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Pachyderm

journal of the African Elephant, African Rhino and Asian Rhino Specialist Groups

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Cover: NOT YET 'OUT OF THE WOODS' BUT AT LEAST FINALLY OUT OF THE WOMB. The successful reproduction of this Sumatran rhino at the Cincinnati Zoo provides an epochal breakthrough that hopefully will enable managed breeding of Sumatran rhinos in captivity to become a viable component of conservation efforts for this beleaguered species (see AfRSG report, page 11).

Photos: David Jenike, Cincinnati Zoo.

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CHAIR REPORTS
RAPPORTS DES PRESIDENTS

African Elephant Specialist Group report
Rapport du Groupe des Spécialistes des Eléphants d'Afrique

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New faces at AfESG

I am pleased to announce that we have finally recruited a dedicated programme officer, Mr Elie Hakizumwami, to facilitate AfESG work in the Central African region. Elie has 23 years of experience in conservation and natural resource management in central Africa, and he has worked as a consultant for IUCN since 1996. His appointment is particularly timely now with AfESG involved in developing a subregional Strategy for the Conservation of Elephants in Central Africa.

Elie, who is based at the IUCN Regional Office for Central Africa in Yaoundé, has already started work on logistical arrangements for the upcoming AfESG members' meeting scheduled for early 2002. Other urgent tasks include sourcing survey reports for the next update of the African Elephant Database, building and consolidating relationships with key elephant conservation authorities in Central Africa and, of course, the never-ending search for more material for *Pachyderm.*

Ms Rowena Costa-Correa left her position as administrative officer at the end of August after a full month's handover to Ms Cecily Nyaga. Rowena's enthusiasm and positive attitude will be greatly missed here at the Secretariat, and her unique qualities will undoubtedly help her find her feet in her newly adopted home in Canada.

Meanwhile, Cecily has adapted to her new job remarkably quickly and has brought to the team much-

Nouveaux visages au GSEAf

Je suis heureuse de pouvoir vous annoncer que nous avons enfin engagé un responsable de programme dévoué, Mr Elie Hakizumwami, pour faciliter le travail du GSEAf en Afrique centrale. Elie compte 23 ans d'expérience dans la conservation et la gestion des ressources naturelles en Afrique centrale et il a travaillé comme consultant pour l'UICN depuis 1996. Sa nomination tombe particulièrement à point au moment où le GSEAf est impliqué dans le développement d'une stratégie sous-régionale pour la conservation des éléphants en Afrique centrale.

Elie est basé au Bureau régional de l'UICN pour l'Afrique centrale à Yaoundé, au Cameroun, et il a déjà commencé à travailler sur les dispositions logistiques de la prochaine réunion des membres du GSEAf prévue pour le début de 2002. Les autres tâches urgentes comprennent la recherche des rapports de suivi pour la prochaine mise à jour de la Base de Données sur l'Eléphant d'Afrique, l'établissement et la consolidation de relations avec les autorités clés de la conservation des éléphants en Afrique centrale et bien sûr, la quête permanente de nouveau matériel pour *Pachyderm*.

Mme Rowena Costa-Correa a quitté le poste de responsable administratif à la fin du mois d'août après avoir assuré pendant un mois entier la transition avec Cecily Nyaga. L'enthousiasme de Rowena et son attitude positive nous manqueront beaucoup ici, au Secrétariat, et ses qualités uniques l'aideront sans

needed financial administration skills borne from extensive experience dealing with international donor organizations.

Pachyderm

In August Dr Mark Stanley Price, a long-term *Pachyderm* editorial board member and a close colleague, left Kenya after many years spent dedicated to conserving Africa's wildlife. Mark has now taken up the post of executive director of the Durrell Wildlife Conservation Trust based in the Channel Islands. Over the years, *Pachyderm* has benefited tremendously from his guidance, strategic vision and solid scientific expertise.

To help fill the void left by Mark's departure Dr Rob Olivier has recently been appointed to the editorial board.

Elephant taxonomy

Until now elephant conservation strategies in Africa have been based on the assumption that all African elephants belong to the single species *Loxodonta africana* with two subspecies (*L. a. africana* and *L. a. cyclotis).* New evidence by Roca et al. published in the August 2001 issue of *Science* seems to suggest that the forest and the savannah elephants should be classified as two separate species: *Loxodonta africana* and *Loxodonta cyclotis*.

The existence of large genetic distance and multiple genetically-fixed nucleotide site differences, morphological and habitat distinctions, and extremely limited hybridization of gene flow between forest and savannah elephants are used to support their conclusion.

The process of accepting new taxonomic distinctions such as the one proposed is not in itself a science and can involve a protracted period of debate in the scientific literature and the greater 'elephant community'.

As a contribution to this debate, the conservation and management implications of this finding will be discussed by the members at the upcoming AfESG meeting.

West Africa programme office

Since January 2001, Lamine Sebogo, the programme officer for West Africa, has been promoting the West African Elephant Conservation Strategy in the subregion.

aucun doute à trouver son rythme dans son nouveau pays d'adoption, le Canada.

De son côté, Cecily s'est adaptée remarquablement vite à son nouveau travail et a apporté à l'équipe qui en avait bien besoin les compétences en administration financière qui lui viennent de sa longue expérience des relations avec les organisations donatrices internationales.

Pachyderm

En août, le Dr Mark Stanley Price, membre depuis longtemps du bureau de la rédaction de *Pachyderm* et proche collègue, a quitté le Kenya après y avoir consacré de nombreuses années à la conservation de la faune sauvage d'Afrique. Mark a repris le poste de Directeur exécutif du *Durrell Wildlife Conservation Trust,* basé dans les îles anglo-normandes. Pendant des années, *Pachyderm* a bénéficié magnifiquement de ses directives, de sa vision stratégique et de sa expérience scientifique solide.

Pour aider à combler le vide laissé par le départ de Mark, le Dr Rob Olivier a été nommé récemment au bureau de rédaction.

Taxonomie des éléphants

Jusqu'à présent, les stratégies de conservation des éléphants se sont basées sur l'hypothèse que tous les éléphants d'Afrique appartenaient à la seule espèce *Loxodonta africana*, avec deux sous-espèces (*L. africana africana* et *L. africana cyclotis*). De nouvelles preuves publiées par Roca *et al.* dans le numéro d'août 2001 de *Science* semblent suggérer que les éléphants de forêt et de savane devraient être classés dans deux espèces différentes : *Loxodonta africana* et *Loxodonta cyclotis*.

L'existence de grandes distances génétiques et de nombreuses différences des sites de nucléotides génétiquement fixés, les distinctions de morphologie et aussi d'habitats, et l'hybridation extrêmement limitée des flux génétiques entre les éléphants de forêt et de savane viennent conforter leurs conclusions.

La procédure pour accepter de nouvelles distinctions taxonomiques telles que celle qui est proposée ici n'est pas en soi une science et peut impliquer une très longue période de débats dans la littérature scientifique et dans la très vaste « communauté des éléphants ».

Pour contribuer à ces débats, les membres qui

West Africa has lost more than 90% of its elephant range during the 20th century, and today most elephant populations are small and isolated. It is estimated that two-thirds consist of no more than 100 elephants.

Lamine has now finished his travels in the subregion to raise awareness of the new strategy among all the key parties concerned with elephant conservation and to disseminate the strategy document to higher levels of government for formal adoption. The response has been overwhelmingly positive throughout the subregion. The Economic Community of West African States (ECOWAS), a regional organization similar in function to SADC, has confirmed its desire to consider adopting this strategy as its reference tool for elephant conservation and management activities. The Convention on Migratory Species has also formally adopted this plan.

Many of the vulnerable elephant populations straddle international frontiers, making a subregional approach vital for long-term conservation of elephants in West Africa.

In an effort to address this important issue of cross-border populations, AfESG is planning to assist governments of the subregion to organize a subregional workshop dedicated to identifying existing elephant corridors and helping to formulate strategies to protect them.

On a national level, the signs are equally encouraging. The governments of Burkina Faso and Togo have recently applied for funding to develop their own national elephant management plans. The governments of Benin, Côte d'Ivoire, Mali and Niger are expected to follow suit in the near future.

Reintroduction guidelines for African elephants

In *Pachyderm* 30, I outlined some of the reasons why I felt that practical guidelines for the reintroduction of African elephants were needed to guide those involved in moving these massive animals from place to place. News of recent and proposed translocation exercises has added impetus for this initiative.

To meet this new challenge, I have approached a number of experts, both within and outside AfESG, to help form a Reintroduction Working Group to assist the secretariats of AfESG and the Reintroduction Specialist Group draft these guidelines. The first meeting of this working group is expected to take place with financial support from the World Wide Fund for Nature–Denmark.

participeront à la prochaine réunion du GSEAf discuteront les implications de cette découverte pour la conservation et la gestion.

Bureau du programme en Afrique de l'Ouest

Lamine Sebogo, le responsable du programme pour l'Afrique de l'Ouest, fait depuis janvier 2001 la promotion de la Stratégie de conservation de l'éléphant pour l'Afrique de l'Ouest dans la sous-région.

L'Afrique de l'Ouest a perdu plus de 90% de son aire de répartition des éléphants au cours du vingtième siècle, et aujourd'hui, la plupart des populations d'éléphants sont petites et isolées. On estime que les deux-tiers ne comptent pas plus de cent éléphants. Lamine a maintenant terminé les voyages qu'il faisait dans la sous-région pour éveiller la sensibilisation à la nouvelle stratégie dans toutes les parties clés concernées par la conservation des éléphants et pour distribuer le document de la stratégie pour qu'il soit adopté formellement au plus haut niveau gouvernemental. Dans toute la sous-région, la réponse a été extrêmement positive. La Communauté économique des pays d'Afrique de l'Ouest (ECOWAS), une organisation régionale dont la fonction est semblable à celle de la SADC (Communauté de développement de l'Afrique australe) a confirmé son souhait d'envisager l'adoption de cette stratégie comme outil de référence pour la conservation et les activités de gestion des éléphants. La Convention sur les Espèces migratrices a, elle aussi, adopté officiellement ce plan.

Comme de nombreuses populations vulnérables d'éléphants chevauchent des frontières internationales, une approche sous-régionale est vitale pour la conservation des éléphants en Afrique de l'Ouest.

Pour résoudre cet important problème des populations transfrontières, le GSEAf envisage d'aider les gouvernements de la sous-région à organiser un séminaire sous-régional destiné à identifier les corridors empruntés actuellement par les éléphants et à les aider à formuler des stratégies pour les protéger.

Au niveau national, les signes sont aussi encourageants. Les gouvernements du Burkina Faso et du Togo ont récemment fait une demande de financement pour développer leurs propres plans de gestion nationaux pour les éléphants. Les gouvernements du Bénin, de Côte d'Ivoire, du Mali et du Niger devraient suivre prochainement.

Developments in MIKE and ETIS

Eight months after European Community funding support was formally announced, the Monitoring of Illegal Killing of Elephants (MIKE) programme is about to be implemented. The EC contract was signed at the end of June and the money was forwarded to the CITES Secretariat in September.

Setting up the Central Coordination Unit in Nairobi has been approved and will be achieved with the help of IUCN EARO. The new director, Nigel Hunter, who began work on 1 September 2001, is now based in Kenya.

During the gestation period, implementation meetings were held in the west, east and central African subregions. At these meetings, steering committees for each subregion were appointed, and the process was initiated for getting national and site officers confirmed. In addition, the selection of sites was finalized. Recruitment of the subregional support officers for the four subregions is also under way. These officers will help implement MIKE at site, national and subregional levels by facilitating training and by standardizing data collection and management. Harmonizing the savannah and the forest protocols is also under way, and these protocols should soon be available for the MIKE Technical Advisory Group to approve.

The Elephant Trade Information System (ETIS) update report to the CITES Secretariat was circulated to the Parties in Notification No. 2001/030 of 18 May 2001. The notification yielded some positive responses from the Parties, resulting in over 300 new elephant-product seizure cases being reported to ETIS through the CITES Secretariat.

Earlier this year data input to ETIS was put on hold to facilitate the compilation and production of the second round of annual ETIS country reports. In total, 179 reports have been produced in an improved tabular format and presented to the CITES Secretariat for circulation to the Parties. At the time of the reports, ETIS contained the details of 5183 individual ivory seizures that have occurred in 59 countries around the world since January 1989. Data entry commenced again in August 2001, and so far, 213 new seizure cases have been entered.

To further refine the database software and to commence the development of the analytical framework for evaluating the information in ETIS, a statistician from the Centre of Statistical Services, University of Reading, visited Harare to work with TRAFFIC staff.

Directives en matière de réintroduction d'éléphants d'Afrique

Dans le numéro 30 de *Pachyderm*, j'avais mentionné certaines des raisons pour lesquelles j'estimais qu'il fallait des directives pratiques pour guider ceux qui sont impliqués dans le déplacement de ces animaux massifs d'un endroit à l'autre. Les nouvelles des exercices de translocation récents et en cours ont donné un nouvel élan à cette initiative.

Pour répondre à ce nouveau défi, j'ai contacté un certain nombre d'experts, membres ou non du GSEAf, pour qu'ils aident à former un groupe de travail sur la réintroduction qui assistera les Secrétariats du GSEAf et le Groupe des Spécialistes de la réintroduction dans la préparation de ces lignes directrices. La première réunion de ce groupe de travail devrait se tenir avec l'aide financière du World Wide Fund for Nature – Danemark.

Développements de MIKE et d'ETIS

Huit mois après que l'on a annoncé le support financier de la Communauté Européenne (CE) le programme pour le Suivi des Massacres Illégaux d'Eléphants (*Monitoring of Illegal Killing of Elephants* : MIKE) est prêt à être mis en place. Le contrat avec la CE a été signé à la fin du mois de juin, et l'argent a été transmis au Secrétariat de la CITES en septembre.

L'installation de l'Unité Centrale de Coordination à Nairobi a été approuvée et sera réalisée grâce à l'aide de l'EARO/UICN. Le nouveau directeur, Nigel Hunter, qui a commencé à travailler le 1er septembre 2001, est maintenant basé au Kenya. Pendant la période de gestation, il y a eu des réunions d'implémentation dans les sous-régions d'Afrique de l'Ouest, centrale et de l'Est. Lors de ces réunions, on a nommé les comités de direction pour chaque sous-région, et on a lancé les procédures pour faire confirmer les responsables nationaux et ceux des sites. De plus, on a finalisé la sélection des sites. Le recrutement des responsables du support sous-régional est aussi en cours pour les quatre sous-régions. Ces responsables vont aider à la réalisation de MIKE sur les sites ainsi qu'aux niveaux national et sous-régional en facilitant la formation et en standardisant la récolte de données et leur gestion. L'harmonisation des protocoles en savane et en forêt est aussi en cours ; ils devraient bientôt être disponibles pour l'approbation par le Groupe de Conseil technique de MIKE.

Le dernier rapport du système d'information sur

Efforts to develop subsidiary databases on domestic markets and background economic factors also commenced.

To assist the parties in improving their reporting to CITES, TRAFFIC is developing a generic two-day workshop module and training toolkit to help build understanding, capacity and commitment at the national level for the implementation of ETIS. The final review draft of the ETIS Action Workshop training toolkit, which lends itself to be either a PowerPoint or an overhead presentation, has now been completed and sent for review.

African Elephant Database

Since his arrival in early June 2001, Julian Blanc, who manages the African Elephant Database (AED), has devoted considerable time to improving aspects of its geographic information system (GIS) and managing its database. Issues addressed range from upgrading hardware and software to streamlining the database design and strengthening the integration between the database and the GIS maps.

In consultation with the Data Review Task Force, work is also being aimed at optimizing the data collection process. New questionnaires are being developed, and links with various organizations and individuals involved in conducting elephant surveys are being forged or strengthened.

Another important area of work has centred on developing GIS-based tools to study human–elephant conflict, with the objectives of standardizing the collection of conflict data, and ultimately integrating such data with the AED.

The AfESG Secretariat continues to receive requests for hard copies of the 1998 AED, although its online version has successfully fulfilled most of these requests.

The Web site

The AfESG Web site

http://iucn.org/themes/ssc/sgs/afesg/

has undergone a major facelift. In addition to a more user-friendly and attractive interface, users can now access a number of AfESG 'tools' and products, many of which are available in both English and French. For example, the 1998 AED version is accessible in a more navigable pdf format, which should save the prospective browser valuable downloading time. In-

le commerce des éléphants (*Elephant Trade Information System* – ETIS) au Secrétariat de la CITES a circulé entre les Parties dans la Notification N° 2001/030 du 18 mai 2001. La Notification a suscité plusieurs réponses positives des Parties, ce qui fait qu'on a rapporté à ETIS plus de 300 cas de saisies de produits issus d'éléphants, par l'intermédiaire du Secrétariat de la CITES.

Plus tôt cette année, l'input de données dans ETIS fut mis en attente pour faciliter la compilation et la production de la seconde série de Rapports annuels d'ETIS par pays. Au total, on a produit 179 rapports sous une présentation tabulaire améliorée, qui ont été présentés au secrétariat CITES, à charge pour lui de les faire circuler entre les Parties. A ce moment-là, ETIS contenait des détails sur 5183 saisies d'ivoire qui avaient eu lieu dans 59 pays du monde entier depuis janvier 1989. L'introduction des données a repris en août 2001, et à ce jour, 213 nouveaux cas de saisies ont été entrés.

Pour affiner davantage le programme de la base de données, et pour commencer le développement du cadre analytique pour évaluer les informations données sur ETIS, un statisticien du Centre des Services Statistiques de l'Université de Reading est venu à Harare pour travailler avec le personnel de TRAFFIC. On a aussi entamé des efforts pour développer des bases de données subsidiaires sur les marchés internes et sur les antécédents économiques.

Pour aider les Parties à améliorer les rapports qu'elles font à la CITES, TRAFFIC est en train de mettre au point un module pour un atelier générique de deux jours et un kit de formation destiné à aider à construire la compréhension, la capacité et l'engagement au niveau national pour la réalisation d'ETIS. Le document de révision final du kit de formation de l'atelier d'action d'ETIS, qui se prête bien comme prise de force ou pour faire une présentation avec projection, est terminé et a été envoyé pour révision.

Base de données sur l'Eléphant d'Afrique

Depuis son arrivée au début du mois de juin 2001, Julian Blanc, qui s'occupe de la Base de Données sur l'Eléphant d'Afrique (BDEA), a consacré beaucoup de temps à améliorer certains aspects de son Système d'Informations Géographiques (*Geographic Information System – GIS*) et à gérer sa base de données. Les problèmes allaient du renforcement du matériel hardware et software à la rationalisation de la conception de la base de données

deed, we have received positive feedback from a number of researchers and others hungry for data on elephant numbers and distribution. The site also offers a wide selection of documents on human–elephant conflict, including the data collection and analysis protocol and training package for enumerators of elephant damage. The new Decision Support System for human–elephant conflict managers in an easy-to-use pdf version should be available in the near future. Other features include a page providing answers to frequently asked questions about elephants and links to many other interesting elephant sites such as the African Elephant Bibliography. We are also now able to offer the last two issues of *Pachyderm* (issues 29 and 30) on line, which should greatly expand our readership and perhaps even generate interest from prospective authors and donors.

et au renforcement de l'interpénétration des cartes de la base de données et du GIS

En consultant la Force Spéciale de Révision des Données, on veut aussi travailler à optimiser le processus de récolte des données. On met au point de nouveaux questionnaires, et on est en train de créer ou de renforcer des liens avec diverses organisations ou personnes impliquées dans la réalisation d'études de suivi des éléphants.

Un autre domaine important du travail a consisté à développer des outils, basés sur le GIS, pour étudier les conflits hommes-éléphants, dans le but de standardiser la récolte des données sur les conflits pour, en fin de compte, intégrer ces données dans la BDEA.

Le Secrétariat du GSEAf continue à recevoir des demandes pour des éditions papier de la BDEA de 1998, mais la version on-line a pu satisfaire la plupart de ces demandes.

Le site Web

Le site Web du GSEAf http://iucn.org/themes/ssc/sgs/afesg/ a subi un lifting d'importance. L'interface est devenu plus facile à utiliser et plus attrayant, et les utilisateurs peuvent maintenant accéder à un certain nombre d'« outils » et de produits du GSEAf dont beaucoup sont disponibles en anglais et en français. Par exemple, la version de 1998 de la BDEA est accessible dans un format pdf plus aisé d'accès, ce qui devrait faire épargner au candidat « surfeur » un temps de chargement appréciable. Nous avons en effet reçu des feedbacks positifs d'un certain nombre de chercheurs et d'autres amateurs de données sur le nombre et la distribution des éléphants. Le site propose aussi une sélection large de documents sur les conflits hommes-éléphants, y compris les protocoles de récoltes et d'analyse des données et le kit de formation pour ceux qui doivent dénombrer les dommages causés par les éléphants. Le nouveau système de support de décision destiné aux gestionnaires des conflits hommes–éléphants devrait être disponible très bientôt en version pdf, facile à utiliser. Il y a aussi une page qui fournit les réponses aux questions les plus souvent posées au sujet des éléphants, et des liaisons avec de nombreux autres sites intéressants sur les éléphants comme la *African Elephant Bibliography*. Nous sommes désormais à même d'offrir les deux derniers numéros de *Pachyderm* (n° 29 et 30) en ligne, ce qui devrait augmenter considérablement le nombre de nos lecteurs et—qui sait ?—peut-être même susciter l'intérêt d'éventuels auteurs ou donateurs.

African Rhino Specialist Group report
Rapport du Groupe des Spécialistes des Rhinos d'Afrique

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New triennium and next AfRSG meeting

The membership has been appointed for the current triennium, and I would like to take this opportunity to thank outgoing members and welcome new members. The AfRSG office is currently planning our next AfRSG meeting, which we hope to hold in Zimbabwe in May or early June 2002.

Cameroon

In the last *Pachyderm,* I mentioned that a technical experts meeting had been held 13–15 November 2000 in Yaoundé, Cameroon which reviewed emergency strategies to save the 'Critically Endangered' western black rhino (*Diceros bicornis longipes*) from extinction. Delegates agreed on an appropriate conservation strategy, and they set short-, medium- and long-term goals. This meeting, chaired by the Ministry of Environment and Forests in Cameroon, was attended by representatives from AfRSG, WWF (International and Cameroon), IUCN (headquarters, France and Cameroon), the North Carolina Zoological Society and Coopération Français Projet FAC Savanes. Following directly from this meeting, WWF-funded surveys of potential rhino range were undertaken to confirm if adequate founder rhinos remained to justify setting up a sanctuary. Fieldwork has been completed and the consultant, Dr Mike Kock, has just produced the final report. Once its findings have been discussed with the Cameroon authorities and other stakeholders, a decision will be made on whether to continue with plans to set up a sanctuary. I will report on the results of these discussions in the next edition of *Pachyderm*.

Namibia

Namibia is one of the major black rhino range states, conserving the second largest number of black rhinos after South Africa, as well as being the strong-

Nouveau bail de trois ans et prochaine réunion du GSRAf

On a nommé les membres du groupe pour les trois années qui viennent, et je voudrais saisir cette occasion pour remercier les membres sortants et accueillir ceux qui arrivent. Le bureau du GSRAf est occupé à préparer notre prochaine réunion du GSRAf qui, nous l'espérons, se tiendra au Zimbabwe en mai ou au début de juin 2002.

Cameroun

Dans le dernier *Pachyderm*, j'avais dit qu'une réunion d'experts techniques s'était tenue à Yaoundé, au Cameroun, du 13 au 15 novembre 2000, qui avait passé en revue les stratégies d'urgence pour sauver de l'extinction le rhino noir de l'ouest (*Diceros bicornis longipes*) en danger grave. On s'y est mis d'accord sur une stratégie de conservation appropriée et sur des objectifs à court, moyen et long terme. Cette réunion, présidée par le Ministre camerounais de l'environnement et des forêts, a été suivie par des représentants du GSRAf, du WWF (international et camerounais), de l'UICN (Quartier Général, France et Cameroun), de la Société Zoologique de Caroline du Nord et du projet français de coopération FAC Savanes. Découlant immédiatement de cette réunion, des études financées par le WWF ont été entreprises pour confirmer s'il existait encore des rhinos capables de se reproduire pour justifier la création d'un sanctuaire. Le travail de terrain est terminé, et le consultant, Mike Kock, vient de sortir son rapport final. Dès que ses résultats auront été discutés avec les autorités camerounaises et les autres partenaires, on prendra une décision quant au fait de poursuivre, ou non, les projets de constituer un sanctuaire. Je donnerai les résultats de ces discussions dans la prochaine édition de *Pachyderm.*

Namibie

La Namibie est un des principaux états de l'aire de

hold of the arid-adapted south-western black rhino (*D. b. bicornis*). The Namibian Ministry of the Environment recently (17–19 June 2001) organized and held a workshop in Windhoek to review and revise the Namibian black rhino conservation plan. A range of stakeholders from both inside and outside the ministry attended the workshop, which was sponsored by WWF. Seven AfRSG members (including five from outside Namibia) participated. The workshop was well facilitated and productive, as by the end of the workshop it had produced a draft of the newly revised strategy. After a bit more editing, the ministry will be presenting the revised draft plan to a meeting of all Namibian stakeholders. Following further discussion and consideration at this stakeholders meeting, it is hoped that the revised plan will be formally approved and implemented.

Rhino and Elephant Security Group

I am also pleased to report that the Rhino and Elephant Security Group (RESG) of southern Africa was recently resuscitated at its first meeting since 1999, held in Windhoek, Namibia. Delegates attended from seven countries, and I am delighted to learn that the meeting achieved its main objective of producing much clearer and more focused terms of reference. These terms should help ensure that the group complements the work of other rhino groups such as AfRSG and should also help focus RESG efforts so that the group can make an important contribution to rhino and elephant security in the southern African region. Further details on the meeting are given in 'Notes from the African Rhino Specialist Group' section in this edition of *Pachyderm*. I wish the newly elected RESG Chair, Mr Lovemore Mungwashu, well and hope RESG now goes from strength to strength.

Biological management workshop for Rhino Management Group

All current national black rhino conservation strategies aim to breed numbers in their metapopulations as rapidly as possible (setting minimum average growth targets of at least 5% per annum). However, in recent years a number of 'Key' and 'Important' black rhino populations in South Africa and other major range states have been performing much below the minimum target level. This poor performance is having a major impact on rhino numbers and greatly increasing the time needed

répartition du rhino noir ; elle héberge le deuxième plus grand nombre de rhinos noirs après l'Afrique du Sud et elle est le bastion du rhino noir du sud-ouest, adapté aux habitats arides, *Diceros bicornis bicornis*. Le Ministère namibien de l'environnement a (du 17 au 19 juin 2001) organisé récemment un atelier à Windhoek pour réviser le plan d'action pour le rhino noir en Namibie. De nombreux partenaires tant internes qu'extérieurs au ministère ont pris part à cet atelier qui était sponsorisé par le WWF. Sept membres du GSRAf (dont cinq venus de pays autres que la Namibie) y ont participé. L'atelier a été bien facilité et il fut productif puisqu'à la fin de la session, on a produit un projet pour la nouvelle stratégie révisée. Après en avoir un peu retravaillé la mise en page, le ministère présentera le projet de plan révisé lors d'une réunion de tous les partenaires namibiens. Après de nouvelles discussions et l'analyse qui sera faite au cours de cette réunion des partenaires, on espère que le plan révisé sera officiellement approuvé et mis en œuvre.

Groupe de Sécurité pour le Rhino et l'Eléphant

Je suis aussi heureux de pouvoir vous signaler que le groupe de sécurité sud-africain pour le rhino et l'éléphant (RESG) a été ressuscité récemment, lors de la première réunion qu'il a tenue depuis celle de 1999, à Windhoek, en Namibie. Il y avait des délégués venus de sept pays, et je suis enchanté d'apprendre que la réunion a atteint son principal objectif qui était de produire des termes de référence beaucoup plus clairs et mieux centrés. Ces termes devraient aider à garantir que les groupes complètent le travail des autres groupes concernés par les rhinos, tel le GSRAf, et devraient aussi aider à recentrer les efforts du RESG pour que le groupe puisse apporter son importante contribution à la sécurité des rhinos et des éléphants dans toute l'Afrique australe. Vous trouverez plus de détails sur la réunion dans la section « Notes du GSRAf » de ce numéro de *Pachyderm.* Je souhaite au président du RESG nouvellement élu, Mr. Lovemore Mungwashu, de réussir sa mission et j'espère que le RESG va se consolider chaque jour davantage.

Groupe de Gestion des Rhinos : atelier de gestion biologique

Toutes les stratégies actuelles de conservation des rhinos noirs visent à reproduire les individus de la méta-

to meet target metapopulation sizes. In South Africa alone, reduced performance in the last five years has resulted in some 250 fewer rhinos than perhaps there would have been had previous metapopulation growth rates been maintained.

