Pachyderm

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Pachyderm

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

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Cover: Jampang, a young Javan rhino male, taken by camera trap in Ujung Kulon National Park, Indonesia, in March 2000 (credit: Foead, Yahya & Sumiadi/WWF & BTNUK)

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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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What would we do without our wonderful donors and partners? Once again, our efforts have been rewarded by the continued support of the US Fish and Wildlife Service and the Department of Transport, Roads and Environment of the UK, and they have been joined once again by a previous supporter, the European Commission. This group of die-hard supporters has made possible the hiring of a new Programme Officer to support me in Nairobi, continuation of an Administrative Officer (to ensure proper handling of their funds) and a new Administrative Officer for Central Africa, the continued support of our Programme Officer for West Africa, a membership meeting in the year to come, production of *Pachyderm,* and core support to the Secretariat and the African Elephant Database (AED) over the next year and, for some activities, beyond.

National and subregional planning

July began with a burst of energy. I was privileged to lead a wonderful team of AfESG members to assist with the development of the national elephant conservation strategy for Ghana. Possibly one of the most challenging facilitation jobs I have ever undertaken, the workshop was attended by local and national politicians, practising Ghanaian elephant managers, and colleagues from the neighbouring range states. I left Ghana exhausted, but with the able assistance of the indefatigable Dr Richard Barnes, the strategy is already in its final draft. Since the

Que ferions-nous sans nos merveilleux donateurs et partenaires ? Une fois de plus, nos efforts ont été récompensés par l'aide soutenue du US Fish and Wildlife Service et par le Département Britannique des Transports, des Routes et de l'Environnement, qui ont été rejoints une fois encore par un ancien support, la Commission Européenne. Ce groupe de fervents supporters a rendu possible l'engagement d'un nouveau Responsable de Programme pour m'aider à Nairobi, la poursuite du travail d'un Responsable Administratif (pour assurer la bonne gestion des fonds) et l'arrivée d'un nouveau Responsable Administratif pour l'Afrique centrale, la poursuite du soutien à notre Responsable de Programme pour l'Afrique de l'Ouest, une réunion des membres pour l'année qui vient, la parution de *Pachyderm*, et un support fondamental au Secrétariat et à la Banque de Données pour l'Eléphant Africain (BDEA) pour l'année prochaine et, en ce qui concerne certaines activités, au-delà.

Programme national et sous-régional

Juillet a commencé dans une débauche d'énergie. J'ai eu le privilège de conduire une formidable équipe de membres du GSEAf pour participer à la mise au point de la stratégie nationale ghanéenne pour la conservation des éléphants. Lors de ce qui fut peut-être une des missions de facilitation les plus stimulantes que j'ai pu entreprendre, l'atelier vit la

workshop, I have been contacted by the government of Burkina Faso, who also wish to proceed with the development of both a national strategy and plans for their transborder issues with Ghana and Mali. By the time of *Pachyderm* 30, I hope to report progress on the current planning process under way in Botswana. In Mozambique, the National Directorate of Forests and Wildlife, in collaboration with IUCN Mozambique and the AfESG, has recently published the final version of their national strategy in Portuguese and English.

We are making progress with plans for a subregional strategy for Central Africa, where there is much enthusiasm and a demonstrated commitment to moving the elephant agenda. Elephants in this subregion, as much if not more so than in others, will require the will and collaboration of all countries to ensure the future of important cross-border populations. We have been fortunate to have the support of the MIKE Steering Group and its coordinator, Dr John Hart, in helping to coordinate the efforts of the AfESG and our conservation partners, the Wildlife Conservation Society, WWF-US, WWF International and IUCN-ROCA (Regional Office for Central Africa), to move this process along. At present, we are confident that the process can and will move forward in the first half of 2001.

Species Survival Commission matters

In October 2000, I attended the Species Survival Commission (SSC) meetings that accompanied the second World Conservation Congress in Amman, Jordan. I was very pleased to be able to present the quadrennial reports for both the AfESG and the AfRSG, on behalf of its Chair, Dr Martin Brooks. It was a novel experience to deliver two PowerPoint presentations without having to grab for the usual acetate overhead backups! Both talks were well received but, more importantly, complemented the incredible contributions provided by specialist group after specialist group throughout the meeting. In addition to many fellow members of the SSC, some members of the AfESG have been contacted directly in connection with a new study that the Executive Committee of the SSC initiated to investigate the problems, challenges and potential for voluntary contribution to the work of the SSC. This should help

participation de politiciens locaux et nationaux, des gestionnaires ghanéens en exercice et de collègues des états voisins de l'aire de répartition. J'ai quitté le Ghana épuisée mais, grâce à l'aimable assistance de l'infatigable Dr. Richard Barnes, le projet de stratégie en est déjà à sa phase finale. Depuis cet atelier, j'ai été contactée par le gouvernement du Burkina Faso qui voudrait aussi procéder à la mise au point d'une stratégie nationale et de plans pour les problèmes trans-frontières avec le Ghana et le Mali. Pour le n°30 de *Pachyderm*, j'espère pouvoir faire rapport des progrès réalisés par le processus de planification qui est en cours au Botswana. Au Mozambique, le Directorat National des Forêts et de la Faune Sauvage a récemment publié, avec la collaboration de l'UICN Mozambique et du GSEAf, la version finale de leur stratégie nationale, en portugais et en anglais.

Nous faisons aussi des progrès en ce qui concerne les plans pour une stratégie sous-régionale pour l'Afrique centrale, où nous rencontrons beaucoup d'enthousiasme et un dévouement avéré pour faire avancer le calendrier pour les éléphants. Les éléphants de cette sous-région, autant si pas plus que ceux des autres, vont exiger la volonté et la collaboration de tous les pays pour assurer l'avenir d'importantes populations trans-frontières. Nous avons eu la chance d'obtenir le soutien du Groupe de Direction de MIKE et de son coordinateur, le Dr. John Hart, pour nous aider à coordonner les efforts du GSEAf et de nos partenaires de coopération, la Wildlife Conservation Society, le WWF-US, le WWF International et l'UICN-BRAC (Bureau Régional pour l'Afrique Centrale) pour faire avancer le processus. Maintenant, nous croyons que le processus pourra et va progresser au cours de la première moitié de l'année 2001.

La Commission de Survie des Espèces

En octobre 2000, j'ai assisté aux réunions de la Commission de Survie des Espèces (CSE) qui accompagnaient le second Congrès Mondial de la Conservation à Amman, en Jordanie. J'ai eu le grand plaisir de pouvoir présenter les rapports trimestriels du GSEAf et du GSRAf, au nom de son Président, le Dr. Martin Brooks. Ce fut une expérience nouvelle de faire deux présentations PowerPoint sans avoir à attraper les habituels supports sur transparents. Les deux communications ont été bien accueillies mais,

to add an African perspective, which I feel strongly that the Commission needs.

On other SSC matters, following Amman the SSC Chair will again appoint new members and reappoint members to serve the specialist groups over the coming three to four years. In preparation for this exercise, I contacted all members of the AfESG to request a complete update on their current activities relating to the conservation of Africa's elephants. These updates will help in advising the Chair on these appointments. It is hoped that all appointments can be finalized early in the new year.

Information and communications

Over the next few months, the AfESG Secretariat in Nairobi will be working with IUCN staff in Gland, Switzerland, to update and upgrade the group's Web site. We are currently looking into the possibility of reasonably priced improvement of the Web site, specifically for posting the *African Elephant Database 1998*, the HEC data collection protocols and training manuals in French and English, and a synthesis report prepared by the Human–Elephant Conflict Task-force—and perhaps even *Pachyderm* in future.

Despite major advances and developments in information technologies, our membership in Africa still has severe constraints in gaining access to this information. At present, the Web site will primarily assist other clients, colleagues, partners and the public in accessing our products and tools. But it is hoped that further investment in computers and electronic communications across Africa will make the Web site more broadly accessible and therefore of greater value to all our membership in the years to come.

I am also happy to announce that in September 2000, the AfESG Secretariat came into possession of a full set of over 3500 documents (housed in four 4-drawer file cabinets) comprising the African Elephant Library (AEL), formerly known as LAEBRA. The AEL was the brainchild of AfESG member Dr Iain Douglas-Hamilton, presently the Chair of his own NGO, Save the Elephants. Dr Douglas-Hamilton is the custodian of the second full set of AEL documents, which build on the solid foundation of his own private collection of published and unpublished literature on the African elephant. On behalf of AfESG and myself, I would like to recognize the extraordinary personal efforts and professionalism of Ms Mary Rigby in

ce qui est plus important, elles ont été complétées par les incroyables contributions apportées par les groupes de spécialistes qui se sont succédé tout au long de la réunion. En plus des nombreux collègues membres de la CSE, certains membres du GSEAf ont été contactés directement, en rapport avec une nouvelle étude que le Comité Exécutif de la CSE a lancée pour étudier les problèmes, les défis et les potentiels en vue d'une contribution volontaire au travail de la CSE. Ceci pourrait aider à apporter une perspective africaine dont je pense vraiment que la Commission a besoin.

En ce qui concerne les autres domaines de la CSE, suite à Amman, le Président de la CSE va encore nommer de nouveaux membres et renommer les anciens pour être au service des groupes de spécialistes pendant les trois ou quatra prochaines années. En préparant cet exercice, j'ai contacté tous les membres du GSEAf en leur demandant une mise à jour complète des activités qu'ils mènent actuellement dans le cadre de la conservation des éléphants d'Afrique. Ces mises à jour pourront aider le Président à choisir. On espère que toutes les nominations seront effectives au début de la nouvelle année.

Informations et communications

Au cours des prochains mois, le Secrétariat du GSEAf à Nairobi va travailler avec le personnel de l'UICN à Gland, en Suisse, pour mettre à jour et améliorer le site Internet du groupe. Nous sommes en train d'examiner la possibilité d'une amélioration à un coût raisonnable du site Internet, particulièrement pour y mettre la *Banque de Données 1998 pour l'Eléphant d'Afrique*, les protocoles sur la récolte de données sur les CHE et les manuels de formation en français et en anglais, et un rapport de synthèse préparé par le Groupe de Travail chargé des Conflits Hommes-Eléphants – et, qui sait, peut-être même *Pachyderm* à l'avenir.

Malgré des avancées et des développements majeurs dans les technologies de l'information, nos membres qui vivent en Afrique connaissent encore de sérieuses contraintes dans l'accès à ces informations. Actuellement, le site Internet aide en premier lieu d'autres clients, collègues, partenaires et ceux qui le désirent à accéder à nos produits et à nos moyens d'action, mais on espère que de futurs investissements dans le domaine des ordinateurs et des communica-

compiling, consolidating and abstracting this incredible collection. A full bibliography of the references and annotations is now available at

http://chebucto.ns.ca/~drigby/eli3.htm

and will soon be hot-linked directly to the AfESG Web site.

The current status of MIKE and ETIS

In April 2000, the Eleventh Meeting of the Conference of the Parties to CITES formally adopted the two new monitoring systems, MIKE and ETIS. At present, an initial pilot phase of MIKE is still under way in Central Africa, the southern African countries are up and running, and plans for initiating the implementation in West Africa and eastern Africa are under way. At COP11, the CITES Secretariat was mandated to form a technical advisory body for MIKE based on nominations from party members. Several months later, the MIKE Technical Advisory Group (TAG) was formed to address COP-approved terms of reference for providing technical oversight to developing and implementing MIKE in Africa and Asia. The TAG comprises 10 persons, half of whom are current members of AfESG—Dr Richard Barnes, Dr Iain Douglas-Hamilton, Mr Moses Kofi, Dr Martin Tchamba and me.

TRAFFIC (Trade Records Analysis of Flora and Fauna in Commerce), the overseers of ETIS, are currently in the process of developing a two-day training workshop kit containing a variety of modules and interactive exercises that will further implement the system. They are hoping to obtain funding to conduct these training workshops in 20 to 30 key countries before COP12.

Product development for mitigating human–elephant conflict

The Human–Elephant Conflict Taskforce (HECTF) has recently secured funds from WWF International for developing a simple decision-support system for managers of conflict situations. It has also been actively disseminating its newly developed tools (the standardized data-collection protocol and accompanying training manuals) to sites across the continent. Thanks to the generous support of the French Committee of IUCN, the protocol and manual are being translated into French. If the process goes

tions électroniques dans toute l'Afrique rendront le site Internet plus accessible et donc plus intéressant pour tous nos membres dans les années qui viennent.

