987/8 | 222 | 1992/3 | 602 |
| 1988/9 | 314 | | |

*Source: Royal Bardia National Park*

It is hoped that a significant tourist industry will soon be established in the region as the highway to Royal Bardia National Park has now been tarmac'd the whole way from Kathmandu. In the future more money from tourism is due to go to the local people; there is new legislation, as for the Chitwan area, allowing 30% to 50% of the tourist revenue to go into local community development projects and for an impact zone around Royal Bardia National Park: Meanwhile, certain international NGOs are supporting community services, research and monitoring of the rhinos, while also helping to equip the anti-poaching personnel with camping gear and walkie-talkies.

*Rhinos are sacred animals to many Nepalese and almost all parts of the animal are used for religious or medicinal purposes. At Bhatapur near Kathmandu, two rhinos can be seen which were carved from stone several hundred years ago.*

## Royal Bardia National Park's budget

In 1992/3 the Park's budget was 19,524,488 rupees ($440,733) of which the army received 72%. This budget works out at $455 per km$^2$. significantly less than Royal Chitwan National Park's. The earnings of Royal Bardia National Park are also far less: The majority of the income comes from the sale of trees: In 1993, the Park earned just 1,233,249 rupees ($26,810) from all sources. The Park also has less government staff than Royal Chitwan National Park; including the full establishment of the army, the Park has a staff of 0:65 per km$^2$ compared with 1.1 for Royal Chitwan National Park.

## Recommendations for Royal Bardia National Park

- The budget and the number of staff for the Park should be increased, as by January 1994 eight rhinos had been poached and the net increase in rhino numbers from the 38 founder animals was only one in early 1994.
- The Park's anti-poaching unit needs to be increased in size and should be given rifles:
- The intelligence system in the area must be improved significantly, to at least the standards of that in the Chitwan area.

- More fencing around the Park is needed to keep out cattle (although this is not practical for Royal Chitwan National Park due to greater floods and human pressure).

- Relations with the villagers must be improved with local development projects.

- Communication with India should be improved so that any rhinos that cross the border can be recovered.

## CONCLUSIONS

Since the establishment of Royal Chitwan and Royal Bardia National Parks, His Majesty's Government of Nepal has provided a large annual budget to protect the growing rhino population, despite being one of the poorest countries in the world. It has also allocated a large security force, namely the army, to the parks. Royal Chitwan National Park has always had strong support, first under His Majesty's Government and now with the new democratic government; and the Nepalese have managed the rhinos almost entirely by themselves with very little foreign expertise or external funding assistance. The number of rhinos has more than quadrupled since the late 1960s, a testimony to Nepal's great conservation success, enabling a second population to be established in Royal Bardia National Park.

His Majesty's new government is also very aware of the importance of providing benefits to the local villagers around the two parks, such as by allowing tens of thousands of people to enter the parks for valuable grass and reed collection each year, and by permitting them to take certain rhino products from the dead animals. Furthermore, foreign tourism is highly encouraged in Nepal's parks and brings the local villagers much needed employment benefits.

These management strategies have been the right ones. As long as good leadership is maintained within the parks so that patrol work is carried out effectively, and as long as funding for intelligence gathering can be secured (by far the most cost-effective method of stopping poaching), Nepal's rhinos should continue to increase to the parks' carrying capacity. The rise in poaching in 1992 should remain an exceptional case, as lessons from this experience have probably already been learned. Thus, with effective management and leadership, Nepal will maintain its reputation as one of the world's greatest conservation success stories for the rhinoceros.

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# RESEARCH ON THE EFFECTS OF TEMPORARY HORN REMOVAL ON BLACK RHINOS IN NAMIBIA

Malan Lindeque and K. Peter Erb

Ministry of Environment and Tourism, Private Bag 13306, Windhoek, Namibia

## INTRODUCTION

In July 1993, Berger and Cunningham (1993) concluded in an unpublished progress report to the Namibian Ministry of Environment and Tourism (MET) that three black rhinoceros *(Diceros bicornis)* calves had died in the only part of their study area in the Kunene region of Namibia where rhinos were dehorned and where large predators occurred. They claimed that two black rhino calves born in 1992 could not be found in 1993, nor could they find a third calf, never seen, but which was assumed to have been born to a dehorned female which had a swollen udder. All three alleged calf deaths were attributed to predation by spotted hyaenas and lions. This report acknowledged, however, the possibility that only two calves had died and that other factors such as drought could have accounted for their deaths. MET was concerned over several aspects of the report, but officially regarded it as an interim progress report and nothing more.

In February 1994, concern turned to disappointment when it became evident that these preliminary data had been submitted as solid fact in a paper to the policy forum section of *Science (*Berger & Cunningham, 1994a), and were cited as the basis for speculation about the relative efficiency of alternative *in situ* rhino conservation strategies. The conclusion that dehorning might not be an effective strategy was considered by MET to be premature, not supported by adequate data, and not in the best interests of rhino conservation. The authors furthermore chose not to provide clarification on some research methods and the scope of their planned work in 1994 as requested, but terminated their study (even before MET had considered not extending their research permit on the basis of their article in *Science*). They have subsequently gained support for their position from their home base in the USA, for example, in Berger & Cunningham (1994b), Brussard (1994) and Macilwain (1994).

In this paper, we examine the calf mortality data and interpretations presented by Berger & Cunningham (1993, 1994a) and Berger *et al.* (1993). We have foregone the temptation of taking issue with the various allegations and speculations concerning the Namibian wildlife management authority and its policies, or indeed the respective roles of science in wildlife management and foreign scientists in developing countries.

A chronology and summary of the circumstances surrounding the three rhino deaths assumed to have occurred by Berger & Cunningham (1993, 1994a) are presented (see Table), based on Berger & Cunningham (1993), Berger *et al.* (1993), Berger & Cunningham (1994a), and the unpublished data of MET Kunene Region staff and B. Loutit of the locally-based "Save the Rhino Trust" (SRT). The essence of the argument that temporary horn removal increases the risk of spotted hyaena *(Crocuta cmcuta)* predation on calves is given in Berger & Cunningham (1994a). Several points of dispute are highlighted below.

## EXPERIMENTAL DESIGN

Berger & Cunningham (1994a) contrasted calf survival in three areas (known as SR, DC and NYF) of hyperarid broken terrain in the Kunene region of Namibia, previously known as Damaraland. Two areas larger than 1,000km$^2$ (SR and DC) each contained fewer than 20 rhinos which had all been dehorned once since 1989 (See Table). Large predators allegedly occurred only in area SR and in the third region where no rhinos were dehorned (NVF). Apart from our concern over extremely small sample sizes as well as a different conclusion reached by Martin (in press) using the same statistical procedure as Berger & Cunningham (1994a), flaws in the experimental design are obvious to those familiar with the region and the environmental conditions over the past few years. It is our belief that other important differences affecting rhino survival occurred between areas SR, DC and NVF, unrelated to predators or dehorning. The alleged rhino calf deaths coincided with the worst drought in human memory in Namibia. Berger & Cunningham (1993) presented photographic evidence of emaciated adult rhinos in areas DC and SR in 1993, but later claimed that the drought had affected their entire study areas

affect a large part of the Kunene region, but Normalized Difference Vegetation Indices derived from NOAA satellites indicate substantially more actively growing vegetation, and thus biomass, in parts of area NVF than in either DC or SR (unpublished MET data).

Apart from being located in a vegetation zone completely different from the other two areas (Geiss, 1971), area NVF is managed as a tourism concession and *de facto* conservation area with negligible presence of livestock, and is partly fenced by a stock-proof veterinary cordon fence. Areas DC and SR are unfenced communal lands used by semi-nomadic livestock farmers. Surface water is scarce throughout the region, but more so in DC and SR than in NVF. Some 500 small stock (goats and sheep) and cattle were moved into the SR rhino concentration area during the 1993 drought, which severely depleted water supplies and displaced black rhinos from their usual watering points (Loutit & Montgomery, in press; B. Loutit, pers. comm.) A lesser influx of people and livestock occurred over a shorter period in DC but nothing comparable occurred in NVF. Berger and Cunningham must have been aware of this, and indeed have cited the increased pastoral use of areas DC and SR during the drought as probable causes of rhino population decline (Berger & Cunningham, 1993). The experimental design presented by Berger & Cunningham (1993, 1994a) thus represents an artificial

*Table. A chronology of black rhino conservation problems and management intervention in areas SR, DC and NVF of the Kunene region of Namibia.*

| Year | Rhino security risks, management intervention and environment conditIons[1] | Average adult female anterior horn length (cm)[2] in SR | Births from dehorned mothers in SR | Recorded black rhino deaths in the SR part of the Kunene region of Namibia |
|---|---|---|---|---|
| 1989 | High risk in SR, 20 dehorned in SR, 3 translocated from SR | 0 | (1)[3] | |
| 1990 | No poaching in SR or DC, 1 killed in NVF area | 6.4 | - | |
| 1991 | High risk in DC, 8 dehorned in DC | 12.8 | - | |
| 1992 | No illegal hunting in SR or DC, onset of drought, influx of livestock in SR | 19.2 | 2 seen[4]<br>1 inferred[5] | 1 sub-adult (starvation)<br>1 calf inferred[6] (unknown causes) |
| 1993 | No illegal hunting in SR or DC, serious drought; SR adults in emaciated condition[3] | 25.6 | inferred[4] | 3 calves inferred[4] |
| 1994 | No illegal hunting, but security risk growing, drought conditions persist in parts of NVF, SR and DC | 32.0 | 1[7] | 1 adult (from Staphylococcus sp. infection) |

1. *Summarised assessment from unpublished reports and data of MET and B. Loutit.*
2. *Average female anterior horn lengths calculated from Berger et al. (1993).*
3. *This calf was less than three months o/d when his mother was dehorned He has survived (B. Loutit, SRT, and unpublished MET data).*
4. *Two calves were recorded in 1992, and a third was never seen, only inferred from photos of a female with a swollen udder (Berger & Cunningham, 1993).*
5. *Results of a 1992 photographic census of rhinos by SRT and MET*
6. *Calf positively recorded but with no subsequent appearances (B. Loutit, SRT and unpublished MET data).*
7. *B. Loutit, SRT, pers. comm.*

oversimplified experiment (with no control, see Martin, in press) not taking account of other environmental factors, and therefore cannot reveal anything about rhino calf survival as a consequence of dehorning or any other mortality factor.

## PREDATOR AND PREY DENSITIES IN THE KUNENE REGION

A contrast in the experimental design of Berger & Cunningham (1994a) is the presence and absence of large carnivores in three parts of a large study area in northwestern Namibia, variously described as ca. 7,000km$^2$ (Berger & Cunningham, 1994a) or 10,000km$^2$ (Berger & Cunningham, in press) or 4,500km$^2$ (Berger, in press). There are enormous logistical and methodological problems in determining large mammal densities in large areas of broken terrain, especially if an aircraft is not used, as, for example in the study of Berger and Cunningham. The two researchers have not explained their methods of monitoring mammal densities, but these could not have been more than sightings of animals and their tracks at waterholes and along the few roads in the region. Such methods may yield valid estimates of ungulate densities under controlled conditions, but we know of no situation in arid savanna or desert regions where such methods have been considered useful for estimating densities of large African carnivores. Experienced MET ranger and research staff consider it most unlikely that more than 30 spotted hyaenas or more than 1O lions occur in the entire 40,000km$^2$ of the "Damaraland" part of the Kunene region, as also suggested by the low reported incidence of predation on livestock in this region (unpublished data, MET). Berger (in press), concedes an estimate of 1O hyaenas in 4,500km$^2$ in "central Kaokoveld".

The brown hyaena *Hyaena brunnea* (which almost never preys on large mammals [Mills, 1990; Skinner & Smithers, 1990]), occurs throughout the Kunene region of Namibia, and partly overlaps in track dimensions with spotted hyaenas *Crocuta crocuta.* Much of the region has coarse substrates not suitable for accurate distinction between the tracks of related species. Intriguingly, Berger & Cunningham (1993, 1994a) report no hyaena presence from area DC at all, while both species have regularly been recorded there (Skinner & Smithers, 1990; unpublished MET records; pers.obs.) Spotted hyaenas were found at the carcass of the sub-adult rhino which died in 1992 (Table 1) in the DC area which, according to Berger & Cunningham, had no large predators at all. In a later manuscript, Berger and Cunningham (in press) mention that the number of spotted hyaenas had not been determined in their study area, and yet they state elsewhere with conviction that some parts of their huge study area had no hyaenas while other parts did.

We conclude that their survey methods were inadequate, given the importance attached to apparent differences in predator density as a factor in rhino calf survival. There is, in fact, no evidence for predation on rhino calves in area DC, where both species of hyaena occur sympatrically with rhinos which were dehorned in 1991.

## PREDATION ON RHINOS

By accepting that black rhino calves are vulnerable to spotted hyaena and lion predation, one cannot simply conclude that any missing black rhino calves in the Kunene region are therefore killed by predators. No carcasses of any calf born in 1992 or later have been located. There is no evidence to suggest that either predation was the cause of death of three rhino calves when their carcasses were never recovered, or that calf predation was related to a horn reduction exercise three years earlier!

Interesting questions may nevertheless be asked about predation on rhinos, such as "How much horn does a rhino mother need to deal with a predator?", or "Is there an optimal size or shape for a rhino mother's horn?". As evident from the table, Berger (1993a) and Berger *et al.* (1993), the anterior horns of the three dehorned mothers had already regrown to between 19 and 26cm by the time their calves had allegedly disappeared. This length of horn overlaps with the natural distribution of adult horn lengths (Berger *et al.*, 1993). Rhino horn shapes and lengths show extreme variation under natural conditions and the horns are the main features used in individual recognition of rhinos by researchers in southern Africa This suggests that horn dimensions *per se* are not that important for the protection of calves. It seems likely that if maternal horn length and shape are important for the protection of the calf, these parameters would have evolved towards an optimum shape and length rather than varying to the degree seen in all populations.

## TEMPORARY DISASSOCIATIONS BETWEEN RHINO MOTHERS AND CALVES

The fact that black rhino cows hide their small calves has been reported *inter alia* by Joubert & Eloff (1971), Hall-Martin & Penzhorn (1977) and Owen-Smith (1988), and not for the first time as claimed by Berger

(1993b). Berger & Cunningham (1994a) alleged that all three calves disappeared within one year after birth, during the interval that calves are most often hidden (Berger, 1 993b). Berger & Cunningham (in press) also recorded spatial displacement by females of several kilometres in one day in response to human presence. No more extreme than their predation theory is the speculation that Berger and Cunningham's activities and presence might have also affected the period of separation between cow and calf, especially in situations compounded by drought, poor body condition and displacement from watering points.

No data have been published comparing the vulnerability of hidden calves versus those accompanied by their mothers, or the proportion of time spent in hiding at various age intervals. If calves are preyed on whilst in hiding, maternal horn length is of no consequence. This possibility should have been discussed in any paper dealing with predation on rhino calves.

## CONCLUSIONS

Considering that rhino cows hide their small calves; that horn shape and length show tremendous natural variation, indicating the lack of any strong evolutionary selection towards an optimum defensive utility; and considering the adverse habitat conditions experienced by the SR rhinos at the time when they seem to have lost their calves; we have to conclude that there is no support for any claim that a prior dehorning exercise had affected calf survival. No evidence exists that any calf died from predation or any other cause such as being abandoned during extreme drought conditions. Until unambiguous proof exists that the same females which were said to have lost calves, have indeed lost their calves, any conclusion about the effects of dehorning on calf survival is irresponsible speculation.

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# RHINO PROTECTION IN COMMUNAL AREAS, NAMIBIA

Blythe Loutit

Save the Rhino Trust, PO Box 83, Khorixas, Namibia

Namibia's black rhino *(Diceros bicornis bicornis)* population which inhabits communal land in the Kunene Province (previously Kaokoland and Damaraland), was heavily poached in the 1970s and early 1980s. Kaokoland's rhino numbers were reduced to only 10 animals, while Damaraland had between 50 and 60 left. The entire population would certainly have been exterminated if it were not for the timely intervention of locally-based conservationists in 1981 and 1982, to which the Damara, Herero and Himba people gave their full support. Since then, patrols and monitoring of the rhino population have been part of a joint venture between NGOs, Namibia's wildlife authorities and the local community game guards, who give advice about wildlife problems in their communal areas and report to their headmen.

Botanists and geologists who worked in these arid areas in the 1950s and 1960s describe how rhino and elephant used to frequent every waterhole, especially in Kaokoland, the area hardest hit by illegal hunting parties.

The habitats in which rhinos have survived are the arid to extremely arid areas east of the dune desert of the Namib and west of the escarpment. Rainfall is minimal and seldom goes above 100mm per year. There are virtually no people living in the main rhino-inhabited area of Damaraland, it being too dry and the vegetation too sparse for any but the toughest human to endure. In addition, the headmen and councilors have entered into a gentleman's agreement with the local wildlife management officers to discourage subsistence goat herders from encroaching on the remaining rhino habitat.

A small number of rhino (about 15 in all) inhabit the peripheral areas where they come into contact with herders and stock owners. Although conservation in communal areas involves the community directly in decision making, and provides revenue from hunting and tourism, these benefits do not overcome the herders' inherent fear of "dangerous" animals such as the rhino. Many of the traditional stock owners hire outsiders to herd their animals, who have not always grown up with wildlife around them and are therefore less willing to endure living with predators and dangerous large game. However, the herders are justified in complaining about the potential dangers when their women and children collect water from springs shared by rhino. Some herders have requested that the rhinos which stray into their area be removed for the safety of both the people and the rhinos. The herders otherwise protect their scarce water sources with branches, and try to frighten away the wildlife by burning the highly inflammable *Euphorbia damarana* bushes and *Colophospermum mopane* trees. They also make "scarecrows" by tying plastic bags to trees and bushes.