With present rates seen against this background, a major initiative in this reporting period was the holding of a Rhino Management Group technical workshop on 'Biological management to meet continental and national black rhino conservation goals'. The meeting, sponsored by the Italian-funded SADC (Southern Africa Development Community) Regional Programme for Rhino Conservation, was organized by the AfRSG Scientific Officer. Delegates, who attended from all 'Big 4' black rhino range states, were specifically chosen to represent a cross-section of field managers, field ecologists and academics. The workshop examined case histories, population dynamics and harvesting theory, as well as existing and alternative approaches to achieving and maintaining rapid population growth.

Consequently, delegates were able to make a clear recommendation on an alternative removal strategy to both improve and maintain rapid metapopulation growth. The new, recommended strategy has a number of practical, strategic and biological advantages. A challenge for the months ahead will be to disseminate results and recommendations to emerge from this important workshop to the relevant conservation agencies and decision-makers throughout the continent. Further details on this meeting can be found in the 'Notes from the African Rhino Specialist Group' section in this issue of *Pachyderm*.

Northern white rhino

Encouragingly, as Kes Hillman Smith points out (see 'Notes from the African Rhino Specialist Group'), the last remaining northern white rhino population has been breeding well and has at least 7 calves among a minimum of 30 animals seen in surveys last year. For the first time in years, a northern white rhino was born in captivity in Dvur Kralova in the Czech Republic, bringing the number in captivity up to 10.

Other news in brief

It has been a busy period. Kenya is continuing to implement its new data management system. Experienced Zimbabwean trackers have been brought into

population aussi vite que possible (Les objectifs de croissance moyenne minimale ont été fixés à 5 % au moins par an). Cependant, ces dernières années, un certain nombre de populations *clés* et *importantes* ont eu des résultats bien en dessous des niveaux minimaux en Afrique du sud et dans d'autres états importants de l'aire de répartition. Ces piètres performances ont un impact majeur sur le nombre de rhinos et allongent considérablement le temps nécessaire pour atteindre les objectifs visés pour la méta-population. Rien qu'en Afrique du Sud, les performances médiocres des cinq dernières années ont fait qu'il y a environ 250 rhinos de moins que ce qu'il y en aurait eu si les taux de croissance antérieurs de la méta-population s'étaient maintenus.

En comparant les taux de croissance actuels avec les taux antérieurs, une initiative importante pour la période couverte par ce rapport a consisté en la tenue d'un atelier technique du Groupe de Gestion des Rhinos sur la « gestion biologique en vue d'atteindre les buts de la conservation des rhinos au niveau continental et régional ». La réunion, sponsorisée par le Programme régional pour la conservation des rhinos de la SADC (S*outhern Africa Development Community*) financé par l'Italie, a été organisée par le responsable scientifique du GSRAf. Les délégués, qui sont venus des « *Big 4* » états de l'aire de répartition des rhinos noirs, étaient spécialement choisis pour représenter une section croisée de gestionnaires de terrain, d'écologistes de terrain et de théoriciens. L'atelier a examiné des antécédents, la dynamique des populations et les théories concernant les prélèvements aussi bien que les approches existantes et les alternatives pour arriver à une croissance rapide de la population et pour s'y maintenir.

Par conséquent, les délégués ont pu faire des recommandations claires au sujet d'une stratégie de déplacement alternative destinée à améliorer et à conserver une croissance rapide de la méta-population. La nouvelle stratégie qu'ils ont recommandée a un certain nombre d'avantages pratiques, stratégiques et biologiques, et le défi des mois qui viennent sera de faire connaître les résultats et les recommandations issues de cette importante réunion chez les agences de conservation et les décideurs concernés dans tout le continent. Vous pouvez trouver plus de détails sur cette réunion dans la section « Notes du GSRAf » de ce numéro de *Pachyderm*.

Rhino blanc du Nord

Fait encourageant, Kes Hillman Smith signale (voir

the Selous Game Reserve in Tanzania on a trial basis to assist and improve the ongoing monitoring efforts of the Tanzanian Wildlife Division and its collaborating partners. Potential rhino areas for restocking have been recently assessed in Botswana. The AfRSG office has also been corresponding with Rhino Fund Uganda concerning its efforts to introduce rhinos back into the country. The SADC programme has approved a large number of projects, but unfortunately problems in releasing the funds have led to a delay in fully implementing many of these projects. It is hoped these problems are only temporary and that the SADC programme can go on to fulfil its potential. Encouragingly, in Zimbabwe aerial surveys of the major lowveld conservancies have revealed that most of the rhino seem to have survived the land invasions. However, it is of concern that a number of black rhinos had to be treated for snare wounds. In some areas, fences have been removed and some bush clearing undertaken. Given the continental importance of some of these populations, I hope that ongoing efforts to resolve the land issue in Zimbabwe are successful. The AfRSG Scientific Officer has been working cooperatively with Dr Raj Amin of the London Zoological Society and an MSc student in mathematics to continue developing horn fingerprinting analysis techniques. Interested readers can also get an update on recent and ongoing rhino work by TRAFFIC from Simon Milledge's note in 'Notes from the African Rhino Specialist Group'.

Finally, I would like to encourage all members to submit suitable short notes to the Scientific Officer for inclusion in the next edition of *Pachyderm.*

Acknowledgements

Once again, I would like to thank WWF especially for their continued financial assistance to AfRSG, without which it would be impossible to operate effectively.

les « Notes du GSRAf ») que la dernière population de rhinos blancs du Nord s'est multipliée et qu'il y a au moins 7 jeunes parmi un minimum de 30 animaux repérés lors des contrôles de l'année dernière. Pour la première fois depuis des années, un rhino blanc du Nord est né en captivité à Dvur Kralova, en République Tchèque, ce qui porte à 10 le nombre d'animaux en captivité.

Autres nouvelles en bref

Ce fut une période très occupée. Le Kenya continue à mettre en place son nouveau système de gestion des données. Des traqueurs zimbabwéens expérimentés ont été amenés à titre expérimental à la Réserve de Faune de Selous, en Tanzanie, pour assister et améliorer les efforts actuels de suivi de la Division Tanzanienne de la faune sauvage et de ses collaborateurs. On a fait récemment l'évaluation d'aires potentielles pour un repeuplement en rhinos au Botswana. Le bureau du GSRAf a aussi entretenu une correspondance avec le *Rhino Fund* ougandais au sujet de ses efforts pour réintroduire des rhinos dans le pays. Le programme de la SADC a approuvé un grand nombre de projets mais malheureusement, des problèmes dans le déboursement des fonds ont entraîné des retards dans la pleine réalisation d'un certain nombre d'entre eux. On espère que ces problèmes ne sont que temporaires et que le programme de la SADC pourra se poursuivre et remplir ses objectifs. Il est encourageant de savoir qu'au Zimbabwe, les surveillances aériennes des aires de conservation majeures en plaine ont révélé que la plupart des rhinos semblaient avoir survécu aux invasions des terres. Il est pourtant inquiétant de constater qu'il a fallu traiter un certain nombre de rhinos noirs pour des blessures dues à des pièges. A certains endroits, les clôtures ont été enlevées et on a commencé à dégager le sol en brousse. Etant donné l'importance de certaines de ces populations à l'échelle du continent, j'espère que les efforts en cours pour résoudre la question foncière au Zimbabwe seront fructueux. Le responsable scientifique du GSRAf travaille en collaboration avec le Dr Raj Amin de la Société Zoologique de Londres et avec un étudiant en sciences mathématiques pour continuer la mise au point des techniques d'analyse de l'empreinte génétique des cornes. Les lecteurs intéressés peuvent aussi découvrir une mise à jour des travaux récents et en cours de TRAFFIC dans la note de Simon Milledge, dans les « Notes du GSRAf ».

Enfin, je voudrais encourager tous les membres qui le peuvent à soumettre leurs brefs commentaires au responsable scientifique pour les inclure dans la prochaine édition de *Pachyderm*.

Remerciements

Une fois encore, j'aimerais remercier tout particulièrement le WWF pour l'aide financière qu'il continue à apporter au GSRAf, et sans laquelle il serait impossible de travailler efficacement.

Asian Rhino Specialist Group report
Rapport du Groupe des Spécialistes des Rhinos d'Asia

Mohd Khan bin Momin Khan, Chair/Président, with/avec Thomas J. Foose and Nico van Strien, Programme Officers/Responsables de Programme

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On 13 September 2001, a healthy male Sumatran rhinoceros calf was born at the Cincinnati Zoo (in Ohio, USA) after a gestation period of 475 days. This is the first calf to have been both born and bred in captivity since 1889, when the only other birth of this species in total captivity occurred. The male calf weighed 33 kg (72.6 lbs.) at birth and added 40 kg (88 lbs.) in its first month. AsRSG congratulates Dr Terri Roth and staff at Cincinnati Zoo, including former director Ed Maruska, and rhino keeper Steve Romo (now on secondment to the Sumatran Rhino Center at Sungai Dusun, Peninsula Malaysia). More information, including many pictures, is available on the Cincinnati Zoo Web site (www.cincyzoo.org) and various other linked Web sites (for example, www.rhinos-irf.org).

Thomas J. Foose describes the birth as an epochal event in the conservation of this species. In 1982, serious discussion started on the possibility, feasibility and desirability of developing a captive propagation programme as part of the conservation strategy for the Sumatran rhino. In a special meeting in Singapore in 1984, the Species Survival Commission of IUCN translated these discussions into recommendations and plans to proceed with the propagation programme in Indonesia, Peninsula Malaysia and Sabah.

Since then, 40 Sumatran rhinos have been moved into captivity. But for a long time, the programme languished for a variety of reasons, including: the vicissi-

Le 13 septembre, est né au zoo de Cincinnati un petit rhinocéros de Sumatra mâle en bonne santé, après une gestation qui a duré 475 jours. C'est le premier bébé qui ait été conçu et soit né en captivité depuis 1889, date de la seule autre naissance en captivité totale pour cette espèce. Le petit mâle pesait 33 kg à la naissance et il a pris 40 kg de plus au cours du premier mois. Le GSRAs félicite le Dr Terri Roth et le personnel du zoo de Cincinnati, y compris son ancien directeur, Ed Maruska, et le gardien des rhinos, Steve Romo (qui seconde actuellement le personnel du Centre pour le Rhino de Sumatra à Sungai Dusun, dans la péninsule Malaise). On peut trouver plus d'informations, et de nombreuses photos, sur le site Web du Zoo de Cincinnati (www.cincyzoo.org) et sur divers autres sites liés (ex. www.rhinos-irf.org)

Thomas J.Foose décrit la naissance comme un événement qui fera date dans la conservation de cette espèce. C'est en 1982 qu'ont commencé les discussions sur la possibilité, la faisabilité et l'à-propos du développement d'un programme de propagation en captivité, dans le cadre de la stratégie de conservation pour le rhino de Sumatra. Lors d'une réunion spéciale à Singapour en 1984, la Commission de Sauvegarde des Espèces de l'UICN a traduit ces discussions en recommandations et en plans destinés à donner suite au programme de propagation en Indonésie, dans la Péninsule Malaise et à Sabah.

tudes of obtaining adult males and females in the same place at the same time; the challenges in husbandry of this species in captivity; and, as revealed more recently, the complexity of the reproductive biology of the Sumatran rhino. This rhino is an induced ovulator, and the males and females exhibit much aggression towards each other except (usually) during the brief periods of oestrus. As a result of these factors, there have been many deaths but no births of the Sumatran rhino in captivity, causing much disappointment, frustration and controversy among conservationists.

Progress and success are occurring in large part because of more communication and cooperation between managers and scientists in major range states—Indonesia and Malaysia—as well as with Canada, Germany, the Netherlands and the United States. Two major workshops (in 1999 and 2000) under joint auspices of AsRSG and the International Rhino Foundation have contributed significantly by convening virtually all of the managers, scientists, and conservationists working on managed breeding. Indeed, the successful pregnancy and birth at Cincinnati may have been the result of progesterone supplement that was a recommendation of the March 2000 workshop.

Efforts continue, with reasonable success, to protect the estimated 300 Sumatran rhinos still in the wild. In situ conservation remains AsRSG's priority. However, the many challenges and uncertainties are intensifying. AsRSG still believes that the most viable strategy against such challenges and uncertainties is to diversify the conservation programme to the maximum, in other words, to have sustainable populations of Sumatran rhinos in as many places and in as many ways as possible. Thus, AsRSG considers the managed breeding programme an integral component of the conservation of the Sumatran rhino.

The species is neither safe in the forest nor, more figuratively, yet out of the woods. A single birth is a significant breakthrough but in itself does not ensure the survival of the species. However, since applying scientific resources has resulted in a birth at Cincinnati, hopes are high that soon more females will also produce calves at the managed breeding centres in native habitats. At Sungai Dusun, Dr Aidi Mohd and Mohd Khan are progressing significantly toward inducing pregnancies in three females with help from Dr Terri Roth and Steve Romo from Cincinnati, and Dr Robin Radcliffe and his brother, Dr Rolfe Radcliffe from the Fossil Rim Wildife Center in Texas. At Way Kambas,

Depuis lors, 40 rhinos de Sumatra ont été placés en captivité. Longtemps, le programme a vivoté pour toute une variété de raisons comme par exemple, la difficulté de réunir des mâles et des femelles adultes au même endroit et au même moment, les défis que pose l'élevage de cette espèce en captivité et, élément révélé plus récemment, la complexité de la biologie de la reproduction chez le rhino de Sumatra. Ce rhino est un ovulateur induit, et mâles et femelles manifestent beaucoup d'agressivité les uns envers les autres sauf (d'habitude) aux brèves périodes de chaleurs. C'est en raison de ces facteurs qu'il y a eu beaucoup de morts mais aucune naissance de rhino de Sumatra en captivité, ce qui a entraîné des déceptions, de la frustration et de nombreuses controverses entre les partisans de la conservation.

Des progrès et le succès sont dus en grande partie au fait que la communication et la coopération sont meilleures entre les gestionnaires et les scientifiques des principaux états de l'aire de répartition, l'Indonésie et la Malaisie, ainsi qu'avec le Canada, l'Allemagne, les Pays-Bas et les Etats-Unis. Deux importants ateliers, tenus sous les auspices du GSRAs et de la FIR, y ont contribué de façon significative en réunissant virtuellement tous les gestionnaires, les scientifiques et les partisans de la conservation qui travaillent sur la reproduction assistée. En effet, la gestation réussie et la naissance à Cincinnati sont peut-être le résultat d'un supplément de progestérone qui était une des recommandations de l'atelier de mars 2000.

Les efforts continuent, avec des succès raisonnables, pour protéger les quelque 300 rhinos de Sumatra qui vivent encore en liberté. La conservation *in situ* reste une priorité du GSRAs. Cependant, les nombreux défis et les incertitudes s'intensifient. Le GSRAs croit encore que la stratégie la plus efficace pour faire face à ces défis et à ces incertitudes consiste à diversifier au maximum le programme de conservation, en d'autres termes, à avoir des populations viables de rhinos de Sumatra au plus grand nombre d'endroits possible et à les gérer des façons les plus diverses possibles. Le GSRAs considère donc que le programme de reproduction assistée fait intégralement partie de la conservation du rhino de Sumatra.

L'espèce n'est en sécurité ni dans la forêt, ni—dit de façon plus imagée—hors du bois. Toute naissance est une percée significative mais elle ne garantit pas en soi la survie de l'espèce. Pourtant, puisqu'en employant les ressources scientifiques, on a obtenu

Bina is considered a healthy, reproductive female. She has copulated numerous times with the male Torgamba, who formerly was at the Port Lympne Zoo in the UK for years, many of those years without a female. He has become more active and successful in his attempts at mating. However, to date, he has only achieved partial intromissions. The problem has now been diagnosed by Dr Mohd Agil as probably an unusually tough and intact hymen. Attempts to remedy this problem are under way. At Sepilok in Sabah, reports indicate the female is cycling regularly.

In conclusion, there is more reason for hope and optimism than there has been in a long time.

une naissance au zoo de Cincinnati, on espère beaucoup que d'autres femelles auront aussi des jeunes dans les centres de reproduction assistée des habitats d'origine. A Sungai Dusun, le Dr Aidi Mohd et Mohd Khan font des progrès significatifs dans l'induction d'une gestation chez trois femelles, avec l'aide du Dr Terri Roth et de Steve Romo, de Cincinnati, et du Dr Robin Radcliffe et de son frère le Dr Rolfe Radcliffe du *Fossil Rim Wildlife Center*, au Texas. A Way Kambas, on considère que Bina est une femelle reproductrice en bonne santé. Elle s'est accouplée de nombreuses fois avec le mâle Torgamba, qui est resté des années au zoo de Port Lympne, en Grande Bretagne, la plupart de temps sans femelle. Il est devenu plus actif et réussit mieux ses tentatives d'accouplement. Cependant, il n'a jusqu'ici réussi que des intromissions partielles. Le Dr Mohd Agil a maintenant situé le problème qui serait dû à un hymen intact et exceptionnellement résistant. On essaie actuellement de remédier à ce problème. A Sepilok, à Sabah, des rapports indiquent que la femelle a des cycles réguliers.

En conclusion, on peut dire qu'il y a plus de raisons que jamais d'espérer et d'être optimiste.

RESEARCH AND REVIEW

Killing of black and white rhinoceroses by African elephants in Hluhluwe-Umfolozi Park, South Africa

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Abstract

Fifty-eight white rhinos and five black rhinos were killed by elephants in Hluhluwe-Umfolozi Park between 1991 and 2001. The culprits were probably young male elephants that are entering musth younger in the absence of older males. Rhino deaths were more frequent from July to December and were distributed throughout the reserve. Deaths were associated with rivers, with 76% of carcasses being within 1 km of a river. Deaths were predominantly adult rhinos (86%), with a ratio of about 0.76♀:1♂. Given the success of the introduction of older male elephants to Pilanesberg National Park, which stopped young bulls entering musth and ended rhinos, being killed by elephants, introducing older male elephants is supported as a solution for Hluhluwe-Umfolozi Park, and for all reserves that have this problem.

Résumé

Les éléphants du Parc de Hluhluwe-Umfolozi ont tué cinquante-huit rhinos blancs et cinq rhinos noirs entre 1991 et 2001. Les coupables sont probablement des jeunes mâles qui entrent en « *musth* » plus jeunes en l'absence de mâles plus âgés. Les morts de rhinos étaient plus fréquentes entre juillet et décembre et se répartissaient dans toute la réserve. Les morts étaient associées aux cours d'eau ; on a trouvé 76 % des carcasses à moins d'un kilomètre d'une rivière. Les morts touchaient surtout les rhinos adultes (86 %) dans un rapport de 0,76 femelle pour 1 mâle. Etant donné le succès qu'a connu la réintroduction d'éléphants mâles plus âgés dans le Parc National de Pilanesberg, qui a mis un terme à l'entrée en musth précoce des jeunes mâles et à l'exécution de rhinos par les éléphants, on encourage l'introduction d'éléphants mâles plus âgés dans le Parc de Hluhuwe-Umfolozi, ce qui serait sans doute une solution là et dans toutes les réserves qui connaissent ce problème.

Introduction

The black rhinoceros, *Diceros bicornis* Linnaeus, 1758, is 'Threatened: Critically Endangered' and the white rhinoceros, *Ceratotherium simum* Burchell, 1817, is 'Lower Risk: Conservation Dependent' and will become 'Near Threatened' in the 2001 IUCN reclassification (Hilton-Taylor 2000). Hluhluwe-Umfolozi Park (HUP) is world famous as the reserve where the last

population of the southern white rhino exists, and all current populations of the southern white rhino are derived from animals exported from this park. HUP is also one of two reserves in South Africa that had naturally occurring black rhinos, and most other black rhino populations in South Africa are derived from animals exported from HUP. The conservation of these two species by the then Natal Parks Board (now KwaZulu-Natal Wildlife) is one of the success stories of modern conservation. HUP today is one of two parks that conserve Key 1 black and Key 1 white rhino populations, as rated by the African Rhino Specialist Group. It includes 37% of South Africa's black rhinos and 17% of its white rhinos (as of 1999).

KZ-N Wildlife

Park officials removed the horns of this rhino, killed by an elephant.

Despite the success of rhino conservation in South Africa, each individual still represents a valuable resource, both for direct conservation and for sale to raise additional funds for conservation purposes. Auction prices in June 2001 for the white rhino were USD 20,000 and USD 33,000 for males and females respectively and for the black rhino were over USD 65,000 each (KwaZulu-Natal Wildlife unpublished auction prices).

KZ-N Wildlife

Elephant tusk holes are clearly evident on the carcass of this rhino.

An unusual, but not unique, situation has arisen in HUP. African elephants, *Loxodonta africana* Blumenbach, 1797, have been killing both black (n = 5) and white rhinos (n = 58), mainly through tusk wounds made to the shoulder and chest area. This abnormal behaviour has been described from a number of reserves but has mainly occurred in Pilanesberg National Park (PNP), where between 1992 and 1997 elephants killed up to 50 white rhinos (Slotow and van Dyk 2001). The culprit elephants were young males (17–25 years old) who were entering a state of musth (heightened aggression from elevated hormones associated with reproductive competition—Poole and Moss 1981) well ahead of schedule—from 18 years of age as opposed to a normal age of 28 years (Poole 1987)—and were doing so because of the absence of an older male hierarchy (Slotow et al. 2000). These young males remained from culled family groups in Kruger National Park (KNP) and matured in the absence of dominant bulls. The problem in PNP

KZ-N Wildlife

Evidence! This action shot, although blurred, shows an elephant attacking a rhino and goring it from behind and above with its tusks.

was solved by introducing six older male elephants, up to 35 years of age, from KNP in early 1998. The older introduced bulls suppressed the musth of the young males, and elephants in PNP have caused no subsequent rhino deaths (Slotow et al. 2000).

Elephants were previously extirpated from HUP and were introduced back into it from KNP starting in 1983 (detailed in Dominy et al. 1998). The HUP elephant population was thus founded in 1983, with all founders being young animals orphaned from culling. As a result, there was no structured age hierarchy, as the oldest males were about 25 years of age by 2000. After the success of the PNP project, 10 older male elephants were introduced from KNP to HUP in May 2000. The results of that introduction are currently being monitored. This paper documents patterns of mortality of black and white rhinos in HUP caused by elephants.

Methods

All records are from rhino carcasses that field scouts found in the reserve. Field scouts patrol the entire reserve, regularly covering each part of it. On finding a carcass, scouts noted if elephant was the cause of mortality. This would apply to carcasses found within seven days of death, when such determinations could be made. With carcasses older than this, the cause of death was noted as unknown, and those carcasses are not included in this analysis. The information provided in this paper is thus a minimum assessment of the mortality from elephants. However, as the patrols were regular, most carcasses were detected within a week. Death was attributed to elephant by observing the injuries that resulted in death (based on autopsy by a veterinarian or assessment by the section ranger), or interpreting the tracks in the area (by experienced scouts), or both. For each carcass, the date; the location of the carcass; the age, as determined by trained and experienced scouts and section rangers; and the sex, where possible, were noted. Data were collated and stored at the central database at Hluhluwe Research Centre.

Data were spatially referenced using GPS locations or estimations from 1:50,000 maps (point accuracy = ±500 m). Maps were produced in Arcview (ESRI). Distance from rivers was calculated using the buffer function, with 100-m buffers being created, and the number of deaths within each buffered distance being extracted.

Results

Five black rhinos and 58 white rhinos have been killed in Hluhluwe-Umfolozi Park up to October 2001. The first death, of an adult female black rhino, occurred on 20 September 1991, and two white rhinos were killed shortly after this, on 8 October 1991 (unsexed adult) and 11 October 1991 (adult male). The next death was of an adult female white rhino in May 1995. From June 1996 to the end of 1998, deaths occurred sporadically in clusters of one to three months (fig. 1). In June 1999, the frequency of deaths increased markedly, with 21

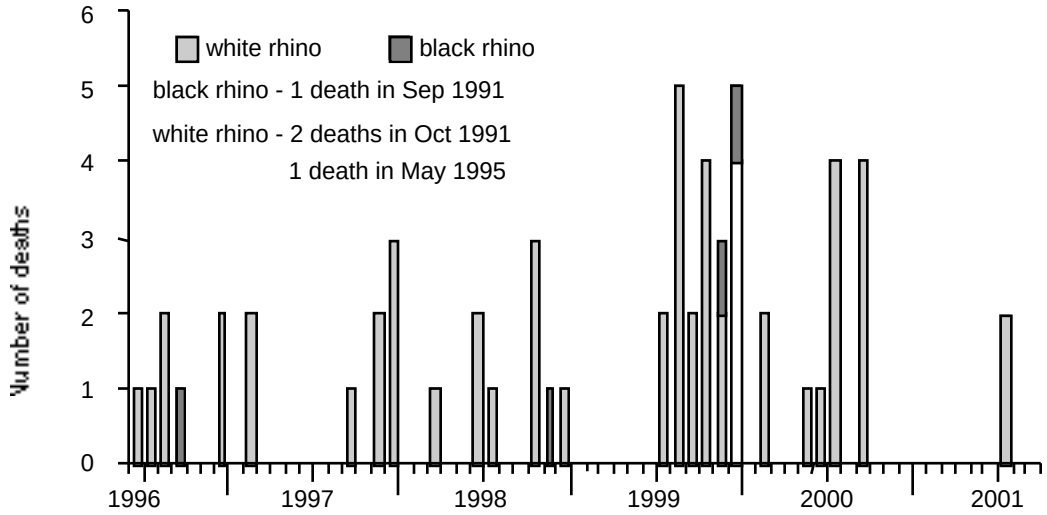

Figure 1. Sequence of deaths caused by elephants in Hluhluwe-Umfolozi Park on a monthly basis (gaps indicate months, with long tick at year-end and medium tick between June and July). To increase clarity, the first four deaths are not shown at the beginning of the sequence.

deaths (including 4 black rhinos) by the end of 1999. Ten older male elephants, up to 45 years of age, were introduced to HUP from Kruger National Park in May 2000. The number of deaths in 2000 decreased, and there were no rhino deaths from elephant between September 2000 and May 2001, two deaths in June 2001, and no deaths from then to October 2001.

Deaths were not limited to one age or sex class for either species (fig. 5). However, the majority of deaths were of adult animals (84.5% for white rhinos, 80% for black rhinos—fig. 5). The bias was towards males over females for both species: white rhino: 0.77♀:1♂ (24♀:31♂ individuals); black rhino: 0.67♀:1♂ (2♀:3♂ individuals) (fig. 5).

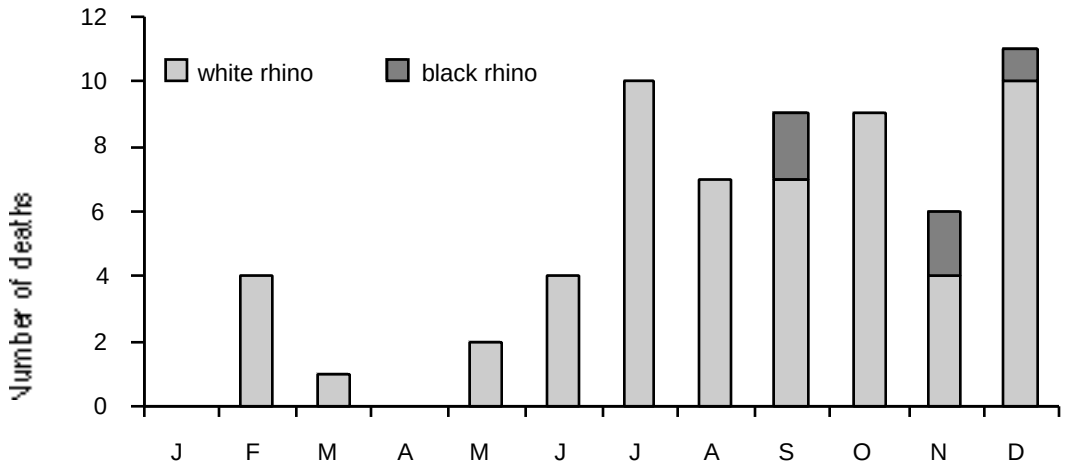

Figure 2. Summary of deaths per month caused by elephants in Hluhluwe-Umfolozi Park over the period from 1991 to October 2001.

Deaths were spread throughout the year, but there were no deaths in January or April. The majority of deaths occurred from July through December (83%), with the four highest months being December, July, September and October (fig. 2).

The deaths were scattered throughout the reserve (fig. 3). The early deaths were all in Hluhluwe, but they spread south to Umfolozi in 1996. The elephants were initially concentrated in Hluhluwe and ventured into Umfolozi only in 1995–1996. Deaths were associated with river systems, with 76.2% deaths occurring within 1000 m of a river (fig. 4).