J'ai aussi le plaisir d'annoncer qu'en septembre 2000, le Sécrétariat du GSEAf a fait l'acquisition d'un ensemble complet de plus de 3500 documents (contenus dans quatre caissons de quatre tiroirs chacun) comprenant l'African Elephant Library (AEL), connue précédemment sous le nom de LAEBRA. L'AEL est le fruit de l'invention d'un membre du GSEAf, le Dr. Iain Douglas-Hamilton, qui est actuellement le Président de sa propre ONG, Save the Elephants. Le Dr. Douglas-Hamilton est le gardien du second ensemble complet de documents de l'AEL, qui est basé sur sa propre collection privée de littérature, publiée ou non, sur l'éléphant africain. Au nom du GSEAf et au mien, j'aimerais reconnaître les efforts personnels extraordinaires et le professionnalisme de Melle Mary Rigby qui a compilé, complété et résumé cette incroyable collection. On peut désormais trouver une bibliographie complète des références et des annotations sur

http://chebucto.ns.ca/~drigby/eli3.htm

qui sera bientôt directement relié au site Internet du GSEAf.

Le statut actuel de MIKE et d'ETIS

En avril 2000, la onzième Réunion de la Conférence des Parties à la CITES a officiellement accepté les deux nouveaux systèmes de surveillance, MIKE et ETIS. Aujourd'hui, une première phase pilote de MIKE est encore en cours en Afrique centrale, les pays d'Afrique australe sont en pleine activité, et les plans pour commencer la réalisation en Afrique de l'Ouest et de l'Est sont entamés. À la onzième Conférence des Parties, le Secrétariat de la CITES s'est vu chargé de former un organe de conseil technique pour MIKE basé sur la nomination de membres des Parties. Quelques mois plus tard, le Groupe de Conseil Technique (GCT) de MIKE était formé pour rencontrer les termes de références approuvés par la Conférence des Parties afin d'apporter une supervision technique à la mise au point et à la réalisation de MIKE en Afrique et en Asie. Le GCT comprend 10 personnes dont la moitié sont des membres du GSEAf – le Dr. Richard Barnes, le Dr. Iain Douglas-Hamilton, Mr. Mose Kofi, le Dr. Martin Tchamba et moi-même.

according to plan, the protocol should be available on the AfESG Web site, in both French and English, within the next six months. We are hoping that active feedback will allow us to modify and improve the material along the way. Early in 2001, HECTF will also begin moving another initiative—developing a companion tool to accompany the standard data-collection protocols. This will be GIS base maps for key sites of human–elephant conflict currently under investigation. HECTF has also recently completed a brief first-draft technical review of 'Compensation schemes for agricultural and other damage caused by elephants'. This document, which was requested by a number of government partners, should provide a solid basis for further policy debate on the issue. The AfESG's technical expertise on the subject of HEC continues to grow, as does the demand for our services.

Pachyderm

You will notice that with this 29th issue of *Pachyderm,* we welcome a new editor, Ms Helen van Houten. Although I had sincerely hoped to be able 'to hand off the baton' on *Pachyderm,* that has not yet been possible. So for the coming year, *Pachyderm* will remain based in the AfESG Secretariat. Helen is a real veteran of science editing and brings with her not only a wealth of technical ability but also a long-standing familiarity with the ins and outs of producing and publishing on the Nairobi scene.

The African Elephant Database

I am happy to report that we have finally been successful in securing funds for at least a couple of years for the next update of the African Elephant Database. At the time of writing, the recruitment for the new AED manager is under way, and I am hoping to finalize the appointment within the first quarter of 2001.

The situation at the Secretariat

It is my ardent hope that by the time this issue is back from the printer we will be on the eve of having a full-time AfESG Programme Officer in Nairobi once again. This past year has been difficult, and we have all done the best we could—but the appointment of a

TRAFFIC (Trade Records Analysis of Flora and Fauna in Commerce), superviseur d'ETIS, est actuellement occupé à la mise au point d'un kit pour un atelier de deux jours, contenant toute une variété de modules et d'exercices interactifs qui vont venir compléter le système. Il espère obtenir des fonds pour mener ces ateliers de formation dans 20 à 30 pays clés avant la douzième Conférence des Parties.

Développement d'un produit destiné à atténuer les conflits hommes–éléphants

Le Groupe de Travail chargé des Conflits Hommes-Eléphants (GTCHE) a récemment reçu la garantie d'un financement du WWF International pour mettre au point un système simple de support de décision apporté aux gestionnaires dans des situations conflictuelles. Il a aussi distribué activement ses nouveaux outils (le protocole standardisé de récolte des données et les manuels de formation qui l'accompagnent) à divers sites du continent. Grâce au généreux support du Comité français de l'UICN, le protocole et le manuel sont traduits en français. Si le processus se déroule comme prévu, le protocole devrait être accessible sur le site Internet du GSEAf, en français et en anglais, dans les six mois. Nous espérons qu'un feedback dynamique nous permettra de modifier et d'améliorer le matériel progressivement. Au début de 2001, le GTCHE va aussi mettre en action une autre initiative – mettre au point un outil pour accompagner les protocoles standards de récolte des données. Ce sera les cartes GIS de base pour les sites clés où des conflits hommes-éléphants font pour le moment l'objet d'investigations. Le GTCHE a aussi complété récemment un bref avant-projet de révision technique des « Projets de compensation pour les dommages agricoles et autres causés par les éléphants ». Ce document qui avait été demandé par un certain nombre de gouvernements partenaires devrait fournir une base solide pour les futurs débats de politique sur ce sujet. L'expertise technique du GSEAf dans le domaine des CHE s'accroît sans cesse, comme le fait la demande pour nos services.

Pachyderm

Vous aurez remarqué que pour ce 29ème numéro de *Pachyderm,* nous accueillons une nouvelle éditrice,

new person in this position will be a welcome relief. In anticipation, we are carefully compiling the pending work of many months and hope to welcome the new Programme Officer on 1 January 2001.

There has been progress, despite our being hampered by the office move and the subsequent difficulties with electronic communications. Basing in Nairobi certainly has its benefits, but the current rationing of power and water has had its impact on efficiency. The move to new offices is behind us, but many challenges are still before us, particularly in obtaining reliable and stable communications. Having said this, however, we should not complain because we know that many of you have many bigger problems than we do here in Nairobi. Let us all try, within the means available to us, to be in better and more regular touch with one another on topics relating to the conservation and management of the African elephant.

Melle Helen van Houten. J'avais sincèrement espéré pouvoir transmettre le relais de *Pachyderm*, mais cela n'est pas encore possible. Donc, pour l'année qui vient, *Pachyderm* restera basé au Secrétariat du GSEAf. Helen est un authentique vétéran de l'édition scientifique et elle apporte non seulement de riches compétences techniques mais aussi une familiarité bien rodée des « in » et des « out » de la production et de la publication à Nairobi.

La Banque de Données pour l'Eléphant d'Afrique

Je suis heureuse de pouvoir annoncer que nous avons enfin réussi à nous assurer, pour au moins deux ans, le financement de la prochaine mise à jour de la Banque de Données pour l'Eléphant d'Afrique. Au moment où j'écris, le recrutement du nouveau gestionnaire de la BDEA est en cours, et j'espère pouvoir finaliser l'engagement au premier trimestre 2001.

La situation au Secrétariat

J'espère ardemment que lorsque ce numéro sortira de presse, nous serons sur le point d'avoir de nouveau un Responsable de Programme pour le GSEAf à temps plein à Nairobi. L'année passée a été difficile – et nous avons tous fait de notre mieux – mais la nomination de quelqu'un à ce poste sera un véritable soulagement. En l'attendant, nous rassemblons soigneusement tout le travail resté en suspens pendant des mois et nous espérons accueillir le nouveau Responsable le 1er janvier 2001.

Il y a eu des progrès malgré les perturbations dues au déménagement du bureau et les difficultés que cela a entraîné pour les communications électroniques. Être basé à Nairobi comporte certes des avantages, mais les rationnements actuels d'eau et d'électricité ont un impact sur notre efficacité. Le déménagement vers les nouveaux bureaux est terminé mais de nombreux défis subsistent, particulièrement pour obtenir des communications stables et fiables. Ceci dit, nous ne devrions pourtant pas nous plaindre parce que nous savons que beaucoup d'entre vous connaissent des problèmes bien plus importants que ceux de Nairobi. Essayons tous, avec les moyens dont nous disposons, d'établir des contacts meilleurs et plus réguliers entre nous sur des sujets liés à la conservation et à la gestion de l'éléphant d'Afrique.

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

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The 2000 AfRSG meeting

The African Rhino Specialist Group's mission is to promote the growth of viable populations of the various subspecies of African rhinos in the wild. The body, at least every second year, seeks to compile and synthesize information on the status and conservation of Africa's rhinos across their range, provide and improve technical information and advice on the conservation of African rhinos, promote and catalyse conservation activities on behalf of African rhinos, and build capacity through the exchange of ideas, information and technical expertise among its membership.

One activity that contributes towards achieving all the above objectives is to hold well-planned and focused AfRSG meetings, if possible, every two years. Apart from encouraging information exchange between range states and members, and addressing a number of identified issues in working groups, AfRSG meetings help us compile updated rhino numbers.

I am pleased to report that the 2000 AfRSG meeting was successfully held at Lake Manyara, Tanzania, from 27 May to 1 June, with 41 delegates attending some or all of the sessions.

As the AfRSG Chair, I introduced and welcomed the members to the year 2000 AfRSG meeting. Mr Emmanuel Severre, the director of the Tanzanian Wildlife Division, officially opened the meeting. The members spent a good portion of the first day presenting individual country reports, concluding the day with updates of the status of Asian rhinos and of African rhinos in captivity. The Group Secretariat has compiled the latest continental statistics from data supplied at the meeting. These figures place the current population of the white rhino in the wild at approximately 10,400 and that of the black rhino at 2700. Therefore, African rhino numbers have exceeded 13,000 for the first time since the mid-1980s. IUCN and WWF jointly issued a press release to publicize this news. For further details on rhino

La réunion 2000 du GSRAf

La mission du GSRAf consiste à encourager la croissance des populations viables des diverses sous-espèces de rhinos africains dans la nature. Le Groupe essaie de rassembler et de synthétiser, au moins tous les deux ans, les informations sur le statut et la conservation des rhinos africains sur toute l'étendue de leur aire de répartition, de fournir et d'améliorer les informations et les conseils techniques concernant la conservation des rhinos africains, de promouvoir et de catalyser les activités de conservation en faveur des rhinos africains et de créer de vrais moyens par des échanges d'idées, d'informations et d'expertise technique entre ses membres.

Une des activités qui contribuent à la réalisation des objectifs ci-dessus est de tenir des réunions GSRAf bien programmées et centrées, là où c'est possible, tous les deux ans. Non seulement ces réunions suscitent les échanges d'informations entre les états de l'aire de répartition et les membres et elles abordent dans les groupes de travail un certain nombre de problèmes identifiés, mais elles nous aident à rassembler les derniers chiffres concernant les rhinos.

Je suis heureux de vous dire que la réunion 2000 du GSRAf s'est très bien passée, au Lac Manyara, en Tanzanie, du 17 mai au 1er juin, et que 41 délégués ont assisté à certaines, voire à toutes les sessions.

En tant que Président du GSRAf, j'ai présenté et accueilli les membres à la réunion 2000 du GSRAf. C'est Mr Emmanuel Severre, Directeur de la Tanzanian Wildlife Division, qui a ouvert officiellement la réunion. Les membres ont passé une grande partie de la première journée à présenter les rapports nationaux individuels, en concluant par des remises à jour du statut des rhinos asiatiques et africains en captivité. Le secrétariat du GSRAf a compilé les dernières statistiques à l'échelle du continent à partir des données fournies lors de la réunion. Ces chiffres placent les populations actuelles de rhinos blancs en liberté aux environs de 10.400, et

numbers and trends, see the report by the scientific officer in this issue in the section 'Notes from the African Rhino Specialist Group'.