It is well known that *Diceros bicornis bicornis* is normally a shy animal which shuns areas where there is a lot of human activity, instead seeking secluded areas which are less inhabited by humans and their livestock. However, those that do stray into the eastern, more populated areas, which have higher rainfall and more vegetation, are young, sub-adults looking for new home rages in which to settle. These animals are known to be inquisitive and they even walk into human settlements where they are sometimes shot. One young rhino bull that was being tracked by members of the Anti Poaching Unit covered a distance of about 250km before being caught and moved to a small game park. This individual often visited homesteads where cattle were in kraals at night and even lay down to sleep in the manure of a disused kraal. Due to their unpredictable behaviour, such animals may easily charge and cause havoc in their confusion.

Because of local involvement and support from the herders and farmers for extension work by the government and NGOs, the presence of a stray rhino is often reported to the authorities and then followed by trackers. The movement of these sub-adults usually takes place during the rainy season, when early rains attract the unsettled rhinos to the east. However, it is extremely difficult to keep constant contact with such animals. Their tracks are obliterated by showers of rain, and a wandering animal can cover huge distances in search of other rhino. Attempts by the Directorate of Wildlife Management to capture these animals have only been successful on one occasion. Inevitably the

cost, time and manpower needed to follow ad ensure the safety of stray rhinos become too great, and the eventual fate of most of them is unknown.

Rhinos are still occasionally poached for their horn by villagers who are paid by wealthy outsiders. The poachers, whose fire arms are often borrowed, mingle with the herders on the periphery of rhino habitat and help to herd goats until they find an opportunity to shoot a rhino.

Under these circumstances, it is unlikely that rhinos will successfully recolonise the communal areas to the east. Therefore, the safety and security of the rhinos that inhabit the western area, which is virtually uninhabited by humans, remains the priority for the rhino conservation programme.

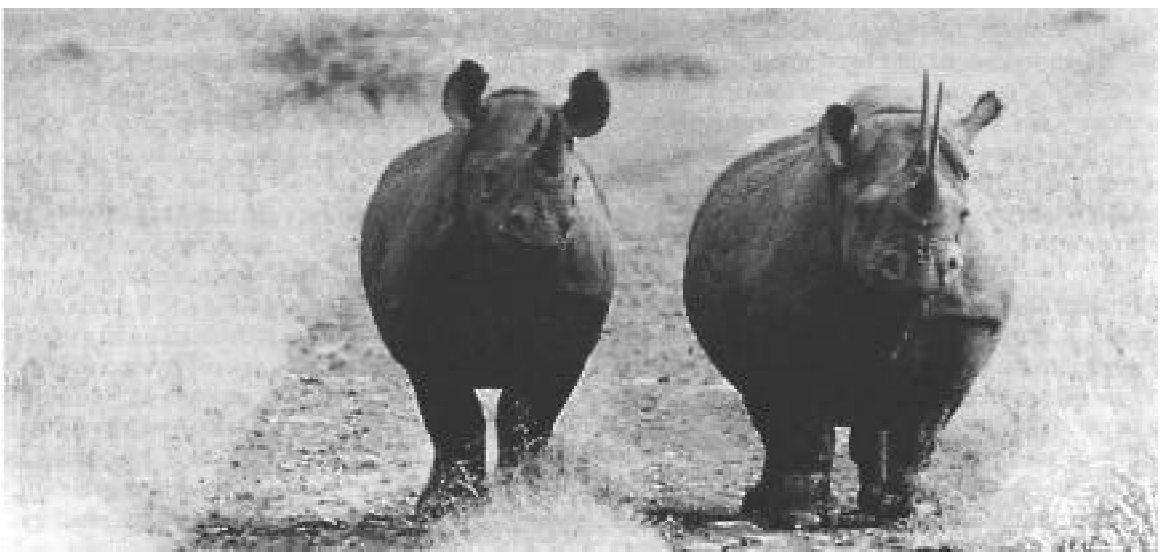
Rhino protection in Kunene Province will depend upon the continuation of combined efforts of government and NGO patrols, individual photographic identification studies of rhinos, monitoring of population trends, local involvement by, and benefits to, the communities, safari concessions ad tourism. Safari concession holders are keen supporters of the rhino protection programme. Specialist safari tours have been introduced which include an outing with the trackers for tourists to "bag" a rhino through the lens of a camera. The fees charged for these safaris are returned directly to the trackers, their families and the rhino protection programme. NGOs, in conjunction with the local Khorixas office of Wildlife and Tourism Management, and members from the community have also built popular rustic tourism camps to cater for campers visiting the area to view its spectacular scenery and its desert rhinos and elephants.

The rhino monitoring staff of the Save the Rhino Trust (SRT) earn a bonus for every rhino properly photographed and identified. This ensures that the monitoring staff take a personal interest in the welfare of the rhinos with which they work. The SRT also pays a reward of N$5,000 for information which leads to the arrest and conviction of a person or persons who shoot rhinos or deal in rhino horn.

The nearest town, Khorixas, is 170km away from Kunene and has about 6,000 inhabitants. Unemployment is high and is matched by a heavy illegal trade in drugs and liquor - an ideal setting for poachers to plan their strategies. In an effort to attract the unemployed to more useful, income-generating occupations, the SRT has, with financial help from CIDA, built a craft market and developed a craft making industry. The increase of tourism to the area attracts about 40,000 tourists per annum. Craft making was non existent in the past and the potential for an increased income for the craft makers is enormous.

The involvement of local communities in the rhino conservation programme in Kunene Province has undoubtedly been of vital importance in helping to eliminate rhino poaching almost entirely. The local people are proud of their achievement and they regard poaching as a crime which can no longer be tolerated, so that when poachers do infiltrate the system, the locals inform the law enforcement officers.

Photo credit: Tim Oloo



*Black rhinos in Kenya.*

# DARTING AND MARKING BLACK RHINOCEROS ON FOOT:

## PART OF A MONITORING AND POPULATION ESTIMATION TECHNIQUE IN HLUHLUWE-UMFOLOZI PARK, SOUTH AFRICA

Norman S. Galli and Jacques R.B. Flamand

Natal Parks Board, Hluhluwe Game Reserve, PO Box 25, Mtubatuba, 3935, South Africa

## INTRODUCTION

It is well known that the number of black rhinos *(Diceros bicornis)* in Africa has declined in recent years and is now estimated at less than 2,550. Black rhinos are currently listed as "vulnerable" both globally and in South Africa (according to IUCN and South African Red Data books). At a meeting to discuss black rhinos in Zimbabwe in September 1985, the Africa Elephant and Rhino Specialist Group (AERSG) of IUCN agreed that all participating countries should draft a National Conservation Plan for the black rhino. The South African/Namibian plan sets out specific goals for black rhino conservation in the region and gives advice on necessary management and monitoring. This plan was adopted in 1989 by all the conservation departments in South Africa and Namibia which are responsible for looking after rhinos. The plan was designed to provide regional goals for the black rhino, as well as guidelines to facilitate their achievement. The primary goals of the plan are to develop, as rapidly as possible, and to conserve, in the long term, genetically viable populations of at least 2,000 *Diceros bicornis* minor and 2,000 *D. b. bicornis* in their natural habitats, and at least 100 *D. b. michaeli* in the wild in the region.

The Rhino Management Group (RMG) was formed in 1989 by all the relevant conservation departments to give support to the plan. The RMG debates the concerns raised by conservation agencies and private owner representatives, develops appropriate strategies, provides advice and co-ordinates certain activities to assist the various agencies in achieving their goals for black rhinos in the region. Annual status reports of all the black rhino populations in the region are submitted to the RMG for comparative data analysis. This analysis helps the reserve management authorities to make sound biological management decisions, which are seen against the regional meta-population goals set out in the plan. The provision of the revised population estimates is a key part of the annual status report.

Close monitoring of rhino numbers is essential to provide revised population estimates for the annual RMG report. According to Brooks (1989), the details of each monitoring programme vary according to the characteristics of the area, the existing population of black rhinos in that area, available manpower and financial constraints. All monitoring programmes need to be strictly controlled, with the appropriate techniques applied, in order to ensure that they are effective in providing field managers with the information required.

As a follow-up to the work of Hitchins on black rhinos in the Zululand Game Reserves, the black rhino monitoring programme in Hluhluwe-Umfolozi Park (HUP) evolved from a concern, expressed by management and research staff, over population numbers. As a result, a monitoring programme was implemented at the end of 1988. Field managers were required to obtain reliable estimates of population size, age and sex structure, and performance of the black rhino population. The monitoring programme was essentially in two parts: 1) the collection of individual black rhino sighting: re-sighting data from the field, and 2) the analysis and interpretation of this data, including the estimation of population size using the "RHINO" Bayesian Mark-Recapture Analysis computer programme (Emslie, 1993). This approach allowed many field managers and game guards to be involved in the monitoring programme from its initial stages, and to develop a personal interest in it.

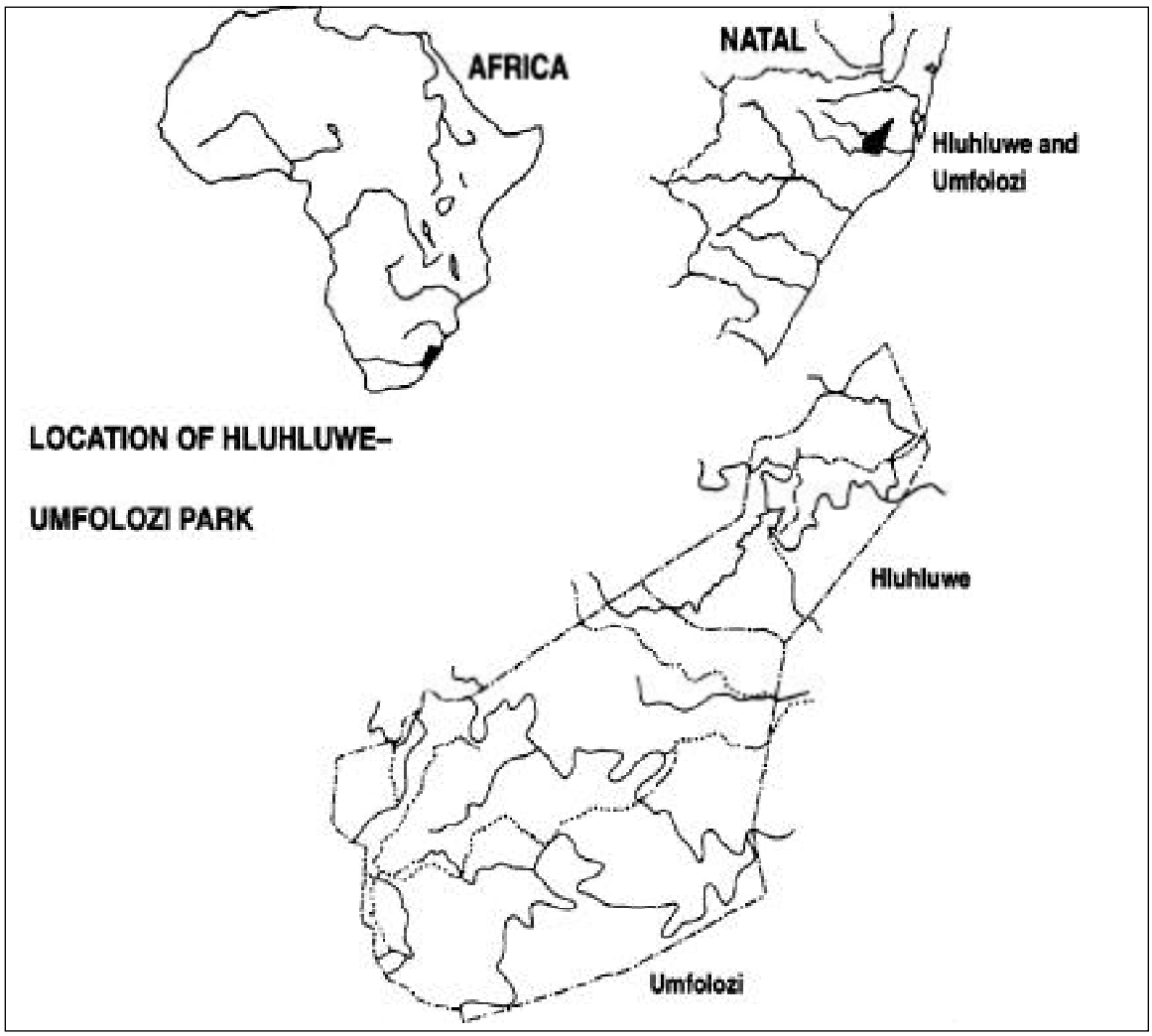
While "RHINO" can estimate the size of a clean (i.e. unmarked) population segment, confidence intervals around clean estimates are larger than around the estimates of the identifiable population segment estimate (Emslie, 1993; Adcock, 1994). Therefore, one way to increase the precision around the total population estimate is to reduce the proportion of the population that is clean by darting and ear-notching animals. In other words, the higher the proportion of the population that is clean, the higher the sample sizes required to obtain precise estimates (Emslie, 1993). Notching has other benefits which allow the reproductive performance of individual females to be monitored.

Provided that the number of sightings is adequate, and if there is a high proportion of clean animals in a population,

"RHINO" still produces unbiased estimates of population size (Adcock, 1994). However, the distribution of the means in surveys with a high proportion of clean animals has been found to be peaked with wide tails. This can affect the likely accuracy of any one single estimate by increasing the chance of getting an extremely high or low single estimate, although in the long term (provided sample sizes are big enough) the estimates will, on average, be unbiased (Adcock, 1994). The variance around clean estimates is higher than around identifiable animals (Emslie, 1993). More explicitly, the marking of clean animals increases both the likely accuracy of population estimates as well as the precision thereof (Emslie, 1993; Adcock, 1994).

Since its implementation, the black rhino monitoring programme in HUP has been carried out on a regular basis with the support of occasional, intensive surveys. The first intensive survey was conducted in 1989 using a fixed-wing aircraft to locate the animals. A ground crew was then dispatched in a helicopter to the exact location of the animals, which were identified, categorised and recorded. Subsequent to the success of this operation it was decided that these surveys should be carried out every second year, depending on the availability of funds.

In 1991, an intensive survey was augmented with the darting and ear-notching of unmarked animals from a helicopter. Ear-notching was also introduced in other parks and reserves within the RMG region as part of the national plan (eg. Mkuzi and Itala Game Reserves, Pilanesberg National Park). The next survey in HUP was due to take place in 1993, but the budget of R25,000 (≈$6,945) was insufficient to cover the costs of using a




*Map of Hluhluwe-Umfolozi Park (HUP), showing its location in South Africa.*

fixed-wing aeroplane and a helicopter. The average cost per rhino in 1991 was approximately R5,000 ( 1,390). Requests for additional funds in 1993 were unsuccessful and the field managers of the Umfolozi section of the HUP proposed that the entire intensive survey be carried out on foot, with the assistance of a suitably experienced wildlife veterinarian.

This paper now describes the ground darting technique used and evaluates the success of the technique in the context of the HUP black rhino monitoring programme.

## MATERIALS AND METHODS

The Umfolozi section of HUP covers 46,000ha of Zululand thornveld (see map). In applying the ground darting technique, the administrative boundaries in the Umfolozi section of HUP were used. This entailed working in four different areas, spending three to five days per area and working in conjunction with the relative section ranger and his staff. There is a network of roads in three of the areas, which facilitated vehicle access. Roads were limited, however, in the fourth area, known as the Wilderness Area.

### Locating the rhino

An initial appraisal of the distribution of black rhinos in each area was carried out by the section rangers. Data collected from the ongoing monitoring programme were used. Areas with the highest concentration of clean (i.e. unmarked) black rhinos were mapped and any females with calves that were old enough (i.e. two years or older) to dart were noted. These areas were used as starting points for game guard patrols. Patrols set out at dawn to locate any clean, black rhinos. Roving patrols on horse-back were also used to locate clean animals and where the terrain permitted, game guards were positioned on high points to survey areas with binoculars and spotting scopes. As soon as a clean animal was sighted, the section ranger was contacted by radio and the darting party was dispatched.

### Materials

Four people usually made up the darting group: a section ranger, the veterinarian and two good trackers. They carried everything they needed in two backpacks. The contents of the packs included immobilising drugs: Etorphine hydrochloride (M99, C-Vet), Acepromazine maleate, Azaperone, antidotes Diprenorphine (M5050), Nalorphine and Naloscone (Narcan), Doxpram (Dopram), a long-acting injectable penicillin (Compropen), an intramammary antibiotic (Streptopen LC), an antibiotic spray (Airbiotic), a number of lml, 3m1, l0ml and 20m1 syringes, 20 and 18 gauge hypodermic needles, plastic 1.1 ml Kruger National Park darts with needles, notching equipment (V notcher. circular punch and hammer), and two artery forceps. A folding gun cleaning rod was also taken to remove darts from the barrel when a dart had to be changed. Also included in the packs was a camera with a 300mm lens, film to record new ear notches, at least five litres of water in various small plastic containers, two towels, a pair of pliers, and the spares for darts and gun. A powder charge dart gun (Palmer long-range projector, adapted to take Kruger National Park darts) was also carried. A cane knife ad bow saw were in hand as were two mobile hand-held radios.

### Darting the black rhino

Reaching the located animal with minimal delay was a priority, and radio contact was essential to achieve this. During the initial stage, vehicles, horses and foot were used to reach the area. The mode of transport depended on the type of terrain and its accessibility.