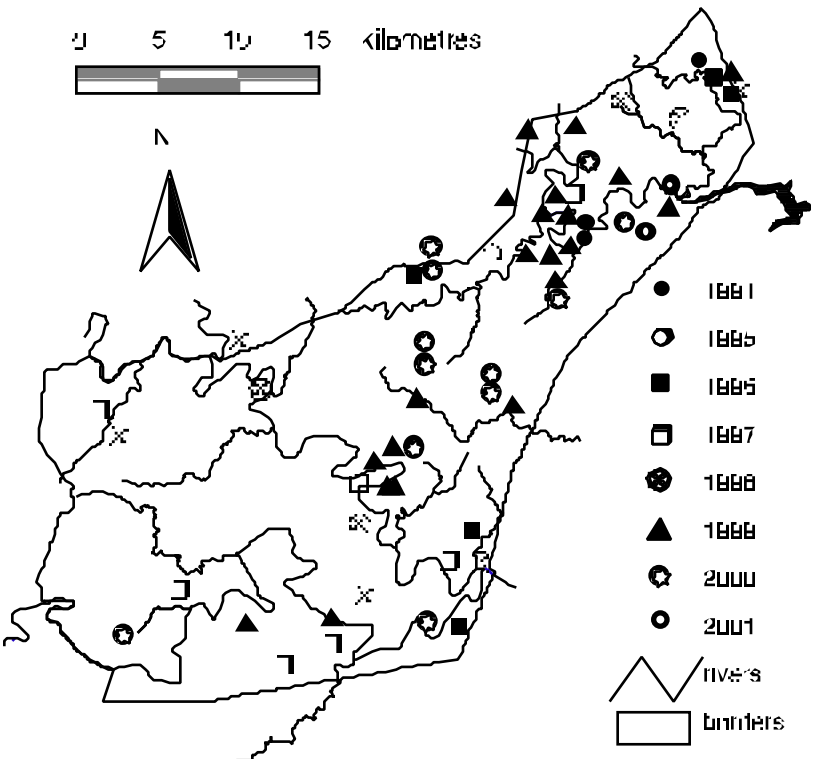

Figure 3. Distribution and timing of rhino deaths from elephants in Hluhluwe-Umfolozi Park.

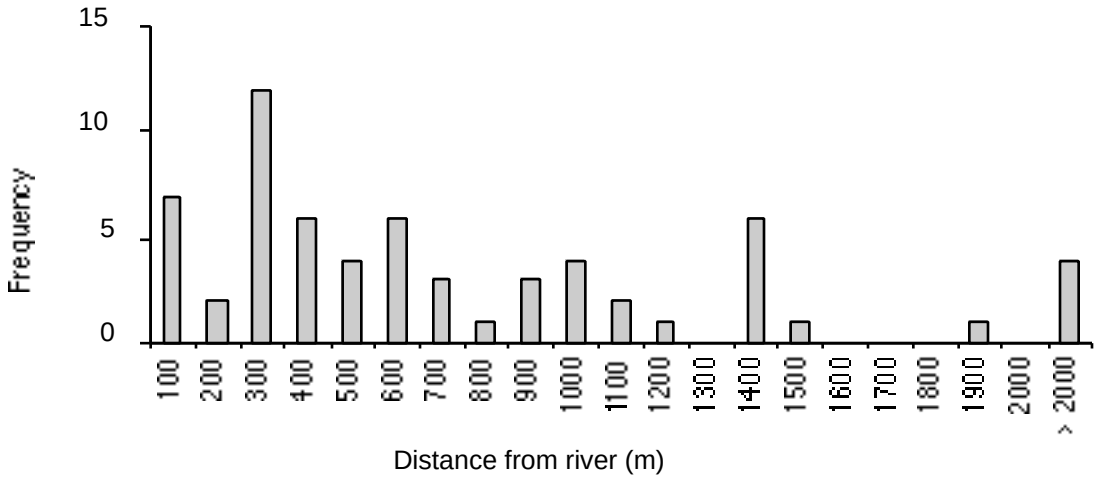

Figure 4. The relationship between the location of water and rhino deaths in Hluhluwe-Umfolozi Park. Deaths tended to be associated with rivers, with 76.2% of deaths within 1000 m of a river.

Discussion

Elephants killing rhinos is clearly not a phenomenon restricted to HUP. This behaviour, however, is uncommon in populations with normal age structures. In PNP, the problem first occurred with any substance in 1992 and 1994; in HUP, 1996 was the year the problem first became common.

The problem increased rapidly in HUP, and the number of deaths in HUP has exceeded those in PNP. One reason for this may be that PNP management staff worked to control the problem through culling male elephants located nearest to the rhino deaths. The culling stopped rhino deaths until the next elephant matured and came into musth.

Most deaths were in the latter half of the year. We estimate elsewhere (Slotow et al., unpublished data 2001) that at least four elephants were responsible for the deaths, one active in February–March, one in June–August, one in September–October, and the last in November–December. The musth males appear to be spreading their musth through the year, without overlapping cycles, which is what occurs in natural populations (Poole 1987).

The rhinos being killed are predominantly adults, and slightly more males than females. A similar pattern was observed in PNP, where all ages and both sexes of rhinos were killed (Slotow and van Dyk 2001). There is no indication that deaths are related to rhino territorial behaviour. Deaths occur along river valleys, and our interpretation is that clashes occur at shared water access points but are random in other aspects.

Implications from the events in PNP and HUP are that other parks that received orphan elephants from KNP culls will encounter similar problems, and management should be proactive to prevent further loss of these valuable rhino species. Given the large number of rhinos killed by elephants in PNP and HUP, the success of introducing big adult male elephants into PNP (Slotow and van Dyk 2000), and the apparent success of their introduction into HUP (Slotow et al., unpublished data 2001), we recommend introducing a limited number of older elephant males from KNP into each of the populations that lack older males. However, the number of older males needs to be carefully considered and should be on the conservative side. The reason for this is that older male elephants have a major adverse impact on large aesthetic trees such as marula *Sclerocarya birrea* (A. Rich.) Hochst. (personal observations in both PNP and HUP), and the impact will increase with the number of males that are introduced. Given that the purpose of introducing older males is to regulate the musth of younger males, we recommend two or four males be introduced to small elephant populations (< 75 animals), and six males be introduced to larger populations. Close study should be made on the effects of the introduced males on musth in the resident young males, and additional males could be introduced if necessary.

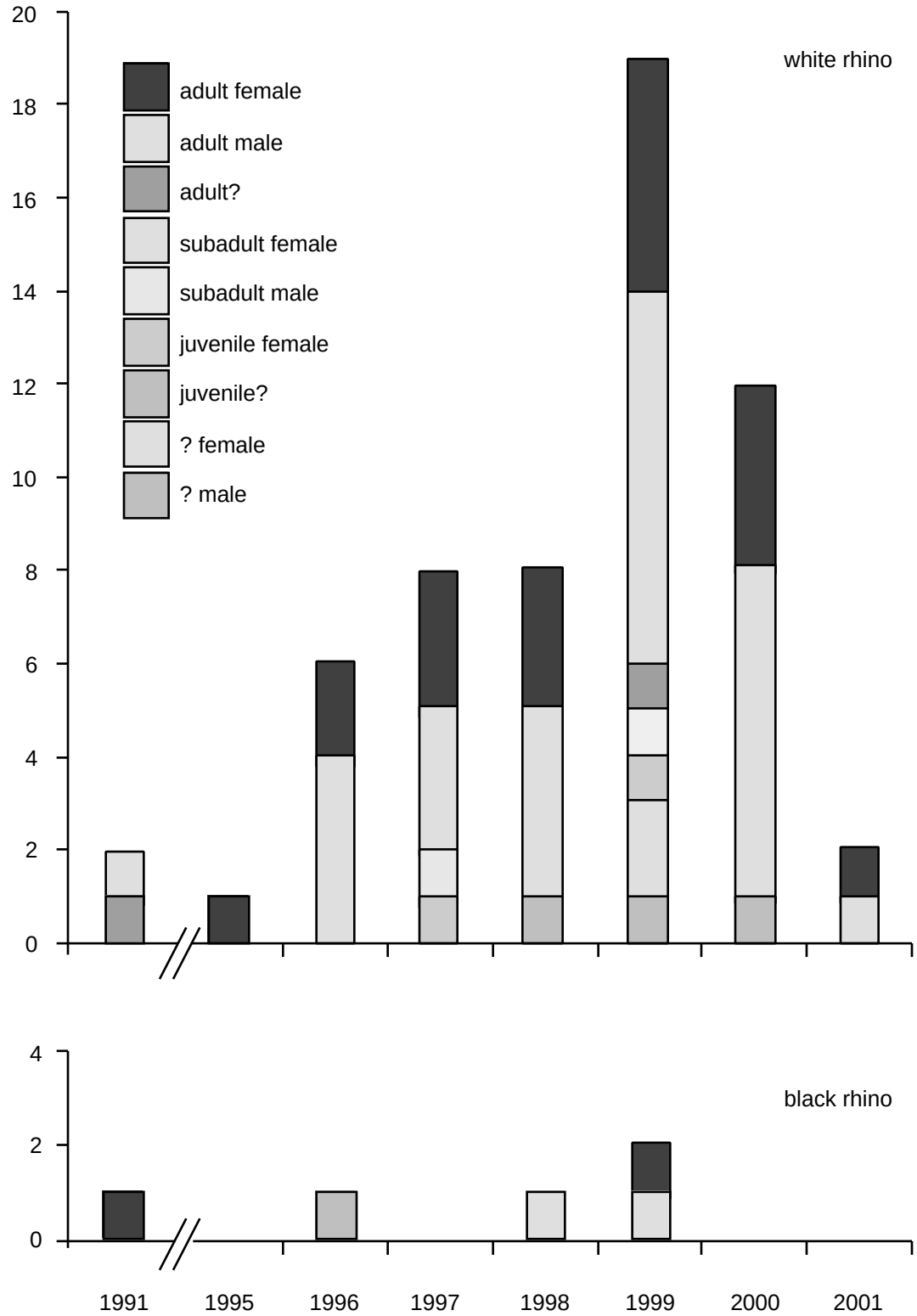

Figure 5. Breakdown by age and sex of rhinos killed by elephants in Hluhluwe-Umfolozi Park. ? = either age or sex was indeterminate.

Acknowledgements

We thank the management staff of Hluhluwe-Umfolozi Park, and particularly the field scouts for collecting data on carcasses. We thank Dave Cooper for performing veterinary post-mortems on most of the carcasses to verify cause of death. We thank Pretoria Portland Cement for funding research into the elephant side of the problem. We acknowledge the close collaboration of Gus van Dyk (North West Parks and Tourism Board) with our elephant research programme, and emphasize that he was the first to document individual young bulls as the main culprits and to implement a sustainable solution to the problem. We thank Keryn Adcock and two anonymous referees for detailed and useful suggestions, which produced a better product.

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Survey and conservation status of five black rhino (*Diceros bicornis minor*) populations in the Selous Game Reserve, Tanzania, 1997–1999

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Abstract

The Selous Game Reserve in Tanzania has the most northerly population of the black rhino subspecies, *Diceros bicornis minor* in Africa. Over the past 50 years, numbers have decreased considerably from an estimated 2000 in the mid-1900s to a few small and scattered metapopulations identified in the late 1990s. This paper summarizes the results of a survey of five populations undertaken between 1997 and 1999 with the objective of determining the suitability of establishing one or more Intensive Protection Zones for the management of rhinos in the reserve. Four small, discrete, breeding populations were investigated: Kidai with 5–7 rhinos, Lukuliro with 10–15, Nahomba with 3–4, and Horogwe with 5–8. No rhinos were found in the Naluale area. There are possibly an additional 10–20 rhinos scattered about the reserve, making a total of 30–50. As the adjoining Lukuliro and Nahomba areas contain possibly the most viable of all presently known rhino populations in the reserve, it is recommended that these areas be managed jointly as the first Intensive Protection Zone for the Selous Game Reserve. This paper also details the conservation and management status of each population surveyed and gives some management recommendations. The constraints under which the Tanzania Wildlife Division is working are critical, and it urgently needs an infusion of funds and expertise if it is to save this last remaining metapopulation of *D. b. minor* in Tanzania.

Résumé

La Réserve de faune de Selous en Tanzanie contient la population la plus au nord pour l'Afrique de la sous-espèce de rhino noir *Diceros bicornis minor*. Au cours des 50 dernières années, leur nombre a diminué considérablement ; au milieu des années 1900, on estimait leur nombre à 2000 environ, et vers la fin des années 1990, on n'a plus identifié que quelques petites méta-populations éparpillées. Cet article résume les résultats d'une étude de cinq populations qui a été réalisée entre 1997 et 1999 dans le but de déterminer s'il était souhaitable de créer une ou plusieurs Zones de Protection Intensive pour la gestion des rhinos de la réserve. On a étudié quatre petites populations reproductrices discrètes : Kidai, qui compte 5–7 rhinos, Lukuliro, avec 10–15 rhinos, Nahomba, 3–4 rhinos et Horogwe, 5–8 rhinos (on n'en a trouvé aucun à Naluale). Il est possible qu'il y ait entre 10 et 20 rhinos supplémentaires dispersés dans la réserve, ce qui ferait un total compris entre 30 et 50. Comme les zones voisines de Lukuliro et de Nahomba abritent peut-être les plus viables de toutes les populations de rhinos connues aujourd'hui dans la réserve, on recommande de gérer ensemble ces deux zones comme étant la première zone de protection intensive dans la Réserve de faune de Selous. Cet article détaille aussi le statut de la conservation et de la gestion de chaque population surveillée et donne quelques recommandations en matière de gestion. Les contraintes avec lesquelles la Tanzania Wildlife Division doit travailler sont énormes et il y a un besoin urgent de fonds et d'expertise si l'on veut sauver la dernière méta-population de *D. b. minor* de Tanzanie.

Introduction

Tanzania has two subspecies of black rhino, *Diceros bicornis michaeli* and *D. b. minor*, the former occurring in the north, the latter in the south of the country (fig. 1). In the 1970s it was estimated that Tanzania had a total population of about 10,000 black rhinos and as a result of extensive and protracted poaching for horns, this number had been reduced to about 3800 by 1980 and 100 by 1992 (Tanzania 1993). By the late 1990s, few animals still existed in their former range, and their survival throughout the country now hangs in the balance. The viability of the few remaining rhino populations in Ngorongoro Crater and Serengeti National Park is uncertain. It was estimated that there were perhaps 3000 rhinos in the Selous Game Reserve (SGR) in 1981 (Stephenson 1987). By the late 1900s, poaching had taken its toll and the population status of these animals was a matter of pure speculation. However, investigations during the early 1990s (Stronach 1991; Laurie 1991) identified four discrete breeding populations of *D. b. minor* remaining in the Selous Game Reserve.

In 1996, the World Wide Fund for Nature (WWF), in accordance with the 1993 National Rhino Policy and Management Plan, agreed to assist the Tanzania

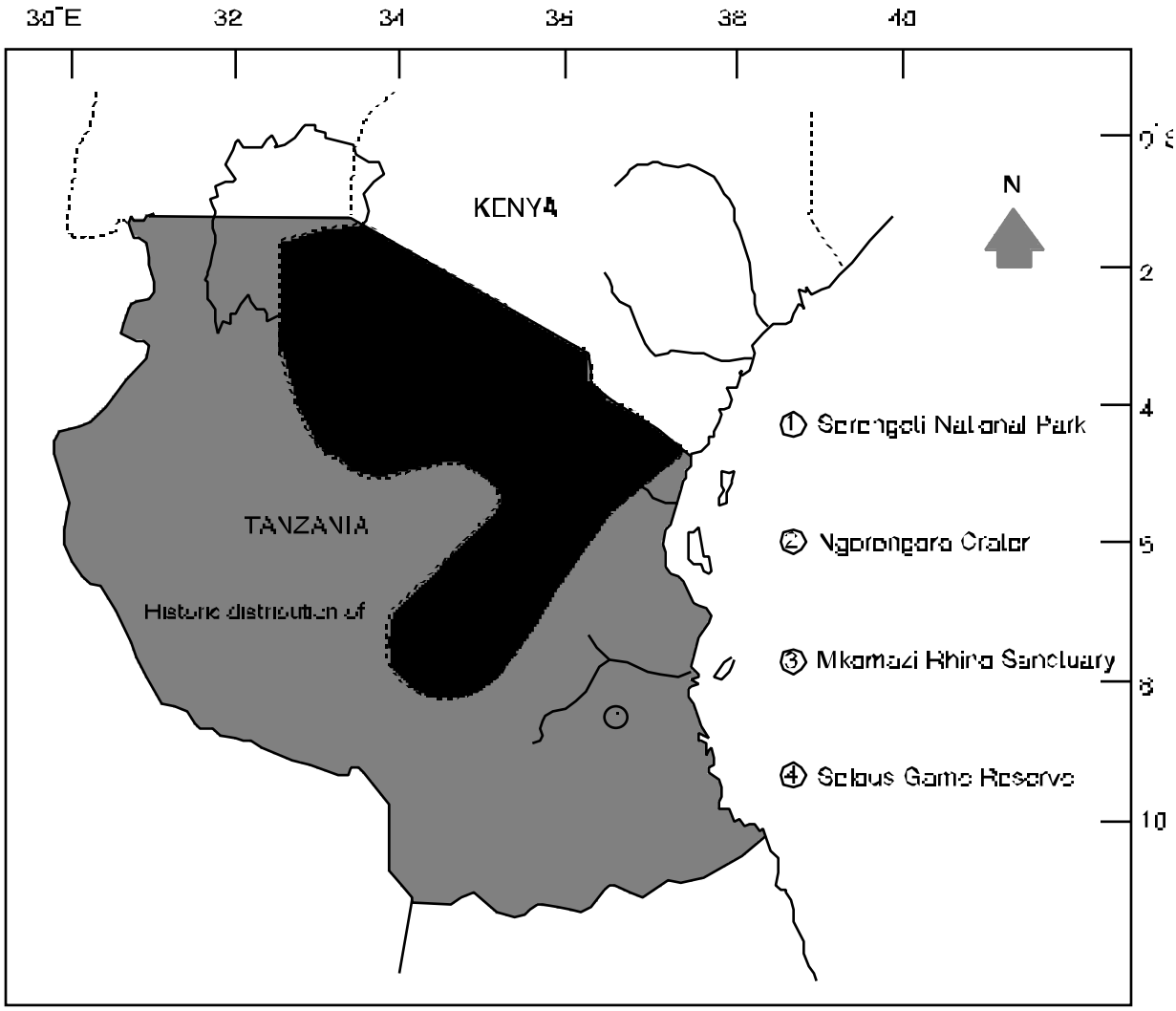

Figure 1. Historical and present distribution of the two taxonomic units of the black rhinoceros *Diceros bicornis michaeli* in the north and *D. b. minor* in the south of Tanzania (after Severre 1993).

Wildlife Division to update its information on the status of some of these Selous populations with a view to:

- providing current information that would assist the Wildlife Division to determine a future management strategy for the conservation of the SGR's remaining rhino population, and
- possibly establishing one or more of these areas as an Intensive Protection Zone (IPZ) for rhinos.

In 1997, I submitted an application to the US Fish and Wildlife Service for financial support under the Rhinoceros and Tiger Conservation Fund (Morgan-Davies 1997). The grant, approved in February 1997, covered field-staff training in rhino monitoring and the surveying of five black rhino populations in the SGR with a view to their future conservation through the establishment of IPZs.

Survey results

Based on observations by Stronach (1991) and Laurie (1991) and aerial surveys I made before the ground surveys, five rhino locations were selected and surveyed—Kidai, Lukuliro, Nahomba, Naluale and Horogwe—a total core area of about 1080 km^2.

Kidai

LOCATION

The Kidai rhino area is located in the northern sector of the reserve immediately north of the Rufiji River and within the only area of the SGR designated for tourist game viewing and not for hunting. It encloses a core area of about 300 km^2.

Within this area are three tourist camp concessions: Beho Beho, Sand River and Stiegler's Gorge. Sand River Camp plays an important part in helping the Wildlife Division to maintain ranger morale and efficiency and thus provides security for this last remaining, northernmost population of *D. b. minor* along the banks of the Rufiji River.

VEGETATION

Unlike the vast area of predominantly *Brachystegia* woodland that extends southwards from the Rufiji, the northern area of the reserve is primarily light *Acacia–Combretum* wooded grassland with numerous lakes, swamps and areas of dense *Hyphaene* palms along sections of the Rufiji River. The banks of the Rufiji, Ruaha and Sumbadsi have relatively small areas of riparian forest of varying density. The 120-m high, east-facing, rocky escarpment between Kipalala and Mtundusi Hills is covered with a dense stand of stunted *Julbernardia–Brachystegia* woodland. Elsewhere, small isolated patches of thicket and forest occur.

WATER

More than adequate water is available for rhinos throughout the year from the Ruaha and Rufiji Rivers. The Sumbadsi, Beho Beho and other minor streams almost invariably dry up during the dry season from July to November. Despite there being water in the Ruaha and Rufiji Rivers, however, available evidence indicates that rhinos seldom use them. The disturbance of tourist motorboats originating from Sand River Camp, the presence of poachers operating along these two rivers, and fear of the large population of Nile crocodiles perhaps compels these animals to drink elsewhere. During much of the year rhinos drink from the smaller streams and temporary pools of surface water. During the dry season they concentrate around the few perennial springs located below the Kipalala escarpment and the remaining pools of water along the lower reaches of the Sumbadsi River.

RHINO NUMBERS AND DISTRIBUTION

Rhino signs indicate a possible small breeding population of 5–7 animals. A fresh track of one calf was recorded. Its track details:

Date: 23 August 1997
Track width: 16.5 cm
Accompanied by one adult

Provided there are no losses from poaching or natural causes, the population should slowly increase. However, the question of long-term viability of a very small, isolated population is pertinent. It has not yet been possible to determine the demographics of this population, although it should become evident within the next 2–3 years, as the local ranger force is now better trained and equipped. Unlike elsewhere in the SGR, where rhinos are very rarely seen, rangers and visitors do occasionally see a rhino in the Kidai area. About mid-1950, a visitor to the Sand River Camp area for the first time successfully photographed what appeared to be a subadult male (Elizabeth Theobald,

pers. comm. 1997). Doubtless, additional photographs of these particular animals will be taken in time. Infrared beam-operated cameras have been procured for the Kidai area and results are awaited.

SECURITY

Poachers travelling up and down the Rufiji River from Maloka and its neighbouring villages along the banks of the river, just outside the north-eastern boundary of the reserve, are a constant threat to Kidai. Although poaching for fish and snaring animals may be their primary objective, the presence of a rhino is undoubtedly a great temptation. Heavy poaching also occurs along the Ruaha River. This was graphically reconfirmed recently (Richard Barnwell, pers. comm. 1999) when nearly 50 poacher camps and considerable poaching activity were recorded along an approximately 30-km stretch of the northern bank of this river.

The Kidai rhinos are the only population of this species in the SGR that have had a permanent force of rangers dedicated to their security for the past few years. This is made possible through the financial support of the directors of Sand River Camp. However, the enthusiasm and competence of the rangers is limited, and they are in need of good leadership in the field. The constant provision of suitable field equipment and clothing by their mentors does not automatically ensure their efficiency. A dedicated officer is needed who will provide daily motivation and leadership, and additional practical training in rhino tracking. It is important that rangers spend more time covering the whole rhino area on foot and camping out more frequently while on patrol, rather than focusing their activities on the immediate area of their permanent camp.

Lukuliro

LOCATION

The Lukuliro rhino population is located immediately north of the Lukuliro River headwaters within the eastern sector of the reserve. The area surveyed is about 370 km^2 in extent and probably represents the core area of this population. The Lukuliro, Kitope and Kinjekenjeke Rivers more or less form the boundary of the area. It is a favoured area for licensed trophy hunters looking for elephant and buffalo.

VEGETATION

The predominant vegetation of the eastern sector of the reserve is the almost ubiquitous *Brachystegia*

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The Lukuliro River looking upstream to its source in the Liwande Hills.

woodland. However, it is the vast dry, sand areas of coastal thicket, dominated by a mixture of evergreen *Canthium* and deciduous *Margaritaria s*pp. that make this area of the reserve so important. Its relative inaccessibility because of the dense impenetrable nature of the vegetation makes these thickets an ideal refuge for rhinos. Although the area surveyed is only about 350 km^2, the Lukuliro thicket area extends at least an additional 500 km^2 to the north. An aerial survey to the north of the Kinjekenjeke River during the dry season revealed neither obvious signs nor actual presence of rhinos, so it was not included in the subsequent ground survey of Lukuliro.

WATER

During the wet season, from November to January and from March to June, adequate water is readily available in the major rivers and in shallow pans and mud wallows. However, by the height of the dry season in September–October all major streams, including the Lukuliro River, have dried up and uncontrolled bush fires are prevalent. Even the vast and relatively luxuriant thicket area is devoid of water for much of the year. At this time the only water to be found is in holes dug by elephants in the dry bed of the Lukuliro River, and in a few small springs, also maintained by elephants, along the dry watercourses that lead into the headwaters of the Lukuliro. It is these few vital perennial springs that the Lukuliro rhinos depend upon for their dry-season water. The majority of these perennial waterholes are located in relatively open *Brachystegia* woodland just outside the major thicket area. This makes the rhinos extremely vulnerable to poachers.

Although up to three rhinos have occasionally been seen around these springs during daylight hours, most

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The ubiquitous *Brachystegia* woodlands dominate the Selous Game Reserve vegetation southwards from the Rufiji River.

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A relatively large thicket waterhole at the onset of the dry season.

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Dry-season waterhole in one of the watercourses that flow into the Lukuliro River headwaters.

activity is at night (Hassan Ndauka, pers. comm. 1997). Emerging from the thickets shortly after nightfall, the rhinos make for the springs and normally return to cover shortly before daylight. In this way they reduce the risk of being ambushed by poachers.

RHINO NUMBERS AND DISTRIBUTION

The Lukuliro area appears to have the largest number of rhinos of the five areas so far surveyed in the SGR. It is estimated that there is a breeding population of 10–15 animals. This could include up to four accompanied calves and five unaccompanied sub-adult animals (table 1).

Table 1. Track details of rhino calves and subadults recorded in the Lukuliro area.

Date (1997)	Track width (cm)	Notes
20 Sep	17.0	accompanied by 1 adult
23 Sep	17.5	single animal
23 Sep	18.0	single animal
23 Sep	17.0	single animal
16 Oct	17.5	accompanied by 2 adults
20 Oct	17.0	accompanied by 2 adults
23 Oct	15.5	accompanied by 2 adults

Although so far there is no information on the demographics of these animals, it does appear to be a viable population with a healthy proportion of calves and subadult animals. It is certainly the largest single metapopulation of rhino so far recorded in the SGR and, together with the Nahomba area, Lukuliro should be considered for IPZ status.

During the dry season when rivers, streams and most pools are dry, the Lukuliro rhino population appears to be concentrated within a core area of about 150 km^2. However, unlike the Kidai rhinos that do not seem to move any great distance from their core area around Mtundusi and Kipalala, the Lukuliro wet-season dispersal area may extend for an additional 500 km^2 or more to the west and north. The heavy cover of intervening wooded grasslands between thicket areas during the verdant wet season provides greater concealment for rhinos and may enable them to move from one metapopulation to another during this time of the year—a possibility that warrants urgent investigation in the interest of breeding and the long-term viability of these scattered rhino populations.

SECURITY

Despite rhinos having been documented as occurring in the Lukuliro area for the past decade, the only protection these animals received before 1997 was occasional foot patrols by Wildlife Division rangers stationed at Kingupira, about 100 km to the east. In the main these patrols kept to the few well-marked vehicle tracks maintained by professional hunting concessionaires, and to the still clearly visible seismic survey lines that criss-cross a large part of the reserve. Most of the rangers are poorly trained, equipped, armed and motivated, and until this survey there were

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Aerial view of one of the many seismic cut lines.

no written records available of rhino incidence other than those recalled from memory by members of the staff. Although this important rhino population is located relatively deep within the SGR, it is not beyond the reach of the numerous elephant poachers who live in and around the Maloka complex of villages and who are such an irritant to the Kidai area. It is highly likely that the old seismic survey lines are still being used by elephant and rhino poachers to infiltrate deep into the reserve.

The dangers of poaching are particularly high during the wet season when ill-equipped Wildlife Division patrols are even less frequent than during the dry season. The area is presently covered by adequate patrol roads, and making any additional tracks, like the track passing the important water points along the upper reaches of the Nahomba River, would be counter-productive. In general, the most effective anti-poaching is done not by vehicle but by conscientious and continuous foot patrols throughout the year.

The present rhino base camp on the northern banks of the Lukuliro River is strategically located to cover both the Lukuliro and the Nahomba rhino areas. For security and administrative purposes, it is important that the old Lukuliro airstrip be made serviceable once again, and that a new all-weather road from Kingupira to the Lukuliro base camp be completed as soon as possible.

Nahomba

LOCATION

The Nahomba rhino area is located in the eastern sector of the SGR around the headwaters of the Nahomba River and about 10 km south-west of the Lukuliro River rhino base camp. Laurie (1991) separated the Nahomba from the Lukuliro area, possibly for reasons associated with the methodology of his survey. Although the Nahomba rhino area is about 400 km^2 in total, time constraints allowed for only about 60 km^2 of it to be surveyed.