Presentations at the meeting included discussions on TRAFFIC's rhino horn trade program, rhino horn in Yemen, the CITES indicators process, sustainable-use options for surplus black rhinos, and a plenary discussion on consumptive use of rhino products. Presentations on techniques and rhino ecology included the use of ultrasonography as a tool for wild rhino management, a detailed presentation on the WWF-funded AfRSG horn fingerprinting project, an update on the determinants of black rhino carrying capacities and productivity, a population case history, and a paper on black rhino diet selection. Members were also briefed on the new SADC rhino program being funded by the Italian government and the work of WWF's Africa Rhino Program, the US Fish and Wildlife's Rhino and Tiger Conservation Fund, the International Rhino Foundation and the Frankfurt Zoological Society.

The working group assigned the critical area of conserving the surviving western black rhinos *(Diceros bicornis longipes)* in Cameroon discussed and evaluated strategic options. The group developed proposals for a high-level technical mission to Cameroon and determined the background documentation needed for such a mission. Other working groups discussed the following:

- a cooperative funding strategy for AfRSG
- effects of immobilization on rhino fertility
- existing knowledge and future research needs
- indicators for assessing rhino population performance
- the impact of community conservation initiatives, determined by examining case studies

A formal closed meeting restricted to AfRSG members was also held.

Delegates visited Ngorongoro Crater where a senior staff member from the Ngorongoro Crater Conservation Authority showed them around. They saw eight of the black rhinos in the crater and learned of several aspects of the local rhino program, especially security and monitoring. The visit included an examination of the bomas that had been used to introduce new blood from Addo.

Outside the formal sessions, delegates had a chance to network and discuss problems—which is always one of the main benefits of AfRSG meetings. One

celles de rhinos noirs à 2.700. C'est ainsi que le nombre de rhinos africains a dépassé les 13.000 pour la première fois depuis le milieu des années 1980. L'UICN et le WWF ont fait paraître un communiqué de presse commun pour annoncer la nouvelle. Si vous désirez plus de détails sur le nombre de rhinos et les tendances actuelles, consultez le rapport du responsable scientifique dans les Notes de la section GSRAf de ce numéro.

Lors de la réunion, il y eut des présentations qui discutaient du programme de TRAFFIC concernant le commerce de corne de rhino, au sujet aussi de la corne de rhino au Yémen, du processus d'indicateurs de la CITES, des options en matière d'utilisation soutenable pour les rhinos noirs en surplus ; il y eut aussi une discussion plénière sur la consommation des produits issus des rhinos. Les présentations sur les techniques et sur l'écologie des rhinos parlaient de l'utilisation de l'ultrasonographie comme moyen de gestion des rhinos sauvages, présentaient en détail le projet d'« empreinte digitale » (empreinte génétique) du GSRAf financé par le WWF, incluaient une mise à jour des éléments déterminants en matière de charge pastorale et de productivité des rhinos noirs, le cas exemplaire d'une population et un article sur la sélection alimentaire du rhino noir. On a aussi informé les membres du nouveau programme SADC pour les rhinos, financé par le Gouvernement italien et du travail du Programme WWF pour le rhino africain, du US Fish and Wildlife's Rhino and Tiger Conservation Fund, de l'International Rhino Foundation et de la Société Zoologique de Francfort.

Le groupe de travail réuni pour discuter la question critique de la conservation des derniers rhinos noirs de l'ouest (*Diceros bicornis longipes*) au Cameroun a envisagé et évalué les options stratégiques. Le groupe a mis au point des propositions de missions techniques de haut niveau au Cameroun et a déterminé la documentation existante nécessaire à une telle mission. D'autres groupes de travail ont discuté les points suivants :

- Une stratégie de financement coopératif pour le GSRAf
- Les effets de l'immobilisation sur la fertilité des rhinos
- Les connaissances actuelles et les recherches nécessaires à l'avenir
- Les indicateurs qui permettent d'évaluer les performances des populations de rhinos

evening, delegates also watched the new video that AfRSG had produced as part of its revised rhino identification course for field rangers. An impromptu workshop was also held to discuss and modify a Kenyan project proposal that had been submitted for funding to the Rhino and Tiger Conservation Fund of the US Fish and Wildlife Service.

Cameroon

The Cameroon authorities have agreed to hold talks with a high-level mission led by AfRSG, scheduled for November in Cameroon. The hope is that this will result in a conservation strategy being adopted and an implementation plan being developed that will list responsibilities and a timetable of events.

The African Rhino Specialist Group, the French Committee for IUCN–Species Survival Commission and WWF have prepared a joint background document for the mission. The document discusses possible conservation options and further examines the biological, security and cost implications of the four main options. For more information, see the section 'Notes from the African Rhino Specialist Group' in this issue. I will report in more detail on the outcome of this critically important mission in the next issue of *Pachyderm*.

Kenya stakeholders workshop

Besides planning for the high-level technical assistance mission to Cameroon, AfSRG members participated in a WWF-funded stakeholders workshop run by the Kenya Wildlife Service. The main objective of this important workshop was to revise the outdated Kenyan National Rhino Plan. The workshop was held at the Kenya Wildlife Service training centre at Lake Naivasha from 11 to 14 September 2000. Delegates were predominantly local stakeholders. The KWS rhino reserves, Masai Mara and private sanctuaries were well represented. The scientific officer of AfSRG gave a keynote address at the beginning of the workshop. Six AfRSG members participated in the discussions and workshop sessions. Delegates worked long into the evenings, and at the end of the meeting they produced a draft revised Kenyan rhino plan. A final version will be produced before the strategy is submitted for approval and ratification. The revised plan emphasizes efforts made to improve biological

- L'impact des initiatives en matière de conservation, déterminé par l'examen de cas exemplaires.

Il y eut aussi une réunion officielle à huis clos réservée aux membres du GSRAf.

Les délégués ont visité le cratère du Ngorongoro où un membre senior du personnel de la Ngorongoro Crater Conservation Authority les a guidés. Ils ont pu voir huit rhinos noirs dans le cratère et ont été informés de divers aspects du programme local pour les rhinos, particulièrement la sécurité et la surveillance. La visite comprenait l'examen des *bomas* qui avaient servi pour l'introduction de sang neuf venu d'Addo.

En dehors des sessions formelles, les délégués ont eu la chance de se rencontrer et de discuter de leurs problèmes – ce qui est toujours très intéressant lors des réunions du GSRAf. Un soir, ils ont regardé la nouvelle vidéo que le GSRAf a produite dans le cadre de la révision du cours d'identification des rhinos pour les gardes de terrain. Il y eut aussi un atelier impromptu pour discuter et modifier un projet de proposition kenyan qui avait été soumis pour un financement auprès du Fonds de Conservation du Rhino et du Tigre du US Fish and Wildlife Service.

Cameroun

Les autorités camerounaises ont accepté de discuter avec une mission de haut niveau conduite par le GSRAf, prévue pour novembre, au Cameroun. Nous espérons qu'elle aboutira à l'adoption d'une stratégie de conservation et par la mise au point d'un plan de réalisation qui dressera la liste des diverses responsabilités et un calendrier d'application.

Le Groupe des Spécialistes des Rhinos Africains, le comité français de la Commission de Survie des Espèces de l'UICN et le WWF ont préparé un document préparatoire pour la mission. Le document discute différentes options de conservation possibles et examine les implications biologiques, mais aussi celles en matière de sécurité et de coût, des quatre options principales. Pour de plus amples informations, voyez les Notes de la section du GSRAf dans ce numéro. Je donnerai plus de détails sur les résultats de cette mission extrêmement importante dans le prochain numéro de *Pachyderm*.

management and to increase the overall national metapopulation growth rates.

Action plan now on line

I am pleased to report that the recently published IUCN AfRSG African Rhino Action Plan is now available and can be downloaded from the Web at the AfRSG page hosted on the International Rhino Foundation's Web site:

http://www.rhinos-irf.org/specialists/AfRSG

Notes from the African Rhino Specialist Group

This issue of *Pachyderm* sees the introduction of 'Notes from the African Rhino Specialist Group'. Members felt that it was more appropriate to include these notes in *Pachyderm* than to produce a separate AfRSG newsletter. Topics covered here include:

- possible options for conserving the last western black rhinos in Cameroon
- current initiatives in the SADC regional program for rhino conservation
- information on the latest numbers and population trends of rhinos in Africa
- progress with AfRSG's project on rhino-horn fingerprinting for security
- AfRSG's revised rhino identification training course for field rangers
- rhino developments at CITES

I encourage all members, and particularly the official country representatives, to submit short notes for inclusion in future editions of *Pachyderm*.

Acknowledgements

I would like to acknowledge the valuable support AfRSG has received from WWF, which supports the Chair's running costs and partially supports the Scientific Officer. It has sponsored the year 2000 AfRSG meeting in Tanzania and is funding AfRSG's project on horn fingerprinting for security. I also thank the US Fish and Wildlife Service's Rhino and Tiger Conservation Fund for its role as the main sponsor of the revision of the rhino identification training course. Finally, I am grateful to the International Rhino Foundation's Dave Clawson for putting the new African Rhino Action Plan on line and for maintaining the AfRSG Web page.

Atelier des partenaires au Kenya

Tout en préparant la mission d'assistance technique de haut niveau au Cameroun, les membres du GSRAf ont participé à un atelier des partenaires financé par le WWF et conduit par le Kenya Wildlife Service. Le principal objectif de cet important atelier était de réviser le Plan National kenyan pour les Rhinos qui était dépassé. L'atelier s'est passé au centre de formation du Kenya Wildlife Service au lac Naivasha, du 11 au 14 septembre 2000. Les délégués étaient principalement des partenaires locaux. Les réserves de rhinos du KWS, Masai Mara et les sanctuaires privés étaient bien représentés. C'est le responsable scientifique du GSRAf qui a présenté le programme au commencement de l'atelier. Six membres du GSRAf ont participé aux discussions et aux sessions de l'atelier. Les délégués ont travaillé très tard et à la fin de la réunion, ils ont fourni un projet de plan kenyan révisé pour les rhinos. Le plan révisé insiste sur les efforts réalisés pour améliorer la gestion biologique et pour augmenter le taux de croissance de toute la métapopulation nationale.

Le plan d'action est maintenant « on line »

Je suis heureux de signaler que le Plan d'action UICN-GSRAf pour les rhinos africains récemment publié est maintenant disponible et qu'il est accessible sur Internet à la page African Rhino Specialist Group, sur le site de l'International Rhino Foundation

http://www.rhinos-irf.org/specialists/AfRSG

Notes du GSRAf

Ce numéro de *Pachyderm* inaugure l'introduction de notes du GSRAf. Les membres trouvaient qu'il était plus approprié d'inclure ces notes dans *Pachyderm* que de faire paraître un bulletin séparé pour le GSRAf. Les sujets couverts ici incluent :

- Les informations sur les derniers chiffres et les tendances des populations de rhinos en Afrique
- Les options possibles pour conserver les derniers rhinos noirs de l'ouest au Cameroun
- Le cours révisé destiné par le GSRAf à former les gardes de terrain à l'identification des rhinos
- Les progrès concernant les « empreintes digitales » des cornes de rhinos pour le projet touchant la sécurité

- Les initiatives actuelles du programme régional du SADC pour la conservation du rhino
- Les développements rhino à la CITES

J'encourage tous les membres, et particulièrement les représentants officiels de chaque pays, à nous proposer des notes à inclure dans les prochaines éditions de *Pachyderm*.

Remerciements

Je voudrais remercier pour toute l'aide que le GSRAf a reçue du WWF, qui supporte les frais de fonctionnement du Président et en partie, ceux du Responsable Scientifique. Il a sponsorisé la réunion 2000 du GSRAf en Tanzanie et finance le projet du GSRAf d'« empreintes digitales » à des fins de sécurité. Je remercie aussi le Fonds de Conservation du Rhino et du Tigre du US Fish and Wildlife Service pour le rôle qu'il a pris comme sponsor principal de la révision du cours de formation à l'identification des rhinos. Ma reconnaissance va aussi, enfin, vers Dave Clawson, de l'International Rhino Foundation, qui a mis le nouveau Plan d'Action pour le Rhino Africain « on line » et qui s'occupe de la page Internet du GSRAf.