On arrival, the black rhino was carefully observed by the section ranger and the veterinarian before its suitability for darting was confirmed. The age, condition of the animal, natural ear notches or other distinguishing marks, were all factors taken into consideration. The time of day was also an important factor, and more specifically, a minimum of two hours of daylight to search for a darted animal was considered essential. Careful observation of the particular animal was also required to avoid confusion and to ensure that the right animal was followed after darting, especially if there was more than one animal present prior to darting. On confirmation that the animal was suitable for darting, the darts were prepared by the veterinarian. Game guards were carefully positioned at observation posts and the follow-up team was debriefed. A plan of action was important because as soon as an animal had been darted it often headed for thick vegetation. Before darting, wind direction was always noted. Darting was done from as close as possible to the black rhino, using available vegetation as cover. This distance ranged from l0m to approximately 25m. Animals lying in the shade or in pans were found to be the easiest to approach and to dart. The side of the neck or rump were the targets of choice for darting.

Photo credit: Andrew Anderson, Natal Parks

*A blind-folded, immobilised black rhino in HUP.*

Photo credit: Andrew Anderson, Natal Parks

Photo credit: Craig Reid, Natal Parks

Ear-notched black rhinos in HUP

## Follow-up and notching

Once darted, the rhino would normally run off; it would be kept in sight by the game guards at their observation posts and by the follow-up team. Every effort was made not to frighten the animal during the follow-up period. The darted animal usually slowed down after an initial run. As soon as the rhino was immobilised, it was blind-folded by draping a towel over its eyes. This had a calming effect on the animal and protected its eyes from direct sunlight. Its vital signs were checked constantly and corrections made accordingly. Dart wounds were treated with the intramammary antibiotic to prevent infection and a long-acting antibiotic was injected intramuscularly. Opthalmic ointment was put into each eye to prevent corneal desiccation and infection.

Notches were cut in each ear (V-notches, 3.5cm wide and 3.5cm deep) and the details recorded on a history sheet. The location was noted. Close-up photographs of ear notches were taken and these were later attached to the animal's history sheet. Section rangers are required to keep a file of each marked animal in their area, which includes initial drawings of ear notches, any other recognisable feature/s, age and sex, photographs and a record of all subsequent sightings of the animal. Sighting information is also transcribed onto a map to reflect home ranges.

Once all the materials were packed and personnel were safely positioned in trees or had left the scene, the antidote was administered intravenously. Photographs of the standing animal were also taken where possible.

As soon as it was safe to do so, the darting party would then leave to dart the next rhino. No more rhino were darted if it was late in the afternoon, with less than two hours of daylight remaining.

## Post-operation follow-up

At the conclusion of the darting and notching programme in each area, a follow-up operation was initiated by the relevant section ranger. This involved an intensive two-week search by the section game guards. It was considered important to establish whether cows and calves had re-united. Darted animals which, for some reason, were not immobilised, were also checked.

## RESULTS

Twenty-six black rhinos were darted and marked in 13 days. No injuries or deaths occurred. Most of the cows and calves had re-united by the following day and all within the two-week follow-up period. Three rhinos failed to be immobilised after darting and three darts missed their target.

The time from darting to release ranged from 30 minutes to a maximum of 120 minutes.

## DISCUSSION

The reason for embarking on the 1993 ground darting exercise was to implement a cheaper method for marking a number of black rhinos. It was initially thought that one or two animals could be darted each day; in fact the figure was nearer four to six. Rather than being a better technique than that used routinely by the Natal Parks Board to capture rhinos, it is a useful alternative when funds are limited.

The method described unquestionably takes longer to implement than working from the air. From a helicopter, rhinos can be found, checked for markings, darted and followed up until immobilisation in a few minutes.

Not only did it take a long time to reach a rhino, but the odd rhino could not be found rapidly due to difficult follow-up conditions. (It is important to consider the time of year to undertake such an exercise, to facilitate optimum conditions for tracking.) After darting, almost all animals became frightened and tended to run up-wind and towards riverine areas. They were immediately followed on horseback and on foot, but even so, it was sometimes difficult to find a rhino once it was immobilised, due to it falling into a gully or retreating into thick bush or reed beds. The use of horses, where the habitat allowed, was an essential element for the successful follow-up of most of the animals. Horses made up, in part, for the lack of a helicopter to guide ground teams to a stray rhino. Experience indicates that about two horses are needed. Whilst still keeping the darted rhino in sight, one has to stay as far back as possible and to remain quiet, to avoid stressing the animal and to minimise the chance of it running even further away.

When a cow and calf were to be darted, the calf was darted first. This resulted in much less running (as little as 200m on one occasion) because if the cow was unaware of human presence, she did not charge off. Once the calf had gone down, the cow was reluctant to leave. Furthermore, once darted, the cow still tended to remain with her calf until the effects of the immobilising drug were felt.

Examining the costs per rhino, it is obvious that considerable savings can be made by using the slower, ground technique. A total of 26 black rhinoceros were darted and notched in the 1993 exercise described here. This compares favourably with the number of rhinos darted in the 1991 exercise when 36 animals were immobilised in eight days using a spotter aircraft and a helicopter. The final total cost for drugs and darts in 1991 was R4,290 (≈$1,190), which includes the cost of missed and malfunctioning darts. This is less than the cost of darting and notching one animal in 1991 using the spotter aircraft and helicopter. The table below summarises the additional budget required to dart a rhino over and above the cost of horses, vehicles and staff (including a vet) which the National Parks Board has at its disposal. The true economic cost of notching rhinos is therefore greater than the figures given in the table.

*Table. Average additional costs (helicopter/fixed-wing aircraft/ drugs) required to dart a b/ack rhino from a helicopter and on foot (excluding the costs of staff, horses and vehicles). Values in South African rands (R) and US dollars.*

| Year | Helicopter | On Foot |
|---|---|---|
| 1991 | R5,000 (≈$1,390) Umfolozi Game Reserve | - |
| 1993 | R2,000 (≈555) Mkuzi Game Reserve | R165 (≈$46) |

**The 1991 costs for the Umfolozi section of HUP include the spotter aircraft and helicopter whereas the 1993 costs for Mkuzi Game Reserve reflect the use of a helicopter to dart animals already located.*

Besides the considerable saving in overall costs, there are other advantages to darting on foot, as follows:

- The greater participation of staff at all levels, particularly the game guards, benefits the monitoring programme directly in that it involves them with an animal from the start, motivates them and helps them to realise the importance of collecting sighting data. In addition, their presence during the notching exercise helps them to familiarise themselves with the newly marked black rhino. They thus find it easier to record data and the field data become more meaningful to them.

- The programme offered game guards a much needed opportunity to change their routine from the monotony of law enforcement. It also familiarised them with areas they might otherwise not have visited on patrols.

- The game guards with limited tracking experience had a valuable opportunity to learn and practise such skills.

- Darting black rhinos on foot causes less disturbance to the remainder of the population, and indeed to other species, than a low-flying helicopter.

## CONCLUSIONS

The method described here was used extensively in the past with success. Over the years it was replaced by the use of the helicopter, a more efficient tool. The transition was largely brought about by the demise of the black rhinoceros in general, and by the international attention which the animal received as a vulnerable species. Funding for using the more efficient helicopter to monitor black rhino populations had been forthcoming up to 1992.

It is well known that the black rhino is still at risk. However, one must realise that in the current economic and political transition that South Africa is experiencing, managers in southern African game reserves where black rhino still occur must face the realities of financial constraints. All managers are, and will be faced with the risk of, losing black rhinos. The cost of continued monitoring programmes and increased law enforcement needs will escalate. The monitoring programmes already in place are considered essential to the ultimate protection of this species. Darting and marking on foot is an important way of ensuring the continuity of Umfolozi's biennial intensive survey of black rhinos.

## ACKNOWLEDGEMENTS

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# SUBSPECIES AND ECOTYPES OF THE BLACK RHINOCEROS

L.C. Rookmaaker

Walstraat 11, 7731 HM Ommen, The Netherlands

The taxonomy of the black rhinoceros *(Diceros bicornis)* has still not been clarified at the level of subspecies. The current classification was proposed initially by Groves (1967), with later modifications (Groves, 1993). Unfortunately, it was cursorily dismissed by the rhinoceros experts (Du Toit, 1987), because it was based on very small skull samples. It is obvious that further research using larger sets of skulls and bones for conventional measurements, or using new DNA techniques, would clarify many uncertainties. However, the original classification could have formed a good basis for reflecting the diversity within the species and for providing a framework to plan conservation programmes aimed at maintaining the genetic differences within the black rhinoceros populations. A revision to the classification is contemplated, but not yet published (Hillman Smith & Groves, 1994). Today, therefore, there is no accepted subspecific classification of the black rhinoceros. This vacuum, combined with the proposal by the African Rhino Workshop in 1986 to focus on four 'conservation units' or 'ecotypes' *(Pachyderm* 9, 1987), has led to several taxonomically confusing statements in recent papers on rhinoceros conservation and has not really led to any greater understanding or even served a practical purpose.

Many authors use the 'ecotype' classification as if each ecotype represents a subspecies and attach names to them accordingly. For instance, Hall-Martin & Knight (1994) wrote about the black rhinoceros of Namibia as the 'south-western ecotype *Diceros bicornis bicornis'*, implying that the animals in northern Namibia today cannot be differentiated from the supposedly extinct, large, typical subspecies of the Cape Province (Rookmaaker & Groves, 1978; Rookmaaker, 1989; Meester *et al.*, 1986). Of course, this could well be correct. Earlier, Hall-Martin (1985) argued that the black rhinos of Etosha in northern Namibia were likely to be the closest existing relatives ('taxonomically, genetically, geographically and ecologically') to those formerly found in the Cape Province of South Africa. O'Ryan *et al.* (1994) studied variation in restriction enzyme profiles of mitochondrial DNA of 33 wild black rhinos and found, using this technique, that the rhinos from Zululand matched with one specimen from Caprivi (Namibia) but differed from those in Etosha (Namibia) and East Africa. While there are arguments that black rhinos from some parts of northern Namibia may not be distinguishable on the subspecific level from the typical subspecies, this conclusion may be premature until the reasons for this new insight are set out in detail. It needs to be shown how the sizes of the existing specimens in Namibia relate to those of the extinct population in the Cape Province, and even to specimens presumed to belong to taxa like *Diceros b. niger Diceros b. occidentalis, Diceros b. chobensis* and even *Diceros b. minor.* Until such a time, it is acceptable to use the concept of a 'south-western ecotype' as a basis for conservation measures, but this should not be confused with the use of formal subspecific names.

The ecotypes are poorly defined, especially in border situations. There is general agreement that black rhinos living in regions from Natal to southern Tanzania are similar, to be called either *Diceros b. minor* or the 'south-central ecotype', while the black rhinos in northern Tanzania and most of Kenya, called either *Diceros b. michaeli* or the 'eastern ecotype' are also considered similar. The status of the so-called 'southwestern ecotype' represented by the viable population in parts of Namibia is taxonomically unclear. However, the uncertainty should not affect practical issues, as the population can be kept separate either as the 'south-western ecotype' or as a taxonomically separate population of uncertain status.

It is my proposal to re-instate the existing taxonomy of subspecific level, as it was proposed by Groves (1967), with all the necessary later amendments. Used in a wise perspective, any differences in taxonomic interpretation should not interfere with strategies designed to keep the species alive for future generations.

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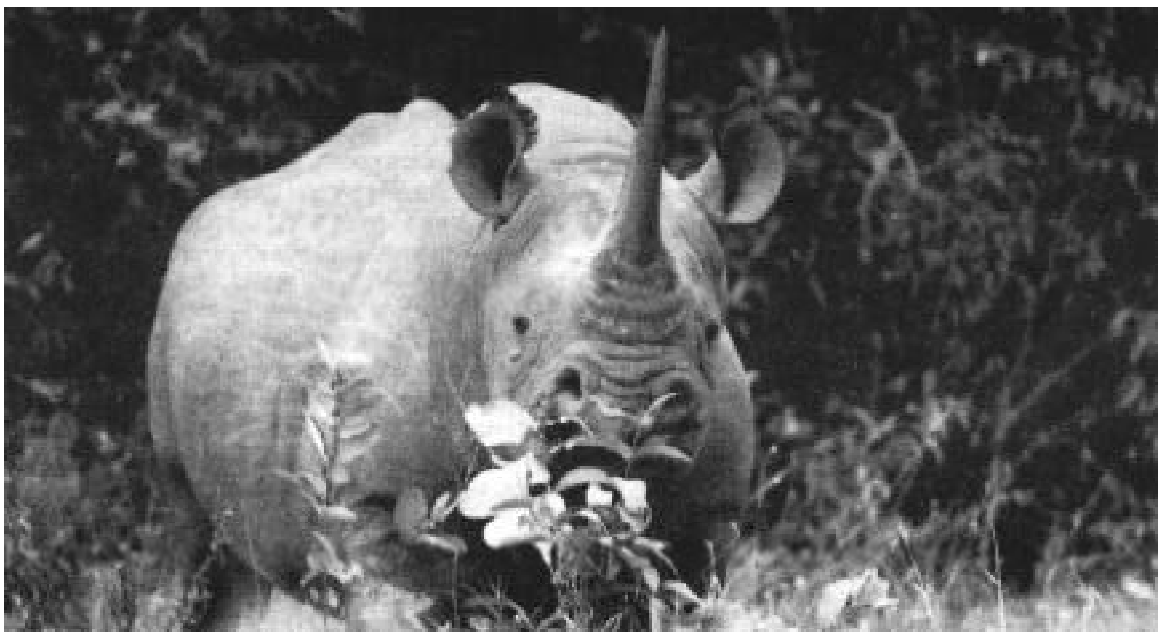

*A black rhinoceros in Kenya*

# FACILITATION OF BOMA ADAPTATION OF AN INJURED SUBADULT MALE SOUTHERN WHITE RHINOCEROS *Ceratotherium simum simum*

## VIA INTRODUCTION TO AN ADULT MALE

Steven A. Osofsky[1], Peter S. Rogers[2] and Andrew Trawford[3]

[1] Botswana Department of Wildlife and National Parks, PO Box 131, Gaborone, Botswana (current address: Director, Animal Health Services, Fossil Rim Wildlife Center, PO Box 2189, Rt.1 Box 210, Glen Rose, Texas, 76043 USA)

[2]Natal Parks Board, PO Box 456, Mtubatuba 3935, South Africa

[3]Botswana Department of Animal Health and Production, PO Box 64, Serowe, Botswana

## ABSTRACT

A rhino operation in Botswana led to the capture and translocation of four southern white rhinoceros, *Ceratotherium simum simum.* At the time of capture, an approximately three to four year-old bull was found to have three recent bullet wounds. Internal injuries that may have resulted from the wounds could not be adequately assessed. All four animals, including the injured bull, were judged to be in good body condition at the time of capture and translocation to holding bomas. The subadult bull refused to eat any significant quantity of food offered, even after ten days in captivity. He appeared to be seeking social interaction - vocalising and rubbing against the fence between himself and the adult bull. The gate between the two bulls' bomas was opened 12 days after the young bull's capture. The young bull's overall attitude improved, he charged the fence much less, and he followed the old bull around constantly and started to eat. The two animals were frequently in bodily contact. The adult bull tolerated the young bull relatively well. Nevertheless, the young rhino died six days after the introduction of the adult bull, despite veterinary intervention for suspected wound-related sepsis. The animal's death from bullet wound-related injuries should not detract from the positive behavioural responses elicited by the companionship of the adult bull.

## INTRODUCTION

By the early 1900's the population of southern white rhinoceros, *Ceratotherium simum simum,* was wiped out everywhere except in Natal, primarily because of human predation and competition for resources (Estes, 1991). Desiccating climatic changes may have also played a role (Hitchins, 1992). Between 1967 and 1982, a total of 94 white rhinos were reintroduced from Natal into protected areas of northern Botswana (Hitchins, 1992). At least 12 white rhinos were known to have been poached in northern Botswana since October 1992. In February 1993 the Botswana Department of Wildlife and National Parks asked the Natal Parks Board Rhino Capture Team to assist them in the capture of whatever remaining rhino could be located in northern Botswana for translocation to a privately developed sanctuary in east-central Botswana. The heavy poaching pressure near Botswana's northern and eastern international borders, combined with the sighting of only seven white rhinos on an aerial survey in September/October 1992 (Hitchins, 1992), prompted the rhino rescue operation.

## CASE STUDY

On 12 February, the first two animals were caught: a cow believed to be approximately 30 years old and her approximately nine-month old calf. The cow had an ear notch in her left ear, and was believed to have been one of the animals introduced from Natal's Umfolozi Game Reserve. These two animals were transported in separate crates to the Khama Rhino Sanctuary in Serowe, where they were released together into holding boma number one (see Figure), 22 hours post-capture. They were from a group of three originally spotted from the air. The third animal, an approximately 30 year-old bull (also with an ear notch and a hole from an ear tag in his right ear), was captured on 15 February in the same general area. The bull was released into his own holding boma, number two, at the Sanctuary 14 hours later.

The final animal to be caught was a three to four-year old bull. He was found on his own, approximately 20km from where the other animals were caught. At the time of capture, this animal had three bullet wounds estimated to be approximately seven to ten days old. One wound was in the right shoulder, one was in the skull above

the frontal sinus, and the third consisted of an entry and exit wound below the right ear near the angle of the mandible. All wounds were cleaned and flushed with commercial bovine intramammary antibiotic preparations (procaine penicillin/ dihydrostreptomycin and potassium penicillin/ procaine penicillin/neomycin). In addition, intramuscular procaine/benzathine penicillin as well as amoxicillin/colistin sulphate were administered. The young bull was released uneventfully into his own boma, number three, at the Sanctuary 18 hours later on the morning of 16 February. All four animals, including the injured bull, were judged to be in good body condition at the time of capture.