VEGETATION

Compared with the adjacent Lukuliro area, the Nahomba vegetation is primarily *Brachystegia* and *Pterocarpus* woodland with relatively small patches of coastal thicket. Some thicket patches appear to be decreasing in area as a result of fire damage. This observation is purely subjective but the subject de-

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Many of the smaller patches of thicket appear to be decreasing in area as a result of annual dry-season fire damage.

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A shallow dry-season waterhole in the bed of the Nahomba River near its headwaters.

serves further investigation in light of the importance of these thickets for rhinos.

WATER

Although the Nahomba River normally flows during the height of the wet season, only five residual waterholes (maintained by elephants) supply water to this area during much of the rest of the year.

RHINO NUMBERS AND DISTRIBUTION

Within the approximately 60 km^2 of area surveyed, the tracks of three to four individual rhinos were identified. All were recorded within a few kilometres of the Nahomba headwaters. It is not possible to estimate the extent of movement of these few animals, although it is likely that they move between Nahomba and Lukuliro, and possibly even further westward.

SECURITY

Many years ago the Wildlife Division permitted the construction of a vehicle track that runs for a distance of 9 km parallel to the upper reaches of the Nahomba River. The track is less than 100 m from the river and has full view of four of the five waterholes. At one waterhole there was a much-used and annually refurbished tree hide. Such hides should be forbidden in areas where there are rhinos. The temptation for poachers to use such gratuitous constructions from which to shoot at, or follow up, a drinking rhino or elephant is obvious. At one waterhole the survey team found a dead elephant. The body was too putrefied to ascertain the cause of death. Anti-poaching patrols in the Nahomba area are as infrequent as in the Lukuliro area.

Naluale

LOCATION

The Naluale rhino area is located in the southern sector of the SGR along its southern boundary. The area straddles a number of small perennial streams that make up the headwaters of the Naluale River. Approximately one-third of the area lies in the Udendeule Forest Reserve, which is outside the Selous Game Reserve, and the remaining two-thirds within the reserve—a total area of about 100 km^2.

VEGETATION

Compared with much of the SGR, the more steeply undulating countryside around the Naluale River headwaters has a relatively thin cover of open *Brachystegia* wooded grasslands and eroded ridgetops. There are scattered patches of light riverine forest.

WATER

Water is relatively easily found throughout the year in many of the smaller streams that run into the Naluale River.

RHINO NUMBERS AND DISTRIBUTION

This area was investigated by Laurie (1991) and evidence of a small number of rhinos was recorded. However, the present survey disclosed no signs of rhinos. From field investigations and discussions with the local rangers, it now seems unlikely that rhinos exist in any viable numbers east of the Ligombe and Naluale headwaters. This is not, however, the situation around the headwaters of the Horogwe River, about 25 km to the west.

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Carcass of an elephant found by the survey team at the head of the Nahomba River.

SECURITY

Foot patrols in the Naluale area are infrequent and no special effort is made by Wildlife Division field staff stationed at Likuyu Sekamaganga to investigate and monitor the occurrence of rhinos in this southern extremity of the SGR. The area immediately outside the southern boundary of the reserve (where rhinos are alleged to occur) is designated a wildlife management area in which villagers have rights to use wildlife on a sustainable basis. The only wildlife seen by the survey team while working in the Naluale and Horogwe areas was a single genet cat and a lone buffalo. Animal tracks of any sort were a rarity. It is debatable if the reduction of rhinos between Laurie's 1991 survey and this 1998 survey seven years later is due to human disturbance or to a natural movement of these animals within a greater home range.

Horogwe

LOCATION

The area was chosen for survey as a result of an earlier aerial investigation and discussions held with the Wildlife Division staff stationed at Likuyu Sekamaganga. The area is located around the headwaters of the Horogwe River between the Luwegu and Ligombe Rivers in the southern sector of the SGR. Like the Naluale area, the southern boundary of the reserve passes through the Horogwe survey area from south-east to north-west.

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One of the many eroded ridgetops in the Naluale area.

Although the area surveyed was only about 250 km^2 in extent, this could have been increased with advantage. Regrettably, the whole survey team succumbed to severe food poisoning and had to be evacuated to Likuyu Sekamaganga for urgent medical treatment.

VEGETATION

In keeping with the majority of the SGR, the vegetation of Horogwe is dry *Brachystegia* woodland that covers the middle and upper slopes of a closely undulating but occasionally steep landscape of ridges and valleys. Nearly all valleys are lined with close canopy, evergreen forests, a verdant undergrowth mosaic and small intermittent patches of perennial swamp or seasonally flooded tall grasslands.

WATER

Unlike the Lukuliro area in the eastern Selous, where water is scarce and restricted to a few small waterholes in the dry season, the whole area of probably more than 1000 km^2 to the north of Nahomba, between the Luwegu and Mbarangandu Rivers, is covered with a vast network of perennial springs, streams and a small number of miniature lakes. A rhino in search of water at any time of the year would not have to travel more than 1–1.5 km almost anywhere in this region. Maintaining vehicle tracks throughout most of this area, even during the dry season, necessitates the constant felling of small trees to place across the numerous streams. Without these temporary wooden crossings, which are regularly washed away during the wet season, even 4 x 4 vehicles can get stuck in the coarse sand that lies below the crystal clear water found in the majority of these streams.

RHINO NUMBERS AND DISTRIBUTION

After only one short visit to the area it was not possible to determine if the Horogwe rhinos are resident within the area throughout the year. It is equally possible that they move around during the wet season, as do the Kidai animals, and possibly also the Lukuliro population. With coarse, dry sandy soils on ridgetops and slopes, it was not possible to ascertain much in terms of possible rhino numbers from their tracks. However, the records of two

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Temporary bridge built with young *Brachystegia* trees across one of the many streams in the Horogwe area.

fresh tracks, 16 dung piles and 17 scrapes indicate that 5–8 animals could be in the area. Two important finding were 1) the identification of a confirmed third breeding population, and 2) the vast area of prime rhino habitat between the headwaters of the Luwegu and Mbarangandu Rivers that still needs to be investigated.

Track details of rhino calf and adult recorded in the Horogwe area:

Date: 20 June 1998

Track width: 16.0 cm

Indistinct track of single calf plus adult

SECURITY

The security of rhinos resident immediately within and along the southern boundary of the SGR is of concern. Rangers and infrastructure at Lukuyu Sekamaganga Wildlife Division headquarters are inadequate, foot patrols are infrequent, and roads and river passes receive little attention. Encroachment by hunters from the Community Wildlife Management Area into the neighbouring Udendeule Forest Reserve and the SGR itself has been recorded and may be the cause of the evident lack of wildlife in the area. It is almost impossible to obtain a true assessment of the extent of human encroachment and poaching as information elicited depends on who is interviewed. The remoteness of the area and the inadequate ranger force does not, under present circumstances, make it a secure location for the long-term survival of rhinos. A further and more extensive ground survey needs to be undertaken as soon as possible in the potentially excellent rhino area between the Luwegu and Mbarangandu Rivers.

Intensive Protection Zone status for the Lukuliro–Nahomba area

The Policy and Management Plan for the Black Rhinoceros in Tanzania (Tanzania 1993) calls for 'establishment of intensive protection zones (IPZs) in suitable rhino areas to ensure the recovery of this species'.

The Selous Game Reserve General Management Plan (Tanzania 1995) states one of its objectives is 'to provide adequate protection of rhinos by establishing IPZs in areas where they are known to still occur, and that these areas will be patrolled very frequently by motivated patrol teams'.

The 1998 draft Policy and Management Plan for the Black Rhinoceros, *Diceros bicornis*, in Tanzania (Tanzania 1998) continues to support the establishment of IPZs in Rhino Protected Areas wherever possible.

The Wildlife Division is therefore eager that the important Lukuliro area (ideally together with the Nahomba area) be approved as an IPZ in recognition of the division's efforts in protecting this unique metapopulation of the southern subspecies of the black rhino. However, AfRSG specifies that a prerequisite for IPZ status is that law-enforcement staff be deployed in the field at moderate to high density specifically to protect the rhino population, at a recommended level of one ranger per 10 km^2 but not less than one ranger per 30 km^2. Additionally, AfRSG will support the development of an IPZ only if there is long-term sustainable funding to support it (Richard Emslie, pers. comm. 2001).

The core rhino area of Lukuliro is about 250 km^2 and that of Nahomba 400 km^2, making a total of about 650 km^2. Complying with AfRSG guidelines, the two combined areas would therefore require between 22 and 65 rangers. However, appreciating existing financial and staff constraints, a more practical figure of 40 dedicated rangers should be able to provide adequate surveillance and security for this area.

Infrared beam-operated cameras

During the course of these surveys, active TrailMaster infrared beam-operated cameras were used wherever and whenever possible. A number of inherent, ongoing practical problems were experienced in the field—not least being vandalism by baboons and total destruction of equipment by hyenas. When these problems did not occur, night photographs of elephants and buffaloes were relatively easy to obtain. A night photograph of a rhino has yet to be obtained. Two major drawbacks inhibited the successful use of this equipment during these surveys:

- The relative complexity of the infrared 'receiver' element excluded the equipment from being effectively operated by any of the rangers.
- The initial setting-up of 6–10 cameras and constant servicing of them every 2–3 days proved more time consuming and disruptive of the survey work than had been anticipated.

With the surveys now completed, and most of the cameras still intact, it is hoped that an effort will be made to pursue an infrared camera monitoring programme in the Lukuliro–Nahomba and Kidai areas.

Max Morgan-Davies

One of the many elephant images taken with an infrared beam-operated camera. A rhino photograph has yet to be obtained with one of these cameras.

Despite not obtaining infrared beam-operated photographs of rhinos during the survey period, with more time available for camera work by a small and dedicated team (particularly if undertaken on a full-time basis with no distractions), valuable results should be obtained (Griffiths 1993).

Rhino faecal DNA

As part of the survey it was proposed that DNA extracted from rhino dung be used to identify individual animals based on unique patterns of different polymorphic loci. The sex of individual rhinos was also to be determined from their dung by using sex-specific primers. In this manner it was expected that

- the minimum number and sex of the rhinos within each surveyed area would be ascertained
- by the use of the Bayesian Mark–Recapture RHINO software, an accurate population estimate could be made, which would, help estimate the carrying capacity of each of the surveyed areas—particularly that of Lukuliro–Nahomba (Emslie 1993)

In March 1997, the faecal DNA research proposal was accepted by Dr Colleen O'Ryan, Department of Biochemistry, University of Cape Town. A total of 50 faecal samples from three locations were collected and sent for analysis (table 2).

Table 2. Details of 50 rhino faecal samples collected for DNA analysis

Date sent for analysis	Number of samples
Kidai area	
September 1998	2
March 1998	5
December 1998	11
Total	**18**
Lukuliro area	
September 1997	7
December 1997	15
April 1998	3
Total	**25**
Horogwe area	
August 1998	**7**

In this pilot study, total genomic DNA was extracted from these dung samples and polymorphic microsatellite DNA loci were amplified using the polymerase chain reaction. Although very low amounts of DNA were extracted, and inhibitors of plant origin were co-extracted with the rhino DNA, positive amplification products were obtained from 60% of the dung samples collected from the Lukuliro area. Nine genotypes were observed using a polymorphic microsatellite locus specific for the black rhino. Preliminary data suggest that eight of the nine genotypes are unique and to date represent the minimum number of individuals present in this particular Selous metapopulation; it is possible that more will be identified when the remaining 40% of the Lukiliro samples have been analysed.

The success of a DNA-based procedure to estimate the minimum number of individual rhinos in a population from their dung will have profound consequences, not only in the SGR but in similar locations throughout Africa and Asia where access to elusive rhino or other endangered wildlife populations cannot be reliably had by any other means.

Discussion and recommendations

Although the number of *D. b. minor* in Tanzania has been considerably reduced over the past 20 years, the present investigation, together with those of Stronach (1991) and Laurie (1991), confirms that the species continues to exist, albeit in relatively small numbers scattered about the SGR. However, the threat to rhinos and elephants from poaching in the reserve is still present. Although no rhino carcasses have apparently been found in recent years (Benson Kibonde, SGR project manager, pers. comm. 1996), the large areas of dense evergreen thicket and riparian forest, and the inadequate ranger force dedicated to daily monitoring of most rhino populations makes the detection of carcasses on foot or from the air very difficult—particularly in the wet season. This could give the false impression that there is no poaching and that the population is stable when, in fact, it is in covert decline as rhinos become fewer and increasingly isolated from each other because of poaching or human disturbance, and breeding finally ceases.

To prevent such a situation and to build up existing rhino numbers in the SGR, the following measures are recommended for priority consideration:

- The joint Lukuliro–Nahomba area is immediately accorded IPZ status as specified byAfRSG.
- A specially trained and dedicated force of rhino rangers, under committed field leadership, must be assigned to this and any other IPZ in the SGR throughout the year exclusively for the surveillance, monitoring and security of these areas. These rangers should not be periodically diverted, as at present, to such duties as road building or boundary demarcation or to accompany licensed sport hunters.
- Additional favourable rhino areas that have not yet been investigated should be surveyed, for example, between the Luwegu and Mbarangandu Rivers, the thickets at the headwaters of the Luwimbi River, and the area of the Nyanga Pan.
- Work with the TrailMaster infrared beam-operated cameras should continue, particularly within the Lukuliro–Nahomba and Kidai areas.
- The rhino faecal DNA work so far undertaken by Dr Colleen O'Ryan to obtain information on minimum numbers and sexes of individual rhinos within each sub-population should continue.
- All rhino rangers should receive additional specialized training in practical rhino tracking and field craft. This training could be provided through the courtesy of one or another of the numerous wildlife management agencies in southern Africa or Kenya.
- Rangers should be instructed to specifically investigate, particularly during the wet season, any movements of rhinos between one sub-population and another. A suitably trained and experienced senior officer should be permanently stationed at Kingupira to administer all matters pertaining to the surveillance, monitoring and security of rhinos throughout the SGR, under the direction of the national rhino coordinator.

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Less elephant slaughter in the Okapi Faunal Reserve, Democratic Republic of Congo, with Operation Tango

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Abstract

The Okapi Faunal Reserve in the Democratic Republic of Congo is one of the most biologically rich of the World Heritage Sites. Yet it is seriously threatened by the effects of war and armed conflict. Support from conservation non-governmental organizations has proved critical given the urgency these crises have caused. In addition, it has been proved through Operation Tango with impetus from these organizations that collaborative action between the local authority for the management of protected areas and the Uganda People's Defence Forces and Congolese military was effective in reducing heavy elephant poaching and coltanore exploitation within the reserve. Difficult choices must be made in attempts to balance the needs of still-fragile wildlife populations with urgent demands of the rural poor. Still, the experience of the Okapi Faunal Reserve gives hope to those working in neighbouring protected areas in Congo. Even as the forest has begun to regenerate, so too the elephant population has survived recent poaching ordeals and has started to show remarkable capability for recovery under today's difficult constraints.

Résumé

La Réserve de faune à Okapi (RFO) figure parmi les plus riches sites de patrimoine mondial en danger en République Démocratique du Congo. A ce jour, ce site est sérieusement menacé par les effets de la guerre et de conflit armé. L'appui des ONGs de conservation a été critiques étant donné l'urgence de besoins de conservation pendant la période de crise. Aussi, il a été démontré à travers l'Opération Tango et ce, avec l'impulsion desdites ONGs que la collaboration entre l'institution nationale de conservation au niveau local et l'UPDF et l'armée congolaise fut effective en réduisant le braconnage intense d'éléphants ainsi que l'exploitation du coltan dans la Réserve. Le processus de rétablissement est au prise avec le choix tragique opéré visant à balancer les besoins de la faune sauvage et ceux urgents de la population rurale démunie. Toujours est-il que l'expérience de la RFO donne espoir aux autres aires protégées en RD Congo. A l'instar de la forêt, la population d'éléphants a survécu l'épreuve du braconnage et a commencé à montrer une capacité remarquable de rétablissement en dépit de contraintes difficiles en cours.

Introduction

Situated in the eastern part of the Democratic Republic of Congo (DRC), the Okapi Faunal Reserve (OFR) was created in May 1992 and proclaimed a World Heritage Site in December 1996 in recognition of its biological significance and in response to the increasing threats to its integrity. The reserve occupies about 20% of the Ituri Forest (60,000 km^2) (fig. 1), which in turn is a small part of the vast Congo Basin forest. The reserve provides a refuge for one of the largest populations of elephants in the Congo. J.A. Hart (pers. comm. 1998) estimated that OFR had 7375 elephants.

Like many African elephant range states, cannot protect its elephant populations under the current political and economic conditions. The high cost of protection is the single most important factor in the fail-

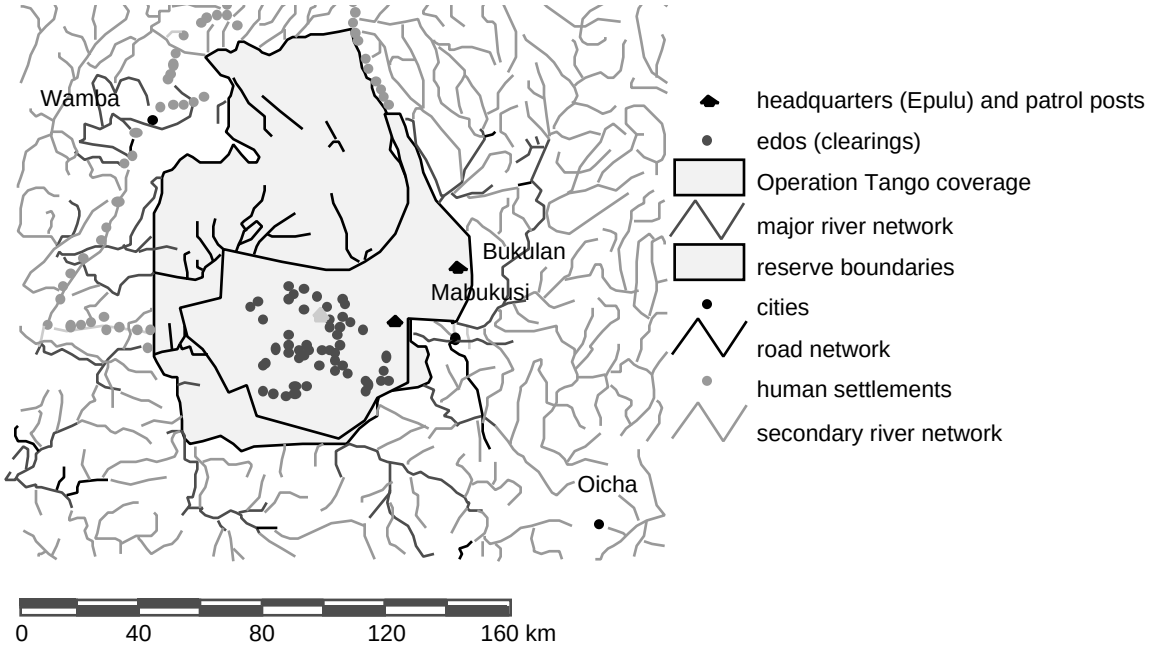

Figure 1. Operation Tango and law enforcement in the Okapi Faunal Reserve.

ure to halt elephant poaching. Today poaching remains the main cause of falling elephant populations, and efforts to save the elephant are a dominant part of discussions of conservation in Africa. Poaching is the most urgent threat to wildlife, and in eastern DRC it is exacerbated by armed conflict. These conservation threats need to be properly addressed.

The correlation between the availability of firearms and ivory poaching, described by Douglas-Hamilton (1987), was also observed in Ituri Forest. Furthermore, with the problems of indisciplined soldiers, the breakdown of authority in national parks, a continued demand for ivory in global markets, and easily obtained profits in ivory, the declining elephant population in Ituri Forest, as well as in other protected areas of DRC, remains a major concern.

Throughout the troubles of the 1990s, local and international conservationists struggled against the odds to maintain the integrity of OFR and its wildlife populations. They have learned to lobby support from an unfamiliar set of national and international players, including local militia, whose objectives generally conflict with those of conservationists.

Threats to elephants in the reserve

Since the 1996 outbreak of civil war, OFR has been under great pressure. The civil crisis in DRC, the arrival of foreign military personnel, and an increased market for bushmeat and ivory all led to increased killing of wildlife. The increased number of weapons in local circulation has exacerbated the increase in hunting. Neither the park authority nor government legislation has proved effective in curbing hunting. Most conservation activities were halted, paving the way for an increase in poaching activities (Mubalama 1999). With only 50 guards patrolling 13,700 km^2, strict control was impossible. In addition, as a new reserve, OFR did not have an adequate protection system and the ill-equipped rangers were often forced to fight fierce battles in and around the reserve.

Congolese National Parks Institute (ICCN) funding for OFR stopped before war broke out. The government's response to the reserve's funding problems was ineffective and ICCN partners, including the Wildlife Conservation Society (WCS) and Gilman International Conservation (GIC), increased their funding for conservation efforts and paid ICCN staff salaries. The security situation in OFR, however, required even greater intervention. WCS raised further funding of USD 50,000 from GIC and USD 4000 from the Cincinnati Zoo to support security measures. This funding enabled the establishment of a programme, known as Operation Tango, to provide joint training

in paramilitary and anti-poaching operations for Ugandan and Congolese military personnel.

The civil war in 1996 toppled Mobutu's government and brought Kabila to power. After a short lull in fighting, further violence broke out in 1998, resulting in increased illegal exploitation of natural resources and effective division of the country into a government-controlled area in the west and a rebel-controlled area in the east supported by neighbouring states. The presence of automatic weapons in the area provided easy means of illegal hunting, and severe wildlife poaching followed the fighting. Law-enforcement agencies monitoring conservation efforts found that local populations, including traditional chiefs and military personnel, were responsible for poaching in OFR. A stone's throw away from the reserve's headquarters in Epulu, elephant meat was easily obtainable. Although poaching began in earnest in 1996, the heaviest slaughter of wildlife occurred between 1998 and 2000.

Other factors contributing to increased ivory poaching were the high market price for ivory, the poverty of local populations and corruption. Barnes et al. (1995) noted that poorly paid officials were susceptible to bribery. In less than three months before the launching of Operation Tango, the retail price of a kilo of raw ivory doubled from USD 10 to USD 20. In July 2000, a kilo of elephant meat was sold for USD 5 in Mambasa, Beni and Bunia. In June 2000, a local informant reported that raw ivory was plentiful in eastern DRC. Smuggled into Uganda and Kenya, a kilo of raw ivory could fetch as much as USD 30 per kilo (Martin and Stiles 2000). According to reliable trade sources, much of the tooled ivory on the Ugandan market is being smuggled from Ituri and Garamba.

OFR scouts carried muzzle-loaded rifles with limited amounts of ammunition and proved no match for the groups of well-armed poachers. Consequently, morale among wildlife staff was severely eroded. According to observers, efforts to patrol the reserve were minimal, with each guard patrolling on as few as eight days per month. Records show that at least 41 elephants were killed by poachers between January and September 2000, and this number is thought to be only a fraction of the actual number of elephants killed since the area under surveillance by wildlife personnel was but one-third of the total OFR area.

Elephants respond to heavy poaching by concentrating in 'safe' areas (Douglas-Hamilton 1987), mainly a few kilometres from the human settlements, where they stand a higher probability of meeting people and thus coming into conflict with them (Kangwana 1995; Mubalama 2000). In fact, many reports on wildlife poaching stress that elephants are usually killed a few kilometres from roads where human settlements occur. Elephant hunting with AK47 automatic rifles proliferated, apparently spearheaded by a small number of unaligned groups of military, now poachers.

Effectiveness of a joint military–wildlife guard operation in the midst of political unrest

This critical situation with regard to elephants in the reserve was brought to the attention of the international nature conservation community. The aim was to alert the world community to the 'ecocide' taking place and to put pressure on those able to take the necessary steps to halt the destruction. The response to this upsurge in wildlife poaching, in the form of Operation Tango, came from an institutional capacity developed through the long-term commitment of locally-focused international conservation projects where the Congolese National Parks Institute had been unable to carry out its own mandate (Hart et al. 1996).

By rallying support from the donor community, and providing soldiers and park guards with both equipment and financial bonuses, WCS, GIC and MIKE/CITES hope to encourage conservation efforts by the reserve authorities. It must be remembered that these efforts are taking place against a background of declining government budgets to wildlife authorities. This shortfall is being met by increased assistance from external donors , with the United Nations Foundation and the UNESCO Conservation in Crisis Programme providing financial support for reserve guards and facilitating cooperation between the higher authorities and the military when there have been problems.

As a result, the fight against wildlife poaching is today carried out by wildlife authorities endowed with the power to protect and manage wildlife and protected areas. They also have political support from authorities at the highest levels of the Congolese Rally-Gathering Liberation Movement (RCD/ML). A written agreement between the RCD/ML authorities and OFR management stressed that any confiscated weapons would remain the property of the re-

serve. A concerted effort was made to enforce laws at every level of the trade, and on the strength of intelligence network records, patrol teams were deployed in hot-spot hunting zones. The patrol teams were armed and supplied with adequate ammunition to ensure that they were on an equal footing with the heavily armed poachers or were even more powerful.

By 18 October 2000, after several contacts between a wildlife management team and RCD/ML authorities in Bunia, it was possible to initiate the intensive military–wildlife guard anti-poaching operation called Tango (akin in sound to *tembo*, 'elephant' in Swahili) in an attempt to wipe out elephant and bushmeat poaching and illegal coltan mining. (Columbite/tantalite is one of the ores from which tantalum powder is made. It is used in the manufacture of tiny tantalum capacitors, which withstand the heat of ever-faster computers and ever-smaller mobile phones.) Baseline data were provided by the findings of the MIKE monitoring teams.

Large-scale poaching activities were evident, with 17 new or recent poaching camps reported. Twenty poachers were caught red-handed and 111 kg of raw ivory and 215 kg of elephant meat were recovered. Three months before the launch of Operation Tango the area under control of the wildlife management authorities was less than 10% of the reserve (fig. 1). Importantly, 17 weapons, most of them small machine-guns, along with 331 rounds of ammunition were confiscated by a joint 34-man team of UPDF (Uganda People's Defence Forces) and APC (Armée Populaire Congolaise) personnel.

Because of poor communication, it was decided that all active law enforcement be vested in a closely supervised rapid-deployment strike force based at headquarters in Epulu. The strike force mounted regular armed patrols on an unpredictable basis throughout the reserve. Patrols also manned semi-permanent observation posts at strategic vantage points. The force responded rapidly on short notice to intelligence reports or calls for assistance forwarded by the various outposts.

After five months of Operation Tango, no new signs of poaching were found, which correlates with information gained from law-enforcement monitoring of poaching levels during the latter part of 2000.

Results

Although we cannot say that the operation has led to an absolute cessation of elephant poaching, the hope has been that the protection levels gained would be consolidated with the deployment in May 2001 of a new group of 28 park guards trained by joint UPDF and APC forces. Armed OFR personnel are recruited among individuals in the local population who demonstrate qualities of leadership and commitment; they then receive regular hands-on training that empowers them to take responsibility for managing their natural resources—the formula proved to sustain long-term conservation efforts under today's difficult conditions (Adams and McShane 1992). The idea of investment in joint patrol forces with locally based conservation institutions is not new. What is clear, however, is that such site-based initiatives must be tied to an international structure that endures through cycles of civil strife (Hart and Hart 1997).

Results from Operation Tango are far better than had been hoped, and the relative lull in poaching gives time to build up other types of support for OFR. Elsewhere, publicity on the plight of elephants has proved effective in reducing the demand for elephant products; therefore, production and dissemination of written information materials in local languages should be intensified. The lessons from these recent operations indicate that a greater level of support, collaborative effort with more partners, and innovative, sustainable means of funding are necessary for the long-term future of OFR. Unless the substantial levels of funding that will be required to run this operation effectively are regularly and reliably forthcoming, the whole strategy will collapse.

We believe Operation Tango has been a success. However, there is still much to do to consolidate these results. Although the operation did not bring poaching to a complete end, it is obvious that the joint military and strike force's basic patrol strategy brought increased protection to the reserve, and international community support helped to boost the morale of reserve staff. Optimized law-enforcement operations have led to optimizing the level of deterrence and hence reducing illegal off-take to earlier levels (Jachmann 1998). Combined with an improved regime of foot patrols carried out from headquarters, and existing and planned outposts, OFR will provide appropriate protection for the elephant population and other wildlife. Nevertheless, as formal armed forces are being withdrawn from the region, exploitation is again a threat; conservation personnel have been attacked and robbed, as have many others. Much of this current increased instability seems

to be associated with the power vacuum left by the withdrawal of troops, which is being exploited (Hillman Smith and Mafuko 2001).