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

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

The Chair, Mohd Khan, and Deputy Chair, S.C. Dey, attended the 2000 Species Survival Commission meeting in Amman, Jordan. Significant developments to report for the various Asian rhino species follow:

Dicerorhinus sumatrensis (Sumatran rhino)

The Rhino Protection Units (RPUs) continue to operate in all areas where the species is known to survive in Indonesia and Peninsula Malaysia. Recruitment of additional resources is making it possible to increase the number of RPUs in some areas. In Way Kambas, Indonesia, the number will increase from four to five; in Peninsula Malaysia, two more RPUs are being added for the buffer area outside Taman Negara National Park to interdict poachers

Le Président, Mohd Khan, et le vice-Président, S.C. Dey, ont assisté à la réunion 2000 de la Commission pour la Survie des Espèces qui s'est tenue à Amman, en Jordanie. Les développements significatifs que l'on peut rapporter pour les diverses espèces de rhinos asiatiques comprennent:

Dicerorhinus sumatrensis (Rhinocéros de Sumatra)

Les Unités de Protection des Rhinos (UPR) continuent à travailler dans toutes les régions d'Indonésie et de la Péninsule Malaise où l'on sait que l'espèce survit. L'engagement de ressources supplémentaires fait qu'il est possible d'augmenter le nombre d'UPR dans certaines régions. À Way Kambas, en Indonésie, leur nombre passera de quatre à cinq. Sur la Péninsule

before they can even enter the park. The Indonesia Rhino Conservation Program, which manages the RPUs, is also conducting a training course for the anti-poaching teams that operate in Gunung Leuser as part of the Leuser Development Project, supported by the European Union. Funds for the RPUs in Indonesia outside Gunung Leuser continue to be provided mainly by a consortium of donors: the International Rhino Foundation, WWF-IP (through donations from other WWF national organizations including WWF-US, WWF-UK, WWF-Switzerland), the Rhino and Tiger Conservation Fund of the US Fish and Wildlife Service, the Anna Merz Trust, and the AAZK (American Association of Zoo Keepers) Bowling for Rhinos Programs. Funds for the Gunung Leuser RPUs are provided by the European Union. Funds for the RPUs in Peninsula Malaysia are provided by the International Rhino Foundation and the Rhino and Tiger Conservation Fund.

RPU activity in Sabah appears about to intensify through combined efforts of the Sabah Wildlife Department, WWF-Malaysia, SOS-Rhino, the International Rhino Foundation, and AsRSG.

The managed breeding program is progressing significantly. The female at the Cincinnati Zoo seems to be sustaining her pregnancy this time, her sixth, perhaps because of the progesterone supplementation she is receiving. This treatment was recommended by the March 2000 workshop, as discussed in *Pachyderm* in the last Chair report. The pregnancy is now at 200+ days, over twice as long as before and over one-third of the way through the gestation period.

Elsewhere, in Peninsula Malaysia, three females have recently copulated at the Sumatran Rhino Conservation Centre–Sungai Dusun. The centre is managing to introduce males and females through a combination of methods developed at the Cincinnati Zoo and blood hormone analyses. Mr Steve Romo, the head rhino keeper at the Cincinnati Zoo, has been at Sungai Dusun for the last six months assisting with these efforts.

More intensive reproductive monitoring of the rhino in Way Kambas Sumatran Rhino Sanctuary-managed breeding centre in Indonesia will commence in November. The monitoring will include ultrasonic examinations. An expanded program will also commence at the Sepilok Rhino Breeding Centre in Sabah in November, with assistance provided by SOS Rhino. All these activities and developments are also

Malaise, on est en train d'ajouter deux UPR destinées à la zone tampon située en dehors du Parc National de Taman Negara, pour arrêter les braconniers avant même qu'ils pénètrent dans le parc. Le Programme de Conservation des Rhinos d'Asie, qui gère les UPR, organise aussi un cours de formation pour les équipes anti-braconnage qui travaillent à Gunung Leuser, dans le cadre du Projet de Développement de Gunung Leuser, supporté par l'Union Européenne. À part Gunung Leuser, le financement des UPR en Indonésie continue de venir principalement d'un consortium de donateurs : l'International Rhino Foundation, WWF-IP (par l'intermédiaire de donations en provenance d'autres WWF nationaux, y compris le WWF-US, le WWF-UK et le WWF-Suisse), le Rhino and Tiger Conservation Fund du US Fish and Wildlife Service, le Anna Merz Trust, les Programmes Bowling for Rhinos de la AAZK (Association Américaine des Gardiens de Zoos). Le financement des UPR de Gunung Leuser est assuré par l'Union Européenne. Le financement de UPR de la Péninsule Malaise provient de l'International Rhino Foundation et du Rhino and Tiger Conservation Fund.

L'activité des UPR à Sabah semble devoir bientôt s'intensifier grâce aux efforts conjoints du Sabah Wildlife Department, du WWF-Malaisie, de SOS-Rhino, de l'International Rhino Foundation et du GSRAs.

Le programme de reproduction assistée évolue significativement. La femelle du zoo de Cincinnati semble cette fois poursuivre sa gestation, la sixième, peut-être grâce au supplément de progestérone qui lui est administré. Ce traitement avait été recommandé lors du séminaire de mars 2000, comme le montre la discussion dans *Pachyderm*, dans le dernier rapport du Président. La gestation en est maintenant au septième mois, ce qui est plus de deux fois plus long qu'avant et presque la moitié du temps de gestation normal.

Ailleurs, sur la Péninsule Malaise, trois femelles se sont récemment accouplées au Centre de Conservation du Rhino de Sumatra, à Sungai-Dusun. Ce centre permet aux mâles et aux femelles de se rencontrer par une combinaison de méthodes mises au point au zoo de Cincinnati et d'analyses des hormones dans le sang. Mr Steve Romo, le gardien-chef des rhinos au zoo de Cincinnati, est à Sungai-Dusun depuis plus de six mois pour prendre part à ces efforts.

an outcome of the recommendations of the March 2000 workshop.

The Malaysian Rhino Foundation, a private NGO, is being established to facilitate and coordinate recruitment and administration of additional funds for rhino conservation in Malaysia. AsRSG Chair Mohd Khan is the prime mover of this effort.

Rhinoceros sondaicus (Javan or Vietnamese rhino)

AsRSG Program Officer Nico van Strien recently conducted a technical assistance mission to Vietnam to help update and implement the action plan for the species in that country. The mission was supported by the Rhino and Tiger Conservation Fund of the US Fish and Wildlife Service.

Rhinoceros unicornis (Indian or Nepalese rhino)

AsRSG continues to encourage and facilitate efforts to develop cooperative programs between ex situ and in situ conservation communities for conservation of these species.

Another issue of *Asian Rhinos* will be published by the end of 2000.

En novembre commençait un contrôle plus intensif de la reproduction des rhinos au centre de reproduction indonésien de Way Kambas géré par le Sanctuaire pour les Rhinos de Sumatra (SRS). Le contrôle comprendra des examens par ultrasons. En novembre débutait aussi un programme élargi au Centre de Reproduction des Rhinos de Sepilok, à Sabah, avec l'aide de SOS Rhino. Toutes ces activités et ces extensions sont un des résultats des recommandations du séminaire de mars 2000.

La Malaysian Rhino Foundation, une ONG privée, est en train de se créer afin de faciliter et de coordonner les recrutements et l'administration de fonds supplémentaires pour la conservation des rhinos en Malaisie. Mohd Khan, le Président du GSRAs, est à la tête de cet effort.

Rhinoceros sondaicus (Rhinocéros de Java ou du Vietnam)

Nico van Strien, Responsable de Programme du GSRAs, a fait récemment une mission d'assistance technique au Vietnam pour aider à la mise à jour et à l'application du plan d'action pour cette espèce, dans ce pays. La mission était financée par le Fonds de Conservation du Rhino et du Tigre du US Fish and Wildlife Service.

Rhinoceros unicornis (Rhinocéros d'Inde ou du Népal)

Le GSRAs continue à encourager et à faciliter les efforts en vue de mettre au point des programmes de coopération entre les communautés de conservation *ex situ* et *in situ*, pour la conservation de cette espèce.

Un autre numéro de *Asian Rhinos* sera publié à la fin de l'année 2000.

HERD BULL

I have tiptoed in the dust of your ways.
I have read the footprints of your fate in the dust.
A memory old and wise hidden deep within your eyes.

So light your touch
Yet the trees bow to you
Sunken eyes letting fall a tear
But the secret is there.
What is your secret of survival?

You are the Lord of Strength
You are the Lord of Courage
We salute your wisdom.

I have drunk at wells you've made
In the dry of the river sand
And thought on and on
At the wonders of a man
Who has marshalled the herd to turn.
What is your secret of survival?

You are the Lord of Strength
You are the Lord of Courage
We salute your wisdom.

—Nicholas Ellenbogen
October 2000, Amman

for Professor Marshall Murphree, in recognition of the many contributions he has made to the cause of conserving Africa's natural resources.

RESEARCH

Changes in elephant demography, reproduction and group structure in Tsavo East National Park (1966–1994)

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Abstract

A study of 557 individually recognized African elephants *(Loxodonta africana)* in Tsavo East National Park, Kenya, aimed to determine demography, reproductive status and group dynamics and to relate them to poaching, the environment and past research findings. More than half of the population number sampled in 1994 was > 20 years old. The age classes ≤ 20 years were skewed in favour of males while females dominated the > 21-year age classes with few males > 35 years old. No known female younger than 15 years was accompanied by a newborn, and the average intercalf interval was 5 years. Males in musth were observed year-round. Mean group size was large, with aggregations of over 50 individuals sighted during the dry season when resources were limited. Almost half of the female groups surveyed were missing an older matriarch or contained calves and juveniles that were not the offspring of the females present. The skewed sex structure, increase in group size and fragmented family groups were attributed to the disruptions that poaching had caused. The recovery of the elephant social structure and calf survival will depend on there being no poaching in the future.

Résumé

Une étude de 557 éléphants d'Afrique (*Loxodonta africana*) connus individuellement a été menée au Parc National de Tsavo Est, au Kenya, afin de déterminer leur démographie, le statut de leur reproduction et la dynamique des groupes et de les relier au braconnage, à l'environnement et aux recherches antérieures. Plus de la moitié de la population étudiée en 1994 avait moins de vingt ans. Les classes d'âge < ou = à 20 ans comprenaient plus de mâles alors que les femelles dominaient les classes d'âge > à 20 ans, où peu de mâles avaient plus de 35 ans. On n'a vu aucune femelle connue de moins de 15 ans suitée d'un nouveau-né, et l'intervalle entre deux mises-bas était de 5 ans. On a pu observer des mâles en rut tout au long de l'année. La taille moyenne des groupes était importante, avec des rassemblements de plus de 50 individus observés en saison sèche, lorsque les ressources étaient limitées. Près de la moitié des groupes de femelles étudiés ne possédaient pas de matriarche plus âgée, ou comprenaient des petits et des juvéniles qui n'étaient pas la progéniture des femelles présentes. On a attribué les déséquilibres de sex-ratio, l'augmentation de la taille des groupes et la fragmentation des groupes familiaux aux perturbations occasionnées par le braconnage. Le rétablissement de la structure sociale des éléphants et la survie des petits dépendront de l'existence ou non de braconnage dans le futur.

Introduction

The Tsavo elephant population within the vast Tsavo ecosystem (40,000 km^2) has suffered from environmental pressures of a severe drought in the 1970s and subsequent intense pressures of poaching during the 1980s.

The 1970–71 drought led to the deaths of over 5000 elephants, primarily reproductive females and young individuals (Corfield 1973). During this time poachers took advantage of these deaths to collect the tusks. As the number of deaths from the drought decreased, poachers began shooting the remaining elephants. Between 1976 and 1989 the Tsavo elephant population was reduced by almost 80%, from approximately 28,000 in 1969 to about 5000 in 1988 (Douglas-Hamilton *et al.* unpubl.). In 1994, an aerial count estimated the population at about 7000 individuals. Whether this reflected an actual increase or increased accuracy in survey techniques is difficult to ascertain.

The first study in Tsavo of elephant population dynamics was in 1966; it was of culled animals, before the drought and before large-scale poaching (Laws 1966, 1969). In 1972 and 1974, following the drought and again before intense poaching, data were collected on age structure and group dynamics (Leuthold 1976a, b). During the poaching era of the 1980s, aerial surveys were conducted to determine age structure (Ottichilo 1986). In 1989 a four-day road survey was conducted to determine the effects poaching had had on the elephant population (Poole unpubl., Poole and Thomsen 1989). Although the research techniques between these elephant studies varied (table 1), they offer an overview of the changes in the Tsavo elephant dynamics so that visual comparisons can be made. The Amboseli data from south-western Kenya represent an undisturbed population for comparative purposes (Lee and Moss 1986, Moss 1988, Poole unpubl., Poole and Thomsen 1989).