Post-capture loss of appetite is potentially a lifethreatening problem for free ranging white rhinos put into bomas, especially older bulls, with animals often not feeding for the first seven to ten days (or longer) post-capture (Rogers, 1993). Ideally, bomas should be situated so that anorectic animals can be released back into the field if no evidence of feeding is seen within this period. Such animals often start grazing almost immediately after they are out of the boma. In the case of this project, security concerns precluded building holding facilities in actual rhino habitat in northern Botswana. In addition, the Khama Rhino Sanctuary was still in the process of trying to raise funds for a perimeter fence, so the only option for release from a boma would be to allow the animal into a slightly larger paddock (refer to Figure). Note that paddock facilities were not utilised for the period covered by this report.

The Sanctuary bomas, with walls two metres in height, are constructed of 15-22cm diameter tanelite-treated poles, spaced approximately 15cm apart. All bomas have water troughs which are kept full, clay-lined wallowing points, as well as appropriate natural and artificial shade. Paddocks are comprised of five strands of 25cm diameter steel mining cable (spaced from the ground at 10cm, 30cm, 30cm, 40cm, and 40cm) strung through steel railway tracks spaced every 20m. Each three metre long rail is sunk one metre into concrete. The initial plan included 19 seven to ten centimetre diameter droppers spaced evenly between every two railway lines in the paddock walls. Larger poles were planted into the ground every 5m to strengthen the walls.

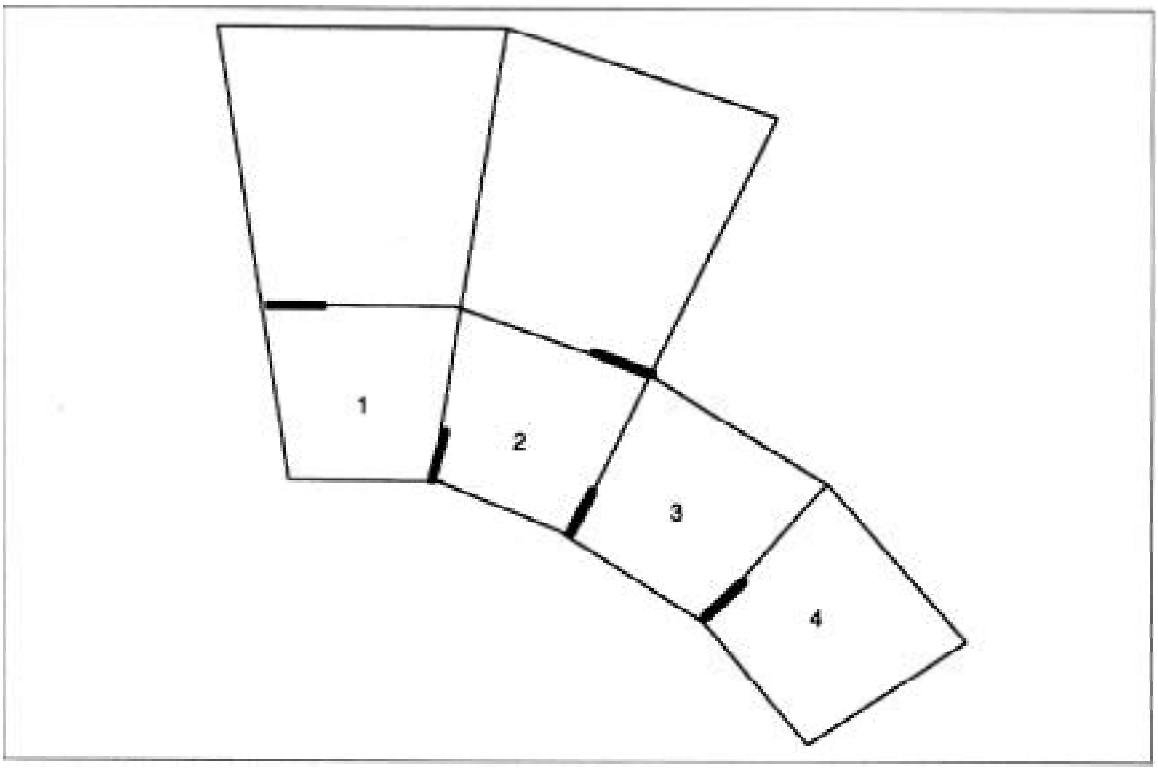


*Figure. Khama Rhino Sanctuary bomas ito 4 and paddocks (not to scale). The front 0f the bomas are at the bottom of the diagram. The front of each boma is five metres long. The side walls of each paddock are 80m long. The back wall of each paddock is 80m across. Internal gates are indicated by bold lines.*

All animals except the subadult bull were eating and drinking fairly well within one week of being placed into the bomas. The cow started eating by day four post-capture, with the calf suckling within 24 hours of release into the boma. The adult bull was eating by day six post-capture. They were being fed grass freshly cut locally, consisting of a mixture of predominantly Eragrostis, Panicum, and Digitaria species. These were initially supplemented with grasses cut in Chobe National Park. By day ten, the subadult bull had only taken a few bites of grass. Attempts at offering the animal a variety of fresh fruits, teff hay, lucerne hay, as well as grass covered with molasses were unsuccessful. The rhino was, however, seen to drink several times per day.

This young animal appeared to be seeking social interaction by vocalising and rubbing against the fence between himself and the adult bull. The subadult bull's predominant vocalisations were classified (Estes, 1991) as whining (juvenile begging call) and squeaking (juvenile in distress). The only animal that seemed to pay much attention to these sounds was the young female calf, who would sometimes look in the direction of the sound. The subadult bull was the most aggressive animal in the bomas. He often charged the walls of the boma when approached by caretakers. It should be noted that ground surveillance in the area where the young bull was captured revealed that he had been traveling in a group with at least two other animals. A week before the capture operation began, an adult cow and a female calf were found to have been poached in the area. Combining the spoor findings and the estimated age of this animal's bullet wounds, it seems quite likely that the poached animals were the young bull's mother and younger sibling.

Given the history, age, and general behaviour of this subadult bull, it was felt that the problem observed was most likely not the "classic" confinement-related inappetence of the white rhinoceros (Rogers, 1993). In addition, internal injuries that may have resulted from the three bullet wounds could not be adequately assessed. The decision was made not to give the young bull access to a paddock, as it was felt this would only serve to isolate him further from the other animals. In addition, the rearrangements necessary to achieve this might have disrupted the otherwise smooth boma adaptation process in the other three animals. Thus, paddocks were kept closed off.

As it was felt that a lack of social interaction was contributing to the overall stress the young bull was experiencing, the gate between the two bulls' bomas was opened on 27 February - 12 days after the young bull's capture. This was a novel yet potentially dangerous approach to the problem of appetite loss. Normally, wild-caught white rhinos believed to come from different social groups are not penned together, especially if they are the same sex (Booth and Coetsee, 1988) and of disparate sizes. The young bull was approximately seven-tenths the size of the adult bull.

The plan seemed to work initially. No aggression was manifested as the young bull crossed over into the adult bull's boma. During the course of the first day, the young bull's overall attitude improved; he charged the fence much less, and he followed the old bull around constantly. He watched the old bull eating, and then he too started to eat. Progress was rapid. The young bull continued to drink regularly. The young bull would often lie adjacent to the adult bull during rest periods. The two animals were frequently in bodily contact when standing. The adult bull tolerated the young bull relatively well, only occasionally gently horning him in the axillary region. Such antagonistic behaviour was generally confined to times when new feed was placed into the boma, or when both animals tried to drink simultaneously at the water trough, which was too small to accommodate both of them comfortably.

The young rhino continued to eat small amounts during the next day, 28 February. On 1 March he again ate a small amount and defaecated. However, on 2 March the young bull appeared weak and depressed. As the possibility of bullet wound-related sepsis could not be ruled out, that evening the young bull was started on broad spectrum antibiotics. He was given enroflaxacin by intramuscular darts. As the animal had received high doses of intramuscular antibiotics at the time of capture (with his wounds flushed with topically active antibiotics), ongoing antibiotic therapy had not been instituted in the bomas. Systemic antibiotics in a wild anorectic rhinoceros need to be administered with large volume darts, and the disturbance this would cause was not desirable during the early boma training period without clear justification. The fact that the rhino started to eat and then stopped again is what altered our perspective and prompted more specific therapeutic intervention. On the same day, the drinking water was supplemented with dextrose, sucrose, and a commercial B-complex vitamin syrup.

On the morning of 3 March, the drinking water was supplemented with appropriate amounts of electrolytes in the form of sodium chloride and potassium chloride. That evening, a second dose of enrofloxacin was given.

On Thursday 4 March, the rhino was still not doing well. He had not, as far as could be determined without night-vision equipment, been eating any significant amounts of feed. The decision was made that day to immobilise him with a very low dose of etorphine hydrochloride in order to implement supportive veterinary measures: 1. stomach-tubing of a calorically dense multi-source carbohydrate/amino acid/vegetable oil/vitamin/electrolyte mixture; 2. administration of intravenous fluids, as well as the administration of intramuscular antibiotics, B-complex vitamins, vitamin E, and selenium. Due to his debilitated state, the rhino was kept on intranasal oxygen during the procedure with continuous real-time pulse oximetry monitoring. He recovered without complication from this procedure, walking away less than two minutes after the naloxone/naltrexone/narcotic/antidotes were given. Nevertheless, the rhino died at 5pm the next day. Necropsy revealed that the bullet which had entered the right shoulder had passed through the thoracic and abdominal cavities, leading to diffuse pleuritis and peritonitis, which was confirmed histopathologically. Examination of the bullet recovered from the abdomen revealed that it was of a 7.62mm calibre, with a 39 Russian casing, fired from an AK-47 or an SKS semiautomatic weapon, according to the Botswana Department of Wildlife and National Parks Anti-Poaching Unit.

## CONCLUSION

The fact that this animal died from bullet wound-related injuries should not detract from the positive behavioral responses that companionship of the adult bull seems to have elicited. The authors were unable to find any similar cases of such an intentional introduction of two captive white rhino bulls documented in the literature.

## ACKNOWLEDGEMENTS

The authors would like to thank the management and staff of the Khama Rhino Sanctuary for all their assistance during this difficult period.

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Photo credit: Kes and Fraser Smith

*A female northern white rhinoceros with her calf, Garamba National Park, Zaire.*

# STUDYING FOREST ELEPHANTS BY DIRECT OBSERVATION:

## PRELIMINARY RESULTS FROM THE DZANGA CLEARING, CENTRAL AFRICAN REPUBLIC

Andrea Turkalo[1] and J. Michael Fay[2]

[1] NYZS, BP 1053, Bangui, Central African Republic
[2] Wildlife Conservation Society, BP 14537, Brazzaville, Congo

## INTRODUCTION

For a considerable number of years researchers have been studying forest mammals in the western areas of central Africa. For the forest elephant *(Loxodonta africana cyclotis)* and the western lowland gorilla *(Gorilla gorilla gorilla),* most studies in the forest environment have been based on tracks, dung and remote cameras for census, feeding site inspection for dung analysis to determine feeding ecology, and satellite tracking to study ranging. Some researchers are even using genetic fingerprinting of hair left in gorilla nests to identify individuals (C. Tutin, pers.comm.). There is a simple reason for using these remote methodologies: direct observations have proven extremely difficult in the tropical lowland forests of central Africa. If a researcher tracks an animal and gets close enough to see it (usually a maximum of ten metres), in most cases the individual soon senses the observer and flees, hardly providing opportune conditions for identification of individuals, observations of behaviour, or habituation.

Since 1986 we have been working in the forests of southwestern Central African Republic and northeastern Republic of Congo in the contiguous Dzanga-Sangha Reserves and the newly created Nouabale-Ndoki National Park (DSNN) (Figure 1). Much of that time has been spent studying gorillas and elephants using secondary evidence, and trying to habituate gorillas. In 1990 we decided that a change of strategy was in order.

An interpreted satellite image of the DSNN area produced by NASA (1993) shows that the terrain is homogeneous and flat. Closer inspection reveals a series of little spots

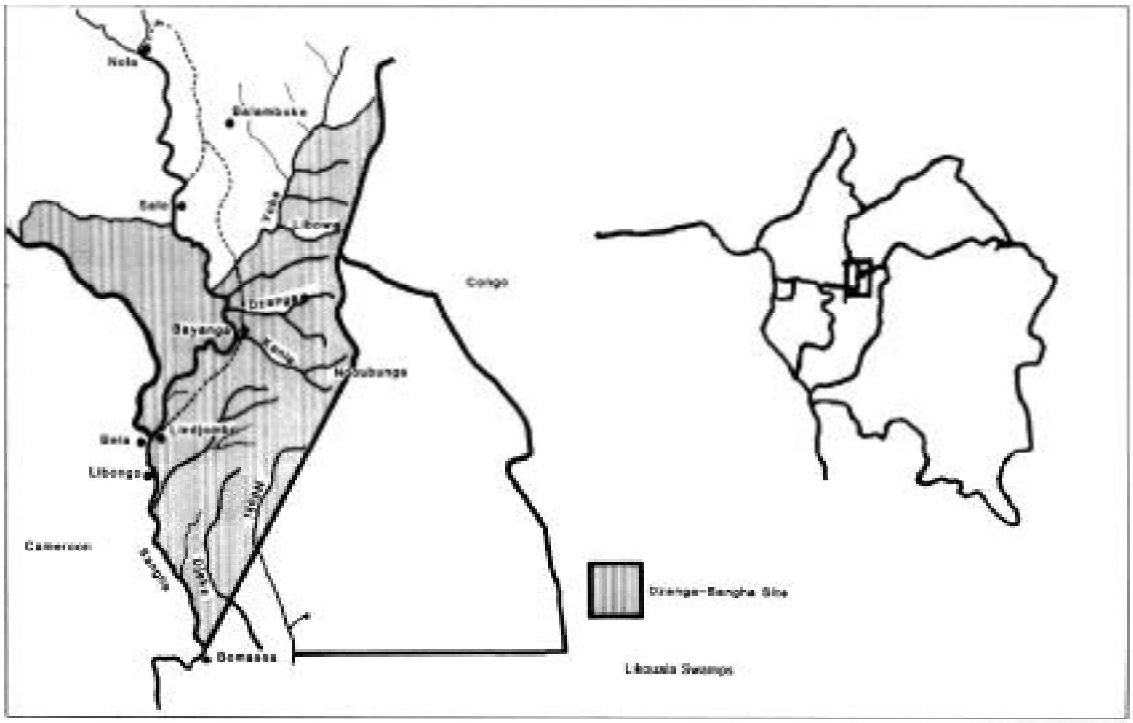


*Figure 1. Map of the Dzanga-Sangha and Nouabalé-Ndokl Reserves and the location of the Dzanga clearing.*

on the image which are in fact clearings in the forest. The local Bambenjele Pygmies group these clearings into two broad categories: *bai*, a clearing with a water outlet, and *yanga*, a clearing with no outlet. We further subdivided the *bais* into swampy bais, those with permanently saturated soils and inundated in the wet season, and elephant *bais*, those with seasonally saturated sandy substrates. All three types usually have a very low tree density, with a terrestrial vegetation that consists of various species of herbs in the families Cyperaceae, Poaceae, Hydrochartiaceae, Melastomataceae and Onagraceae. Similar clearings exist in Nigeria, Cameroon, Gabon and Zaire.

The origin of these clearings varies. There is no doubt that large mammals, because they are attracted in high numbers to exploit food resources and mineral salts, contribute to their maintenance and may even be responsible for creating forest clearings (Ruggiero & Fay, 1994). It is the concentration of large mammals in these clearings, including forest elephants, gorillas, forest buffalo *(Syncerus caffer nanus)*, bongo *(Tragelaphus euryceros)*, sitatunga *(T spekei)* and giant forest hogs *(Hylochoerus meinertzhageni)*, which provides unique opportunities to study forest mammals using direct, sustained observations.

We have initiated two studies exploiting this opportunity, the "Dzanga Bai Forest Elephant Study" in the Central African Republic and the "Mbeli Bai Gorilla Study" in the Republic of Congo. Both have proved to be successful. In over 1,800 hours of observation at Dzanga, elephants have been present in the clearing over 99% of the time. Over 1,000 hours of observation in the Mbeli clearing have revealed that gorillas are present more than 25% of daylight time both in the wet and dry seasons.

Dzanga has been well known to the local Pygmy population for a very long time as a *bai* favoured by elephants. With the onset of commercial elephant hunting around 1900, Dzanga undoubtedly suffered several depredations for a sustained period of time (Fay & Agnagna, 1993). With the advent of logging in the area in 1970 hunting pressure greatly increased at the *bai*, but elephants continued to visit Dzanga, at least in small numbers, up to 1987 when conservation efforts were initiated in the area. Since that time elephants have enjoyed a high level of protection in the clearing. Consequently the number of elephants visiting Dzanga has increased dramatically.

In 1990 we undertook a pilot study to investigate the possibility of identifying individual elephants at Dzanga. Methodologies similar to those used in East Africa (Douglas-Hamilton, 1972; Moss, 1988) were employed. Using a simple index card system, in which elephants were classed by sex and inferred age, with schematic drawings of tusk morphology, rip, hole, break, and scar patterns on ears, tails and sides, it was discovered that most mature adults could be readily identified and re-identified. The confirmation of this methodology led to a full-time study which began in January 1991. In this paper we present preliminary results and describe how a study in a single location can be used to elucidate population characteristics.

## METHODS

Data are being collected on the size, demographics, morphometrics, social structure, social behaviour and genetics of the Dzanga elephant population. The project has been designed in two phases: the primary objective of Phase I was to identify the majority of elephants that come into the clearing and in Phase H data collection has been tailored to answer some of the more complex questions about this forest elephant population.

Since the beginning of the study, the identification of individuals has been based on morphological characteristics as described above. A card has been opened for each individual, which is classed by its sex and morphology. Each identified elephant is given a name. Dependants are given the name of the mother with a Roman numeral H for the oldest offspring, and m, IV, etc. for the younger siblings. This classification system, even with a large number of elephants, has proved to be effective.