The important question remaining is whether the great reduction in elephant slaughter in the reserve and surrounding areas will in time be reflected in the price of ivory and what effect this will have on African elephants and poaching. Is the current extent of the coltan trade likely to have an adverse effect on the protection of the remaining wildlife? These questions must be addressed before a situation develops in which commercial ivory poachers work with disenchanted local communities–a situation that could have serious ramifications for the elephant population (Dublin et al. 1995) in the OFR. The answers will have important implications for future decisions on world ivory trade (Vigne 1991). Further, elephant numbers may increase within the reserve in the short-term, but it may be unrealistic to expect that elephants will ever recover to historical levels, even with effective control of all levels of illegal elephant killings (Dublin et al. 1995). Current human demographic trends across the reserve indicate such a recovery may be rare.

Proposed management strategy

Ensuring the success of law-enforcement efforts is probably the most important management objective for the future conservation of elephants (Leader-Williams 1993). A large component of the work of wildlife managers in OFR relates to law enforcement, particularly with regard to large species with valuable trophies like the elephant (Bell 1983; Cumming et al. 1984; Leader-Williams 1993), and it is of paramount importance that monitoring the enforcement of those aspects of the law is accorded a very high priority. Monitoring of law-enforcement efforts in actual encounters in the field will provide vital indicators of the rates of encounter in the various classes of illegal wildlife use to guide field operations and optimize their efficiency.

We believe that a strategy to win the battle against poaching in OFR needs to include the following measures:

- Ensure that there is continued political will for wildlife conservation laws to be properly enforced. This political will can be maintained by adaptation of national legislation and by collaboration between local people and the local administration.
- Increase the number of staff and patrols involved in law enforcement and provide sufficient funding, resources and equipment to enable them to carry out their work with input from well-established intelligence records.
- Improve the awareness of the population with regard to wildlife and habitat laws, particularly those relating to protected areas.
- Produce and, where possible, implement the outcome of the OFR Zoning Plan Initiative as part of an integrated development policy that will provide sustainable economic alternatives to poaching and the bushmeat trade. The initiative is a project involving local communities and indigenous peoples that aims to guarantee the Mbuti people that they will be able to continue their low-impact hunting and gathering throughout a large area of OFR and at the same time guarantee the long-term integrity of the natural resources of the reserve.
- Ensure the availability of information on elephant status and numbers, which is vital for the effective conservation and management of OFR's remaining elephant populations.

To monitor law enforcement, conservationists should learn to lobby for support from an unfamiliar set of national and international players, including military bodies and humanitarian agencies, which have very different objectives and agendas.

If the reserve is to consolidate the positive results of Operation Tango, the consortium of partner institutions needs to make a long-term commitment to local conservation problems with the ultimate aim of building national capacity to promote conservation.

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What strategies are effective for Nepal's rhino conservation: a recent case study

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Abstract

The huge increase in rhino poaching from mid-1998 to mid-2000 in the Chitwan Valley of Nepal was due partly to the slackness and ineffective leadership of one of the chief wardens, and the lack of a full-time experienced and competent senior officer in the valley to supervise the anti-poaching activities. To the credit of the Parks Department, some officers realized what had gone wrong and compiled a report detailing park deficiencies. It was circulated to interested parties at the end of 1999 and early 2000. Unfortunately, by then at least 20 rhinos had been killed illegally in 1998 and 1999. Soon after this report was issued, a highly competent officer was appointed to supervise the anti-poaching activities, and later in the year an experienced and forceful chief warden was put into position. From mid-2000 to early February 2001 only one rhino was poached as far as is known. This incident highlights the importance of a single person or at most two in successful rhino protection.

Résumé

L'augmentation énorme du braconnage des rhinos entre le milieu de 1998 et le milieu de 2000 dans la Chitwan Valley, au Népal, était due en partie à la négligence et à l'inefficacité d'un des conservateurs en chef et aussi à l'absence d'un responsable expérimenté et compétent travaillant à plein temps dans la vallée pour superviser les activités anti-braconnage. On peut mettre au crédit du département des Parcs le fait que certains responsables ont identifié ce qui était en cause et rédigé un rapport détaillant toutes les déficiences du parc. Ce rapport a circulé chez toutes les parties concernées fin 1999 et début 2000. Malheureusement, à cette date, au moins 20 rhinos avaient déjà été illégalement tués en 1998 et 1999. Peu après la parution de ce rapport, on a nommé un responsable extrêmement compétent pour superviser les activités anti-braconnage et, plus tard dans la même année, un conservateur en chef expérimenté et énergique fut mis en place. Entre le milieu de 2000 et le début de février 2001, un seul rhino a été braconné à notre connaissance. Cet incident souligne l'importance que peuvent avoir une ou deux personnes seulement, dans la réussite de la conservation des rhinos.

Introduction

Over the past three decades, the Department of National Parks and Wildlife Conservation (DNPWC) in Nepal has implemented one of the most successful programmes in the world for conserving rhinos (Martin and Vigne 1995). In 1968, there were an estimated 95 greater one-horned rhinos in Nepal, but by 2000, when the most recent census was carried out, numbers had increased to 612 (DNPWC 2000). However, from mid-1998 to mid-2000, Royal Chitwan National Park and the surrounding areas, which harboured 89% of the country's rhinos, experienced the worst poaching for any two-year period since the park was established in 1973. On the other hand, the rhinos in the Royal Bardia National Park have remained secure.

Reasons for this sudden increase in illegal killings of rhinos in Royal Chitwan National Park are examined and recommendations are presented that could reduce the chances of another upsurge in poaching in the future.

The fieldwork for this project was carried out in a three-week period in February 2001.

Rhinos poached in the Chitwan Valley, mid-1998 to mid-2000

From 1994 to 1997 the average number of rhinos illegally killed each year in the Chitwan Valley (Royal Chitwan National Park and surrounding areas) was

under two a year (Martin 1998). However, poaching began to escalate in mid-1998. From July 1998 to October 1999 at least 19 rhinos were poached in the valley and another 15 were illegally killed from November 1999 to August 2000 (see table 1). These poaching statistics are the minimum figures, as several additional rhino carcasses were found too late to diagnose the cause of death.

Several other sets of poaching data exist. For example, the figure given in the DNPWC annual reports of 1998/1999 and 1999/2000 for the period from July 1998 to October 1999 is 12 (Subba 2000, 2001). Tika Ram Adhikari, who is the team leader of the anti-poaching units in the Chitwan Valley and the acting chief warden of Parsa Wildlife Reserve, believes, however, that there were 19. From November 1999 to July 2000 the figure given in the annual report is 11; Adhikari's count is 13, which is quite close to the official figure. From late 1999 to early 2001, the veterinarians, especially Jacques Flamand of the Wildlife and Domestic Veterinary Programme of Royal Chitwan National Park, have examined most of the rhino carcasses in and around the park. Judging from the autopsies they performed, they believe that from November 1999 to August 2000 at least 15 rhinos were illegally killed (Flamand 2000), which tallies with Adhikari's counts.

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This 3-month-old male rhino, attacked by a tiger 15 days before this picture was taken, is being hand reared at Royal Chitwan National Park headquarters.

Using the statistics from the DNPWC annual reports for 1998/1999 and 1999/2000 (Subba 2000, 2001), we can determine that from mid-1998 to July 2000, 55% of the rhinos poached were outside the park. From mid-1999 to July 2000, however, the percentage of rhinos poached outside the park rose to 65. This is significant when we analyse the causes of poaching, because the government organizations responsible for patrolling inside the park are different from those patrolling outside it.

Table 1. Minimum number of rhinos poached in the Chitwan Valley, mid-July 1998 to early 2001

Time period	Number illegally killed
July 1998 to October 1999	19
November 1999 to August 2000	15
September 2000 to early February 2001	1
Total	35
1998 and 1999	20
2000	15
Total	35

Source: Tika Ram Adhikari, acting chief warden, Parsa Wildlife Reserve and team leader for the anti-poaching units in the Chitwan Valley (data collected for 1998 and 1999), and Jacques Flamand, Zoological Society of London, senior veterinary adviser in Chitwan (data collected for 2000 and early 2001)

Poaching methods in the Chitwan Valley

Poachers in the Chitwan Valley use six main methods to kill rhinos: shooting with firearms, pit trapping, spearing, snaring, poisoning and electrocuting.

During 1999 and 2000, the most common method was with firearms, usually musket or rifle. Some of these arms are locally made, others factory-produced. Generally the gangs, which number two to five men armed with three guns, are from outside the park. One or two local people from the buffer zone are recruited as they are familiar

with the topography of the park and the surrounding zone. Park staff believe that some former army personnel have recently been hired by the gangs, and one soldier retired from the Indian army is involved in the actual shooting. The poaching gangs usually enter the northern park boundary (where most of the rhinos are located) or the surrounding areas in the evenings when the army is not patrolling, and they depart at night or early in the morning, when they are least likely to be detected.

The gang size for pit trapping is large, as people are needed to construct the big rectangular pits and to cover them with sticks and other vegetation for camouflage; some of these gangs may number up to 15.

Spearing is rather ineffective because often the animal does not die immediately and the authorities find the carcass before the hunters have had a chance to remove the horn, hooves and other body parts. For example, in 1999 one adult male rhino was speared inside the Baghmara Community Forest close to the park, but the wounded animal left the forest and wandered into the elephant breeding centre near the tourist centre of Sauraha, preventing the hunters from taking the valuable horn.

Another method for killing rhinos, which is also not very efficient, is snaring. Most of the snares are put down for deer, but they are occasionally set for rhinos as well. Nylon, rope and wire have been found around the necks and legs of rhinos. Sometimes it takes many days for a snared rhino to die, usually from infection, and by that time, the army or park authorities may have discovered the carcass.

Poisoning has become common. In 1999 more than nine rhinos were poisoned in the Chitwan Valley. The poisons used are chlorinated hydrocarbons of the DDT family, widely used in southern Nepal for crop spraying (Jacques Flamand, pers. comm. 2001). The poisons specifically used for rhinos are put into oranges and pumpkins on the edge of Chitwan Park; they take on average from three to eight hours to kill the animals.

Villagers in southern Nepal have been stringing wire cables (usually two) about one metre above the ground and connecting them to the village power supply to electrocute bears, deer and wild boars. Occasionally rhinos run into the wires. This accidental killing of rhinos by electrocution started in 1997 in Nawalparasi District, and since then at least four rhinos have been killed in this way.

The trade in rhino products

When a rhino is illegally killed in the Chitwan Valley, it is usually organized by a trader, who wants the animal primarily for its horn. Sometimes the hooves and occasionally pieces of skin are also removed. But by far the most valuable part of the rhino is the horn. In 2000 a poaching gang in the Chitwan Valley might have received up to 300,000 Nepalese rupees (NPR) or USD 4253 for a horn weighing on average 722 g (Martin 1983), which works out to NPR 415,512 (USD 5894) for 1 kg. The first middleman is usually located in a village in the valley. He sells the horn by weight to another trader (the second middleman), who usually lives in a town such as Kathmandu, Pokhara, Nepalganj or Narayangadh. This trader, who may or may not be an exporter, sells the horn for NPR 90,000–100,000 (USD 1277–1418) per 100 g (T.R. Adhikari, pers. comm. 2001).

In mid-2000, the main buyer of rhino horn in the valley at that time was arrested. He had also organized illegal gangs and sometimes poached himself. He was transporting a rhino horn from

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The best way to see rhinos in Nepal is from the back of an elephant.

Tikauli (just north of Chitwan Park) on a bus to Narayangadh town on his way to Kathmandu to sell it to a main dealer, a Mr X, for whom he was an accomplice. After his arrest he helped the authorities track down Mr X and accompanied park staff to Kathmandu where, with the assistance of the police and the Forest Department, Mr X was arrested in late July 2000. This was the first time that the authorities caught a major rhino horn dealer. The Kathmandu trader later talked to Tika Ram Adhikari about his dealings. He admitted to selling six rhino horns, but the Park staff believe he sold 11. He sold his horns, at the prices given above, allegedly to a Chinese woman employed in the Chinese embassy in Kathmandu, who is fluent in Nepalese, Tibetan, Mandarin and English. Adhikari thinks she has been exporting horns since 1990. Besides these horns, she also allegedly buys tiger bones and other medicinal products and sends them by road, first to the border town of Tatopani, then on to Lhasa in Tibet, and finally to China.

Mr X, formerly a managing director of a charcoal company, is a businessman from the Manange ethnic group. Originating north of Annapurna, this group has a recent tradition of organizing dubious schemes with businessmen in Singapore, Bangkok and Hong Kong to import gold, clothes and electronic goods. He started buying horn around 1990, mostly from his Chitwan Valley accomplice mentioned earlier. He is prosperous and presents himself as benevolent by helping flood victims and donating to monasteries. He is now in Bharatpur Prison with five major counts against him (Gopal Prasad Upadhyay, chief warden of Royal Chitwan National Park, and Dhubra Acharya, DFO Kathmandu, pers. comm. 2001). Besides Mr X and the Chinese woman, who buys horns from him, three other known main dealers in rhino horn are based or partly based in Kathmandu. One is a Tibetan who buys rhino horns, tiger bones, rare herbs and gemstones in Nepal. He speaks only Tibetan so he works closely with the multilingual Chinese woman in exporting rhino horns from Nepal to Lhasa and beyond. Especially from 1991 to 1994, another Manange, who is a former British Gurkha officer, was involved in buying rhino horns and is still active today. The third, also a Manange, is a relative of Mr X, with whom he works. He is a proprietor of a guest house in Kathmandu, and he buys rhino horns and tiger bones.

Reasons for the increase in poaching in the Chitwan Valley from mid-1998 to mid-2000

There was no single cause for the major increase in rhino poaching in the Chitwan Valley from 1998 to 2000, but one factor was overriding: mismanagement. First, in the middle and late 1990s, there were four transfers of chief wardens in Chitwan Park involving three people. The continuity of management suffers from rapid changeover such as this.

Second, one of the chief wardens was not effective enough, as he sometimes procrastinated in making decisions. In addition, he did not coordinate well the activities of the five groups of people responsible for protecting the rhino. These groups are the regular staff of 277, the army, the rhino anti-poaching units, the DFOs (district forest officers) and the non-governmental organizations (NGOs). He did not communicate adequately with the commander of the army stationed inside the park. (Most of the rhino anti-

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Just north of Royal Chitwan National Park, a Nepali villager prepares reeds that he collected legally inside the park for his house. The cutting season has been reduced from 15 days to 7 days each year.

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It is not uncommon to see rhinos in Royal Chitwan National Park eating dung as shown here.

poaching activities in Chitwan Park are carried out by an army battalion of about 800 men who are well armed; none of the park staff carries firearms.) Nor did he deal well with his anti-poaching units, five of which are based inside the park, two in Parsa Wildlife Reserve and three in the surrounding national forests located in the buffer zone. This chief warden did not have close relations with DFOs in Chitwan, Nawalparasi or Makwanpur Districts, where the rhinos are found. This lack of strong coordination with these DFOs was especially regrettable as over half the rhinos poached in 1998, 1999 and 2000 were killed in these districts. Neither did this chief warden cooperate closely enough with the NGO community such as WWF Nepal, which helps support the anti-poaching units; the King Mahendra Trust, which carries out training programmes and supports research projects; and the International Trust for Nature Conservation (ITNC), which provides most of the reward money for helping to arrest poachers and traders. Previous chief wardens, who had kept poaching at low levels (except in 1992), all had excellent, strong working relations with all these organizations. The chief warden's role in coordinating all the groups involved in rhino protection is essential for successful rhino conservation.

A third factor contributing to the mismanagement was that the anti-poaching units were not as active as they should have been as they were not well supervised by one of the chief wardens. The result was that they were not as mobile as they should have been and did not patrol intensively enough.

Another main reason for a rise in rhino poaching was financial difficulties. The anti-poaching units and Chitwan Park's other personnel lacked adequate resources. The senior staff of DNPWC, aware of these problems, issued a report in December 1999 stating: 'APU staff are not well equipped. The informants are not adequate in number. Anti-poaching units are very weak because [of] lack of effective intelligence system, field gear, proper training, supervision, guidance, coordination, transportation and weapons…' (Adhikari et al. 1999). The report also confirmed that 'joint patrolling of APU's staff and armed forest guard has not been developed in the Chitwan Valley due to lack of proper coordination mechanism between the park warden and DFOs' (Adhikari et al. 1999).

A further cause of the poaching was that the main buyer of rhino horn in the valley in the late 1990s was not arrested until mid-2000. The main trader in Kathmandu, Mr X, continued buying rhino horn until his arrest in late July 2000.

Also, from 1996 to around 2000, perhaps 60% of the rhino poachers were supported by political party leaders, making it more difficult to apprehend and jail them.

A final cause for more poaching in the late 1990s, as DNPWC director general Tirtha Maskey and others believe that because of a surplus of rhinos in certain northern areas of the park there has not only been more infighting among males, sometimes resulting in death, but also some have wandered out of the park, making it easier for hunters to poach them.

Finally in late 2000, a former chief warden, Gopal Prasad Upadhyay, who was well respected and a good leader, was moved back into the position of chief warden of the park. In the same year, the former as-

sistant warden, Tika Ram Adhikari, who was in charge of anti-poaching activities in and around Chitwan Park, returned, this time as team leader of the anti-poaching units of the Chitwan Valley.

Decline in poaching in the Chitwan Valley from mid-2000

With the reappointments of Upadhyay as chief warden and Adhikari as the anti-poaching team leader, rhino poaching in the valley ceased almost totally from August 2000 to early February 2001, when these data were collected. The last known rhino-poaching incident occurred outside the park, when a rhino wounded by a bullet took three months before it finally succumbed and died in the national forest in November 2000.

Since the major threat to rhinos was outside the park, where the army has no jurisdiction, a major effort was put into reinvigorating the anti-poaching units working there. Adhikari showed strong leadership and personally spent 10 days each month in the field supervising anti-poaching strategies. To complement the anti-poaching units, which do not possess guns, 54 armed forest guards with .303 rifles were employed from around December 1999 to patrol the areas outside the park. One four-wheel-drive vehicle and one motorbike were obtained to improve logistics.

Perhaps the most important component of any successful anti-poaching campaign is intelligence, which was greatly improved. Besides the intelligence officers attached to the anti-poaching units, the user committees that help run the 750-km^2 buffer zone on the edge of Chitwan Park provided five informers. Thus the total number of informers in and around the park is now 17, 6 paid by ITNC, 6 by WWF Nepal and 5 by the user committees. ITNC, which raises funds from tourists at Tiger Tops Jungle Lodge, continued to allocate considerable sums of reward money. It donated NPR 295,000 (USD 4184) of reward money in 2000 to the chief warden, which led to the arrest of many poachers in the Chitwan Valley (Marcus Cotton, general manager, Tiger Tops Jungle Lodge, Chitwan, pers. comm. 2001). From January 2000 to early February 2001, 28 rhino poachers, 4 leopard poachers (the bones are sold for only USD 14/kg) and 4 people in possession of fake rhino horns (made from wood) were arrested (Adhikari, pers. comm. 2001). A man was also arrested for creeping around the park in the early mornings photographing rhinos, presumably to identify those with the largest horns for the poaching gangs.

To improve further the coordination of those involved in anti-poaching, monthly meetings were set up with the army, the Forest Department, the Parks Department and the police. This greater cooperation increased the efficiency of conserving the rhinos.

In addition, the political support that the poaching gangs and traders used to get from some of the political parties has now decreased. Senior park staff have convinced the politicians that this former policy was not in their interest.

Excellent protection of rhinos in Royal Bardia National Park

Between 1994 and 2000 not one rhino was illegally killed inside Royal Bardia National Park, although

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Baghmara Community Forest, part of the buffer zone to Royal Chitwan National Park and covering 400 hectares, raised USD 74,000 for the financial year 1999/2000, almost all from tourism.

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There were 492 rhinos in Royal Chitwan National Park and 52 in the buffer zone in 2000, an increase of 3.88% per year since 1994.

two were poached outside it—one in 1998 and one in November 2000 in the buffer zone, the last known rhino to be illegally killed. Using a home-made gun, the poacher fired a bullet into the rhino; however, the animal did not die instantly but first travelled several kilometres. When it died and the four poachers in the gang started to chop off the horn with an axe, they were discovered by several villagers, who reported the incident to the park authorities. Army and park staff immediately went to the site and were able to collect the full horn as the poachers had fled.

Table 2. Number of rhinos in Nepal, April 2000 census and 1994 count

Location	April 2000 census	1994 count
Chitwan Valley[a]		
Inside park	492	411
In buffer zone	52	29
Total	544	440
Royal Bardia National Park	67	–
Royal Suklaphanta Wildlife Reserve	1	–
Total for Nepal	612	–

Source: DNPWC 2000

[a] Growth rate of the Chitwan Valley population from 1994 to 2000: 3.88% per annum

From 1994 to 2000, hunters have been unsuccessful at poaching rhinos in Bardia Park, compared with Chitwan Park, for several reasons. There are fewer rhinos in Bardia; in the year 2000 there were 67 rhinos in the 968 km^2 of Bardia Park compared with 492 rhinos in Chitwan, which is approximately the same size (see table 2). Most of the Bardia rhinos are located in the Babai Valley, a remote and inaccessible part of the park, whereas in Chitwan they are usually found along the river close to human habitation. In addition, far fewer people live around Bardia (about 70,000) than Chitwan (about 242,000 in the buffer zone alone) according to DNPWC (1999). Rhinos have been in the Chitwan Valley for thousands of years but were eliminated in the Bardia area many decades ago and were not brought back until the translocations from Chitwan commenced in 1986 (13 rhinos in 1986, 25 in 1991, 4 in 1999 and 16 in 2000). Thus, there is no long tradition of rhino poachers and middlemen around Bardia. From 1986 to 1993, eight rhinos have been poached, six in and two outside the park.

Before the buffer zone was set up around Bardia in 1997, the forests outside the park were fairly large compared with those surrounding Chitwan, and they offered the local people ample supplies of wood, thatch and other materials, and adequate grazing for their livestock. Thus, the incentive to enter Bardia Park to hunt for a small, isolated population of rhinos for economic gain was slight.

Perhaps the most important factor for the recent reduction of rhino poaching in and around Bardia Park is because a well-thought-out rhino anti-poaching strategy has been implemented and managed. There are five anti-poaching units which patrol inside the park and each unit employs one informer who moves around the villages outside the park gathering information on possible poachers and middlemen.

Other informers are also working in the villages, gathering information for Bardia's chief warden. In 2000, for example, 11 rhino poachers were apprehended because of information that informers supplied. One of the poachers admitted that between 1991 and 1993 he shot several rhinos with a home-made gun and sold the horns for NPR 100,000 to 200,000 (the equivalent of USD 3144 to 6287/kg) to a trader from Nepalganj town (Shiv Raj Bhatta, manager of the Bardia Integrated Conservation Project, pers. comm. 2001). The actual poaching gang consisted of about six people who came from Taratal village outside the buffer zone to the south of the park.

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These cattle have been impounded by the Royal Nepali Army for illegally grazing inside Royal Chitwan National Park. The owners will have to pay a fine to get them back.

The Bardia anti-poaching units are well trained, disciplined and effectively led. WWF Nepal has provided them with communication sets, transport facilities and other equipment such as camping gear. The informers have also received financial rewards from ITNC. All these extra benefits from the NGOs have notably increased the motivation of the men in these units, which in turn has greatly increased their effectiveness.

As a further incentive to improve the efficiency of the guard posts inside Bardia, each month one or more guards receives a reward of NPR 1000 (USD 13.80) in early 2001 for outstanding service. A third factor of the anti-poaching strategy is the method of patrolling. Park authorities have developed what they call 'sweeping operations'. When they are notified by their informers that there may be a poaching gang in a certain area and there is insufficient manpower in that place, the park staff and the army unite and carry out a joint patrolling exercise, sometimes with elephants. Park officials have shown that these sweeping operations, which often last for days in critical areas, have greatly deterred poachers and those engaging in other illegal activities, such as collecting firewood, smuggling timber and grazing livestock illegally (see table 3).

The strong cooperation between the park and its partners—the Royal Nepali Army, DFOs, the Buffer Zone Development Council, and NGOs—over the past few years has greatly reduced poaching in and around Bardia Park. This strong cooperation is probably the most important single component of Bardia's

Table 3. Illegal activities carried out in Royal Bardia National Park, 1998 and 1999

Case	1998		1999	
	Incidents (no.)	Offenders (no.)	Incidents (no.)	Offenders (no.)
Animal poaching	6	8	1	1
Firewood collection	11	195	16	295
Timber smuggling	3	9	1	10
Grass cutting	13	71	9	134
Fishing	6	67	3	22
Fish poisoning	1	8	–	–
Mushroom collection	2	12	2	43
Fern collection	3	24	–	–
Illegal entry	1	7	1	21
Illegal cattle grazing	–	–	–	512

Source: Bhatta and Subba (2000 p. 4, 8)
– no data

anti-poaching strategy for rhinos, followed closely by the effectiveness of the informers.

The importance of adequate budgets

Chitwan Park earned USD 746,926 in the financial year of 1999/2000 (see table 4), 97% of this coming from tourist activities, but all this has to be given to the central government. In turn the central government gives DNPWC a budget for Nepal's parks, and from this Chitwan Park was allocated USD 146,971 in the financial year of 1999/2000 (see table 5). This is less than 20% of what the park earned and is not enough to operate the park adequately. The budget of Chitwan Park (excluding the army) was cut from USD 219,488 in 1994/95 to USD 146,971 in 1999/2000 because the funds supplied by the Central government to DNPWC were reduced. The budget for Bardia Park (excluding the army) has also significantly declined from 1994/1995 (see table 5). For the first time in the park's history, however, revenue in 1999/2000 exceeded Bardia's budget (except for the cost of the army) because of the sharp increase in tourist numbers (see table 6). DNPWC officials report that they need more government money to ensure a bright future for the rhinos.

Conclusion

The anti-poaching strategies that DNPWC has developed for the Chitwan Valley and the Bardia area are excellent, but they are complicated and definitely require superior management skills if they are to be implemented successfully. DNPWC does have a few officers who are capable of putting into action such strategies. Its director general must ensure that such officers are always in place, as these parks contain one of the most endangered large animals in the world, the greater one-horned rhino.

For the successful conservation of the rhino to continue in Nepal, more financial resources need to be allocated in keeping with the large sums of money raised from tourists who come to see the rhinos. The DNPWC director general is aware of the importance of greater funding for Bardia and Chitwan. He also realizes the value of informers and reward money. Most

Table 4. Revenue raised in Royal Chitwan and Royal Bardia National Parks for 1997/1998 to 1999/2000

	Royal Chitwan National Park		Royal Bardia National Park	
Year	Nepalese rupees	US dollars	Nepalese rupees	US dollars
1997/1998	48,150,192	801,969	2,669,277	44,193
1998/1999	54,543,777	814,086	4,226,068	63,076
1999/2000	51,537,864	746,926	7,615,768	110,373

Source: Subba (2000 p. 14, 2001 p.18)

Table 5. Department of National Parks and Wildlife Conservation budgets for Royal Chitwan and Royal Bardia National Parks, 1994/1995 to 1999/2000

Year	Nepalese rupees	US dollars
	Royal Chitwan National Park	
1994/1995	10,893,200	219,488
1998/1999	8,197,000	122,343
1999/2000	10,141,000	146,971
	Royal Bardia National Park	
1995/1996	16,634,000	312,669
1998/1999	6,389,000	95,358
1999/2000	6,770,000	98,116

Source: Subba (2000 p. 23, 2001 p. 27)

Table 6. Number of tourists visiting Royal Chitwan and Royal Bardia National Parks, 1997/1998 to 1999/2000

Year	Royal Chitwan National Park	Royal Bardia National Park
1997/1998	104,046	?
1998/1999	105,884	5,864
1999/2000	117,512	9,610

Source: Royal Chitwan and Royal Bardia National Parks, unpublished statistics

of this money comes from NGOs, and DNPWC Director General Maskey acknowledges that there is no long-term guarantee that the NGOs will continue to pay money to informers and for rewards at the levels required. To partially remedy this situation, he has proposed that a trust fund be established with considerable sums of money to help support Nepal's parks (T. Maskey, pers. comm. 2001).

The demand by some North American zoos is for at least six pairs of rhinos from the wild populations of the Indian subcontinent. For political reasons, India is unlikely to allow the export of live rhinos in the near future. Since one breeding pair of greater one-horned rhinos is worth to certain zoos a minimum price of USD 250,000 to 300,000, perhaps the Nepal government might consider selling several pairs of their rhinos from those areas of Chitwan Park where there is a surplus. This money could then be put into the trust fund to ensure that the remaining rhinos are well protected from poachers. This proposal is a controversial one, but Nepali officials should not be deterred from considering it. There is also a precedent for such a sale; the government of Nepal, as well as having donated live rhinos as state gifts, has sold some to various foreign institutions, such as the pair sold to the Singapore Zoological Gardens for USD 250,000 in 1987 (Bernard Harrison, executive director of Singapore Zoological Gardens, pers. comm. 1990). Between 1980 and 1997, 25 live rhinos were sent from Nepal to various countries including 4 to India, 4 to the USA, and 3 to Germany (Suwal and Shakya 2000).