This study presents new baseline data for 1989 to 1994, following the drought and the end of intense poaching and after a prolonged absence of research on the Tsavo elephant population of both individuals and groups. These population categories will be used for future studies in Tsavo to monitor trends and to provide comparisons for other elephant populations.

Study area

The study area (4200 km^2) was in the semi-arid Tsavo East National Park, Kenya, south of the Galana River. Rainfall is variable and inconsistent with an annual average of 270–740 mm between March–April and November–December. The vegetation has changed considerably over the past 30 years. During the 1960s and 1970s, the woodlands were dominated by *Commiphora* spp. and *Acacia* spp. but were altered to open grassland by the influence of fire and large numbers of elephants immigrating into the protected park (Glover 1963, Leuthold 1977). Since that time, the elephant population has decreased substantially and the woody vegetation is beginning to recover (Wijngaarden 1985, Leuthold 1996).

Study animals

A photographic identification file was started in 1989 using standard field techniques, noting ear patterns, tusk shape and physical features or anomalies (Douglas-Hamilton unpubl., Moss 1988). The individually recognized elephants (n = 557; 313 females, 244 males) represented 20.6% of the elephants that could potentially be studied in Tsavo East National Park.

The tusk records from Tsavo East Park headquarters and the Community Wildlife Service between January 1993 and March 1995 were reviewed to record mortality and, where possible, cause of death. Standard techniques regarding the shape and size of tusks were employed to estimate sex and age distribution (Laws 1966, Elder 1970, Corfield 1973, Pilgram and Western 1986).

Field methods

Scan and focal sampling (Altmann 1974) were used at each sighting of one or a group of elephants and during waterhole surveys. The following data were collected: date, time, location, individual identification, group structure and size, age and sex structure of the group, activity, and the percentage of greenness of the vegetation. Identification photographs were also taken. Observations were made from a vehicle on park

Table 1. Summary of the data on Tsavo elephant population dynamics from 1966 to the current study completed in 1994

	Predrought and prepoaching 1966	Postdrought and poaching 1974	Poaching 1989	Postpoaching 1994	Natural population Amboseli 1989
Demography					
% >15 years old	49.5	57.5	43.5	56.4	49.7
% females	53.2		81.7	66.9	59.7
% males	46.8		18.3	33.1	40.3
% tuskless				5.5	3.0
Reproduction					
age at first conception	11.7 years (± 0.9)			11–15 years (33%)	11–15 years (50%)
% females > 11 years old	83.8		95.0	78.8	77.9
% males > 25 years old	15.2		5.0	21.2	22.1
mean calving interval (yr)	6.8			5.0 (± 1.8)	4.6
Group dynamics					
mean group size	8.2	6.79 (± 5.3)	9 median	22.9 (± 15.1)	19 median
mean bull group size	2.43			2.5 (± 0.9)	3 median
range in bull group size	2–14			2–22	2–11
Family structure					
average family size	6.0			7.8 (± 0.4)	12
% of fragmented families			31.2	45.3	6.4
ratio female (> 20 yr) to calves (0–5 yr)	1:1.3		1:1.1	1:0.7	1:1.1
Total population estimate in national park (year)	15 038 (1965)	22 174 (1973)	4327 (1988)	5119 (1991)	708 (1989)
method (*n*)	culled (296)	aerial (368)	road survey (503)	known individuals, road surveys (557)	known individuals (708)

Data for the Amboseli elephants represent a relatively undisturbed and natural elephant population. Predrought, prepoaching 1966 (Laws 1966, 1969), postdrought 1974 (Leuthold 1976a, b), poaching 1989 (Poole 1989), postpoaching 1994 (McKnight 1996) and the natural population—Amboseli (Lee and Moss 1986, Moss 1988, Poole 1989, Poole and Thomsen 1989), Tsavo National Park elephant population estimates (Douglas-Hamilton et al. 1994).

roads. All roads in the study area were covered by vehicle once a month. However, areas where elephants were known to concentrate were visited frequently to monitor known individuals and to add to the photographic identification file.

Determining age

Photographic shoulder height measurements and comparison of relative body size and shape between individuals were used to estimate ages (Douglas-Hamilton unpubl., Lee and Moss 1995, McKnight unpubl.). In addition, footprint-length measurements (Western *et al.* 1983) were taken with a minimum of three clear footprints for each individual. Finally, shoulder height and footprint length measurements were correlated in a linear regression to establish age classes. Age classes were divided into 5-year intervals: newborns (1–3 weeks; McKnight 1992), 0–5, 6–10, 11–15, 16–20, 21–25, 26–30, 31–35, 36–40, 41–45 and > 45 years.

Reproductive status

FEMALE SEXUAL MATURITY

After approximately nine months of pregnancy, female elephants start to develop mammary glands (Moss 1988). Recognized young females were monitored for changes in the development of their mammary glands to determine age of first conception. Three classifications were used to describe the stages of mammary gland development:

- *No swelling*—torso flat, no loose skin (that is, no development past or present), not pregnant or lactating
- *Swollen or full*—distended glands, suggesting pregnancy or lactation
- *Shrunken*—area around mammary glands consisting of loose folds of skin with no swelling (Poole unpubl.)

INTERVAL

The time between the birth date of one calf and the birth of the next for recognized mothers was monitored. Estimation of the ages for successive calves born to the same female was determined by newborn date of birth, date the tusks became visible (2 1/2 years; Laws 1966) and the calf's height relative to that of siblings.

Group dynamics

GROUP COMPOSITION

During road surveys members of a group that were feeding, resting or moving as a coordinated unit were recorded into one of the following group structures.

- *Female group*—one or more adult or subadult females and calves, with no males > 20 years old
- *Mixed group*—a female group with one or more males > 20 years old
- *Bull group*—two or more males within 60 m of each other in the absence of females
- *Lone bull*—a single male elephant, no other elephants in sight

FAMILY STRUCTURE

To decrease the possible biases of known family units, a dry-season waterhole survey was conducted. As a female group of elephants moved from the bush into a clearing towards a waterhole, the sex and estimated age of each individual were recorded. Recognized family units were noted and ear sketches of unknown individuals were made to avoid double counting. Young males older than 10 were not counted, as they tended to move from group to group at the waterhole (group structure modified from Poole unpubl.). Families were categorized as follows.

- *Intact family a) Old:* At least one female in the group was > 30 years old with calves, juveniles and subadult females, all of an age to belong appropriately to the females present; *b) Young:* A group with one or more females that were all ≤ 30 years old, with offspring of the appropriate age to indicate relatedness.
- *Fragmented family:* The calves and juveniles within a female group the same age or too close in age to be the offspring of the females present; for example, young individuals < 2 years apart were considered not to be siblings. Three classes were used. *a) Old:* One or more females > 30 years; *b) Young:* One or more females ≤ 30 years old; *c)* All individuals in the female group ≤ 20 years old.

Results

Shoulder height and footprint-length measurements

Shoulder height (*SH*) and footprint length measurements in centimetres were collected for 43 individuals, ranging in age from newborns ($n = 4$) to calves whose tusks were visible (2 1/2 years old; $n = 5$) and a further 34 individuals of progressively larger body size. A highly significant correlation was found between the shoulder height and the footprint-length measurement from each individual. For females ($n = 24$) $SH = (-10.635 + 5.913)$foot, $r^2 = 0.91$, $n = 24$, $p < 0.001$. For males ($n = 19$) $SH = (-4.9124 + 6.150)$foot, $r^2 = 0.88$, $n = 19$, $p < 0.001$. This correlation, divided into 5-year age intervals, was used as a guide to estimate ages for additional individuals sighted (fig. 1).

Demography

In contrast to previous results on Tsavo elephants and Amboseli data, there were more males than females (ratio of 1.4:1) in each of the four age classes between birth and 20 years old. The reverse was true of the > 20-year age classes, 1 male to 2.4 females. Twenty-four individuals (5.5%) were tuskless, including two

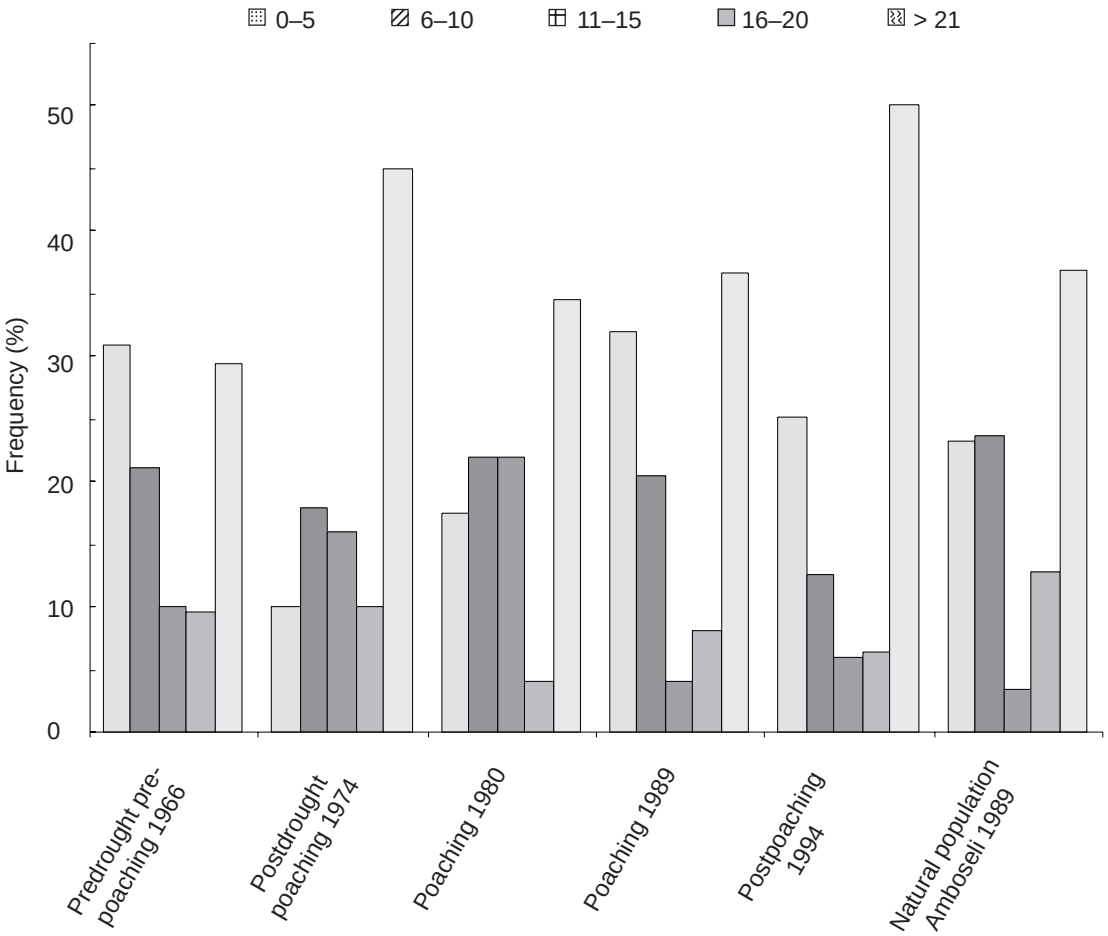

Figure 1. Frequency distribution of the changes in the age structure of Tsavo East National Park counts from 1966 to 1994 and the natural population of Amboseli. Poaching 1980 data from Ottichilo; other references listed under table 1.

males older than 25 years. Nine individuals were missing the tip or a portion of their trunk.

Between January 1993 and December 1994, 43 deaths were recorded. Over half of the individuals were > 20 years old (11 females, 10 males, 6 of unknown sex). Six individuals had been poached, tusks cut away (3 females, 2 males and 1 of unknown sex). Eight males were shot on control and five females > 26 years old were found dead of unknown causes (tusks intact). Six calves (birth to 5 years) of known females were missing and presumed dead. The mortality rate was most likely higher than recorded if any of the 12 adult females that died had an unweaned offspring. The skeletal remains of a very young calf are difficult to detect because they are scattered by scavengers, they decompose quickly, and there are no tusks to measure.