Observations are made solely by Andrea Turkalo and one Pygmy spotter using a Bushnell Elite zoom spotting scope and binoculars, from a centrally located platform that is seven metres above the ground at the edge of the clearing. Observations begin in the early afternoon because the majority of elephant visits occur during late afternoon and night. This also permits initial daily observations to be made on a relatively small number of elephants. Upon arrival at the clearing, a total count of elephants is made and identification of the elephants present proceeds for about 30 minutes. Subsequently all elephants entering the clearing during the observation period are recorded and if possible identified. If an elephant is not identifiable by name, its sex is determined and its age estimated. Records are also kept of group composition as elephants enter the clearing. Information on time, group (even if single),

names of individuals (or sex and age of each), and location from which they enter, is recorded. Each entrance event serves as a sampling unit. Observation is halted at 17:00 hours when positive identification becomes difficult due to low light levels. In addition, total counts of elephant and other large mammals in the clearing are made at 30 minute intervals. This permits an estimate of not only the number of elephants entering the clearing, but also the total number of elephants, on average, present in the clearing during the observation period.

The study of social structure within elephant groups requires competent identification and re-identification of all individuals and groups. In order to identify primary groupings it is necessary to identify aggregations as they enter the *bai* from the forest, because they disperse once in the clearing. Each group is identified by locating known individuals and observing group composition. Relationships between individuals are inferred from affiliated behaviour. We are confident about the identification of mother-offspring relationships based on association, especially if we observe the same grouping at least twice over several months, and, for example, by suckling behaviour. For secondary associations, assumptions about filiation have been taken one step further. If groups of adult females with young enter the *bai* at least twice together, on different days, they are then classified as secondary groupings. As group data accrue with records of repeated, yet sporadic, affiliations, the identification of secondary associations becomes more definite. Greeting behaviour is not frequently observed in the Dzanga elephants and is not useful in the identification of complex relationships between groups.

Demographic information is based entirely on data obtained from groups. Births to known individuals are recorded, as are absences from groups. The absence of a very young individual is recorded as a death while that of a more mature individual as a separation or death. Height measurements are taken of known individuals to monitor growth. Additional data are collected on behaviour, such as musth, injury, dominance hierarchy and interspecies interactions.

Phase II methodology includes data collection on group composition, with identification, if possible, of all groups and individuals entering the clearing, even those previously recorded during the session. This gives a more quantitative estimate of the percentage of unknown and "clean" elephants in the population. A clean elephant has no readily identifiable characteristics.

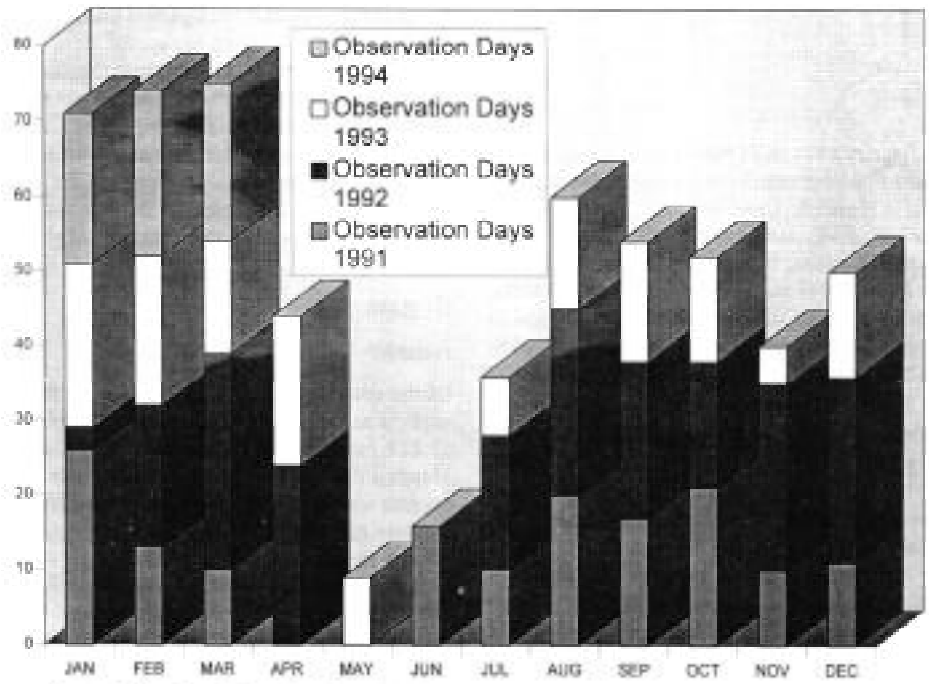


Figure 2. Number of observation days in the Dzanga clearing from 1 January 1991 to 1 March 1994.

*Fgure 2. Number of observation days in the Dzanga clearing from 1 January1991 to 1 March 1994.*

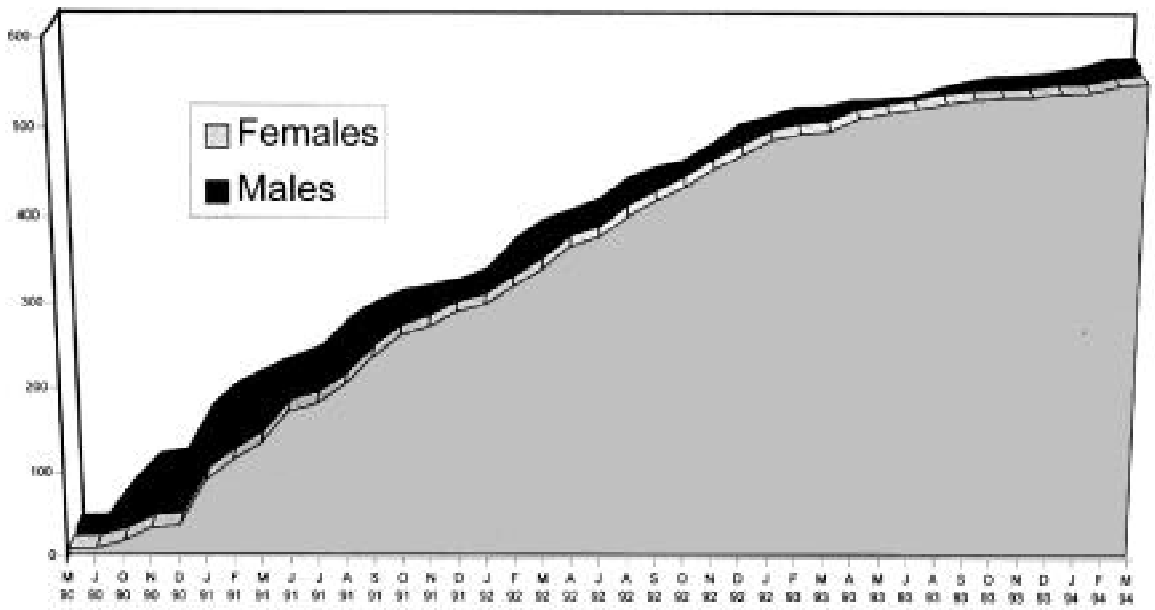


*Figure 3. Cumulative number of male and female elephants identified at Dzanga from March 1990 to March 1994.*

## RESULTS

### Individuals

From 1 January 1991 to 31 March 1994 a total of 602 days and 1,806 hours had been logged in the clearing, as shown in Figure 2. Up to this date, 1,705 elephants had been identified, named and catalogued. Of these, 509 are adult females, 50 are independent, subadult or juvenile females, 448 are adult males, 103 independent, subadult or juvenile males, and 495 are classed as offspring (non-adults) which are dependents within groups. Figure 3 shows the number of identified males versus females over the study period. Of the individuals which have been sighted, 81.3% have been seen on more than one day. Since the start of the study the number of elephants identified per day, expressed as a percentage of the maximum half-hour count, has increased. During a period of 17 observation days in March 1994, the average number of elephants identified, expressed as a percentage of the maximum 30 minute count, was 80.5%. Since the start of Phase II, an average of 80% of the elephants entering the clearing can be identified. The number of identified elephants has begun to reach an asymptote, i.e. the number of new elephants identified has begun to approach zero (Figure 3). Based on the estimate that 80% of individuals have been identified, we can calculate that the minimum population visiting the clearing consists of about 2,100 elephants. While new identifications are becoming more infrequent, it is believed that the total number will continue to increase to a minimum of about 2,500.

### Groups

#### *Females*

Of the adult females, 438 (88.7%) were recorded as mothers accompanied by at least one offspring. A total of 422 mother-calf groups had been identified by March 1994. Stable groups vary in size from two (mother with one offspring) to nine (three adult females with six offspring). The mean group size including solitary individuals is 2.3, and 2.7 if the solitary are excluded. The mean number of offspring/female with offspring is 1.3. The table shows the frequency distribution of different group compositions. The number of old females that are apparently no longer reproductive is 52, of which 6 are associated with groups.

*Table. Frequency distribution of female-cal/group compositions including solitary adult (old) females.*

| GROUP | FREQUENCY |
|---|---|
| Old Solitary | 46 |
| 1 Adult 1 Offspring | 211 |
| 1 Adult 2 Offspring | 169 |
| 1 Adult 3 Offspring | 19 |
| 2 Adult 1 Offspring | 5 |
| 2 Adult 2 Offspring | 4 |
| 2 Adult 3 Offspring | 6 |
| 2 Adult 4 Offspring | 3 |
| 2 Adult 5 Offspring | 1 |
| 3 Adult 0 Offspring | 1 |
| 3 Adult 2 Offspring | 1 |
| 3 Adult 6 Offspring | 2 |

Dzanga groups consist primarily of mother-calf groups often with non-reproductive females. Groups with more than one reproductive female are rare. Most multi-mother groups have been seen on numerous occasions. It should be noted, however, that there is observer bias involved in the identification of these groups. The majority of groups have been seen between one and five times. Known multi-mother groups often enter the clearing as single-mother groups. Conversely, single-mother calf units often enter with other groups, but they have not been seen frequently enough to say whether they represent a cohesive group or not.

More complex (tertiary) relationships have not yet been clearly observed in Dzanga, but there are indications that they do exist. For example, the association between a group of six (Second Broken-Tail with two offspring and Mandy with two offspring), a group of four (Fourth Tuskless with her three offspring), and a group of three (Maureen with two offspring). Fourth Tuskless frequently enters the clearing with Second Broken-Tail and they are almost always present in the clearing together. Maureen is also very often in the clearing with both of the other groups and Maureen's newborn is seen associating with Fourth Tuskless's subadult female offspring. While these relationships are subtle, we believe that if they were common, many more would have been evident.

## Males

There is no indication that males associate in groups in the Dzanga clearing. Certain young males rejoin their maternal groups occasionally, but do not remain consistently in any group. Independent males associate loosely while in the clearing, but their associations appear to be temporary, lasting from a few minutes to possibly a day.

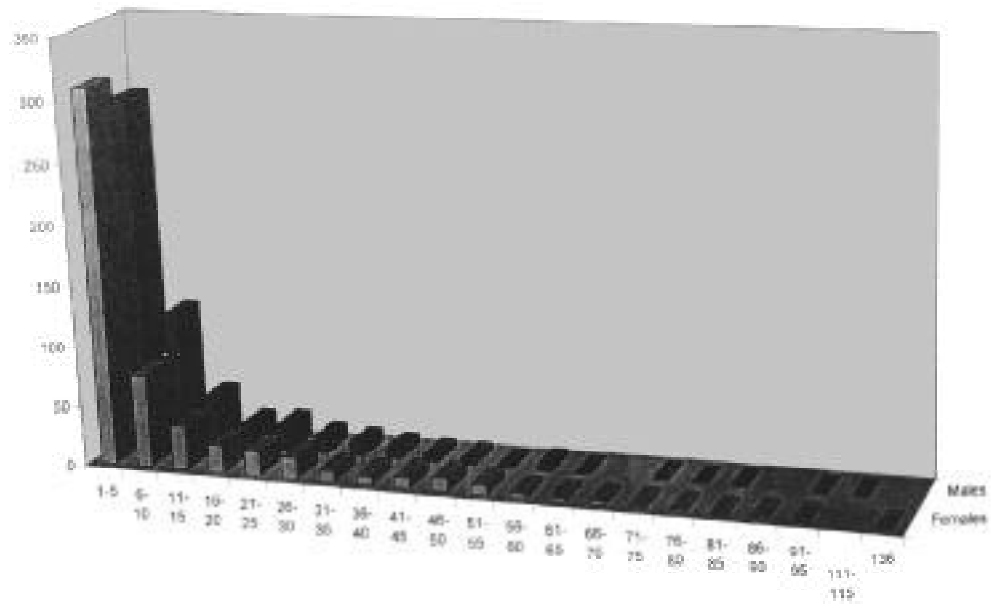


*Figure 4. Number of observations per individual (male and female) since October1990.*

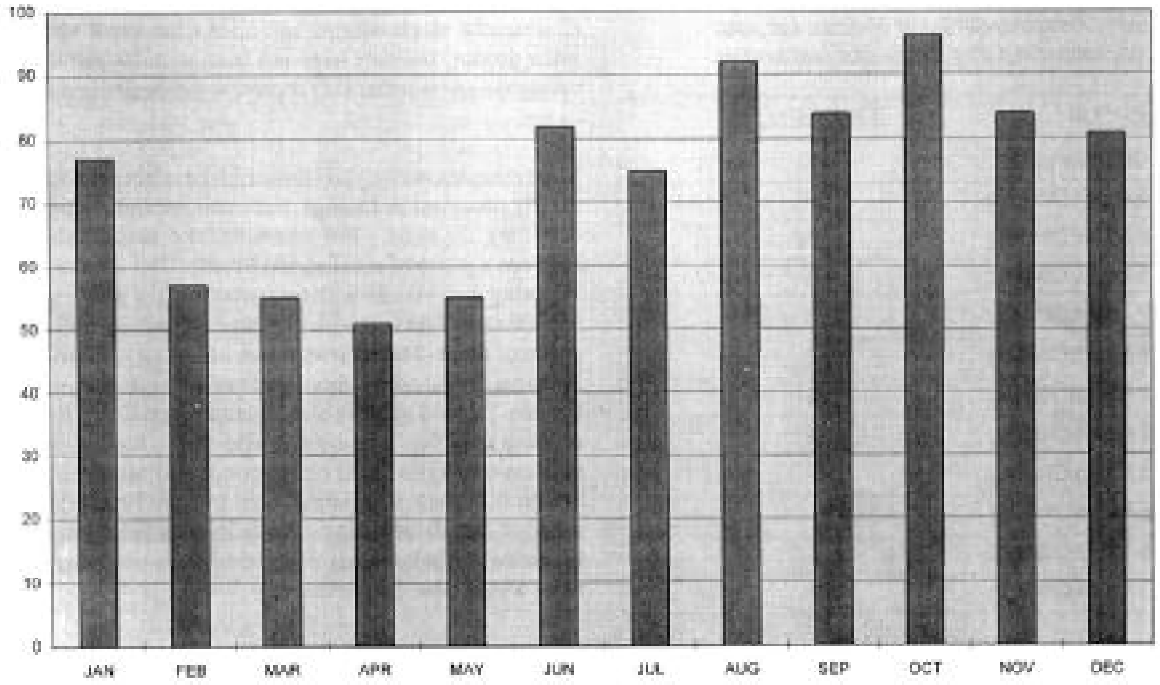


*Figure 5 Maximum number 0/elephants observed on one complete count in Dzanga over the study period.*

## Visitation by males and females

Figure 4 illustrates the visitation rate to the clearing over the study period. Figure 5 shows the maximum number of elephants recorded in one half-hour count in Dzanga for all months over the study period.

## Reproduction

Up to 31 March 1994, 72 newborns of known females had been recorded. Second births to individual females have yet to be recorded. The first birth recorded was in January 1991 to an individual named Fourth Tuskless. This individual was last seen on 8 February 1994, still without a second infant. There are many cases of individuals that have not given birth in three years.

## Behavioural observations

The majority of elephant behaviour observed in the clearing consists of jockeying in an endless series of dominance bouts for a place at a particular water hole, some of which are obviously preferred. In the dry season the clearing is marked by a series of some twenty to thirty holes in the sandy substrate where elephants pump water out of the sub-stratum. The holes are about one metre deep, beneath which is a layer of gravel. It is common for an individual to wait hours for the chance to drink from a particular hole. Conversely, however, it is not unusual for a single individual, usually a male, to monopolise a waterhole for several hours.

The hierarchy of most individuals in the population seems to be known by other elephants. Hierarchy is often tested at the waterholes. In all cases adult males take precedence and displace adult females and smaller males at a particular hole. Depending on the size and "robustness" of a particular male, the more imposing usually wins, but not always. Amongst the larger males competitive bouts can last for over an hour. The males continuously jockey for position. In very close matches, an elephant's position on the slopes leading down into the clearing can provide the height and momentum needed to defeat an opponent, with dominance often switching from one individual to another. As more data are gathered, specific relationships between individuals will become evident. We believe that the Dzanga clearing is a testing ground for the establishment of dominance hierarchy in the population.

Musth males which visit the saline rarely drink mineral water but instead circulate in the clearing, probably in search of receptive females. Usually they are unsuccessful and leave the clearing after a relatively short time.

## DISCUSSION

One striking result of the Dzanga study is the large number of elephants that visit the clearing. Seventeen hundred elephants are more than expected. This is in contrast to the forest buffalo, for example, which visit the clearing on approximately one-third of observation days and comprise only one group of about 18 individuals. Even if the elephant population density in the Dzanga area is one elephant per square kilometre, which is considerably higher than previous dung count surveys would indicate, this would mean that every elephant over the entire Dzanga-Ndoki National Park visits the clearing.