There is also another precedent, in a different part of the world, for the commercial sale of rhinos by a government department. The KwaZulu-Natal authorities in South Africa have been selling live black and white rhinos for years. In their auction held in 2000, six black rhinos were sold for a total of USD 330,000 and 43 white rhinos for USD 1,230,000 (Emslie 2000).

Money plus good leadership and efficient management by senior personnel are going to continue to be the two key factors for the success of rhino conservation in Nepal.

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Unsuccessful introductions of adult elephant bulls to confined areas in South Africa

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Abstract

South Africa's successful elephant conservation strategies have initiated the translocation of elephant breeding groups and adult bulls from high-density populations to smaller confined areas. A limited number of the adult bull introductions were unsuccessful. An investigation was undertaken to determine the causes of the bull break-outs. No common factors were identified. Recommendations are offered as a guide to future translocation efforts.

Résumé

Les stratégies réussies de conservation des éléphants en Afrique du Sud ont donné naissance à la translocation de groupes reproducteurs et des adultes mâles des populations très denses vers des zones confinées plus petites. Un petit nombre d'introductions de adultes mâles n'a pas réussi. On a mené une enquête pour déterminer les causes des échecs chez les mâles. On n'a identifié aucun facteur commun. On présente des recommandations pour aider les efforts futurs de translocations.

Introduction

This investigation forms part of a project commissioned by the Elephant Management and Owners Association (EMOA) to develop a database of all elephant populations in South Africa that cannot be considered part of the Kruger National Park (KNP) metapopulation. The investigation was considered a priority by the Northern Province Nature Conservation Department as a result of a recent unsuccessful attempt to introduce a mature elephant bull older than 40 years to a confined area in Northern Province, and the fact that other break-outs by mature bulls have occurred in the past. The department's decisions on future permit applications are based on these recommendations that have further been incorporated into the new EMOA elephant policy. The Kruger National Park capture team fully supports these recommendations.

Investigation *modus operandi*

The aim of this investigation was to determine the reasons for a limited number of unsuccessful mature elephant bull introductions to game-fenced properties, while others had been successful. The expertise and experience of as many interested and affected parties as possible have been considered in this process.

The investigation was conducted as follows. (The term 'boma' as used here is a large, electrified holding camp of at least one hectare into which the elephants are released after transportation.)

- Kruger National Park was approached for a list of all recipients of mature elephant bulls.
- The 15 landowners or their respective managers who had received adult bulls from KNP were interviewed.
- Information on the construction of the release bomas, and their electrification in particular, was

collected. Where possible the actual release bomas were inspected.
- The circumstances under which break-outs occurred were investigated.
- Discussions were held with a number of conservation scientists who among them have had considerable experience with the capture, translocation and release of elephants into confined areas.
- Attempts were made to establish if any common factors were associated with successful and unsuccessful introductions.

History of bull elephant introductions

From 1998 to 2000, KNP sold 71 adult elephant bulls to 15 properties within South Africa. Sale of family units has been ongoing since 1995. The capture operation was carried out by KNP officials using their own specialized equipment and personnel, and the elephants were transported to the purchaser's property.

The distance between the capture and the release sites varied considerably. The straight-line distances between the nearest KNP boundary to the release site ranged from 8 to more than 300 km. On arrival at their destination the elephants were released into an electrified acclimatization boma. The function of this boma is essentially to introduce the elephants to an electric fence and ensure that they experience sufficient meaningful electric shocks for them to develop a permanent respect for such fences.

The vegetation, and therefore available food plants for elephants, varied in all instances between the capture and the release sites, in various degrees. Unfortunately no detailed analysis of the vegetation at capture and release sites could be done because of prevailing financial and time constraints. However, since the type and quality of available food differed in each case (including those with no break-outs), food sources were not regarded as a primary cause for any adult bull break-outs.

Success rates

The purchasers of the bulls included the KwaZulu-Natal Wildlife (Hluhluwe-Umfolozi Park received 10 bulls), the North West Parks and Tourism Board (Pilanesberg and Madikwe Game Reserves each received 6 bulls), and 13 private landowners (55 elephants).

Following their introduction, a number of escapes from the fenced area were reported, occurring under a variety of circumstances that rendered the electric fence ineffective. In some cases these elephants returned to the property within a few days while others never returned. These instances therefore cannot be regarded as unsuccessful introductions or constitute break-outs and for the purposes of this investigation are defined as escapes.

Some of the reasons for the escapes are as follows:
- power failure on a perimeter fence during the rainy season
- avoidance of the perimeter fence by swimming across a flooded river
- destruction of fences in drainage lines caused by excessive rainfall
- inability of management to patrol and maintain the perimeter fence during an excessively wet season
- lack of electrification of gates in the perimeter fence
- placement of food outside the boma fence

In two instances free-ranging elephants entered an enclosure and joined the introduced elephant group.

An elephant introduction is considered to have been unsuccessful in instances where the bulls have either broken out of a functional electrified perimeter fence or broken out of the release boma and subsequently the perimeter fence.

Out of the 15 introductions, break-outs occurred on five properties under circumstances that indicate that the eight bulls in question had not developed a respect for the electric fence. Kruger National Park has an area more than 5000 km^2 and has about 10,000 elephants. It is therefore not possible to monitor all elephant bulls to the extent that the behaviour of all is known. Therefore, it is not possible to know whether a bull that is being captured for translocation has had previous experience with breaking fences. The number of elephant bulls introduced to the 15 properties, along with the subsequent escapes and break-outs, is summarized in table 1.

Factors that appear to have influenced break-outs

The release boma

The relevant provincial conservation authority had in all cases prescribed the design of the release boma. These designs were essentially adequate and were based on past experience. However, different construction

standards were applied in each case. The most important shortcomings of these release bomas are listed here:

- The use of only one energizer for all live wires. Multiple circuits reduce the risk of the fence being rendered inoperative should one of the circuits be shorted out or a live wire snap.
- The use of inadequate materials in the construction of the release gate. In more than one instance the release gate was constructed by welding two standard production cattle gates together. These gates are made from 2.5 or 3.0 mm steel tubing and are inadequate for elephants.
- Inadequate electrification of the release gate.
- Poor electrical conductivity of the soil inside and adjacent to the boma fence, resulting in an inadequate earth circuit. This may have reduced the effectiveness of the electric fence in some instances, particularly in dry, sandy or stony soils.
- The release of bulls from the boma before they have attained a respect for the fence.
- Electric wires under tension, which break easily. Bulls with long tusks are able to use them to break highly strained wires.

Age, social status and numbers of bulls introduced

It is reasonable to assume that the older a bull is, the greater is the chance that it has developed ingrained behaviour patterns. Older bulls can also be expected to have come into contact with electric fences in KNP, and some of these have almost certainly developed techniques for traversing such obstacles. Plenty of anecdotal evidence exists to support this. KNP field personnel have in the past recognized particular individuals as 'problem' bulls and these bulls have well-earned reputations as fence breakers. Old bulls, 30–35 years of age or older, have possibly migrated beyond the borders of KNP during their lives.

It is also most probable that these older bulls have consorted with numerous female groups during their reproductive lives. The number of females of reproductive age on the properties where these bulls have been released has in all cases been limited to a handful. In addition, if none of these cows was in oestrous at the time and therefore of no particular interest to the bulls, this could well have enhanced their urge to escape.

When older bulls are removed from their traditional home ranges and introduced to a new locality with foreign vegetation and surroundings and not enough adult females, their urge to return to a familiar environment appears to be greater than that of younger bulls and cows. Bulls with large tusks can also be expected to be more adept at avoiding electric shocks while manipulating fences and gate mechanisms.

Table 1. Results of adult elephant bull introductions to 15 properties between February 1998 and August 2000. Properties are grouped according to locality and not in chronological order of the introductions

No.	Province	Reserve	Adult bulls introduced	Escaped because of fence fault	Break-outs through live fence
1	KwaZulu-Natal	Mkuze Falls Safaris	16	0	1
2	KwaZulu-Natal	Pongola Biosphere Reserve	3	2	0
3	KwaZulu-Natal	KwaZulu-Natal Wildlife–HUPs	10	0	0
4	KwaZulu-Natal	Senekal Suikerboerdery, Pongola	1	0	0
5	KwaZulu-Natal	Magudu Game Reserve	2	0	0
6	Mpumalanga	Wilson's Kop Boerdery	2	0	2
7	Northern	Ndzalama Game Reserve	10	1	0
8	Northern	Thornybusch Game Lodge	1	0	0
9 & 10	Northern	Maremani Nature Reserve and Dubamanzi Conservancy	7	0	0
11	Northern	Limpopo Safaris	4	2	2
12	Northern	Greater Kuduland Safaris	2	0	0
13	Northern	Shambala Game Reserve	1	0	1
14	North West	Pilanesberg Game Reserve	6	0	0
15	North West	Madikwe Game Reserve	6	0	2
		Total	71	5	8

When bulls were introduced in pairs they reportedly had a mutual calming effect on each other. In one instance two mature bulls were released into a boma and the older broke out through the fence during the night to feed on oranges that had been dumped just outside the fence. This was discovered only the next morning; the younger bull was still in the boma, but in an extremely agitated state. Amazingly the older bull returned through the damaged boma fence after a few hours, and when they saw each other, the younger one immediately calmed down and stopped its attacks on the fence.

Elephants are individualistic and differ widely in behavioural traits and temperament. Docile individuals habituate more easily in their new surroundings than aggressive ones. Elephants with an established history of fence breaking and general intolerance towards humans will obviously be more difficult to acclimatize. It is possible that it is these so-called problem bulls that have repeatedly broken out through a fence. However, a number of scientists with practical experience in introducing elephants to confined areas are of the opinion that any bull, irrespective of its age, size and temperament, can be taught to respect electric fences. The key to success, they say, is ensuring that these bulls receive effective and meaningful electric shocks from the release-boma fence.

Experience in South Africa indicates that elephants remember the effect of an electric fence for a very long time. Where successfully introduced elephants (that is, those that have been successfully conditioned in an electrified release boma for as little as 24 hours) use a vehicle track that runs parallel to an electric fence they walk only on the tyre track farthest from the fence. This is possibly to avoid accidental contact with the electric wires. This behaviour is also quickly learned by young calves (R.D. Carr, personal observations).

The presence of an established founder-family group

The presence of a family group on the property before the mature bulls are released appears to have had little effect in the cases studied. Instances exist where female and juvenile groups were present on the property yet the mature bulls broke out. In one case the bulls remained in the vicinity of the family group for a couple of days, then they moved to the opposite end of the property and broke out of the perimeter fence. They then joined a family group on the adjoining property. Quite possibly the reproductive state of the females influenced their behaviour.

In most instances the mature bulls associated with the female group after being released from the boma for varying periods of time, and thereafter they showed no inclination to escape.

In two other instances free-ranging bulls broke into the property and joined either the family group or the bull group. On one reserve three subadult bulls pushed open an unlocked gate to enter.

Proximity of previous home range and release sites

In one instance two bulls were released onto a property that was only 8 km from the KNP boundary near Malelane, the vicinity of their capture. Both these bulls broke out of the boma and perimeter fence during the first night and returned to the park.

In a second instance where two bulls broke out, the reserve lies on the Limpopo River. Free-ranging elephants occur just across the river in Zimbabwe, and these animals form part of the KNP population. Since all four of these bulls were captured in the northern section of KNP, it is likely that they recognized their surroundings. However, two other reserves in a similar situation had no break-outs.

Recommendations

The most critical phase of the introduction of elephants to a new and strange environment is the time they spend in the release boma. In particular the elephants will be introduced to an electrified fence system, and must, in a short period, attain a lasting respect for such a fence. The construction of the boma is only part of the process. Successful management of the boma-training period requires a particular understanding of elephant behaviour. If specialist knowledge and experience can be acquired for this phase of the operation, then this should be considered. It is unrealistic to expect that this critical phase can be left to the limited skills of the new, inexperienced owner or manager, irrespective of their general wildlife management capabilities.

This investigation was unable to identify any common factors or circumstances that might have led to break-outs. However, various shortcomings were apparent in some cases, and the following recommen-

dations are offered for introducing bulls to confined areas.

The bulls

- Adult bulls should be translocated only to areas where there is already an established family unit.
- The introduction of elephants to areas that are in close proximity to hunting activities should be avoided or at least temporary cessation of hunting should be considered.
- Adult bulls should be translocated in pairs, preferably of differing ages. The companionship between two bulls that are introduced as a pair has a mutual calming effect, possibly resulting in a lowered urge to break out.
- Bulls should not originate from an area with known 'problem bulls'. (Removal of a problem animal from a particular area to a very large reserve is a different matter.)
- It is advantageous to capture bulls from an area where there is tourist activity and where they are habituated to human presence. This will help considerably to calm them in the new reserve.
- Bulls over the age of 30 years should not be translocated to areas smaller than 30,000 hectares and with a population of less than 50 elephants. Experienced persons can determine this age by head shape and broadness, neck thickness, tusk thickness at base and the molars when the animal is anaesthetized. Although there is no evidence showing that age alone has played a determining role in the success or failure of bull introductions, the morality of removing an old bull over 30 or 35 years old from a comfortable and well-established environment and subjecting him to the social and physical hardships of translocation is questionable. These old bulls are best left in the environment where they are settled.
- Old bulls over 40 should not be translocated at all.

The boma

Differing opinions exist among experienced elephant managers regarding the strength of the release-boma fence. Some are of the opinion that the fence needs to be extremely strong in construction while others have stated that a well-designed electrical system is the key issue. There is reason to believe that most bulls, irrespective of their temperament, can develop respect for an electric fence provided they receive meaningful electric shocks while in the release boma. Bulls that have learned to break the wires with their tusks or push trees onto the fence or have learned to cause a short by other means remain a problem. The following points should be considered in constructing the boma fence:

- The boma for adult bulls should be 2 ha in size.
- Sufficient food must be available for the elephants during their confinement. If the boma is large enough, with dense natural vegetation, and the elephants are confined for only one or two days, this should not be a problem. Artificial food is not advisable for various reasons.

Electrification of the fence should have the following specifications over and above the standard specifications given in the EMOA policy:

- A voltage of 6000–9000 should be maintained throughout the elephants' stay in the boma.
- The entire steel and wire fence of the release boma must be effectively earthed to the ground. This can best be done by burying the bottom strand or strands of the mesh along the entire length of the boma fence.
- The soil should be saturated with water up to a distance of 4 m on the inside of the fence just before the elephants are off-loaded from the truck to maximize the earthing effect of the electric fence. This is particularly necessary for sandy or stony soils. The more effective the shock the quicker the elephant will learn to respect the fence. For old bulls, or those with long tusks, that might have learned to negotiate electric fences in the past, additional live wires should be positioned inside the fence, especially in corners, to guarantee an effective shock. A successful technique used at Pilanesberg was to string a live wire across the corners of the boma high enough to touch the back of the elephant and give it an unexpected shock.

Alternative fence designs to modify existing bomas are possible, such as this one successfully used at Mkuze Falls Safaris: two parallel fences are set about 3 m apart with additional slack electric wires. The inner one consists of only four to five live strands of steel wire, supported on wooden poles, and the outer one (the main fence) constructed from Bonox-mesh or diamond-mesh; the cables act as the earth. The wires of the inner fence must be slack enough to prevent a bull from breaking them easily with his tusks. Slack wires tend to slide off the tusks easily. The in-

ner fence will also prevent even bulls with long tusks from getting to the main fence or the gates to do any damage.

- Multiple energizers should be used. If only one energizer is used for all the live wires a single short circuit will render the entire fence inoperable. Two or more separate circuits are therefore more effective.
- The release gate should preferably be of a sliding design and one that can be opened remotely with a cable or rope if necessary. This gate must also be electrified.
- The construction of the release gate and the offloading ramp must be of heavy steel because this is the weakest section of the confinement. It must also be carefully electrified.

The release

It is essential that large adult bulls receive a shock and learn respect for the perimeter fence before they are released from the boma. Adult bulls should not be confined in the boma for long, or they become bored, hungry and agitated. They should be released once the dominant individual has experienced the electric fence and appears to have calmed down. One to two days is recommended.

- A specialist should be present and advise on the release time of bulls from the boma.
- Large bulls should be fitted with a radio collar.
- Specifically in areas where there is hunting, bulls should be monitored.

Conclusions

This investigation did not reveal any common factors or circumstances to which break-outs by mature bulls can be attributed. It must be accepted that elephants are intelligent animals and that each individual will behave differently depending on its unique temperament and life experiences. No two elephants will react in the same way in the same situation.

The most important step in introducing and establishing elephants in a new environment and specifically into relatively small, confined areas is the training period in the release boma. It is here that they must be introduced to an electrified fence, in some instances for the first time, and develop a lasting respect for it. The effectiveness of the fence and the management of this critical period are essential to the success of the entire operation.

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Authors' note

The EMOA policy document, 'The introduction to and management of elephants in confined areas', may be ordered from the corresponding author.

Resolving human–elephant conflict in Luwero District, Uganda, through elephant translocation

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Abstract

In Uganda, elephants have traditionally migrated through the Luwero Valley to Murchison Falls National Park in the north and to Queen Elizabeth National Park in the south. As human settlement in the Luwero area has blocked this migration corridor, people and elephants now compete for water and land resources. In the face of human–elephant conflict, the option authorities chose was to translocate problem elephants out of the area to Murchison Falls National Park. The move involved a multidisciplinary team effort of 46 Ugandans and Kenyans. An aerial search with a plane and a helicopter located the elephants. They were darted and anaesthetized then crated and transported, with veterinarian care throughout. Four problem elephants were successfully relocated.

Résumé

En Ouganda, les éléphants migrent depuis toujours par la vallée de Luwero pour aller du Parc National des Murchison Falls, au nord, vers le Parc National Queen Elizabeth, au sud. Comme des installations humaines bloquent maintenant le couloir de migrations dans la région de Luwero, les hommes et les éléphants sont dès lors entrés en compétition pour l'eau et les ressources du sol. Confrontées aux conflits hommes–éléphants, les autorités ont choisi l'option de déplacer les éléphants à problèmes hors de la région du Parc National des Murchison Falls. Le déplacement a nécessité les efforts conjoints d'une équipe de 46 Ougandais et Kenyans. Des recherches réalisées avec un avion et un hélicoptère ont permis de localiser les éléphants. Ils ont reçu une flèche anesthésiante, puis ils ont été placés dans de grandes caisses et transportés, sous la surveillance continue d'un vétérinaire. On a ainsi réussi à déplacer quatre éléphants à problèmes.

Background

In June 2000, the Kenya Wildlife Service (KWS) received a request from the Uganda Wildlife Authority (UWA), seeking technical assistance in translocating 10–13 elephants from Wakyato Sub-county, Luwero District to Murchison Falls National Park. The translocation exercise was aimed at resolving a long-standing human–elephant conflict.

An initial attempt at translocating the elephants had been made in August 1999 but had to be aborted after moving five of them, largely due to financial constraints. Following this, UWA sent out an international appeal to the donor community seeking financial support to move the rest of the elephants. The appeal received positive response from the International Fund for Animal Welfare (IFAW), which pledged just under USD 100,000 for the exercise. By the end of June 2000, KWS and UWA had reached consensus to collaborate in moving these elephants. Using the IFAW funds, KWS sent a reconnaissance team to the capture and the release sites in July 2000. The team confirmed that the exercise was feasible.

On 8 December 2000, UWA staff started monitoring the elephants in Luwero. Meanwhile, documents and various government protocols were processed for KWS to import equipment into Uganda. On 12 February, an advance team arrived in Uganda to set up camp, resurvey the capture and release sites, and complete any pending logistical arrangements. The main capture team arrived on 18 February 2001, and a

multidisciplinary team worked together to carry out the exercise on 19–20 February 2001.

Introduction

The elephants in Wakyato Sub-county had lived amid human settlement since the early 1970s after having been cut off from other herds that had roamed the entire area in earlier years. Elephants are reported to have traditionally migrated through this area to Murchison Falls in the north, and to Queen Elizabeth National Park in the south (John Bosco Nuwe, pers. comm.). Human settlement blocked off the migratory corridors, leading to isolation of this small population in Luwero. Increase in human population, which was accelerated by an influx of pastoralists into the area in the late 1980s and 1990s, led to drastic reduction of ranging space for these elephants and increased human–elephant conflict. The elephants competed for watering points that the people had dug out for their livestock. They also terrorized villagers, killing five people and wreaking havoc on crops and other property.

In the face of this escalating conflict, various options were considered. Relocating the people in favour of the elephants was neither politically right nor humane. Killing the elephants would have been the easiest option but was considered to be neither humane nor of conservation value. Leaving the situation without intervention would expose the elephants to the risk of being killed by the local community. UWA considered moving the elephants to a better location to be the best option.

Here we describe how this small herd of elephants in Luwero was successfully translocated to Murchison Falls National Park to resolve the long-standing human–elephant conflict and save the elephants.

Capture area

Luwero is generally a swampy area. The vegetation structure could be described as a mixture of patches of open grassland with bushy woodland. This type of vegetation did not pose any visibility difficulties from the air although it greatly reduced accessibility on the ground. The swampy terrain made it necessary to do the operation during the dry season.

Kenya Wildlife Service

Taking the body measurements of the anaesthetized elephant.

Kenya Wildlife Service

The elephant is loaded on a trailer . . .

Kenya Wildlife Service

. . . and hauled by tractor.

Materials and methods

Total aerial count

To ascertain how many elephants were present, we did an aerial search, using the standard technique of 'total aerial count' as described by Douglas-Hamilton (1996), Douglas-Hamilton et al. (1994) and Norton-Griffiths (1978). Success of the method depends on the experience of the pilot and the flight crew (Douglas-Hamilton 1994; Litoroh 1995). This search had the advantage of a well-experienced front-seat observer and two experienced pilots, familiar with the survey area, who acted as rear-seat observers.

A six-seater Hughes 500 Jet Ranger helicopter and a two-seater Husky plane were used for the search. Both aircraft have good visibility, allowing observers to make accurate counts. Approximately 300 km^2 were covered in 2.25 hr of count time, giving a searching rate of about 120 km^2/hr. This rate gives data quality of category two as described in the *African elephant database* (Said et al. 1995). The helicopter hovered low over the thick bushes in an effort to flush out any hiding elephants, but none were seen.

Capture and translocation

A multidisciplinary team of 46 people from KWS and UWA was involved in the exercise. We used a wide range of equipment including capture, communication, security, veterinary and laboratory equipment as well as different types of vehicles and aircraft. We also used a wide variety of veterinary and first-aid drugs.

The elephants were located using the Husky plane and darted from a helicopter. The darted animals were herded towards open glades close to where the ground capture team had been positioned. They resisted being pushed to the open, however, and fell in the forest, from where they had to be recovered using a tractor and trailer and moved to a suitable loading area.

The elephants were immobilized using 18 mg of etorphine hydrochloride (M99) mixed with 5000 i.u. of hyaluronidase administered using the method described by Kock et al. (1993). The animals went down in about 6 minutes on average except in one case where the first dart landed obliquely, depositing the drug just under the skin, and the animal had to be redarted after about 20 minutes.

Once the animal was down, the helicopter directed the ground team through the woods to the site. The

veterinarians and some capture rangers armed with heavy-calibre rifles advanced speedily to the site on foot to ensure that the animal was in a suitable lateral position and in a stable state of anaesthesia. Meanwhile with the aid of a bulldozer, an access way was quickly made to the site to enable the rest of the team with the vehicles and the recovery trailer to move in.

The elephants were kept in a state of unconsciousness using additional doses of etorphine of about 4 mg. The vital parameters (temperature, pulse rate and respiration) of the animals were monitored and recorded at 5-minute intervals. The mucous membranes were frequently observed to gauge the level of circulating oxygen in the animal's blood. The animals were kept cool by pouring cold water on their earflaps. Dart wounds and other injuries were treated conventionally.

Elephants were recovered from the woodland and put into transportation crates using conveyor and hydraulic systems. They were revived using 50 mg of diprenorphine administered into the ear vein. The elephants were tranquillized for transportation using 120 mg of azaperone tartarate administered into the neck muscle just before reviving them. They were escorted by a veterinarian and rangers to the release site, where they were free released at an off-loading ramp.

A radio collar was fitted on one of the elephants and the others were marked with paint for monitoring, to determine if they would settle down and establish new home ranges.

Kenya Wildlife Service

Elephants were put into transportation crates and escorted to the release site.

Results and discussion

Four elephants were counted during the aerial surveillance, two males and two females. All four were successfully captured at Luwero, translocated and released at Murchison Falls National Park with no mortality.

Any possibility of elephants hiding in thick vegetation was remote, as the helicopter would likely have flushed them out. Therefore, previous elephant numbers assessed before translocation were an overestimation. This was attributable to the limitations of the monitoring method, which used footprint observations as an index of elephant abundance.

We concluded that Luwero had only four elephants, and all four were safely moved to Murchison Falls National Park, thus resolving the human–elephant conflict at Luwero. The translocation was 100% successful when measured against its objectives.

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Elephant census in the Ankasa Conservation Area in south-western Ghana

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Abstract

A dry-season dung count was carried out in January 2001 at the Ankasa Conservation Area in south-western Ghana to estimate the elephant population. After a reconnaissance, the study area was stratified into three strata of density: high, medium and low. But a better design was to arrange a high-density stratum along the Suhien River, on which 43 dung piles were spotted on the 16 transects that constituted the stratum. No dung piles were seen on the four transects that fell outside the Suhien River band. The elephant population was estimated to be 21 with 95% confidence limits of ± 15. This is probably the smallest elephant population in Ghana's forest zone.

Résumé

En janvier 2001, on a fait un recensement des crottes d'éléphants en saison sèche, pour estimer la population d'éléphants dans l'Aire de Conservation d'Ankasa, au sud-ouest du Ghana. Après une reconnaissance sur le terrain, la zone d'étude a été partagée en trois strates de densité dense, moyenne et faible. Mais on a trouvé préférable d'arranger une strate de forte densité le long de la Suhien, où l'on a aperçu 43 tas de crottes sur 20 transects. On a estimé que la population d'éléphants s'élevait à 21 individus, avec une limite de confiance à 95% de ±15. C'est probablement la plus petite population d'éléphants de la zone forestière du Ghana.

Introduction

In West Africa, the number of elephants has decreased dramatically as a consequence of hunting and habitat loss (Roth and Douglas-Hamilton 1991). Today, West African elephants account for less than 5% of the continental total (Barnes et al. 1999). They are found in small, isolated populations scattered throughout the region. This situation has necessitated the development of a subregional elephant management strategy (AfESG 1999) and Ghana has prepared a national strategy (Wildlife Division 2000).

As part of the implementation of the strategy, the Ghana Wildlife Division is required to survey all the elephant populations in the country. This report describes the first elephant survey of the Ankasa Conservation Area (ACA).

Study area

The census zone covered the Ankasa Conservation Area, which comprises the Ankasa Resource Reserve and the Nini-Suhien National Park (fig. 1). These two adjacent forests cover a total area of 509 km^2. The area lies in the wet evergreen zone (Hall and Swaine 1981) and falls within the western block of the Guinea–Congolian zone (Hawthorne and Musah 1993). The terrain is hilly. Parts of the Ankasa Resource Reserve have been lightly logged. The Nini-Suhien National Park has been less disturbed by logging because access to it is difficult (Hawthorne and Musah 1993). Hawthorne and Musah (1993) have described the condition of the Ankasa Resource Reserve as 'good' and the Nini-Suhien National Park as 'excellent'. The Ankasa Conservation Area is the most

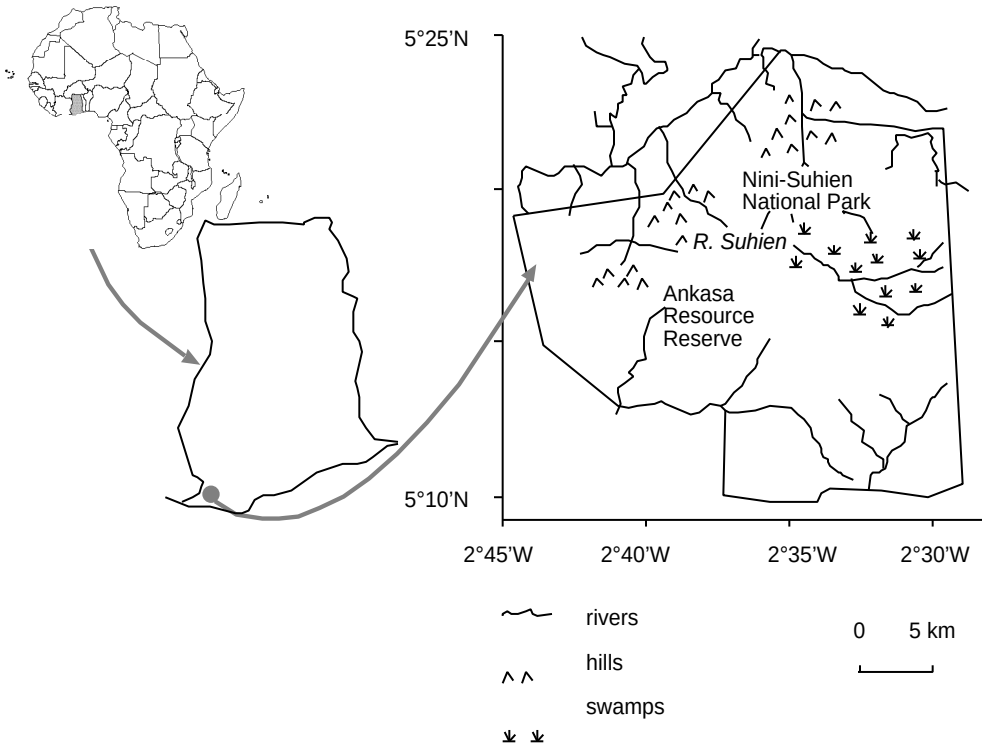

Figure 1. Ankasa Conservation Area (modified from PADP 1998). The River Suhien forms the boundary between the Nini-Suhien National Park and the Ankasa Resource Reserve. The insert maps show the location of Ankasa.

important forest block in Ghana in plant biodiversity.