Reproductive status

FEMALES

None of the females in the 6–10-year age class (n = 29) showed mammary gland development. Two-thirds of the females in the 11–15-year age class (n = 9) showed no swelling and none had offspring with them. Five of the 13 females in the 16–20-year age class showed no mammary gland development. Two of the seven with swollen glands in this age class had a calf of less than 1 year while the other five appeared pregnant. Three of the females that were > 25 years old had shrunken mammary glands. This suggests that 1) the pregnancy was in an early stage when development of the mammary gland was not yet visible, 2) the foetus had been aborted, 3) the calf had died, or 4) there was a long intercalf interval.

POTENTIAL BREEDING SEX RATIO

The age designated for a potential breeding female was calculated from the assessment of mammary gland development. A male ≥ 25 years old was considered socially mature and defined as a potential breeding male (Poole 1987). Based on the mammary gland development data, the ratio of potential breeding adults (females > 15 years old, males > 25 years old) of recognized elephants was 3.6:1.

CALVING INTERVAL

The estimated interval between the birth of one calf and the next for 74 known mothers was 5.0 (± 1.8) years. There were no 10–20-year-old females (n = 21) with more than one offspring with them. Two possible reasons for this are 1) their previous calf was a male that had left the family and become independent or 2) the calf had died.

Group dynamics

FREQUENCY OF AGGREGATION

Groups of 50 or more individuals (third quartile of group distribution) were defined as an aggregation (n = 92). Although there appeared to be wet-season peaks in aggregation size, there was no significant difference between aggregation during wet (n = 42) and dry (n = 50) months (x^2 = 3.14, df = 1, p > 0.10) (fig. 2). Aggregations of 50 or more elephants in months of little or no rainfall were not expected in an environment where resources are limited in the dry season, yet during relatively dry months large groups were sighted. It is likely that there were more aggregations during the rains, but they were difficult to find and see because of the poor visibility resulting from the abundance of vegetation and the fact that many groups moved outside the study area.

GROUP STRUCTURE

Female groups were significantly larger during wet months than during dry months (Kolmogorov-Smirnov x^2 = 6.08, df = 2, p < 0.02). Mixed groups were also significantly larger during wet months than dry months (K-S x^2 = 7.61, df = 2, p < 0.02). Conversely, bull groups were significantly larger during dry months than wet months (K-S x^2 = 17.82, df = 2, p < 0.001). There were significantly more groups of ≥ 5 bulls in dry months than wet months (x^2 = 17.78, df = 1, p < 0.001). Large groups ranging from 10 to 22 bulls were observed more frequently during dry months (n = 21) than during wet months (n = 3); combining all sightings of these groups during dry months, the mean group size was 16.2 bulls (± 3.64). During wet months, three groups with ≥ 10 bulls were

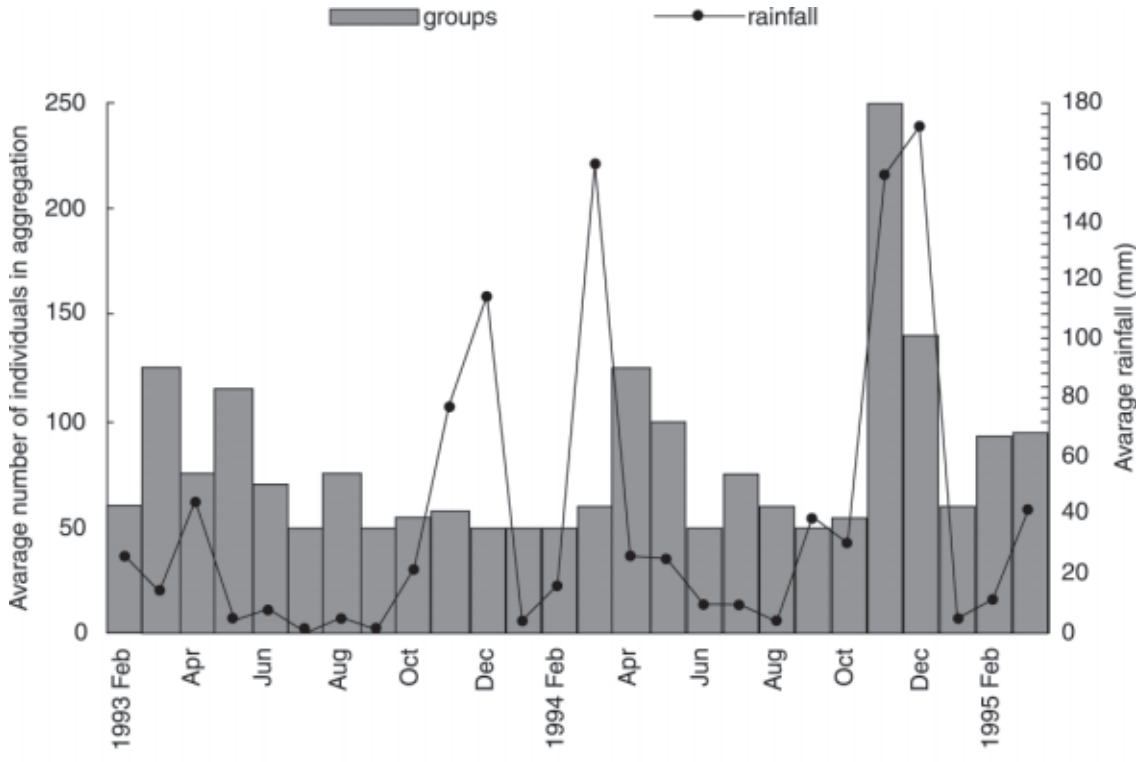

Figure 2. Average number of elephants in an aggregation of 50 or more individuals (n = 92) per month compared to monthly rainfall (average of 20 rainfall gauges) February 1993 to March 1995.

observed: 11,12, 20 bulls (mean group size 14.3 ± 4.93 SD). These large groups of bulls, which were observed feeding and travelling together, were generally all the same height, and thus close in age.

FAMILY STRUCTURE

Of the 106 discrete female groups recorded, the median group size was 6.0 with a range of 2–21 individuals (mean 7.8 ± 0.41). Almost half (45.3%) of the groups consisted of fragmented families, either lacking a female > 30 years old or a group with calves and juveniles that could not be the offspring of the females present. The difference between the 1989 and the 1994 fragmented family structure was not significant (32 groups, $x^2 = 1.98$, $df = 1$, $p > 0.20$, 31.2%, n = 10; Poole unpubl.).

Discussion

The results of this study provide new baseline data on the Tsavo elephant population following poaching and the long-term impact of the 1970s drought. The demographic survey results indicate a low proportion of individuals in the 16–20-year age class; this can be attributed to the effects of the 1970s drought. After the drought in 1974, there were almost three times as many adults as calves. In this study, there were twice as many adults as calves, suggesting calf survival is still below 1966 levels.

The sex ratio per age class was of particular interest. The ratio of more females to males in the older age classes would be expected, as poachers concentrate on bulls (Poole and Thomsen 1989). What is surprising is the ratio of males to females (1.4:1) in

the birth-to-20-year age classes, which is unlike other poached populations and the undisturbed population in Amboseli (see Poole unpubl. data and comparisons with other poached populations). There are two possible reasons for this unusual sex ratio. During the drought 'the mortality of females was consistently higher than for males' (Corfield 1973). This was attributed to strong maternal bonds and long postnatal care, which contributed to the high percentage of deaths among females because they were restricted by the distance they could travel in search of food (Corfield 1973).

The data in this study suggest that, in an effect similar to that of the drought, the social development and greater independence of juveniles and adolescent males may have helped them to survive the loss of older females to poachers. Secondly, mothers in Amboseli invested more in male calves than female calves (Lee and Moss 1986). This in part could explain the higher ratio of males to females in the younger age classes. The data suggest that young females are more vulnerable to the stresses of poaching (loss of matriarch, fragmentation of families) than are the young males and that female survival rates under these conditions were lower.

A further impact of poaching for ivory can be demonstrated by the percentage of tuskless individuals. The 5.5% identified tuskless elephants appears relatively low in comparison with other poached populations in national parks in East Africa: 7.8% in Meru, Kenya (Demmers and Bird unpubl.), 46.9% in Mikumi, Tanzania, and 38.0% in Queen Elizabeth, Uganda (Poole unpubl.). Nevertheless, the percentage in Tsavo is higher than the 3.0% in the protected population of Amboseli (Poole unpubl.). The six elephants killed by poachers between January 1993 and March 1995 were evidence that poaching was continuing in Tsavo. Furthermore, poachers who set snares for bush meat in and around the park continue to be a hazard for elephants. These snares are most likely the cause of damage to the tip of the trunk, as seen in nine individuals; this could indicate a problem that will need to be monitored.

The results of this study indicate that the majority of females attained first conception when about 15 years old, older than during the 1966 study (Laws 1969) and in a natural population (Amboseli; Poole unpubl.). Furthermore, the mean calving interval of 5.0 years was less than the 6.8-year interval during the 1966 Tsavo study and longer than the average in the Amboseli population of 3.5 years during wet years and 5.6 years in dry years (Lee and Moss 1986).

When adult male elephants live in a population well protected from poaching, the majority of musth bulls are > 30 years old and most of the mating is by bulls > 35 years (Poole 1987). Of the 14 Tsavo bulls observed in musth, 4 were relatively young males in the 21–25-year age class (similar to young Asian elephants; Sukumar 1989). During this study no two males were observed in musth at the same time in the same location, and no fighting between males in or out of musth was observed. The occurrence of young males in musth is most likely because of the low proportion of bulls > 35 years old. Most likely old (40+) and large Tsavo bulls will not have to compete for access to females in oestrus for many years to come. Long-term study on the reproductive behavioural patterns of the bulls in Tsavo will be needed to determine what role musth behaviour will play in a population with few older bulls.

Social organization studies during the prepoaching era in Tsavo (1967 and 1974) showed that the mean group size increased with rainfall and decreased during the dry season (Laws 1969, Leuthold 1976b). Postpoaching group size distribution for females and mixed groups was significantly larger during the wet season than during the dry season. However, the frequency of aggregation sightings year round and the increase in overall mean group make it appear that these large groups are forming as a response to the stress, harassment and lack of matriarchal leadership resulting from poaching in ways similar to other disturbed populations (Eltringham and Malpas 1980, Lewis 1986, Ruggiero 1990, Abe unpubl.).

The grouping patterns of adult males are of special interest, as they were the main targets of poachers. Tsavo males have historically been sighted in large aggregations of 20–35 individuals (Laws 1969). Even after intensive poaching, aggregations of bulls were still observed forming groups of up to 22 individuals in the dry months. The group-size distribution for bulls was significantly larger during dry months than wet months, similar to a study on bull groups in the Serengeti, Tanzania (Croze 1974).

The presence of fragmented female groups (45.3%) and the lack of old and experienced matriarchs in the population can be attributed to

poaching pressure. In the protected Amboseli population, the families were stable, led by a matriarch (median 41 years old) with several related adult females, and on average consisted of 10 members (Moss 1988). Mothers in Amboseli < 25 years old were not as successful at raising their calves as older mothers (Poole unpubl.).

With almost half of the family units fragmented, it is therefore not surprising that aggregations were sighted during the dry season as well as the wet season. These data suggest that young and inexperienced females as well as juveniles of both sexes have joined a group with an older female, possibly to gain from the knowledge that an older female would have about the resources within her environment and for security reasons.

Important conclusions of this study are the unusual ratio of males to females in the younger age classes and the apparently delayed age of first conception, both of which will need to be monitored to determine what effect these factors will have on the future age structure of the population.

The high frequency of fragmented family units is also cause for concern. The loss of the older members of the population to poaching influences all aspects of elephant social organization, with implications for future calf survival, group dynamics and reproductive potential. Even if Tsavo does not experience another severe drought, both biological and social recovery will be a long, slow process and will depend on there being no poaching.