**Why do so many elephants visit the clearing?** Water is not a limiting factor in this area and therefore cannot be the reason. Minerals may provide the key. Preliminary water analysis from the waterholes indicates that calcium and other cations are found in high concentrations in comparison to those of stream water in the clearing and of the soils surrounding the *bai.*

While we believe that the minerals attract elephants, there may be other reasons why they spend hours at the holes. As in most other waterhole or mineral lick areas frequented by the large mammals, social activity is intense at Dzanga. Perhaps the possibility of social interaction in large numbers is a major attraction for elephants at Dzanga. In this setting, young elephants can learn a great deal from interactions, females have a better chance of being inseminated by prime bulls, and males can establish dominance hierarchy.

### Groups

Data presented here suggest that the group size found in the Dzanga clearing is similar to other forest data sets (Merz, 1986; Dudley *et al.*, 1992; White *et al.*, 1993). White (1993) found the average group size (excluding solitary individuals) to be 2.8 compared to 2.7 at Dzanga. In general forest elephant group sizes are considerably smaller than those of documented savanna populations (Douglas-Hamilton, 1972; Moss, 1988, 1990; Ruggiero, 1989).

There are three factors cited as being important in the formation of elephant groups and aggregates: predation, the distribution and abundance of food, and social interaction (Western & Lindsay, 1984; Moss, 1988; Ruggiero 1989).

The predominant predator of the African elephant throughout its range is man. Even in cases where predation by lions on elephants is high, the underlying cause may be man (Ruggiero, 1989). Intense killing of elephants for ivory removes older individuals from groups and may cause aggregation (Laws *et al.*, 1975; Western & Lindsay, 1984), because orphans seek to group with other elephants (Ruggiero, 1989) and there is safety in numbers (Moss; 1988). Increased pressure by secondary predators such as lions and hyaenas may reinforce the tendency to aggregate (Ruggiero, 1991). In the forest environment, man is the only predator of elephants. In historical times many populations of forest elephants were subjected to considerable predation by man. It is unlikely however, that this pressure has ever been as intense in the forest environment as in the savanna. In the Dzanga population, group structure consists of either solitary males or intact single mother families. From an evolutionary point of view, selection for large group size in the forest elephant, through predation, has not occurred. In heavily hunted areas it is possible that elephant groups would band together for safety, but there is no evidence for this in the forest environment. We suggest that small group size in forest elephants, in particular in the Dzanga elephants, may be due to relatively low predation.

Forest elephants are highly frugivorous (Alexander, 1977; Merz, 1981; Short, 1981; Dudley *et al.*, 1992). White *et al.* (1993) suggest that small family units are better able to exploit a patchily available resource, such as ripe fruit, than larger groups. This is in contrast to savanna elephants, for which grass, a more abundant and ubiquitous resource, forms the bulk of the diet. While fruits are important in the diet of the forest elephant, it is doubtful that they could be of sufficient selective significance to determine group size. Tchamba (1993) found that forest elephants in western Cameroon feed extensively on grass in a mixed forest-savanna habitat. White *et al.* (1993) suggest that forest elephants in Lopé, Gabon, do not graze extensively on grass, but their diet consists of a wide diversity of bark, leaves, roots and fruits including the rhizomes of many species of herbaceous monocotyledons in the families Marantaceae or Zingiberaceae. Analysis of over 1,000 dung samples at the Dzanga site indicate that the dietary pattern found at Lopé is similar to that in the Dzanga population. We agree with Dudley *et al's.* (1992) suggestion that it is the patchy nature of food resources in the forest, not just the presence of

fruits, that accounts for small primary group size in the forest elephant.

In savanna environments elephants tend to aggregate when fresh grass is abundant (Western & Lindsay, 1984; Moss, 1988; Ruggiero, 1989), unlike forest elephants which do not appear to aggregate even when seasonally abundant and preferred food stuffs are available, such as *Raphia* spp. stems in the Likouala aux Herbes swamps (see below), or grass at Lopé. Moss (1988) suggests that where the resource base permits, such as during a flush of green grass on the open plains of Tsavo or Amboseli in Kenya, these aggregations may serve to establish and re-establish social relationships, and to provide breeding opportunities, social stimulation and a setting for elephants to learn a variety of social and practical skills. The physical constraints brought about by dense vegetation in the forest environment may discourage forest elephants from forming large groups, though this does not explain the lack of aggregations among the Lopé elephants. Forest elephants may generally shun large, open areas. In the gallery forest areas of the Central African Republic, forest elephants were found only in very thin bands of forest along creeks and at the savanna forest ecotone (Fay, pers.obs.), while savanna elephants were abundant just beyond the galleries but never frequented the forests. It is possible, too, that some aggregations of forest elephants pass unobserved because they are hidden by the forest environment.

A high percentage of the total population from a large area visits the Dzanga clearing. Forest elephants apparently prefer the physical conditions of clearings, rather than forests or swamps, for social interaction. The opportunities for social interaction between elephants visiting Dzanga may be similar to those of the Amboseli and other savanna populations. The physical environment of forest clearings encourages intense social activity, often identical to roving savanna aggregations.

## Males versus females

The almost equal number of males and females in the clearing is striking. Most populations of elephants in Africa show a much higher percentage of adult females than males, probably due to a high level of selective hunting by humans in the majority of cases. The number of adult males in the Dzanga population is very high compared to populations with a long history of being selectively poached for ivory. Furthermore, the age curve of Dzanga elephants is not significantly different from what one would expect in a population without poaching. Large-tusked old males account for about 7% of the Dzanga population (i.e. about 100 out of 448 males). A thorough analysis of age structure from data on height measurements will provide a powerful data set with which to compare other elephant populations in Africa.

**Do the Dzanga elephants represent a population which is not poached or at least not selectively poached?** In order to address this question we must first look at the possible sources of bias which come from observing elephants in the clearing.

In general, males leave groups at an earlier age than females. Once an individual is independent of its mother it is given a name if it can be identified. While a large number of independent juvenile males are nameless, because they possess no distinguishing features, juveniles and sub-adult males which have been named account for about about 6% of the population. Named, independent sub-adult and juvenile females account for about 3% of the population. Naming bias therefore may interject about a 3% bias in favour of males.

A second source of bias may arise because adult males possess more distinct and conspicuous features than females, so that one tends to name males preferentially both overall and on a daily basis. The data showed that males were identified more frequently in most months, even though their overall number almost equals the females. This may either indicate a bias towards the identification of large males, or that males visit the clearing more often, the latter being true for mature bulls which probably come to engage in competitive bouts with other males and to find oestrous females.

Visitation by large males to the clearing has certainly increased since the inception of the study. Any observer bias should tend to disappear with time as the elephants become more familiar to the observer.

If males travel further to visit the clearing seasonally and/or on a daily basis, then probably there are lower densities of males being drawn from a larger area. The overall frequency data concur that on an individual basis, males have been recorded more frequently than females and there are more males in the clearing than females in all months of the year except April, May and June. These data, while

inconclusive, indicate that there is male dominance for most of the wet season and female dominance in the late dry season-early wet season. A systematic analysis of the data on individual visitation will help to determine if visitation by males and females is clumped, random or regular. Visitation by large males appears to be clumped and seasonal, mostly being noted in two months of the year.

## Migration

Reconnaissance surveys in the Nouabale-Ndoki National Park have shown that most elephant trails in the area are orientated from north-west to south-east. Over a seven-year period (since 1987), in areas south of the Dzanga clearing, both in the Ndoki National Park in the Central African Republic and the Nouabale-Ndoki National Park in adjacent Congo, we have noted that elephants migrate in and out of these areas. Based on observations and anecdotal information from hunters and others, it would seem that elephants in the Dzanga Sangha-Nouabale-Ndoki complex migrate from the north-west to the south-east in an annual cycle. This migration appears to be correlated with diet. In the dry season elephants travel to the Likouala swamps to the south-east of the two parks where there is an abundance of *Raphia* spp. stands. During the wet season they migrate north to feed on the fruit that ripens as the season advances from south to north.

Strong evidence for this migration pattern has emerged from the Dzanga data, with distinct differences between males and females. Based on half-hour counts, there is a period during the dry season, February to April, when there are fewer elephants in the clearing. When more data from the late dry season are collected, this trend may become more marked. The total number of individuals identified daily, divided by the number of observation days and tallied per month, drops sharply in the short, wet season from May to July. By examining male and female daily sightings separately, the data reveal that males, which range further than females, probably form the migratory segment of the population. For nine months of the year, the number of males is larger than females but during three months, April to June, the number of females is greater. However, while the number of males drops considerably during this period, the female numbers stay relatively constant. These data indicate that there is indeed migration which may be accentuated in males; they may be more mobile and migrate from greater distances.

In conclusion we stress that these results are preliminary and thus our hypotheses should be regarded as tentative. Continued data collection will help to elucidate patterns. For a clear understanding of social organisation of the Dzanga elephants, long-term observations, combined with a thorough knowledge of most individuals in the population, are absolute necessities. Our aim in this article has been to show the wealth of information that can be obtained on a wide variety of aspects of the forest elephant using data collected from a single point.

## ACKNOWLEDGEMENTS

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# EVIDENCE FOR THE EFFECTIVENESS OF AN OLEO-RESIN CAPSICUM AEROSOL AS A REPELLENT AGAINST WILD ELEPHANTS IN ZIMBABWE

Ferrel V. Osborn[1] and L E L Rasmussen[2]

[1]Department of Zoology, Cambridge University, Cambridge, UK;
37 Lewisam Aye, Chisipite, Harare, Zimbabwe (Correspondence should be sent to this address)
[2]Oregon Graduate Institute, Beaverton, Oregon, USA

## ABSTRACT

Between July 1993 and May 1994 a series of tests was conducted on free-ranging elephants in Zimbabwe to evaluate the effectiveness of a Capsicum-based aerosol as an elephant repellent. Reactions from the elephants were observed in 80% of three types of tests in Hwange National Park and 89% of two types of tests in the Gokwe Communal Lands. The test results suggest that this Capsicum solution has validity as an elephant repellent over both short (20-30m) and intermediate (50-l00m) ranges and that Capsicum is an effective short-term repellent. No data were collected on possible long-term effects. These preliminary results suggest that this chemical may act as a practical elephant deterrent when combined with aversive conditioning of problem elephants. Research is continuing into improving the delivery system and the methodology of application.

## INTRODUCTION

Elephants cause considerable damage each year to both subsistence-level agriculture and commercial crops in Africa and Asia. For example, Asian elephants *(Elephas maximus)* in Sumatra annually destroy millions of dollars worth of agricultural crops, including date palms and sugarcane (Sterba, 1989). In India, several hundred people lose their lives to raiding elephants each year (Sukumar, 1989). The African elephant *(Loxodonta africana)* is increasingly in conflict with humans throughout sub-Saharan Africa. Especially vulnerable to elephant depredation are drought-prone areas where crop-raiding elephants threaten food security. Both excessive costs and ambiguous results have hampered the development of effective, non-lethal repellents and deterrents.

There is a pressing economic and social need for a reliable, low cost, easy-to-use elephant repellent. However, elephants are highly intelligent and it is notoriously difficult to modify the behaviour of free-ranging animals. A number of logistical challenges must be accommodated in order to modify effectively the behaviour of a solitary 'problem' elephant or a group of crop-raiding elephants. Crop-raiders quickly habituate to false threats (e.g. drum beating, shouting, etc.), and in some cases persistent bulls have not been deterred by gunfire, including shooting one of the group (R. Martin, pers. comm.). Kangwana (1993) played back tape recordings of Maasai cattle to elephants which have periodically been hunted or injured by the Maasai. She concluded that elephants retreated from the recordings because of an association made between the danger posed by the Maasai and the sounds of their cattle.

A number of studies of elephant communication have demonstrated possibilities for manipulating elephant behaviour with play-backs of vocalisations. Bull elephants were attracted by play-backs of recorded post-copulatory rumbles (Poole *et al.*, 1988; Poole & Moss 1989; Langbauer *et al.*, 1991). Play-backs using the musth rumble repel non-musth males, but not musth males or females (Poole, unpublished). There are a number of other calls which could be used to attract or repel elephants which are less well understood, but perhaps could be used in the future. The problem with elephant sounds is that most are of very low frequency and thus require expensive equipment to record and play-back (Anon. reviewer, pers. comm.).

In addition to the need for fast-acting repellents, longer lasting deterrents are needed for application in vulnerable crop-raiding regions. The results of tests in Malawi and South Africa involving a German manufactured deer repellent "HATE-C4" have been equivocal. In Malawi, Bell & Mcshane-Caluzi (1984) reported no significant decrease in crop damage. In South Africa, La Grange (1989) reported positive results with "HATE-C4" but no details were given. This chemical was also tested in Amboseli National Park on refuse dumps in 1981 but the elephants ate the treated material nonetheless (Anon. reviewer. pers. comm.).

The control of crop damage by insects, birds and mammals through the use of long-lasting, passive deterrents, is an active area of research in Europe and North America. To control insect predation, attractant pheromones are often combined with lowered amounts of pesticide (Booth, 1988). A variety of non-lethal repellents specific to birds have been used to protect important agricultural crops (Avery, 1989; Mason, 1989; Nolte *et al.*, 1993c). Among mammals, mink and coyote urine deterred mountain beaver damage to Douglas fir trees in the western United States (Nolte *et al.*, 1993a, 1993b). North American deer avoided predator urine (Melchiors & Leslie, 1985; MullerSchwarze, 1972; Sullivan *et* al.,1985; Swihart *et al.*, 1991). Elk were deterred from feeding on alfalfa by coyote urine (Andelt *et al.*, 1992).

The problem of people-habituated and refuse-raiding black and brown bears prompted a search for deterrents and repellents (Hunt, 1983). Free-ranging and captive bears in a variety of situations have been tested (Hunt, 1984). One of the most promising chemical deterrents has been a Capsicum-resin aerosol. This mixture has been used to repel attacking bears and to condition aversively, habituated, problem bears (Smith 1984; Hunt, 1984, 1985). Because the active principle may affect several sensory systems, the exploration of its possible use as an elephant deterrent was considered. Two unpublished studies in Kenya on the use of Capsicum were known prior to our initial investigation. Capsicum was tested on refuse dumps in Amboseli National Park (Anon. reviewer, pers. comm.) and Capsicum was applied to fence posts in the Laikipia District (V. Booth, pers. comm.). Both tests yielded negative results.

Capsicum, usually derived from the dried, ripe fruits of several species of the family Solanaceae, for example *Capsicum frutescens* (African chillies) or *Capsicum annum* (Tabasco pepper, Louisiana long pepper) are very complex mixtures; over 80 peaks have been detected (using chemical tests) in the head space of Tabasco pepper seeds, including alcohols, aldehydes, ketones, esters, hydrocarbons and furans (Ingham *et al.*, 1993). Capsicum stimulates extrinsic (non-olfactory) innervation in the olfactory mucosa, namely the trigeminal nerve. Capsicum eliminates or severely reduces trigeminal chemosensitivity in the nasal cavity without significantly affecting olfaction or taste (Mason *et al.*, 1987). Trigeminal response to volatile chemical stimuli disappears in human adults chronically tested with large doses of Capsicum (Silver *et al.*, 1985, 1991). Especially relevant to studies involving repellency and deterrence to Capsicum are the relationships between sensitisation and desensitisation and repetitive tests and/or long-term use (Green & Shaffer, 1993; Green, 1991).

In elephants, as in other mammals, the nasal mucosa, both olfactory and respiratory, receive sensory innervation via two branches of the trigeminal (cranial V) nerve. Chemical stimuli, such as the complex Capsicum aerosol used in these tests, may stimulate a variety of sensory receptors including those of olfactory, vomeronasal and trigeminal systems, on entering the nasal cavity (Tucker, 1963, 1971). The elephant, with its long nose, possesses one of the most extensive trigeminal systems known. Its large turbinate areas makes the elephant a highly macrosomatic mammal; its sense of smell is one of the most acute in the animal kingdom. In this nasal region a variety of senses interplay (Rasmussen, 1994).

This report presents the findings of two series of experiments to test the effectiveness of Capsicum spray on wild elephants. The first set was designed to ascertain whether the spray had any effect on the elephants and if so, to establish the range of reaction. The second set was designed to identify potential logistical modifications needed for application of the spray as a deterrent.

## MATERIALS AND METHODS

Tests were conducted on wild African elephants at two locations in Zimbabwe: Hwange National Park (22 tests between 16 and 22 July, 1993) and in the Gokwe Communal Lands (GCLs) surrounding the Sengwa Wildlife Research Area (SWRA) (18 tests between February and May 1994).

The chemical tested was OC-l0 (made by Bushwacker Backpacking Co.), a 10% oleo-resin Capsicum solution which was propelled from a 15oz aerosol canister. The resin was atomised on firing and had a spray width of approximately one metre and an initial range of four to five metres. The oleo-resin floats in a cloud and can remain effective for up to 75m in a light wind. Partial controls were employed to discount the effect of the investigators presence and/or the discharge of the cans' contents.

In all tests it was likely that the elephants would have been able to smell the testers. In order to control for the presence of people (i.e. scent and sound), a period of 10 to 20 minutes was allowed to pass before testing. This period increased the probability that the reactions which were recorded were elicited by the spray, rather than the presence of the researchers.

*Two men spraying to demonstrate the initial range of the Capsicum units.*

The tests in Hwange were conducted in three types of situations. In seven trials elephants were tested by investigators on foot. The elephants were sighted at random (i.e. the first encounter off the road network) and approached from down-wind so as to determine age and sex. The testers would then move up-wind and spray after a short control period. Seven tests were conducted opportunistically from the vehicle when one or more elephants were within range (between 25-50m) and the wind was favourable. Elephants which appeared to react to the vehicle were not tested. After a pre-test control period the spray was fired in a wide burst towards the selected elephant. The average distance from the vehicle to the elephants in these tests was approximately 40m. In eight tests a radio-controlled remote firing stand was used at waterholes. The stand was located up-wind from a pre-selected water hole, camouflaged with grass and elephant dung and fired from a distance of approximately 250m. The experiments were video-taped from approximately 150m down-wind. After the elephants arrived at a waterhole a pre-test period of 10 minutes was allowed to elapse before the experiment commenced. The test was aborted if the elephants appeared to react to the observers or the sight or smell of the spray stand during this interval.