The annual rainfall is between 1800 and 2000 mm (EDG 1992), falling mainly in two wet seasons: May–July and October–November. The driest months are January and February.

Methods

A reconnaissance was conducted in December 2000 to obtain a general impression about the terrain, types of vegetation and approximate dung-pile abundance, among other factors. The study area was then divided into three strata: the whole of the national park constituted the high-density stratum; the medium-density stratum covered the northern fringes of the resource reserve and extended to about 4 km south of the Suhien River (fig. 2); the entire southern part of the resource reserve constituted the low-density stratum. No dung piles were seen in the low-density stratum during the reconnaissance; the elephant density was therefore assumed to be zero and no transects were placed there (fig. 2).

A similar survey had been conducted in February and October 2000 in the Kakum Conservation Area, with an area of 366 km^2 and lying in the moist evergreen zone (Hall and Swaine 1981) of southern Ghana. It showed that 13–15 transects is the optimum sample size for dung counts in the Kakum area. This sample size was considered and increased to 20 transects for our survey at Ankasa. According to the reconnaissance, dung density in the high- and medium-density strata was in the proportion of 65:35. The 20 transects were thus allocated to the two strata in that proportion: 13 transects to the high-density and 7 transects to the medium-density stratum. The standard line transect method (Buckland et al. 1993; Barnes 1996) was employed for the dung counts (Barnes and Jensen 1987). The transects, each one minute of latitude or longitude long (1.84 km), were randomly distributed in the two strata and aligned perpendicular to major streams and water courses in north–south or east–west directions.

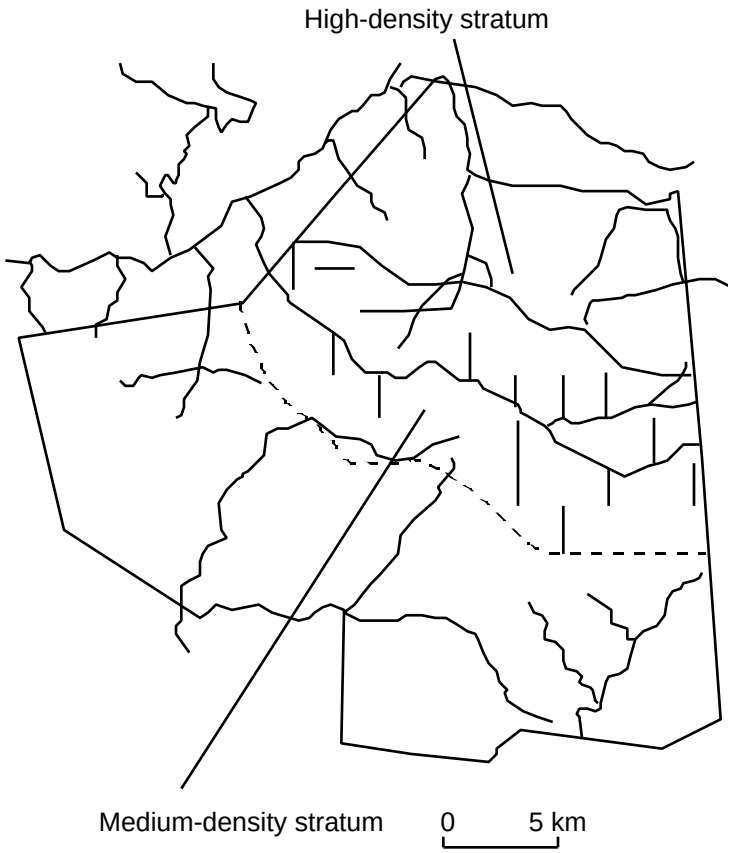

Figure 2. Ankasa Conservation Area showing the distribution of transects in the high- and medium-density strata.

The survey team worked in two groups of three plus a line cutter. Each group walked once down the transects, which were temporary, led by a compass man and a line cutter. Stages of dung piles were recorded and their perpendicular distances from the centre-line of transects measured with tapes. Distance along transects was measured using a Keson Roadrunner (a long-distance measuring wheel with a five-digit counter fitted with an adjustable handle and used for measuring straight or curvilinear surfaces).

The program DISTANCE (Laake et al. 1993) was used to analyse the data to obtain the dung-pile density estimations.

Elephant numbers

Assuming that ACA was in a steady state (McClanahan 1986) at the time of the dung count, we estimated the density of elephants (E) using estimates of three variables: $E = Yr/D$, where Y = dung-pile density, r = decay rate, D = defecation rate; r = 0.0209 for the Ankasa dry season (Barnes et al. 1994). Since there was no estimate of the defecation rate for ACA, the one from Tchamba (1992) was used: D = 19.8.

The densities were then converted into elephant numbers by multiplying the respective densities by the corresponding area of each stratum. The analysis was done separately for each stratum, after which the separate estimates were combined (Norton-Griffiths 1978) to obtain the overall estimate of elephant numbers for ACA. The confidence limit calculations for the estimation of elephant numbers are given in Barnes (1993).

The rainfall model is probably the most accurate method for analysing dung-count data because it takes into account the rainfall preceding the count and makes no assumptions concerning either steady states or normality (Barnes et al. 1997; Barnes and Dunn forthcoming). However, it requires rainfall data for the two months preceding the survey. These data were not available for ACA; the only available data were those for 1993 and 1994. Rainfall data for the rainfall model were therefore collected from the nearest meteorological station, which is Axim, 40 km from the study area.

Results

Dung-pile density in each stratum

In all, 43 dung piles were spotted: 20 in the high-density stratum and 23 in the medium-density. The number of dung piles per transect ranged from 0 to 12 for the high-density stratum with an average of 1.54 per transect. In the medium-density stratum the number ranged from 0 to 8 with an average of 3.29 dung piles per transect. The dung-pile density per transect was significantly higher in the medium-density stratum (U = 45, $p < 0.01$). Table 1 shows the density of dung piles in each stratum and their variances.

Table 1. Estimates of dung-pile density per stratum in Ankasa Conservation Area

Stratum	Area (km^2)	Dung-pile density (*Y*)	Variance	Number of transects
High-density stratum (1)	166.00	HZ 63.74	HZ 1603.60	13
Medium-density stratum (2)	75.84	HN 196.88	HN 6696.80	7
High-density stratum after the post-facto stratification	142.81	FS 142.69	FS 2336.18	16

The mathematical models used for the dung-pile density estimations: HZ = hazard rate, HN = half normal, FS = Fourier series

Post-facto stratification

Observations on the ground during the main survey showed that elephants were active along the Suhien River. We therefore made a post-facto stratification (White and Edwards 2000) of the study area to improve the precision of the estimates.

All the dung piles were spotted within 4 km on either side of the river (fig. 3). This band was thus treated as one stratum (the high-density stratum), with 16 transects in which 43 dung piles were recorded, an average of 2.69 dung piles per transect. The rest of the study area where no dung piles were spotted constituted the low-density stratum (fig. 4).

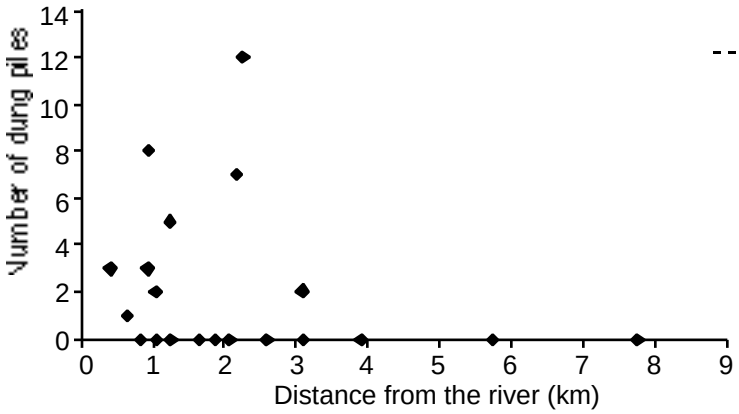

Figure 3. Scatter diagram of the number of dung piles seen on transects and the nearest distance from the midpoint of the transect to the Suhien River.

The line transect model gave a better fit to the perpendicular distances in the new stratum (fig. 5) compared with the poor fit to the data in the previous arrangement of strata (figs. 6 and 7).

Elephant numbers

The scatter of points in figure 8 gives the regression poor predictive power; therefore, any estimates of Ankasa rainfall made from this regression would be unreliable. The Axim data for two months preceding the survey

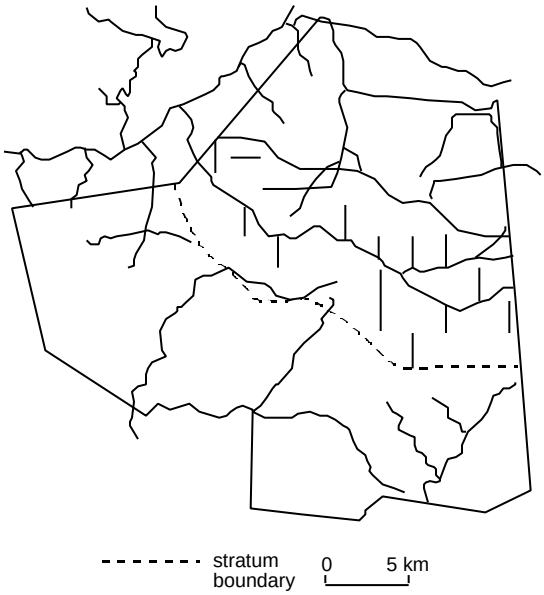

Figure 4. Ankasa Conservation Area showing the distribution of transects after the post-facto stratification.

thus could not be used to predict ACA rainfall, and the rainfall model could not be used in this case to estimate elephant numbers.

Elephant numbers were derived by using the steady-state assumption model of elephant densities: dung pile density as given in table 1, dung rates from Barnes et al. (1994) and

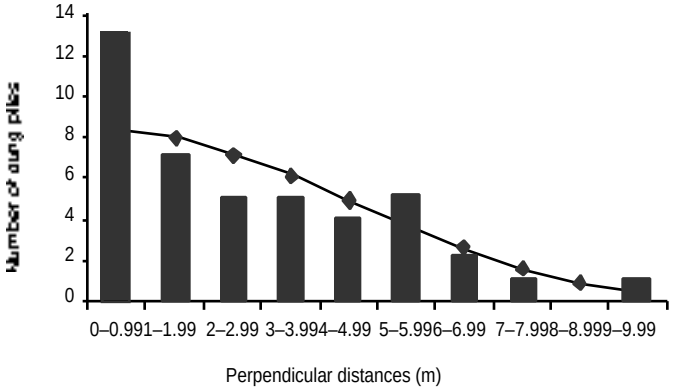

Figure 5. Frequency distribution of the perpendicular distances of dung piles after post-facto stratification (n = 43, $f(0)$ = 0.20).

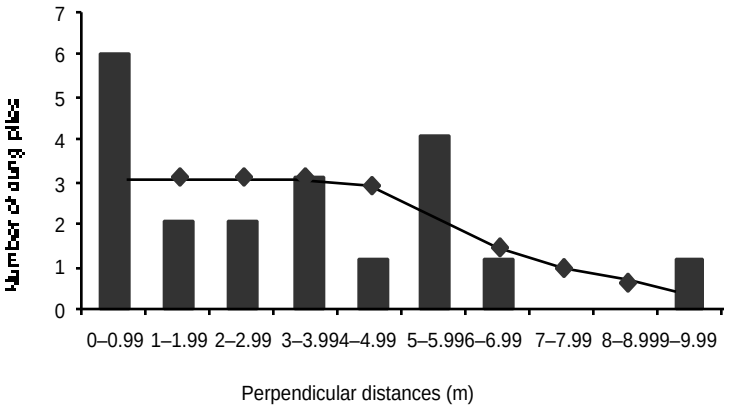

Figure 6. Frequency distribution of the perpendicular distances of dung piles in the high-density stratum (n = 20, $f(0)$ = 0.15).

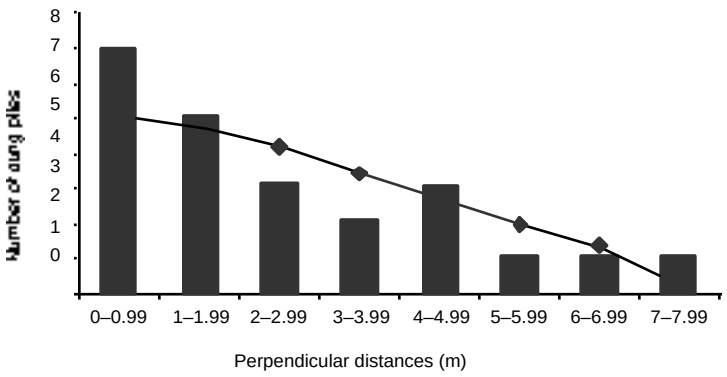

Figure 7. Frequency distribution of the perpendicular distances of dung piles in the medium-density stratum (n = 23, $f(0)$ = 0.22).

defecation rates from Tchamba (1992). Values were multiplied by the area of each stratum (table 1). Elephant numbers thus derived were 11 ± 15 in the high-density stratum and 16 ± 16 in the medium-density stratum.

Discussion

The stratification was based on the reconnaissance conducted in December, but a month later the transects recorded a higher dung-pile density in the medium-density stratum (table 1). This could be due to the relatively short period of the reconnaissance coupled with the small, mobile and clumped nature of the elephant groups. Also, there was little literature on the distribution of elephants in ACA. Survey teams are likely to encounter this kind of problem in areas holding small populations. To avoid this, a reconnaissance should be done to identify the area with no dung piles and then the rest of the study area should be treated as one stratum.

The number of dung piles recorded was 20 in the high-density stratum and 23 in the medium-density stratum. These numbers are fewer than the minimum of 60 to 80 needed to achieve a satisfactory level of precision (Buckland et al. 1993). The post-facto stratification resulted in a better fit of the line transect model to the data and thus probably gives a better estimate of the elephant population than the original stratification.

The estimate of 21 elephants confirms the suspicion of the park management that ACA holds a very small population. It may currently be holding the smallest elephant population in the wildlife-

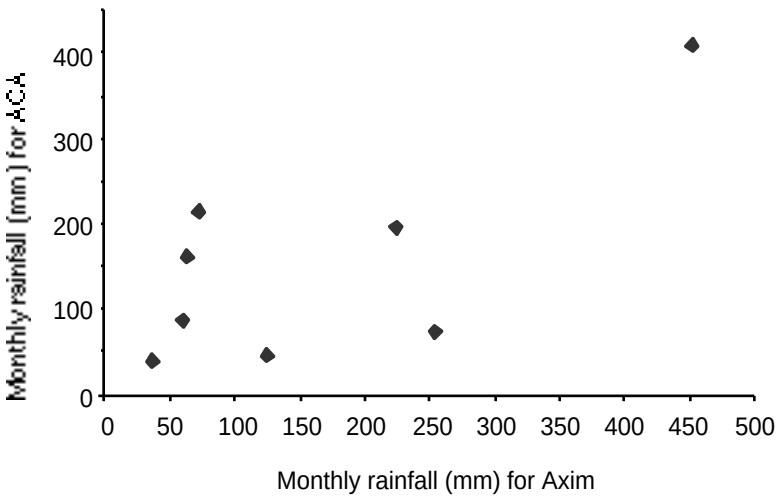

Figure 8. Regression between ACA and Axim 1993–1994 rainfall data ($r = 0.71$, $p < 0.05$).

protected areas of the forest zones of Ghana. According to Sukumar (1993), it is unlikely to be a viable population size. Such a population, if isolated, runs the risks of demographic and environmental stochasticity (Sukumar 1993; Barnes 1999). We have established that the Ankasa elephant population is small. However, it has not been proven whether this population is an isolated one. It is thus recommended that further work be carried out to determine whether the elephants move between Ankasa and the adjacent Draw River Forest Reserve.

At the time of our survey, elephant activities were common along the Suhien River, and we recommend that future surveys conducted in the dry season should follow the stratification shown in figure 4.

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Quelques éléments sur les effectifs d'éléphants au parc national du Niokolo Koba (année 2000)

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Résumé

Une étude sur les éléphants du parc national du Niokolo Koba au Sénégal a été menée au premier semestre de l'année 2000. Prospection pédestre et aérienne ont ainsi permis de préciser l'effectif présumé de l'espèce dans le parc et confirment ainsi sa faiblesse.

Abstract

During the first semester of 2000, an elephant survey was carried out in order to get a precise knowledge of the number of elephants in Senegal's Niokolo Koba National Park. Ground and aerial surveys confirmed that the number of elephants in the park is very low.

Introduction

Le présent article dresse le bilan d'une étude réalisée dans le parc national du Niokolo Koba (PNNK) (9130 km+ en zone soudano-guinéenne, 13° nord et 13° ouest, 1000 à 1500 mm de pluie annuelle) au cours du premier semestre 2000 sur la population d'éléphants qui vit dans les limites de l'aire protégée. L'ensemble de l'étude a été financé par le Fonds Français pour l'Environnement Mondial, dans le cadre du projet FAC/FFEM de réhabilitation du PNNK et de sa périphérie.

Les agents et cadres de la Direction des parcs nationaux du Sénégal ont permis sa réalisation, en particulier le personnel du parc national du Niokolo Koba.

Contexte général

Les données concernant les éléphants à l'Est du Sénégal font cruellement défaut jusque

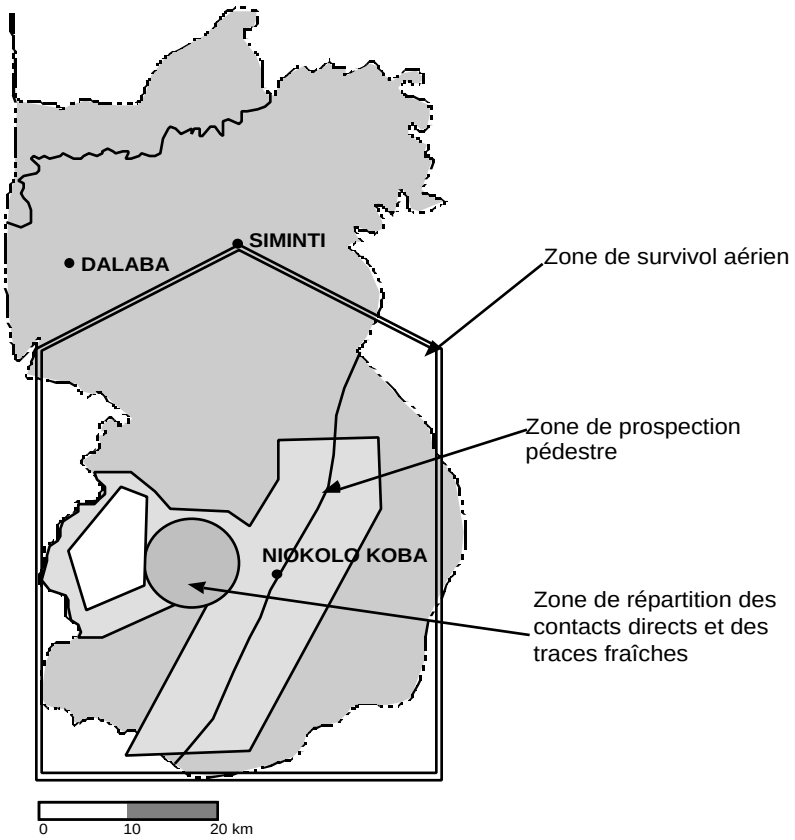

Figure 1. Les méthodes différentes employées indiquent que peu d'éléphants existent o au parc national de Niokolo Koba.

dans les années 50. On sait qu'ils faisaient l'objet d'une chasse sportive non réglementée. Quant au commerce de l'ivoire, il a cours depuis le dix-septième siècle sans restriction. En 1967 (octobre), 1968 (janvier et juin), des dénombrements aériens laissent supposer la présence d'une centaine d'éléphants sur le territoire du parc du Niokolo. En 1969 (mai) alors qu'une sécheresse importante a tari tous les points d'eau intérieurs, 150 animaux sont comptés sur le fleuve Gambie, en une journée de survol. En 1970 (mai), ce sont 200 individus qui sont estimés, au cours d'une seule journée. Mais en 1985, on n'estime plus la population qu'à une cinquantaine d'individus et, en 1993, à 30 individus seulement.

Le tableau 1 suivant fait la synthèse des informations disponibles sur les éléphants au parc national du Niokolo, par compilation des rapports de surveillance du parc.

Tableau 1. Nombre de mois/an où au moins une observation d'éléphant est consignée au parc

1982	11	1989	6	1995	3
1983	10	1990	5	1996	4
1984	11	1991	4	1997	4
1985	10	1992	6	1998	0
1986	9	1993	4	1999	2
1987	7	1994	6	2000	2
1988	6				

La réduction de la dispersion des postes dans le parc, au milieu des années 80 explique en partie la diminution du nombre de contacts. Le braconnage intensif dont l'espèce a fait l'objet accroît ce phénomène et, à partir de la fin des années 80, les contacts mensuels deviennent rares. Les plus gros troupeaux observés récemment au parc ont été de 37 individus (avril 85) et 17 individus (août et décembre 85), et ces dernières années, moins de 5 individus.

Opération pédestre de recherche des indices de présence

Cette opération avait pour objectif de repérer tous les indices directs ou indirects de la présence des éléphants dans le parc, pour établir la carte de distribution de l'espèce. Elle s'est déroulée du 17 avril au 16 juillet 2000.

A partir des axes de circulation, des prospections pédestres, réparties au hasard, sont effectuées à la boussole. Les cours d'eau, les galeries forestières, les mares, sources, forêts ou plateaux importants sont individuellement prospectés. Certains transects systématiques sont parcourus. Ces lignes font approximativement 10 km. Tous les éléments permettant d'estimer la présence récente ou ancienne des animaux sont enregistrés en détail sur une fiche et localisés par GPS.

Résultats

Sur les 10 patrouilles principales menées dans la zone, 8 ont permis la localisation de traces anciennes, et 1 seulement le contact avec des traces fraîches. Dans la plupart des cas, les groupes étaient constitués d'un ou deux adultes et d'un ou deux jeunes. Plusieurs galeries et mares asséchées ont été prospectées spécifiquement sans succès. Sur 48 transects systématiques effectués (500 km), 15 ont révélé des traces anciennes et aucun n'a permis le contact avec des traces fraîches. Les fiches de relevé des indices mentionnent en général un faible nombre d'animaux mélangeant adultes et jeunes (au maximum 2 adultes et 2 jeunes). Enfin, la Gambie a été longée sans succès également.

Aucune présence récente d'éléphants n'est décelée dans la zone, y compris aux abords des points d'eau qu'ils fréquenteraient nécessairement à cette saison, à l'exception d'un cours d'eau affluent du Niokolo où sont passés un adulte et un jeune.

Survol aérien de recherche des éléphants

Par défaut de disponibilité d'un avion à ailes hautes, recommandé pour ce type de travail, l'avion utilisé est un Piper (PA 128) équipé d'un GPS GARMIN 100. Trois personnes (en plus du pilote) ont pris place à bord de l'avion pour assurer le dénombrement. La visibilité des observateurs en places arrières est considérablement réduite dans ce type d'appareil, c'est pourquoi seule la recherche des éléphants a été assurée au cours des vols pour éviter toute dispersion de l'attention.

Le survol de la zone Est du parc (voir carte) s'est étalé sur 5 jours au départ de l'aérodrome de Siminti. L'altitude moyenne de survol était de 300 à 400 pieds. La vitesse de vol moyenne sur transect était de 160 km/h. L' échantillonnage de la zone s'est fait par transects systématiques, prédéfinis sur carte et

programmés dans le GPS de navigation. Les transects (axe Ouest–Est) sont des bandes parallèles de 75 km de longueur espacées de 4 km (chacun d'eux est divisé en 3 tiers de 25 km). Des transects complémentaires ont été faits, de longueur variable selon la zone (30 à 60 km), du même espacement mais décalés de 2 km pour éviter le chevauchement.

Résultats

Sur un total de 29 heures 30 de vol, un peu plus de 21 heures ont été utilisées en survol méthodique de la zone, soit une longueur approximative de 3360 km linéaires.

Seul un crâne a pu être repéré, au sud-est du parc. Dans les catégories de Douglas, Hamilton et Hillman (1981), il s'agirait d'un squelette « vieux » (au moins un an) car les ossements ne portent plus de peau et sont d'un blanc très clair. L'utilisation d'un avion à ailes basses, l'importance du couvert végétal et de la zone non couverte par les transects doit cependant tempérer les conclusions qui peuvent être tirées de ce travail.

Données complémentaires

Dans le cadre d'opérations conduites sur le parc avec des partenaires privés, un hélicoptère a assuré la prospection du parc (par transects bandes et survol libre) pendant 21 heures. Un contact visuel direct a pu être établi à l'Est du mont Assirik en mai. Il s'agissait de 4 individus, dont 2 adultes (un mâle et une femelle d'une quinzaine d'années) et 2 jeunes (environ 4–5 et 7–8 mois).

Une observation directe d'un adulte isolé a été signalée sur le territoire du parc, réalisée par un touriste et un guide sur la montée vers Assirik le 17 février.

Conclusions

Le résultat de cette opération est fort modeste : trois contacts directs (un solitaire, une famille de 4 individus et un animal mort). La prospection au sol a permis d'identifier divers sites occupés au cours de l'année, mais a pointé ceux qui ne le sont plus (les rives de la Gambie, diverses mares…). Partout où des groupes ont séjourné, on note la faiblesse de l'effectif (1 à 2 adultes, 1 à 2 jeunes) et la similitude de leur composition qui fait penser qu'il s'agit des mêmes animaux. On observe donc que :

- la population n'est plus au niveau des années 90 (30 individus) comme en témoigne la faible dispersion de l'espèce au cours de cette étude
- deux très jeunes animaux ont été observés avec un mâle et une femelle adultes : l'espèce poursuit donc sa reproduction ce qui indique qu'elle trouve encore dans le parc les conditions favorables à sa survie
- dans ce groupe familial, un éléphanteau était orphelin. Or la mortalité naturelle d'une femelle en âge de reproduction est plutôt exceptionnelle
- l'observation d'un crâne et d'ossements d'un individu mort récemment (un an environ) témoigne également du maintien d'une mortalité

Les effectifs globaux de l'espèce dans le parc, en l'état de nos connaissances, sont donc extrêmement limités, peut être même en deça du seuil de viabilité de l'espèce.

FIELD NOTES

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By definition, Queen Elizabeth National Park (QENP) Uganda as a Biosphere Reserve has elephants and humans cohabiting and 'sharing' resources, including land. Uganda's elephant population crashed by over 90% from poaching during the civil chaos of the 1970s and 1980s. One would imagine, therefore, that the human population and the resultant low elephant population would interact but little. This assumption could not be further from reality. Years of park encroachment, uncontrolled resource use and human pressure in the region mean that local farmers now cultivate land alongside elephants, sometimes even sharing resources. The interaction between humans and elephants in this region is negative, and it seems set to worsen as it continues. Ironically the Ugandan Wildlife Authority originally started in 1925 as the Elephant Control Department. What have we learned in 75 years? One aspect is that protected areas always need to be actively managed in close partnership with local people. After QENP was ravaged by severe poaching and began to be restored, government departments functioned under considerable fiscal, political and infrastructural constraints. Management priorities focused on other issues, to the detriment of community relations and partnerships.

Unlike in other African countries and parks, no land outside the protected areas is available to elephants, and the very borders of this reserve, which used to harbour Africa's highest biomass of mega herbivores, are under constant and ever-increasing pressure from human demands, in both the northern and the southern areas of the park.

Away from the well-researched northern QENP elephant population, the Elephants, Crops and People (ECP) project started work in southern QENP, bordering the Parc National de Virunga in the Democratic Republic of Congo (DRC). ECP is researching the status of the elephant population and is carrying out long-term management-oriented research with the Uganda Wildlife Authority and local farmers to find ways to mitigate current and future elephant–human interactions in the region. The project is also monitoring the recent immigration of elephants into southern QENP from DRC as they attempt to move away from adverse human activity. From a feasibility study in 1998 to identify the key management problems in the area, ECP found start-up funds from the Royal Geographical Society, the Rufford Foundation and the US Fish and Wildlife Service and started fieldwork in early 2000.