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Effects of habitat on visibility of elephants during aerial census

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Additional key word: stratification

Abstract

During a study of elephant biology in Zimbabwe a relatively simple opportunity arose to document the effects of habitat and topography on the aerial visibility of elephants. This involved relocating individually radiocollared elephants concurrent with aerial census of the population to which they belonged. Sightings of elephants were considered 'failed' when no elephants could be seen by aerial observers once the aircraft had been flown in a tight circle around the radiocollar signal location for some 8 minutes. These cases, which amounted to 15% of the sighting sample (n = 88), were all in steep, rocky hills covered by high-canopy woodland and incised by narrow, thickly wooded valleys. Such terrain did not cover enough of the study-population range to affect the accuracy of the census estimate in survey strata sampled by aerial transects. Nevertheless, the unique trial was useful in allowing localized failure rates of elephant visibility under theoretically ideal observation conditions to be appreciated by those seeking to improve routine census technique.

Résumé

Lors d'une étude portant sur la biologie de l'éléphant au Zimbabwe, nous avons eu la possibilité relativement simple de montrer les effets de l'habitat et de la topographie sur la visibilité des éléphants à partir d'un avion. Il s'agissait de localiser individuellement des éléphants équipés de colliers radio tout en recensant d'avion la population à laquelle ils appartenaient. On estimait que la vue des éléphants avait « échoué » lorsque les observateurs aériens n'avaient pas pu voir d'éléphants alors que l'avion avait effectué des cercles étroits pendant quelque huit minutes autour de l'endroit donné par la localisation radio. Ces cas, qui représentaient 15% de l'échantillon (n = 88), se produisirent tous dans des collines abruptes et rocailleuses, couvertes de forêts à haute canopée et coupées de vallées étroites et densément boisées. Ce genre de terrain ne couvrait pas de portions suffisantes de l'aire de répartition de la population pour affecter l'exactitude des estimations fournies lors de l'étude des strates échantillons par les recensements par transects aériens. Néanmoins, ce test unique s'est avéré utile puisqu'il permet à ceux qui cherchent à améliorer les techniques routinières de recensement d'apprécier les taux d'échecs localisés de la visibilité des éléphants, dans des conditions d'observations théoriquement idéales.

Mot clé supplémentaire : stratification

Introduction

Researchers agree that aerial counting of elephants in the savanna range is precise and cost efficient when sample counts are used (Craig 1993, Mbugua 1996). However, even sample aerial surveys underestimate true numbers of elephants because some animals within the sampling units are overlooked (Craig 1993). Therefore, it is beneficial to establish the degree to which observers conducting aerial census fail to see elephants. Unfortunately, opportunity to critically assess such visibility bias has been limited by expense, logistics and lack of adequate personnel to do the job. During a recent study of elephant biology in Zimbabwe, an opportunity arose to document the effect of different types of habitat on

the visibility of elephants whose location was accurately known. This paper compares possible visibility bias of elephants in four different habitats of one census zone.

Study area and methods

The study took place in the Sebungwe region of Zimbabwe, a 15 000-km^2 semi-arid savanna of mainly undulating topography. Vegetative cover is dominated by *Brachystegia* and *Julbernadia* spp. (miombo) and *Colophospermum* (mopane) woodland, interspersed with numerous riparian fringes and occasional dense thickets. Isolated ranges of rocky hills protrude from the savanna. Land use is a mosiac of protected areas for wildlife and communal land for humans. In the latter, elephants still occupy habitats not yet transformed by agriculture. The elephant population in Sebungwe of approximately 12 000 animals is isolated from other populations in the country, making immigration and emigration of elephants impossible. Unnatural mortality, such as from poaching or problem animal control, is low. Aerial census of elephants has been conducted across the entire region annually for over 20 years.

Nineteen elephants, 12 cows and 7 bulls, were fitted with radio collars as part of a three-year study comparing the biology of elephants inside and outside protected areas (Hoare 1997). The success in visually locating these tagged animals from an aircraft was assessed when searching took place during the same times of day in the same months as the annual aerial census for the Sebungwe population. These times were from 0800 to 1100 h and from 1530 to 1700 h during the late dry-season months of August, September and October. Standard aerial tracking techniques were used (Kenward 1987) by a two-man team of pilot and observer. All collared animals were tracked on the same flight on each occasion (every 7 to 10 days) and the data set was compiled from two successive years, 1994 and 1995.

Each collared elephant had a different radio frequency. Having homed in on the signal from each radio transmitter, the aircraft was flown in a tight circle above the signal location until elephants were sighted. A string of data was recorded at each elephant fix: location coordinates, group size, group type, age classes in group, habitat occupied, and estimated distance to human settlement and to water. Sightings were assigned to four broad habitat categories commonly used in botanical studies of this part of the Zambezi Valley (Timberlake *et al.* 1993): miombo, mopane, thicket, riverine.

Sighting success was scored according to three categories: *succeed* meant all animals in the group were counted; *fail* meant that no elephants were seen; *partial*, which applied only to female groups, meant that one or two individual animals were seen but that the remainder of the family group (whose size was known from many previous observations) was obscured by vegetation. Failure of the sighting was admitted only when no elephants had been seen after 5 to 8 minutes. During this time the aircraft circled the area repeatedly, up to 10 times, in both directions and flew low over the signal location in an attempt to use engine noise to flush animals from their concealment.

Results

The overall scores in 88 attempts at census-concurrent sightings were: 'succeed' 82.9%, 'partial' 2.3%, and 'fail' 14.8% (table 1). Failures were greater among the collared females (85%) than among the males (15%).

Of the 11 failed sightings for cows, 9 (82%) were from elephants living in the same communal land study area—Omay. The remaining two failures for

Table 1. Census-time sightings of elephant groups containing a radiocollared animal in the Sebungwe region, Zimbabwe. Data are numbers of sightings and are separated into the four major habitat types and by sex of elephant

	Miombo			Mopane			Thicket			Riverine			Total		
	S	P	F	S	P	F	S	P	F	S	P	F	S	P	F
Cows	17	0	3	16	0	5	5	1	1	8	1	2	46	2	11
Bulls	3	0	0	7	0	0	3	0	0	14	0	2	27	0	2
Total	20	0	3	23	0	5	8	1	1	22	1	4	73	2	13

S = succeed, P = partial, F = fail

cows were from the protected area of Sijariara-Chete, which is nearest to Omay and has similar topography and vegetation. The only two failures for bulls were also in the Omay communal land. Of the 13 failures overall, 9 (69%) were in thickly wooded rocky hills and 4 (31%) in dense riparian fringes. Mean crude densities of elephants in the Sebungwe protected areas (1.15 per km^2) are consistently much higher than those in the contiguous communal lands (0.46 per km^2) (Hoare and du Toit 1999). But there was no significant difference between the failures of cow sightings in the two land categories ($x^2 = 1.77$; $df = 1$; $p < 0.05$).

In the areas where sighting failures occurred, there are steep hills strewn with large boulders and covered by high-canopy woodland. Elephants in this area often stand in shadow under canopy trees. The ground is uneven and the animals are the same colour as the rocks among which they may be standing. In addition, the numerous watercourses are narrow, often supporting a dense fringe of riverine vegetation. A combination of these factors can make elephants indiscernible from above. In several cases of failed sightings, the radiocollared animal was situated in the worst places for visibility, such as a steep and thickly wooded rocky gorge.

Interestingly, few failures occurred in thickets, which are botanically the densest of the habitat types. But they are mainly composed of multistemmed shrubs, which, while severely restricting visibility on the ground, are short enough to allow the backs of elephants to protrude above them. Thus the animals remain visible from the air. In areas where complete success was achieved in sighting the tagged cow and bull groups (Gokwe District—both inside and outside protected areas), the topography is flatter and includes more open-canopy miombo woodland on sandy plateaux and wider rivers with alluvial woodland on terraces. To an airborne observer, these vegetation types do not effectively conceal elephants.

Discussion

The study data confirm that habitat and topography combinations can account for the failure of aerial observers to see a proportion of the elephant population in certain areas. A 'localized' failure rate of 15% gives an indication of the proportion of elephant sightings that may be missed in the most difficult parts of this census zone, even under ideal observation conditions. Under less than ideal observation conditions, such as from a survey aircraft on a transect passing rapidly overhead concealed or partially concealed elephant groups, this shortfall could be higher. But in the Sebungwe, these conditions probably apply only to relatively small areas, and it is likely that elephant population estimates for all census subunits (strata) are within the calculated confidence limits, consistently 20–25% over many years of annual aerial census (DNP&WLM 1996).

The Sebungwe elephant population is one especially suited to census experimentation. It is geographically enclosed, has known low levels of mortality, occupies mosaics of land use and habitat, and has census data spanning many years. The population trend over the last 20 years is stable, although from year to year the estimates vary (Hoare 1997). The present experiment therefore supports the hypothesis that visibility bias may be contributing to the variable year-on-year population estimates, which are obtained from census with fairly consistent precision. In turn, visibility bias is probably influenced by other unquantifiable factors, such as the use of different observers and differences in vegetation condition between years.

The possible net effect on the elephant population is that the contiguous administrative subunits of elephant management, in this case districts, are not being provided with population estimates of uniform accuracy, because of the influences of habitat. Nevertheless, these districts are allocated equal proportions of their respective elephant populations by the wildlife authorities as offtake quota for hunting and problem animal control—about 1%.

Craig (1993) reviews the possibilities for prior allocation of sampling effort to survey strata and examines the pitfalls of using post-hoc correction factors on survey data. Prior allocation of sampling effort to census strata is usually based on prior knowledge of likely elephant density. Allocation of increased sampling effort in problem strata has been the traditional way to overcome the effects of terrain on visibility. In the Matusadona National Park, for example, adjacent to the Omay communal land, a smaller, slower aircraft is used, and block sample counts replace transect sample counts in the rough terrain of the Zambezi escarpment (Mackie 1995). In strata with blocks, sample blocks are each total counted for elephants, and these block strata typically

have a higher sample intensity (20–30%) than transect strata (5–15%).

In areas where the transect sample count method crosses rugged terrain but has to be retained for logistical reasons, elephant census design should find a way to accommodate the association between habitat, topography and visibility bias. In this study, the numbers of individual elephants being missed during census in problem strata can be estimated using the proportion of failed sightings from the radiocollar relocations (14.8%). If one were to consider using a local correction factor, a possibility could be

corrected estimate	=	*C* (raw estimate)
where *C*	=	correction factor of 100 / (100 – 14.8)
	=	1.17

Theoretically, the use of such correction factors in other situations presents a dilemma because it has to make the assumptions 1) that sighting failure is independent of the group size of elephants and 2) that habitat conditions and the census technique are equal between years. Cases where a correction factor may be justified include a first-time census where habitats can be mapped but where there is no prior indication of elephant density.

Acknowledgements

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Eléphants et dissémination des graines de quelques espèces végétales dans le Ranch de Gibier de Nazinga (sud du Burkina Faso)

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Mot clé supplémentaire : germination

Résumé

L'étude de la dissémination des graines par les éléphants a été menée de juillet 1996 à juin 1997 par une collecte mensuelle des tas de crottes, une estimation des graines qui y sont contenues et une germination naturelle simulée. Les résultats révèlent une forte consommation des fruits pendant la saison sèche. Ils révèlent en outre une forte variation de la densité de graines au fil des mois et suggèrent que les fruits constituent, à coup sûr, une alimentation d'appoint pour les éléphants pendant la saison sèche avec un maximum obtenu en avril. Environ 20% des espèces ligneuses qui ont des graines dans les crottes sont potentiellement disséminées par les éléphants à travers les habitats. Par ailleurs, seules les graines collectées en début de saison sèche ont un taux de germination plus élevé comparativement à ce qui est obtenu en fin de saison sèche. L'ensemble des résultats obtenus révèle le rôle important joué par les éléphants comme agents de dissémination de graines dans la région de Nazinga.

Abstract

The dispersal of seeds by elephant was surveyed from July 1996 to June 1997 by collecting dung monthly, counting seeds contained in the dung piles and simulating natural germination. The results showed that elephants feed on fruits mainly during the dry season. Seed densities varied greatly between months, with a maximum in April, suggesting that fruits replace green forage as the food supply for elephants during the dry season. It was found that elephants dispersed about 20% of the woody species in various habitats of the ranch. The seeds collected at the beginning of the dry season germinated at a higher rate than those collected towards the end of the season. These results showed the important role that elephants play in disseminating seeds in the Nazinga area.