The 18 tests in the GCLs were conducted in cultivated areas on groups of habituated crop-raiding bulls. In 12 tests the spray was administered while the investigator was on foot and in six tests the remote stand was used. In this series all tests were conducted at night. The sessions were video-taped on nights with moonlight using light-enhancing equipment. The taping began at least 10 minutes prior to the stimulus release. When the elephants entered a selected field, the group was counted, the sexes noted, and individual identification made whenever possible. The owner of the field would then attempt to chase the elephants from the field by traditional means (shouting, throwing burning sticks or shooting sling shots). If after a short period the elephants did not leave the field, the test would begin. The tester moved into position up-wind of the elephants at a distance of 30-50m. When the control period (5-10 minutes) had elapsed, the camera personnel alerted the tester to fire. The firing time was recorded on video tape. An entire can was expelled per trial and the test continued for 30 minutes or until the elephants were out of sight. The area was monitored to ascertain whether elephants returned to the field the same night. However, revisitation rates to fields by tested elephants were not known due to the inability to identify individuals at night.

Observations of the resin cloud indicated that the spray held together for 20 minutes or more in little or no wind

Photo credit: Ferrel V. Osborn

*Test field 4 in GCLs: retarded by drought, then destroyed by elephants*

and was still effective after traveling 50-75m in a light wind. Depending on the wind velocity and the distance between the elephants and the testers, a period of 30 seconds to two minutes elapsed before reactions were observed. This period, after the spray was fired and before the elephant reacted, indicated that the animals were not reacting to the sound of the aerosol can, but probably to the components in the spray. When the spray was fired it created a sound similar to that of a high pressure air hose. During the initial spray stand tests, elephants within five metres of the stand seemed frightened by the unusual sound and retreated before inhaling the spray.

## RESULTS

The 22 tests conducted at Hwange National Park resulted in 19(86%) positive responses (Table 1). Of the eight trials with the spray stand, five appeared to cause a repellent reaction. In the other three tests the elephants appeared to react to the sound of the can firing rather than to the spray itself. The nearest animal down-wind of the stand was the first to be affected by the mist from the spray; the animal froze momentarily and audibly expelled air. Affected elephants shook their heads and vocalised, often roaring and trumpeting, before moving off. In four of the tests the elephants stopped, then touched their eyes repeatedly with their trunks, before re-orientating and moving off rapidly.

The seven trials from the vehicle, conducted exclusively on bulls found singly or in small groups, resulted in the selected animal retreating in all tests. When the spray reached each elephant, it froze, exhaled air and 'periscoped' with its trunk towards the source of the spray. Upon testing the air, the elephants immediately shook their heads vigorously. In all seven tests the bulls turned away from the spray and moved off rapidly. The presence of the vehicle and the testers may have influenced the reaction of these elephants, but the subjects appeared to be unaware of the testers' presence. In each test the "reaction" was recorded after a period of time which corresponded to the rate the Capsicum travels in light wind conditions.

Results from the third type of test, with the investigator on foot, were similar, except that in three of the tests the subjects first 'bluff charged' (moving towards the testers rapidly then stopping and vigorously shaking their heads) before being sprayed. No hesitation was observed after the elephants inhaled the spray, unlike among those observed from the vehicle and during the remote stand tests.

*Table 1. Results of tests in Hwange National Park (July 1993.).*

| Test | # Ele. | Mode | Location | Reaction | Results |
|---|---|---|---|---|---|
| 1 | FG17 | ST | WH | Retreat | After 17 seconds |
| 2 | FG9 | ST | WH | Unclear | After 31 seconds moved off |
| 3 | B4 | OF | BSH | Retreat | Closest bull moved first (15 seconds) followed by three (28 seconds) |
| 4 | 83 | V | BSH | Retreat | All three retreated (21 seconds) |
| 5 | FG15 | ST | WH | Disorientate & retreat | Group confused for 18 seconds, then moved off rapidly |
| 6 | FG12 | ST | WH | Retreat | Group moved off after 33 seconds |
| 7 | B2 | OF | BSH | Retreat & vocalise | Closest bull touched trunk to eyes |
| 8 | B1 | OF | BSH | Retreat | (27 seconds) |
| 9 | FG7 | ST | WH | Unclear | FG smelled testers, waited 20 minutes, then reacted to the sound of the stand |
| 10 | FG12 | V | BSH | Retreat | FG inhaled spray and retreated rapidly |
| 11 | FG6 | ST | WH | Unclear | FG moved off in panic because of sound of spray stand |
| 12 | B1 | OF | BSH | Retreat & vocalise | Bull became disorientated and roared, bluff charged |
| 13 | B4 | V | BSH | Retreat | Closest bull exhaled air, paused, and all moved off together |
| 14 | FG9 | ST | WH | Retreat | FG retreated when cow closest to stand inhaled spray |
| 15 | B2 | V | BSH | Retreat | Bull did not react immediately but after 30 seconds |
| 16 | Bi | OF | BSH | Retreat | Into thick bush |
| 17 | FG11 | ST | WH | Retreat | FG after two cows inhaled spray |
| 18 | B1 | V | BSH | Retreat& vocalise | Bull vocalised (roars and rumbles) after inhaling spray |
| 19 | B4 | V | BSH | Retreat | The first bull's reaction seemed to cause the others to retreat |
| 20 | B6 | V | BSH | Retreat | First bull to inhale spray charged |
| 21 | B1 | OF | BSH | Retreat | Thick bush |
| 22 | B1 | OF | BSH | Charged | Bull charged and when sprayed retreated |

*FG = family group, 8= bull; WH= water hole; BSH= bush; ST= spray stand; V= vehicle; OF= on foot*

*Table 2 Results of tests in the Gokwe Communal Lands (February-May 1994)**

| Test # | # El. | Mode | Reaction | Results |
|---|---|---|---|---|
| Test 1 | 4 | ST | Retreat | Bulls moved off rapidly after inhaling spray |
| Test 2 | 2 | OF | Retreat | Reaction of the first bull occurred 2:50 seconds after stimulus was released |
| Test 3 | 7 | ST | Retreat | After 25 seconds, stand approx 30 minutes. |
| Test 4 | UNCL | OF | Retreat & disorientate | Bulls became disorientated; after 28 seconds , moved off; 20 minutes paused, then off in a new direction |
| Test 5 | 2 | ST | Unclear | Bulls seemed to react to the sound of the spray |
| Test 6 | 7 | OF | Retreat | Closest group of four retreated rapidly; other three left after 15 minutes |
| Test 7 | 14 | OF | Retreat & vocalise | Bulls moved from the field slowly |
| Test 8 | 2 | OF | Retreat | Wind erratic; bulls reacted after 58 seconds |
| Test 9 | 9 | OF | Retreat | Bulls appeared to panic; moved towards testers then retreated |
| Test 10 | 1 | ST | Retreat | Bulls moved across field in panic after inhaling spray |
| Test 11 | 1 | OF | Retreat | Bulls immediately left field after inhaling spray |
| Test 12 | 6 | OF | Retreat | Two groups of three bulls; only one group retreated |
| Test 13 | 3 | OF | Retreat | Bulls retreated 2 minutes after first reaction |
| Test 14 | 8 | OF | Retreat & disorientate | Group became disorientated and moved in a number of directions before retreating |
| Test 15 | 4 | ST | Retreat & vocalise | First bull vocalised; group moved towards stand, then retreated |
| Test 16 | 2 | OF | Retreat | Bulls were 20 metres apart; only one bull moved |
| Test 17 | UNCL | OF | Unclear | Sound of the spray |
| Test 18 | 4 | OF | Retreat | Bulls all moved from the field in different directions |

**All test were conducted on bulls at night on agricultural land.*
*ST= spray stand; OF= on foot*

Results from the 18 tests in the GCLs, as recorded on video tape, revealed a similar pattern of response throughout (Table 2). In two tests it appeared that although the conditions seemed satisfactory, the elephants did not inhale the spray. In the other 16 remaining tests, the elephants seemed to ignore the sound of the spray being fired and continued to feed. The elephant in contact with the spray immediately stopped feeding and raised its head in alarm. This action was followed by an audible exhalation of air, then a rumble or roar. The rest of the group froze until the next animal in line inhaled the spray. The elephants then emitted a series of excited trumpets, rumbles and roars, followed by a hurried and disorientated exit from the field in the opposite direction from which the spray came.

## DISCUSSION

The data presented in this study suggest that Capsicum oleo-resin spray possesses short-term repellency towards African elephants. Affected elephants retreated and did not continue their normal routine (i.e. drinking at a waterhole or continuing to feed). However, in these field tests we could not eliminate completely the variables of human scent and the sound of the firing can. It is impossible to quantify precisely the reaction of a wild elephant to a specific stimulus in a situation with numerous confounding factors. This difficulty has been pointed out in the study by Langbauer *et al.* (1989, 1991) on the reactions of elephants to play-backs of infrasonic calls. These investigators recognised that actions as subtle as lifting the head or increased ear fanning could be considered responses. They usually had no way of asserting whether the responses they recorded were a response to the play-back or to infrasonic calls from distant elephants. With regard to these Capsicum tests, it is similarly difficult to ascertain the details of how the elephants were affected. Tests on captive elephants would be more conclusive, but ethical considerations of tests with irritants pose a constraint.

### Can elephants be aversively conditioned?

Information from wildlife managers and recent field observations during this study suggest that crop-raiding may be taught by example from a small number of older bulls to younger ones. We suggest that elephants which are "initiators" of destructive behaviour should be targeted for behaviour modification. If a relatively small number of bulls are inciting others to engage in destructive behaviour, problem populations could be controlled by altering the actions of a few individuals. If the elephants which initiate crop-raiding could be taught to avoid agricultural areas a serious economic problem could be ameliorated. Conditioning through the use of aversive stimuli (ie. pepper spray) when the elephant is engaged in an undesired behaviour, may be sufficiently disturbing to cause the raider to associate adversity (i.e. itching skin, watering eyes, burning sensation in the trunk mucosa, trigeminal pain reception) with the particular behaviour (i.e. crop destruction). Theoretically, elephants could be discouraged from foraging in agricultural areas. In this experiment the repellent, but not the deterrent properties of this spray have been demonstrated.

In 1982, Hunt (1984) offered two definitions in the context of Capsicum spray research on bears:
"Repellents are activated by humans and should immediately turn an animal away in a close approach or attack. A deterrent should prevent undesirable behaviours by turning an animal away before a conflict occurs. Deterrents need not be monitored or manually activated by humans". Our current studies are aimed at increasing the effectiveness of Capsicum as a deterrent now that we believe we have demonstrated its repellent properties. The possibility that an elephant may associate a sound (whistles or horns) with the adverse reactions (pain) to the Capsicum is currently being evaluated. Periodic reinforcement of a sound with Capsicum spray may be necessary, if an elephant learns that the single stimulus of sound is a false threat.

The economic considerations of the application of these chemicals are very important. It is recognised that the logistical hurdles regarding the cost and effective application are formidable. The Capsicum aerosol which was tested is relatively expensive (US$18 per unit) and has to be imported. However, electric fencing schemes in Zimbabwe are funded by foreign donors at an installation cost of US$500 to $1500 per km (Hoare, 1992). Most crop damage in Zimbabwe occurs between February and May (Taylor, 1993; Hoare & Mackie, 1993), followed by eight months of relatively low levels of conflict. Considering these factors, non-permanent deterrents may become more economically viable over time. In addition, the value of subsistence agriculture cannot be measured in purely economic terms. Often the affected crop is the only source of food for rural families. The time spent defending crops and sourcing the availability of alternative food must be considered. If the chemical experiments described above are successful in deterring elephants, these technologies could be simplified and administered by local wildlife authorities during the crop-raiding season.

Photo credit: Ferrel V. Osborn

*Bulls crossing through an electric fence.*

## Future areas of research

The responses of an animal are dictated by genetic selection pressures, learning experiences and instinctive propensities of particular species (Bullard, 1985). Protecting crops from animal consumption with a chemical compound with which the animal is unacquainted, may be less effective than a biological product which has been repeatedly encountered by the animal in its environment. The understanding of the repellent and attractive properties of natural scents and their components is only in the initial stages of development. Tests to assess the effectiveness of chemical repellents that include natural products such as elephant pheromones or other semio-chemicals, are being planned. Such chemical communicators could prove to have long-term biological effectiveness and, similar to insect pheromones, could be synthesised and used in economically viable pest control programmes.

Chemical compounds with potential species-specific deterrent capabilities may prove an effective way to deter elephants. Gorman (1986) tested African elephant temporal gland secretion as an elephant repellent with somewhat ambiguous results. However, areas of potential research include studies similar to the recent study of the chemical senses of Asian elephants which specifically examined how female elephants communicate sexual receptivity (Rasmussen *et al.*, 1993). The ongoing studies of musth awareness chemosignals emitted by musth Asian bulls and perceived by females (Perrin *et al.*, 1994, Perrin *et al.*, submitted) also offer possibilities for future elephant attraction, repulsion and containment. The avoidance reactions exhibited by female elephants to specific light volatile fraction from musth bulls when expelled from air canisters (Perrin *et al.*, , submitted) are also potentially useful. It has been suggested that elephants secrete different chemical components through the temporal glands depending on differing situations (Anon. reviewer, pers. comm.). Synthesised temporal gland secretions from periods of intense fear (i.e. culling) could be used as a repellent.

## Ongoing and future work in this project

Ten crop-raiding bull elephants were radio-collared in the SWRA of Zimbabwe and their movements monitored during the 1994/5 wet season. Fields adjacent to SWRA were defended with Capsicum in an effort to determine the validity of this method which will be tried again during the 1995/6 growing season. Improvements aimed at the design of the Capsicum delivery system and reduction in the cost per unit are ongoing (e.g. an inexpensive Capsicum powder grenade). Field testing of semio-chemicals and identified elephant pheromones is planned for early 1996.

Farmers, researchers and wildlife managers in Africa and Asia are exploring techniques for repelling elephants. However, very few of these data are published. For example, farmers in Kenya burn chili peppers claiming the smoke keeps elephants away. It

has been suggested that a slowly burning Capsicum device, made by a farmer and placed around his fields, might keep elephants away (Anon, reviewer, pers comm). We are very interested in any ideas or suggestions regarding the control of elephants by chemical means and we invite correspondence to the first author's Zimbabwe address.

To conclude, with proper design, a Capsicum or chemical-based technique could be a cost effective supplement, or even an alternative to electric fencing or the shooting of problem elephants. The results of our first experiments offer hope that chemical repellents such as Capsicum may provide affordable, non-lethal tools for managing elephants in areas of conflict with humans.

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# THE DOMESTICATION OF THE AFRICAN ELEPHANT

Eve Iversen

International Agricultural Development, University of California, Davis, 1953 22nd St, San Pablo, CA 94806 USA

## HISTORICAL BACKGROUND

The history of elephant domestication in Asia and Africa stretches back for centuries. On both continents elephants have served humans in times of peace and war. While the tradition has remained intact in Asia, it has not been stable in Africa.

African elephants were trapped in the wild and tamed for military use in ancient times (Armandi, 1843; Grower, 1947; Grower, 1948; Scullard, 1974). One of the most famous generals of long ago who used elephants was Hannibal. His crossing of the Alps from Gaul into Italy to fight the Romans in 219 BC is still well known. In 1988 three Asian elephants participated in a re-enactment of Hannibal's march. Two cows, Tali and Dido, completed the walk but the third, Batman, was returned to Circo Medrano due to lameness (Taylor, 1990).

The ancient Carthaginian victories were celebrated with silver coins which depicted African elephants and their riders (Grower & Scullard, 1950). The size ratio of man to elephant on the coins indicated to Scullard (1948) that the elephants were less than eight feet high at the shoulder and probably belonged to the forest subspecies *(Loxodonta africana cyclotis).*

In military units elephants were valued because they caused panic to men and horses not accustomed to them (Armandi, 1843; Scullard, 1974). However, in many battles, injured or frightened elephants harmed their own side more than the enemy. Riders sometimes carried weapons to kill elephants which threatened them (Scullard, 1974).

There are no records describing any domestic use for elephants in the Mediterranean region apart from their participation in parades, Roman "games" and other ceremonies. It seems odd that the Carthaginians and Egyptians did not use their elephants for any other work. They may have accorded them a status higher than a beast of burden, much as that of the sacred white elephant in Asia. This may be the reason why they were no longer used after the fall of the Roman Empire. They were also neither employed by Europeans for farm work, nor by the Goths, Vandals or other tribes for military enterprises.

## THE ASIAN ELEPHANT IN AFRICA

King Leopold II of Belgium was impressed by the value of elephants during a trip to Ceylon (Sri Lanka) before he ascended the throne in 1865. Previous efforts to enter central Africa using animals such as oxen, horses, and donkeys had met with failure (Laplae, 1918). The King believed that Asian elephants might be used to secure and expand his new conquests in the Congo (Zaire). His Majesty paid all the expenses for the experiment.

On 1 June, 1879, the ship *Chinsura* debarked four Indian elephants from Bombay at Msasani, Tanganyika (now Tanzania). The two males (Sundergrund and Naderbux) and two females (Sosan Kalli and Pulmalla) swam ashore and caused a sensation (Leplae, 1918). Domesticated elephants still had the same shock value as they had displayed on the ancient battlefields.