Within one month of setting up a version of the standardized interaction monitoring system along the whole border region, we had confirmed over 150 separate crop-raiding incidents. All interaction has so far happened at night. Not only bull and bachelor groups raid the crops but also family groups and large aggregations sometimes numbering over 150. We have found that most of the interaction occurs when elephants move into Uganda from DRC in the wet season.

The ECP team monitors the transmigration between DRC and Uganda by walking a 25-km stretch of the Ishasha River and recording evidence of

elephants at known crossing points. November 2000 saw a large influx of elephants into the area. During Uganda's poaching years it was thought that some elephants took refuge in DRC, and this does seem likely. However, the reverse now appears to be happening. We also believe that elephants are moving back into the southern areas of QENP, from where human pressure had previously forced them out.

Other than on the odd occasion, the southern QENP elephants have proved difficult to observe, not least because of their reactions and flight from humans and vehicles. Within the past year, ECP has found that the prospects for these elephants are good, and their numbers are once again increasing. Young and subadults are abundant, being supported by strong family groups. Few matriarchs are over 40 years old, and we have found only one bull over 50 years. We believe that elephants are still moving in semi-permanent aggregations but that these may be starting to break up. The aggregations usually contain regular-sized family groups (12 to 14 elephants). Only in one aggregation have we seen evidence of broken family groups, some of which could be orphan groups.

ECP places priority on developing and expanding Ugandan expertise and experience. The ECP team consists of two research assistants, a field support team (including a driver-mechanic and cook) and 18 local community farmers who are employed to monitor the elephant–human interaction along the border. Core team members are given an ongoing opportunity to develop in a number of ways, from learning to drive and giving lectures to attaining academic achievements.

The ECP programme is also sponsoring two Ugandan master's research projects at Makerere University. The projects have been designed to be relevant to the concerns of both ECP and the Uganda Wildlife Authority. One is titled, 'The status and distribution of *Acacia sieberiana* regeneration in southern QENP and its potential effects on elephant–human interaction'; the other, 'The human natural resource use in southern QENP and its potential effects on elephant–human interaction'.

We will keep *Pachyderm* informed.

Two successful elephant translocations in Kenya

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Although translocation of elephants has been practised in countries such as South Africa for many years, it is a relatively new aspect of conservation in Kenya, the first such exercise having taken place seven years ago. Thus we are pleased that two exercises undertaken in 2000 were successfully completely without the loss of a single animal.

In March, 10 elephants were moved from two private game sanctuaries in Laikipia (north of Mt Kenya) to Meru Park; in October, three elephants were moved from Shimba Hills National Reserve (in Kwale District, near Mombasa) to Tsavo East National Park. All three of the source sites had been fenced to keep wildlife from ravaging the neighbouring smallholder farms, but certain elephants had taken to breaking down the fences and the havoc they were wreaking incurred the understandable wrath of the farmers. Previously the Kenya Wildlife Service (KWS) had dealt with such cases by shooting the culprits, but now it was decided that security in the parks had been improved to the extent that it would be possible to use these elephants to begin restocking the poached-out parks and broadening the genetic base of their remaining elephant populations. In keeping with the policy of not breaking up family groups, all the elephants moved were bulls—except one, who had

everyone fooled. This animal was identified by the Sweetwaters Sanctuary Manager Kosgei.

The Laikipia exercise was headed by Moses Litoroh with John Kanyingi, Elizabeth Wambwa and Adeela Sayyed as vets. Ted Goss piloted the helicopter, and Mark Jenkins and Bongo Woodley, senior wardens for Meru and Mt Kenya National Parks respectively, piloted the small aircraft.The translocation was funded mainly by the International Fund for Animal Welfare (IFAW) with additional support from the Eden Wildlife Trust.

Seven elephants were translocated out of Sweetwaters Rhino Sanctuary, which lies within Ol Pejeta Ranch in the heart of Laikipia District, and three from the Lewa Conservancy, on its eastern edge. We took out only obstreperous bulls, which were confirmed to be crop raiders.

All 10 elephants were taken to Meru National Park, where poaching in the late 1970s and early 1980s had reduced the elephant population from an estimated 2500 to a mere 300. These 10 elephants will serve to broaden the genetic base of the whole Meru–Bisanadi–Kora ecosystem. Unfortunately the programme's budget did not allow for the fitting of radio collars.

The Shimba Hills ecosystem has about 600 elephants, and although electric fences had been erected, certain elephants learned they could easily knock them down to get to the appetizing maize of the surrounding small farms. In late 1999, a group of 30 elephants had been translocated from the Mwaluganje Forest Elephant Sanctuary, which is just 5 km north of Shimba Hills Reserve and connected to it by a corridor. But still elephants were causing grief to the farmers, three bulls in particular in the Marere–Msongatamu area.

The Shimba Hills exercise of October 2000 was headed by the KWS Elephant Programme coordinator, Patrick Omondi, with KWS vets Elizabeth Wambwa and Thomas Manyibe, with Kashmir of Mombasa lending a volunteer hand. Ted Goss piloted the helicopter, while volunteer pilot Peter Atkinson handled the small aircraft. The funding came from the Born Free Foundation, with Winnie Kiiru contributing enormously to the exercise and its chief executive officer, Will Travers, taking the time to witness the operation itself. The exercise was difficult in that the Shimba Hills are precisely that—hilly—and the vegetation is thick forest. Nevertheless, all three were successfully darted, loaded and carted off within a period of two days.

All three Shimba elephants were released in Tsavo East National Park, whose elephant population had been poached out from over 40,000 to 8000 but where security has now greatly improved. Some of the Mwaluganje group had trekked from their release site coastwards as far as Kilifi, well over 200 km away. The new trio were fitted with radio collars and subsequent monitoring has shown them to be staying within 50 km of where they had been released.

By removing selected identified problem animals, fence breaking and crop raiding have decreased and conflict between elephants and their human neighbours has been successfully ameliorated.

BOOK REVIEW

Estimating abundance of African wildlife: an aid to adaptive management, by Hugo Jachmann

Kluwer Academic Publishers; price: GBP 77; ISBN 0 7923 7959 4

review by Deborah Gibson and Colin Craig

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Central to the conservation and management of wildlife in Africa is the enumeration and monitoring of wild animal populations. This is the subject of *Estimating abundance of African wildlife: an aid to adaptive management*, by Hugo Jachmann, a wildlife biologist with 23 years of experience in African wildlife management.

Access to the wide literature on the subject is sometimes difficult, and Jachmann's book aims to provide students, ecologists and wildlife managers with a comprehensive and self-contained practical guide to most of the available techniques. It starts with an introduction to, and classification of, wildlife counting methods. A brief overview on technique selection leads to a chapter explaining the theory and statistics involved in sample counting and subsequent chapters provide details of the various methods. The book ends with a concise guide to the selection of a method appropriate to the species and objectives under a variety of circumstances.

Despite its subtitle, the book does not deal with how to incorporate population monitoring into an adaptive management system and only partly fulfils its promise in other regards. It does provide a good overview of methods appropriate to African animals, and it contains much useful detail that will aid in the implementation of surveys. But it falls short of providing a new stand-alone practical guide.

While some methods are covered in enough detail to enable the reader to carry out the work, this is the exception, and it is doubtful if even key methods such as aerial sample counts or dung counts could be carried out without reference to other literature.

There would have been more space for practical details if theoretical sections could have been cut. However, although disclaiming expertise beyond that of an ecologist, Jachmann attempts discussions of the statistics that would have been better dealt with by reference to other works. This has produced sections that are unclear, potentially misleading or which contain examples whose interpretation is arguable.

Many of the book's shortcomings could have been avoided with good editing. In fact, the general standard of publishing is poor; tables that could easily fit on a page are often split and continued overleaf, equations look as though they have been written on an inferior word processor and the standard of illustrations is poor. The presentation has not done justice to the author or the subject.

Provided it is used critically, *Estimating abundance of African wildlife* could be a useful addition to the already available works on the subject, but at a cost of over USD 100 it is doubtful if many will add it to their libraries.

NOTES FROM THE AFRICAN RHINO SPECIALIST GROUP

SADC Regional Programme for Rhino Conservation update

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In the last *Pachyderm*, the AfRSG Chair reported on the activities funded by the SADC Regional Programme for Rhino Conservation up to July 2001. The program has continued to support a number of regional rhino conservation projects with funding from the Italian government. Many of these projects have involved the provision of expertise available within the SADC region towards the rhino conservation efforts of individual countries, or collaborative activities addressing the needs of several range states, or regional and continental priorities as identified by AfRSG. Apart from assistance provided for the development of new or revised national rhino management plans for Botswana and Namibia (funded by the WWF African Rhino Programme), the programme has provided regional expertise for evaluating and guiding future plans for reintroducing rhinos to Zambia (with focus on Luangwa National Parks) and Botswana (Moremi Game Reserve), and technical advice for future management and development of existing rhino reserves in Malawi (Liwonde National Park), Botswana (Khama Rhino Sanctuary) and Zambia (Mosi-o-Tunya National Park). In August, a team of rhino survey and tracking specialists from Zimbabwe assisted Tanzania with monitoring remnant black rhinos in the Selous Game Reserve.

Funds have been approved for projects in Namibia that will assess biological factors limiting the black rhino population of Kunene Region, and for building a capacity to monitor rhinos in the north-west of the country by the Ministry of Environment and Tourism. The programme is also supporting a project (now implemented by TRAFFIC) to improve the security and management of rhino-horn stocks in the SADC region. The rhino database software (WILDb) produced under the programme continues to provide field testing and refinement of its site-based modules in Intensive Protection Zones and conservancies in Zimbabwe. A national database module is now being developed to import summary data for analyses from different areas and report on rhino conservation status along with performance of populations. Following the meetings and workshops supported in the last six months of the Rhino Management Group (RMG), the Rhino and Elephant Security Groups, and the RMG Biological Management of Black Rhinos (see reports by AfRSG Scientific Officer in this issue), the programme will convene the first meeting of the SADC Rhino Recovery Group to coordinate support for range states whose rhino conservation programmes are at a relatively early stage of development, where there is need for more emphasis on re-establishing rhino populations, and developing local expertise in rhino management. Further training courses will be provided for instructors in rhino monitoring techniques (revised Sandwith/AfRSG course), as well as specialist instruction in scene-of-crime investigations. Implementation of several approved projects in the last six months has been constrained by delayed release of funding to the programme.

Update from TRAFFIC East and Southern Africa

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TRAFFIC continues to emphasize significantly its project activities within Africa, to help strengthen control measures and minimize the risk of rhino products entering illegal trade. Work on rhino horn stock management has been elevated to a SADC-level agenda in southern Africa, and the support given to law enforcement in eastern Africa has resulted in numerous seizures of rhino horn over the past year.

Adequate management of horn stockpiles and prevention of illegal trade were identified as priorities by Parties at CITES COP11. Since 2000, TRAFFIC has been undertaking the first systematic effort to identify and track stocks of rhino horn and other rhino products worldwide. Funded by WWF, the Rhino Horn and Product Database (RHPD) currently stores over 1600 records relating to stocks and seizures for both government and private sources in 54 countries. One of the best data sets collected to date is for rhino range states in eastern and southern Africa where over 12,000 kg of rhino horn stock have been documented, of which almost 1000 kg is privately held. RHPD remains the only system for analysing rhino horn stocks and seizures. It is therefore a very appropriate future tool for implementing aspects of Res. Conf. 9.14 (Rev.). Current analyses of stockpile accumulation dynamics and relative stockpile volumes in Africa and Asia will assist future policy decisions.

Under the SADC regional programme for rhino conservation, TRAFFIC has continued to review practices for managing rhino horn stockpiles, including marking, registration and security. In-country visits and reviews have been conducted in Namibia, South Africa (Kruger National Park, Gauteng, KwaZulu-Natal, Mpumalanga, Northern and North West Provinces) and Zimbabwe. This comes at an essential time, because African horn stockpiles continue to accumulate at an increasing rate and efficient registration and tracking systems are needed before stocks become too large to manage. In addition to short-term interventions, outcomes will include the promotion of examples of best practice and a framework to comply with CITES directives.

In Kenya, to improve CITES law enforcement, TRAFFIC has undertaken a range of activities, including intelligence-gathering through an informant network, training courses for personnel from various institutions to develop a basis for coordinated enforcement action, and assistance in developing a sniffer-dog unit. A TRAFFIC report, 'Halting illegal rhino horn trade routes in East Africa: an assessment of rhino horn trade routes and Kenya's capacity to halt such trade', was produced. These efforts have yielded impressive seizure results for CITES-listed species, including many rhino horns.

In a more dramatic moment, TRAFFIC recently assisted law enforcement authorities in Djibouti to raid what could well have been the most open and flagrant market of endangered wildlife products in East Africa. A 1999 survey had previously documented a range of illegal CITES-listed products, including over 80 leopard and cheetah skins and hundreds of ostrich eggs from the endangered North African subspecies. After ensuring that there was a firm legal basis and strong government will to shut down the illegal trade in Djiboutiville's Rue de Brazzaville curio market, TRAFFIC developed a list of target species for seizure. In June 2001, the active participation of 25 police officers in a surprise raid resulted in the seizure of spotted cat skins, African elephant ivory, ostrich eggs and carapaces of marine turtles.

Status of northern white rhinos and elephants in Garamba National Park, Democratic Republic of Congo, during the wars

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Since early 1997, Garamba National Park in the northeast of the Democratic Republic of Congo (DRC—previously Zaire) has been subjected to the effects of two wars within the country. The park is home to the last known wild population of northern white rhinos (*Ceratotherium simum cottoni*) and the densest elephant population in DRC. Figure 1 shows how poaching levels have increased during the two recent wars, as indicated by the number of contacts for patrol effort. The poaching there in recent years has been primarily for meat. Patrol monitoring indicates that 70–80% of the poaching gangs' members are Sudanese, usually 'SPLA deserters', using weapons from the ongoing war in adjacent southern Sudan. The others are local Congolese. The increase in poaching during the active phases of the two DRC wars, however, was not caused by influxes of Congolese poachers or the occupying military. The same poachers were there throughout, but the anti-poaching effort of guards was temporarily stopped or reduced and the general breakdown of law and order was exploited.

Figure 1 shows how the poaching increase was greatest during the first war in 1997. For several months when the military forces arrived, guards were disarmed and no efforts could be made to control poaching. Without resistance, poachers were able to move south through the park to areas where elephant, rhino and hippo were concentrated. The second war in 1999–2000 had an initial active phase that included a two-month occupation of park headquarters by the Ugandan-backed rebel forces when project personnel and conservateurs were moved out. During this phase, there was little reduction in anti-poaching effort, because park guards continued their anti-poaching efforts and monitoring. The Ugandan forces acted positively towards conservation efforts and prevented the sale of bushmeat; a small increase in poaching was checked. The current phase of the second war largely involves a jostling for power and resource exploitation rather than open combat. Peace talks are under way.

The effect of increased poaching and military actions on wildlife was measured by systematic aerial sample counts of large mammals. These counts were carried out over the park after the first war in May–June 1998 and after the main phase of the second war in June 2000. Estimate count results for elephants from systematic aerial surveys before, between and after the active phases of the two wars in DRC are 11,175 in 1995 (standard error 3679), 5874 in 1998 (standard error 1339) and 6022 in 2000 (standard error 1046).

Half of the elephants were lost during the first war, but there was no significant change during the initial phase of the second war. These elephants have now further gained in value by their genetic significance. It has long been noted that they appear morphologically and behaviourally as an intergrade between forest *(Loxodonta africana cyclotis*) and savannah *(L. a. africana)* types, and now genetic studies show that they are intermediate and cannot be clearly classified as either forest or savannah subspecies.

The rhinos are monitored by means of systematic block counts using individual recognition, backed by ongoing standard recording of rhino observations. This means that the population present can be found cumulatively where an individual missed in one survey is seen in a subsequent survey. Table 1 summarizes the cumulative results of surveys and reconnaissance flights before, between and after the wars.

An intensive aerial rhino survey was carried out in April 2000 using the stratified block count method, but it was curtailed at the end when the plane developed an engine problem. Twenty-four animals were found, including seven new calves, one of which was probably less than a week old. The other five, which were among the minimum number seen in 1998, were subadult

Figure 1. Poaching in Garamba National Park,1993–2000.

Table 1. Population dynamics of northern white rhinos between surveys over war periods (combined totals of different individuals seen over a series of surveys during the preceding six months)

	Surveys in 1996	War	Surveys in 1998	War	Surveys in 2000
Min (–max.) population est.	29		26 (–31)		30 (–36)
Births		+4		+7	
Known poached		–2		–2	
Previously known animals not seen (missing or dead)			5		1

males, three of which would recently have left their mothers on the birth of her new calf. At this stage they are their most nervous and secretive, hiding in long grass and very difficult to see. During the systematic sample count of large mammals over the whole park and other reconnaissance flights in June of the same year, another individual not seen in April was observed, bringing the total to 25. In August during reconnaissance flights, two of the young males that had been missed in April were found, and purely by chance two more of the younger ones were found outside the park. This brought the total seen in 2000 to 30. Of the new calves, all born between the end of 1999 and April 2000, four were male, one was female and the sex of the other two could not be determined.

The age and sex structure of the population at the end of 2000 was

Total confirmed individuals		
Male adults	6	
Female adults	6	
Male subadults	5	
Female subadults	4	
Male juveniles	5	
Female juvenile	1	
Male infant	1	
Unsexed infants	2	
Total	30	confirmed August 2000
sex ratio	17♂: 11♀ + 2 unknown	
adult : subadult + juvenile ratio	12 : 18	

It has not been possible to do a survey in 2001. There are no reports of major poaching, but it has been reported that guards found a rhino carcass in April and a rhino horn was offered for sale to a consultant across the border in Sudan in May.

Distribution was mapped on each of the surveys and was each time associated with the central protected areas and the long–short grass mosaics. The burning programme at each period of unrest had been designed to ensure that substantial areas of long grass remain in the most protected central southern area to afford maximum protection for the rhinos while creating mosaics with short grass patches so that they could alternate rapidly between grazing and cover. These areas were found each time to be favoured by the rhinos.

Factors that have been key in maintaining the rhino population relatively stable despite the circumstances have been that the guards have maintained their patrolling and protection as much as possible during each period of unrest and that the supporting partners with the National Congolese Parks Institute have maintained their ongoing commitment to protect the park. The International Rhino Foundation is currently the main supporting partner for Garamba, along with the US Fish and Wildlife Service. A larger umbrella programme has been developed by the main supporting partners with the Congolese National Parks Institute and UNESCO and UN Foundation to support the five World Heritage Sites in DRC, one of which is Garamba, throughout the armed conflict and in the future. Garamba personnel were key in developing the programme in which rhinos, elephants, gorillas and other key species of the park were central to its World Heritage status.

The umbrella programme aims to provide financial support and capacity building for field staff. The economy of the country had declined well before the wars started, which meant that the government could not financially support the parastatal agency to which the park belonged. The UN Foundation is the core funding agency, operating through UNESCO with NGO partners implementing the programme in the field. These NGO partners are also committed to continuing their own support. The UNESCO umbrella is key to providing active diplomatic support, which will facilitate the essentially neutral field operation of conservation staff even within a somewhat insecure and politically unstable region.

Rhino and elephant security group resuscitated

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After a protracted period of inactivity, the Rhino and Elephant Security Group (RESG) of southern Africa was resuscitated at an RESG meeting held in Windhoek, Namibia, 14–15 June 2001. The meeting was made possible through funding provided by the SADC Regional Programme for Rhino Conservation and the efforts of Simon Pillinger and Lovemore Mungwashu. RESG delegates attended from conservation agencies in Botswana, Namibia, South Africa, Swaziland, Tanzania, Zambia and Zimbabwe. The South African Police Services' Endangered Species Protection Unit, Namibia's Protected Resources Unit, Interpol (subregion for southern Africa), and the Botswana Defence Force were also represented. Invited observers included the AfRSG Scientific Officer, the coordinator for the SADC Regional Programme for Rhino Conservation, representatives of TRAFFIC East and Southern Africa, and Kenya Wildlife Service's national rhino coordinator. Nine AfRSG members were present.

The main objective of the meeting was to develop clear and focused terms of reference and a modus operandi for the group. Because of time constraints, Simon Pillinger requested the AfRSG Scientific Officer to prepare illustrative terms of reference for the group. The preparation was accomplished in consultation with conservation colleagues experienced in wildlife law enforcement and investigation. Although this document was intended only to be illustrative it catalysed discussion, assisting delegates to develop and agree on new terms of reference from scratch in just one day. Apart from setting out a vision, overall goal and objective for RESG, the group's modus operandi was set out. Nine focus areas were identified by RESG—each of which needed to be addressed to meet the overall goal. These were

- law enforcement
- intelligence
- procedures for effective investigation and prosecution and for minimizing illegal international trade
- security and management of rhino horn and ivory stocks
- coordination, networking and information exchange
- training and capacity building
- positive public involvement, awareness and education
- international and regional conventions
- sustainability, functioning and support of RESG

Specific goals and activities were set for each of these nine key focus areas. The group's new terms of reference provide clearer focus and should help RESG make a significant contribution to rhino and elephant security as well as ensuring it will complement the work of other existing rhino groups. The new RESG terms of reference will also be a useful document when soliciting future funds from donor agencies.

The type and the level of membership were discussed. RESG members also elected Lovemore Mungwashu (Zimbabwe Department of National Parks and Wildlife Management) as RESG Chairman, and Rusty Hustler (South Africa's North West Parks and Tourism Board) as Vice Chairman. Peter Ratema (South African National Parks) agreed to assist the Chair when needed.

A number of presentations were also given at the meeting. TRAFFIC's Simon Milledge discussed the improvement of rhino horn stockpile management including registration, marking and tracking systems. Rod Potter from KwaZulu-Natal Wildife discussed the use of transponders to mark horns. He outlined his courses dealing with scene of crime, field investigation and collection of evidence as related to unnatural deaths of rhinos and elephants. These courses provide training to reduce the chances of destroying valuable evidence, ensure the chain of evidence is collected in such a way as to be acceptable in court, maximize the information that can be gained from the crime scene, and ensure that no time is wasted when a crime scene is detected. A number of participants from range states expressed interest in crime-scene training. Members were informed that the SADC rhino programme has approved the development of manuals for scene-of-crime training and the offering of regional courses in crime-scene techniques. Unfortunately, funding release problems by

the Italian donors have delayed the implementation of this project. AfRSG's Richard Emslie presented the results of horn fingerprinting to date, listing outstanding problems and mentioning the steps being taken to solve these problems. Samantha Watts and Simon Pillinger of KwaZulu-Natal Wildlife demonstrated the Intelligence database that has been developed by KwaZulu-Natal Wildlife and how it is used. Their presentation elicited great interest from members. It is hoped that the system will find wider application among range state participants.

Workshop on biological management of black rhino

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All current national strategies on black rhino conservation aim to increase numbers as rapidly as possible, setting minimum metapopulation growth targets to an average of at least 5% per annum. However, in recent years several 'Key' and 'Important' black rhino populations in South Africa and other major range states have been performing below this minimum target level. In some cases recommended biological management strategies have not been fully implemented.

Suboptimal growth is a problem for a number of reasons. Because of the effects of compounded growth, small differences in growth rate matter a lot. The slow growth rate brought about by poaching has resulted in markedly fewer rhinos. For example, in South Africa, lower growth rates over the last five years have resulted in approximately 250 fewer black rhinos than anticipated if previous metapopulation growth rates had been maintained. The time it takes to reach conservation goals also markedly increases as growth rates decline. It will take South Africa's *Diceros bicornis minor* metapopulation 70 years to reach the goal of 2000 animals at 1% growth per annum compared with only 11 years at 7%. Rapid growth also enhances the ability to withstand poaching outbreaks, and the loss of genetic heterozygosity is minimized when metapopulations increase through breeding at a rapid rate. Long-lived, large, K-selected species like rhinos can also overshoot the carrying capacity of an area for a period, thus potentially damaging its 'vegetation capital', which is another reason for keeping densities below carrying capacity.

Given this background, the SADC Rhino Management Group (RMG) found this an opportune time to re-evaluate and examine existing guidelines on biological management and theoretical performance models in the light of experience and RMG monitoring over the last 12 years. The RMG therefore organized a technical workshop on biological management of the black rhino to debate the successes, failures and alternative strategies of biological management and to review how best to maintain rapid metapopulation performance. The workshop took place 24–26 July 2001 at Giants Castle Game Reserve in the Ukhahlamba-Drakensberg Park, KwaZulu-Natal, South Africa. Delegates who attended from all the 'Big 4' black rhino range states of South Africa, Namibia, Zimbabwe and Kenya, were experts in a broad range of areas—from field managers of rhino areas to theoretical ecologists.

The workshop reviewed factors affecting the population growth of black rhinos. They examined case histories, population dynamics, harvesting theory, and existing and alternative approaches to achieving and maintaining rapid population growth. Participants also discussed monitoring of rhino population performance and resources available (carrying capacity issues) for rhino populations. Key indicators that would aid decision-making were identified. The workshop recognized that biological management has to be proactive, rather than responding only when monitoring detects a problem (which, sadly, is often too late).

Participants developed guidelines for enhancing metapopulation growth of black rhino populations. In reviewing harvesting, the workshop considered the size, nature (age and sex), frequency and location of the rhinos to be removed, as well as reconciling the needs of both donor and recipient areas. The principle of keeping densities at a productive and safe level (not letting populations approach or exceed ecological carrying capacity [ECC]) was upheld. However, a particularly

important workshop recommendation was that a proportional removal strategy be implemented in larger populations to maintain rapid growth rates. This strategy differs in application from the existing one of managing at or below 75% of ECC strategy.

Two versions of the new proportional removal strategy were developed depending upon 1) whether the population concerned is rapidly growing and lightly stocked or 2) is overstocked and has exceeded 75% of the estimated ECC.

Based on this strategy, current stocking levels first need to be assessed in relation to an ECC estimate. If the population is in a lower-density growth phase, the recommendation is to do nothing until densities exceed 50% of ECC. Then management would start removing 5% per annum. Population performance is assessed after a few years, and if the population has continued to grow, removals should be increased. For example, if after 5% removals, the population continues to grow by 2% per annum, the annual removals can be increased to 7%. However, removal levels must never exceed r_{max} (around 9%). On the other hand, if the population is close to or above the estimated ECC, densities should be reduced to 75% of ECC as soon as possible (preferably in one year and by at least 10% per year). To help achieve this, and to avoid skewing donor populations towards older animals, it was recommended, based on Zimbabwean experience, that cow-and-older-calf pairs also be removed. Once the population has been reduced to 75% of ECC, 5%+ per year may be removed (again, never exceeding 9%).

The principle underlying this new strategy is that the population itself will adjust its density to the level that can sustain the given percentage offtake. Should carrying capacity increase or decrease over time, the population will automatically adjust its density, up or down. For larger populations, the proposed revised removal strategy has a number of practical and biological advantages over the existing strategy of 'manage at or below 75% of ECC'. One is that continual reassessment of carrying capacity and sustainable yield densities will no longer be necessary. If implemented, this new harvesting strategy will ensure that donor populations contribute at least 5% per annum to the metapopulation and that populations cannot be 'under-' or 'over-harvested'.

The proposed revised strategy is an attractive and understandable option. Field managers appear to be more comfortable with this strategy and hence more likely to support it. It also provides a better idea of approximately how many animals may be available for translocation at a national level, thus facilitating better decision-making on metapopulation management.

Because the dispersal of black rhinos is ostensibly poor, concern was expressed about the potential negative effects of concentrating removals in particular areas within a park. Such removals may create low-density zones and in the short term do little to reduce rhino density in the rest of the park. Existing data should be analysed to show if this has happened in any park. As part of a post-doctoral research program funded by the San Diego Zoo, Dr Wayne Linklater will investigate the social aspects of translocations for both donor and recipient populations. It is hoped this research will result in guidelines to increase the success of future translocations.

The results of the workshop are currently being written up. The challenge for the months ahead will be to disseminate workshop findings and recommendations to individual management agencies and management teams on the ground. If the recommendations, especially the recommended proportional removal strategy, are implemented, the result should show increased metapopulation growth, more rhinos and a shorter period needed to reach metapopulation targets.

The workshop was made possible by the Italian-funded SADC Regional Programme for Rhino Conservation, which funded the workshop and organized the air tickets for the delegates. WWF's partial support of the AfRSG Scientific Officer enabled him to locate funding and organize the workshop. The able facilitation by Trevor Sandwith, the good background presentations, and delegates'active and good-spirited participation in the workshop contributed greatly to the workshop's success, ensuring that key issues were raised, and debate was stimulated both ahead of and during the working group sessions. The RMG thanks all delegates for their hard work.

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Use common names of animals and plants, giving scientific names in italics on first mention; include the authority.

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