The expedition proceeded into the interior. Progress was slow but the people along the route were impressed by the sight of white and brown men commanding *tembo.* However, the animals died one by one, probably from overwork and diseases acquired in Africa, while the last, Pulmalla, apparently died of "sadness" (Watson, 1990; Smith, 1992). A second Belgian-sponsored attempt also met with failure. In spite of this, King Leopold continued to believe in the concept of domesticating elephants for use in his colonies.

A later importation of Asian elephants was made by Sir Hesketh Bell, Governor of Uganda, in the early 20th Century. This also failed, due to the misuse of a trained tiger/game hunting elephant.

## THE MODERN DOMESTICATION OF AFRICAN ELEPHANTS

The first modem domestication of the African elephant was accomplished by missionaries at Fernand Vaz in Gabon in the late 1890s. They had

trained a male (named Fritz) which had been bought from local people who had trapped the animal in a marsh. The missionaries taught him to do simple tasks around the compound. Reports of this success came to the attention of King Leopold II who decided to try domesticating African elephants in his colony.

In June 1899 Commander Jules Laplume was sent by His Majesty to begin a regular programme of domestication in the Congo. In March 1900 Laplume established an elephant school at Api. With the help of the Azande chief Kiravongu, pit traps were dug but all the captured young animals were rescued by adult elephants or died (Laplume, 1911; Smith, 1992).

By trial and error other systems of capture were tested (Watson, 1990; Smith, 1992). The most successful involved startling a herd with gun fire. The hunters chased the frightened herd and grabbed the calves with bare hands and ropes. If the mother could not be frightened away by more shots she was killed along with any other adults that tried to rescue the calves.,

By the end of 1902 four calves had been caught and domestication had begun (Watson, 1990). Once enough trained animals were available, experienced adults ("monitor" elephants) were used to move and calm the newly captured orphans. The men assigned to training were called *cornacs* and they hand-fed their assigned calves with the "monitor" elephant providing psychological and social support., Training progressed gradually as the animal grew. Kindness and rewards formed the basis of the training.

The first basic commands taught the elephants to move around, stop, turn, and allow a *cornac* to guide them. Later they were taught to pull loads such as logs and wagons, which proved more effective than loading the elephants with back packs. Elephants were even employed to pull ploughs when the land was cleared around the station.

By 1925 Captain Keith Caldwell, Deputy Game Warden of Kenya, reported that there were 50 elephants in the Belgian Congo at Api (Caldwell, 1925). Of these, 19 were adults doing full work, 25 were young animals doing light work and six were still in training. He also noted that the elephant school had been directly supported by King Albert I of Belgium since about 1918. In 1920 seven Indian (or Ceylonese) mahouts were sent to improve the local training methods (Watson 1990). Their techniques were more forceful than those which had evolved in the Congo. Captain Caldwell reported that the mahouts "seemed to be afraid of the elephants and treated them with great severity. Of five newly-caught animals two died immediately on account of the *dressage des Hindous"* (Caldwell, 1925). The mahouts left after a labour dispute, but their methods had a beneficial effect on the training at Api. The same methods, which stressed the need for the trainer to dominate the animal, are still in use. The original Indian commands have been replaced by commands in the local language, Bangala (Smith, pers. comm.).

Between 1927 and 1929 the school was moved to a new location in the northeast corner of the Belgian Congo which was originally a hunting reserve, and became Garamba National Park in 1938. The number of elephants at the new Gangala station reached a maximum of 84 (Smith, 1992). Twice, the wildlife photography team of Martin and Osa Johnson took pictures of the operations at the station. These provide some of the best documentation of the school at the height of its success.

Watson (1990) reports that operations continued until Independence in 1960., He states that "By then there were only 15 elephants left. Serious internal disturbances followed, culminating in the infamous Simba rebellion., The area around Garamba National Park was overrun by rebels and the cornacs took as many elephants as they could into hiding in the forest until the rebels were defeated ... Now (1989) four of the original herd remain: Lwiru, Kukutu, Zombe and Kiko ...their average age is about 35" (Watson, 1990).

Watson further reported that"... in the early 1 980s, the World Wildlife Fund for Nature, Frankfurt Zoological Society and UNESCO agreed to sponsor a rehabilitation project at the park...further proposals for rehabilitation of the centre itself are being considered along with renewed domestication of local elephants." (Watson, 1990). He concluded by writing "…it still seems too much to hope that the domesticated African elephant will ever be seriously used as an economic asset, working in forests, farms or game parks".

## DOMESTICATED AFRICAN ELEPHANTS IN THE 1990s

The first stage towards the redevelopment of Garamba's Elephant Domestication Centre took place in 1987, with the capture of three young elephants (Smith, 1992), followed by more in 1989. Although tourists are now few at Garamba, the income generated by the domesticated elephants is an economic asset to the park

Photo credit: Kes and Frasser Smith

*Riding domesticated elephants in Garamba National Park, Zaire.*

(Smith, 1992) and elephant riding "is one of the long-term hopes for helping to support ecosystem conservation" (Smith, pers. comm.).

In the 1 980s Randall Moore took up the challenge of returning three circus and zoo elephants to work in Africa., In the Okavango Delta in northwest Botswana he helped to develop a new form of safari for tourists., African elephant riding safaris were initiated at the Ker and Downer Inc. safari concession of Abu's Camp on the banks of the Xhenege River.

Unlike in Zaire, all the animals are bush elephants *(Loxodonta africana africana),* rather than forest elephants or an integrade between forest and bush elephants (Smith, 1992). The adults, Abu, Bennie and Kathy, were orphaned in a culling operation in Kruger National Park in South Africa. The calves, Letaba, Sirheni, Gika, Nandipa, Kideboni, Thando and Mafuyane are all less than three years old. This is a core group which is as large as that at Api in the early days of domestication., With three working adults available to act as role models, the project looks promising.

From Abu's Camp the three adult elephants take two guests each to see wildlife. Each person pays $3,625 (single supplement of $1,100) for a six-day luxury camping safari. There were 45 departure dates scheduled for 1994 which is an increase from the 31 offered in 1991.

The increase in the number of trips despite the premium price indicates that this method of game viewing is a success. Tim Farrell, Vice President of Marketing for Ker and Downey, had this to say when he compared his African elephant ride in Okavango to his Asian elephant rides in Royal Chitwan National Park in Nepal: "The African elephant definitely provides a far smoother ride that its Asian counterpart.. in Asia, the jungle is so thick and the grass so high, that it's virtually impossible to see anything at all ...riding in Botswana is akin to traveling through a beautiful planned park...truly magnificent, especially from the back of our elephants" (Ker and Downey, press release "Trunk call", 1991, p.4).

## THE FUTURE OF AFRICAN ELEPHANT DOMESTICATION

Tourists seeing wildlife from the back of an elephant represents a new marketing angle for managers of national parks and other protected areas., Tourism is

one of the largest industries in Africa and although domesticated elephants are slow to move compared to vehicles and the safari is expensive, apparently visitors are willing to pay for the unique experience. The use of tamed elephants in national parks and reserves can therefore potentially increase park revenue as well as increasing local employment. It might also help indirectly to reduce vehicle-related erosion to parks. However, it has to be recognised that trained elephants are a major investment and represent a long-term responsibility of 50 years or more per animal. Such a responsibility can only be taken up by people who are knowledgeable and experienced in the training and caring of elephants.

There is theoretically no reason to limit the work elephants can do. There are many places in subSaharan Africa where they could help to clear land, construct roads, erect buildings, harvest timber on a sustainable basis, and patrol reserves, as they do in Asia., The great naturalist Pliny the Elder wrote in book four of his *Natural History:* 'There is always something new out of Africa". It is time to review the idea of domestication of the African elephant.

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# MAN AND ELEPHANT IN THE TSAVO AREA OF KENYA: AN ANTHROPOLOGICAL PERSPECTIVE

Jean-Luc Ville

28 rue Gabriel Péri, 78220 Viroflay, France

For thousands of years, man and elephant have shared the vast Tsavo plain in Kenya, which is generally too arid for farming and of little use for pastoralism. Up to the middle of this century, part of this area (which is now Tsavo East National Park) belonged to the Waata, an Oromo-speaking group of hunters who were experts at elephant and other big game hunting, as well as honey gathering. Three hill ranges which rise from the middle of the plain comprise the home of the Taita who have settled there as permanent agro-pastoralists. For centuries, they hunted on the nearby plains in the area that now form part of the Tsavo West National Park. However, these two neighbouring peoples, the Waata and the Taita, did not hunt in the same way. The Taita, unlike the Waata, were not predominantly hunters. The Waata specialised in elephant hunting, partly to provide ivory for the coastal trade, while the Taita practised their hunting skills on a wide variety of game which did not normally include the elephant.

This article, based on a research study, examines the co-existence of the Waata and the Taita people with the elephant from an anthropological perspective, revealing an interesting age-old complicity between the two species.

## THE TAITA CASE: ELEPHANTS AS PEOPLE

Hunting was quite important to the traditional subsistence way of life of the Taita. In the 19th century, several Europeans mentioned the existence of numerous game-pits at the foot of the hills and some thought that they were being used to trap elephants for ivory (Guillain, 1856; Krapf, 1860; New, 1873). Today, however, the Taita dispute this assumption, asserting that elephants are too clever and will always "nose out" the pit with their trunk.

During the great famine of 1884, when many Taita tried to survive by hunting, other witnesses refer to rhino and buffalo hunts, but not elephant. The missionary A. Wray wondered why the Saghala people were not killing the elephants which were often seen at the foothills (Johnston, 1886; Wray, 1928; Tyrell, 1985).

There were some Taita, the Wasi, who did spend most of their time hunting elephants, though they rarely took part in the ivory trade even though it was flourishing in the second half of the 19th century. A famous Taita hunter at that time was nicknamed Mundwachovu or "Man of the elephants". His grandson, who inherited his skill, remembers having killed several elephants to defend his crops and to sell ivory. However, as he explained, he was ceremoniously cleansed by a traditional doctor after his first kill; and after subsequent kills, he always cleansed himself with the stomach contents of the dead elephant. In fact every hunter who had killed an elephant had to undergo a cleansing ceremony *(kuombochua)* before going back home or sleeping with a woman, just as was the case for a warrior who had killed an enemy or another Taita in a feud. The killing of an elephant was thought of as "murder" and the elephant was seen as a man . For this reason, its flesh was never eaten.

The Taita explain this human identity by referring to the elephant's naked skin and to its mammary gland which ressembles a woman's breast. They give a female character to the elephant in contrast to a male character to the rhino., They say that an elephant will never attack unless it is endangered, or if its young are endangered, but rhinos will charge without any reason., Thus with these two animals they express the opposing images of tranquil strength and blind fierceness.

However, the Taita people have always known that the elephant's tranquil strength can be dangerous. In a blessing to a departing missionary called Rebmann in 1849 they said, "May this friend continue on his way unimpeded, may the bush not hold him back, may this friend not meet with elephants, rhinos or enemies... (Krapf, 1860).

The inhabitants of the Taita hills are no strangers to the hunger and anger of elephants. The crop depredations and deaths of several people in the early 1980s, and from 1990 to 1993 (Ngure, 1995) were almost a repetition of events in 1916, when the District Commissioner of Voi asked permission for natives to shoot elephants which were damaging crops, and again in the 1950s (Anonymous, Kenya National Archives, 1913-1925; 1951-1962).

Being good hunters, the Taita could have traditionally killed elephants for at least two reasons: to protect their crops from damage and to trade ivory to the caravans, to which they were already supplying food and water. But to the Taita this would have amounted to murder. Instead, they used the strength of the elephant for their own benefit., For example, they sprinkled elephant dung around their fields to protect them from robbers and sorcerers, or they burned the dung to cure a sick person through fumigation. The old *kufighika* ritual, which aimed at guarding the land against enemies or wild animals, made use of elephant dung and the earth from elephant footprints. Even today, Taita shepherds burn pieces of dung, or wild sisal *(Sansevieria spp.)* chewed by elephants, to keep elephants at bay. The Taita explain that because elephants eat a wide range of plants found on the plain, their dung contains many useful constituents which act as efficient medicines or repellents to chase away intruders, including elephants themselves.

Interestingly, the Taita ascribed a similar effectiveness to the medicines and arrow poison of their neighbours, the Waata. They thought about the plain as a powerful and potentially dangerous place and bestowed these same characteristics on the plain dwellers. Following the principle that evil can be treated by evil, the Taita tried to control this danger by using the power it contained., The Waata hunter and the elephant were classed in the same category, and since the Waata were often called "animals" it is no surprise that in turn, elephants were regarded as "men".

## THE WAATA CASE: THE HUNTER AS AN ELEPHANT-MAN

For several centuries, the Waata hunters have roamed the arid bush and woodland which stretch from the Tana River to Mount Kilibasi and the Taita hills. In contrast to the Taita farmers, the Waata specialised in elephant hunting, supplying the coastal traders with tonnes of ivory. Their archery technology - an extraordinarily powerful long bow and a very potent arrow poison - possibly had no counterpart in East Africa. Their traditional way of life revolved around the elephant. Camps were built next to the animal which had been killed and were moved according to the kills. In good times, elephant meat was their only food, aside from honey. The Waata also used the elephant fat to smear on themselves.

The tremendous importance of the elephant is shown in a myth which associates the creation of elephants with the emergence of the Waata as real hunters.

> Famine was in the country because the (first?) Waata hunter always came home empty-handed. So his wife and children started eating grass and leaves and anointed themselves with red earth. They did so everyday until they became a mother elephant and her calves. Thus, elephants were born and Waata never experienced famine again.

To become an adult, the young Waata male had to kill a dangerous beast, for example a buffalo or a rhino, but especially an elephant from which the tusks were required for marriage. As explained by an old hunter, the first hunting success was greatly celebrated. As soon as an elephant had been killed, the young hero was dressed up as an elephant with pieces of its skin, a part of its trunk for a hat, the tail pulled on as a sleeve, and the ears slung over the shoulders to act as an apron. Once in the village, the hero remained secluded for seven days, wearing a necklace rubbed in elephant fat every day. On the last day of seclusion, beer was poured over his head which was shaved by an old, skilled hunter, in the hope that the new hunter would become another good marksman. A different version of the same story describes how the ears of the elephant were cut off by the women and placed as a shelter "hut" for the young hero. The women then performed a dance in front of the shelter, hurling taunts at the dead animal and praising the slayer, who received the elephant's tail as a bracelet. Then, having sat in his "hut", the hero's head was shaved and annointed with the fat of his victim. When all the meat had been removed from the carcass, the ears were placed under the animal's skull to ensure its peaceful sleep (Sharpe, unknown date; Parker & Amin, 1983).

The hunter also had to make use of "animal skills" when stalking his prey: by moving quietly, making good use of all his senses and being able to read every sign left by elephants - in other words, trying to understand the elephants' language. To the Waata people, the hunter and his game are one and the same thing.

The Waata people remained almost unknown until Tsavo National Park was created in 1948. By that time, most of them lived in permanent settlements and had taken up farming. But ivory trafficking was by then well organised, and the Waata men who had not given up hunting turned to full-time poaching, killing elephants only for their tusks, and rhinos for their horn, and leaving the flesh to rot. Together with other tribes, namely the Kamba and the Giriama, the Waata were a

real threat to the Tsavo elephant population. The Park's authorities reacted sharply and by 1958 had totally dismantled the bush underworld of these poachers.

For centuries before they became poachers, the Waata had been well integrated into the lowland, semi-arid, savanna ecosystem of Tsavo. Their lives were so dependent on elephants that the destruction of herds would have meant death to themselves. The antiquity of the ivory trade on the north coast of East Africa suggests that the hunting habits of the Waata people had never endangered the elephant population even though their hunting was focused on the elephant.

It is arguable that the Waata in fact contributed to the ecological balance by reducing pressure on woodland through elephant hunting. By killing elephants, the Waata were actually preserving another important resource, wild honey, which they mostly found in trees. The honey is produced either by the honey bee, *Apis mellifica,* or by several species of social bees belonging to the genus *Trigona.* These small, stingless bees usually build their hives in the hollows of trees such as *Commiphora spp. (hammess, hagarsu)* or Bowswellia spp. *(d'akar)* from which the resinous sap is sold at the coast as incense, and - less commonly -*Cordia sinensis (mad'era).* The Waata also made use of other plant species, such as *Adansonia digitata* for food and beer fermentation, in which the honey bee is frequently found; *Sterculia africana* for making carrying straps, snuff, and natural water storage; and *Grewia* spp. for food and for making bows and arrows. Most of these species constitute a portion of the elephants' diet. With the increase in the elephant population during the 1960s, coupled with the effects of fire and the cessation of poaching by the Waata, many *Commiphora* spp., *Sterculia* spp. and *Adansonia digitata* were destroyed, thus depriving the Waata of essential resources, especially honey (Bax & Sheldrick, 1963; Agnew, 1968; Leuthold, 1977).

## CONCLUSIONS

Although elephants were more important to the general livelihood of the Waata than the Taita, and although the two groups have traditionally approached hunting from different angles, they have the same respect for the elephant. They believe that it is a powerful and intelligent animal, which is on an equal footing with man, especially to a hunter. The elephant's equality and power were regarded as useful, not harmful, because elephants secured the Waata's existence and provided the Taita with protection.

Modem research confirms the appropriateness of the traditional approach. The elephant is called a "keystone" species which, with man, shares the capacity to shape its environment. Man and elephant also compete for the same resources in the same habitat (Western, 1989; Shoshani, 1993; Parker & Graham, 1989). Both species have a long life-span, follow a similar reproductive cycle, rear their young for several years, have no serious predators except man, react to death.. .and so on.

The complicity between the two species existed in some societies long before the development of science. Man and elephant have not always been enemies. Traditionally, man had respect for the elephant and recognised its worth and usefulness. The dramatic reduction of elephant populations can be linked not only to habitat reduction and human population growth, but to the advent of modernisation and the breakdown of traditional societies.

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