Additional key word: germination

Introduction

Une importante stratégie de pérennisation des plantes supérieures repose sur la dissémination des graines à partir d'un parent (Carlquist 1974). Mais il faut que la dispersion se fasse dans un environnement où la germination est non seulement possible mais aussi où les plantules auront une chance optimale d'atteindre la maturité et d'avoir la capacité de produire d'autres graines (Fenner 1985). Dans les conditions xérophytiques, la stratégie semble plus tributaire de l'évolution de la dispersion des graines selon qu'elle coïncide ou non avec la saison des pluies (Opler *et al.* 1978, Foster 1986). La faune est, entre autres, l'un des principaux agents de dissémination.

Nombre de travaux rapportent le rôle très important des fruits dans le régime alimentaire des éléphants, notamment les éléphants de forêt (Feer 1995, Merz 1981, Short 1983, Wing et Buss 1970). La conséquence bénéfique et immédiate de cet intérêt

pour les fruits est la dissémination des graines. En effet, des graines de diverses formes sont rejetées dans les crottes (Alexandre 1978, Short 1983, Gautier-Hion *et al.* 1985, Lieberman et Lieberman 1986, Feer 1995). Alexandre (1978) avait montré que près de 30% des espèces d'arbres de la forêt de Taï doivent leur dispersion à l'éléphant de forêt.

En outre, certaines espèces végétales doivent leur survie à cette action disséminatrice des éléphants. Ainsi, l'éléphant est passé pour être le principal agent de dissémination des graines de *Balanites wilsoniana* au Ghana et en Ouganda (resp. Lieberman *et al.* 1987, Chapman *et al.* 1992). De même, Lewis (1987) notait que la germination des graines et la vigueur des plantules de *Sclerocarya caffra* sont améliorées par l'ingestion des graines par l'éléphant.

Par ailleurs, la recherche des fruits mûrs par les éléphants semble fortement influencer leurs déplacements saisonniers (Short 1983, White 1994).

Peu de données portent cependant sur les éléphants de savane pour ce qui est de leur consommation des fruits. La présente étude a été menée afin de déterminer les espèces ligneuses dont les fruits sont consommés par les éléphants lors de leur quête de nourriture et qui sont disséminés dans les crottes à travers les habitats.

Milieu d'étude

Le Ranch de Gibier de Nazinga se situe dans la partie sud du Burkina Faso, entre 11°01' et 11°18' de latitude Nord et entre 1°18' et 1°43' de longitude ouest (Dekker 1985). Il se localise à mi-chemin entre les chefs-lieux des provinces du Nahouri et de la Sissili, mais relève administrativement de la première. La superficie du ranch est estimée à 940 km^2 et délimitée par une piste périphérique dont la portion sud marque la frontière entre le Burkina Faso et le Ghana (fig.1). L'altitude moyenne du ranch est de 300 m, le paysage est constitué par une plaine doucement vallonnée, mais de façon générale, la zone présente une inclinaison légère du nord-est vers le sud, à l'exception de la partie

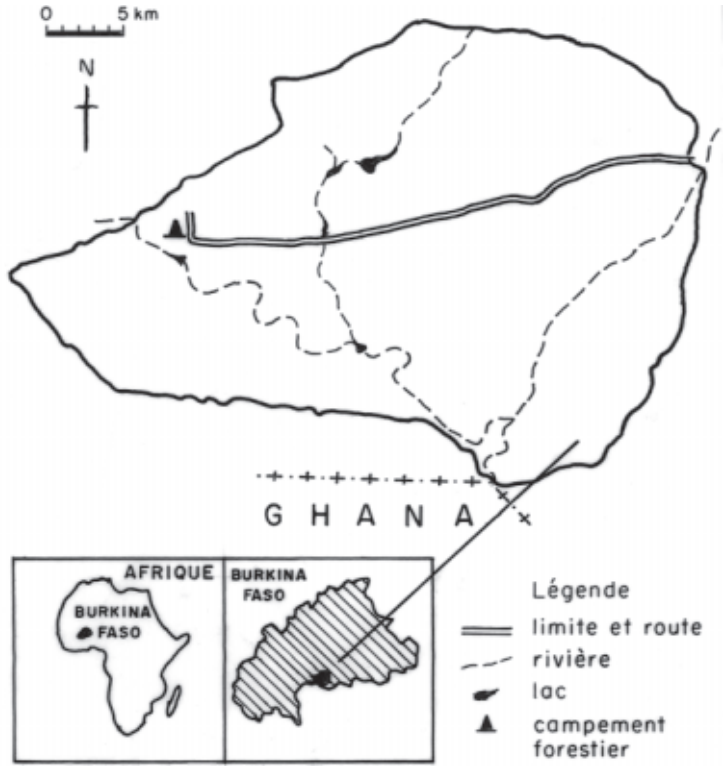

Figure 1. Ranch de Gibier de Nazinga, localisation du milieu d'étude.

sud-ouest où une pente rapide échoue dans le lit de la rivière Sissili (Spinage 1984).

Kaloga (1968) dans son étude pédologique de la région du centre-sud du Burkina avait identifié sept familles de sols. Celles-ci sont réparties dans les classes des sols minéraux bruts, des sols évolués et des sols hydromorphes.

Le ranch se situe dans une zone de climat sud soudanien (Guinko 1984) avec des précipitations moyennes annuelles de plus 1000 millimètres. Ce climat est caractérisé par une saison de pluies allant de mai ou d'avril à septembre et une saison sèche couvrant la période d'octobre à avril (fig. 2). La figure 3 présente la température des dix dernières années de la station météorologique de la ville de Pô située à 20 km de la périphérie est du ranch.

Matériel et méthodes

Les tas de crottes ont été ramassés mensuellement de juillet 1996 jusqu'en juin 1997. Les ramassages ont eu lieu dans la dernière semaine de chaque mois afin de marquer la différence éventuelle des fruits consommés au fil des mois. Les tas de crottes de plus grand diamètre, issus des sujets adultes ont été préférés à ceux de petit diamètre des jeunes éléphants, beaucoup plus sélectifs dans leur alimentation. Une partie des tas de crottes retenus a été séchée à l'air libre. Vingt autres tas, ramassés de façon aléatoire dans la zone d'étude ont été passés à l'eau en vue du comptage systématique des graines après tri manuel pour chaque tas de crotte. Les graines comptées sont celles qui ont étaient reconnaissables à l'œil nu. Au total 240 tas de crottes ont été examinés au cours des douze mois d'investigation. Une analyse des variances a été appliquée sur les densités mensuelles des graines dans les tas de crottes tandis qu'un test de Student a permis la comparaison par paire de moyennes. L'interpré-tation est basée sur le signe (+ ou –) de la valeur obtenue. Ces analyses ont concerné les douze mois d'investigation et le programme JMP®.Statistics a été utilisé. Une analyse exploratoire des données par le calcul de « skewness » et « kurtosis » a permis de vérifier les conditions de distribution normale des données. En effet, si les valeurs respectives de skewness et de kurtosis sont en dehors de l'intervalle –2 à +2 du coefficient standard, les données pourraient s'éloigner de façon significative de la distribution normale (Manugistics Inc. 1994).

Les graines contenues dans les crottes séchées à l'air libre, ont été soigneusement triées à l'aide d'une pince et mises à germer. La germination a été réalisée dans des pots de 20 cm^3 remplis de terre en guise de germoirs. Les germoirs contenant chacun quarante graines réparties proportionnellement entre les différentes espèces en présence, ont été arrosés régulièrement à l'eau de forage. L'apparition des plantules a été régulièrement enregistrée afin de comparer les taux mensuels de germination.

L'identification des espèces dont les fruits sont consommés s'est faite par la reconnaissance directe des restes des enveloppes, par la comparaison des graines issues des crottes avec d'autres graines déjà connues ou issues des fruits cueillis sur place et par leur identification après germination.

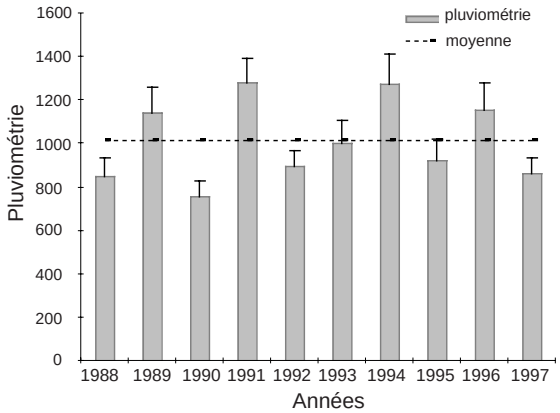

Figure 2. Pluviosité de 1988 à 1997 à Pô.

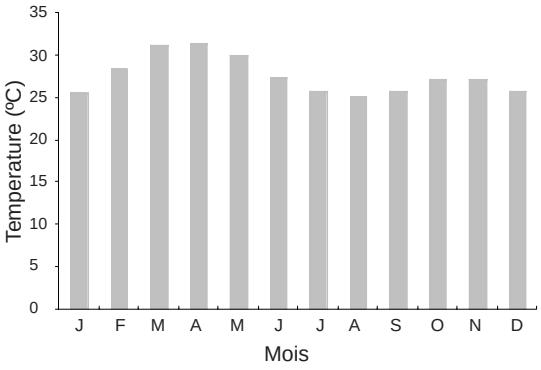

Figure 3. Température mensuelle moyenne de 1988 à 1997 à Pô.

Résultats

Densité des graines dans les tas de crottes

Les graines contenues dans les tas de crottes examinés varient énormément (0–188) d'un tas à l'autre et ceci au cours des mois. L'exploration des données a donné skewness = 0,8062 et kurtosis = –0,8822. Ces valeurs indiquent la relative distribution normale de nos données et permettent l'application de l'analyse de variances. Ainsi, l'ANOVA a donné une différence hautement significative ($F = 818,58$, $p < 0,0001$. Dl = 11). Le nombre de graines, toutes espèces confondues, s'élève à 13 441. De par la densité de graines dans les tas de crottes, il s'est avéré que le mois d'avril est le mois au cours duquel les éléphants consomment le maximum de fruits (fig. 4). De part et d'autre de la grande moyenne (ligne horizontale de la fig. 4), les mois sont distribués conformément aux densités de graines.

Les valeurs critiques de comparaison par le test de Student pour chaque paire sont consignées dans le tableau 1. Les valeurs positives donnent les paires de mois où les densités moyennes de graines sont significativement différentes.

Densité de graines et leur taux général de germination

La densité des graines dans les tas de crottes est quasiment inversement proportionnelle à leur taux de germination (fig. 5). En effet, cette densité est croissante d'octobre à avril avant de chuter brutalement en juin. En revanche, le taux de germination décroît progressivement d'octobre à juin.

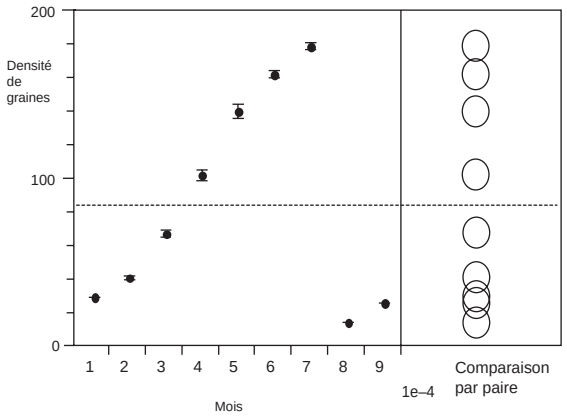

Figure 4. Densité mensuelle de graines dans les tas de crottes.

Identification des espèces dont les fruits sont recherchés

Le tableau 2 donne par mois la liste des espèces dont les fruits servent de nourriture pour les éléphants. Au moins seize (16) espèces ont été identifiées, appartenant à 12 familles, soit environ 20% des espèces ligneuses enregistrées dans le parc. Conformément au plan d'échantillonnage retenu, des graines ont été retrouvées dans les crottes pour 9 mois sur 12, à savoir d'octobre à juin. Ceci indique que les mois de juillet, août et septembre sont caractérisés par la consommation de graminées abondantes à cette période de l'année.

Dominance des graines de Bauhinia thonningii *et de* Cassia sieberiana

La densité des graines dans les tas de crottes est fortement influencée par la présence des graines de *Bauhinia thonningii* et de *Cassia sieberiana*. La figure 6 qui compare le taux global mensuel de germination des graines issues des crottes à celui des deux espèces prises séparément illustre très bien cet état de fait. En effet l'allure générale du taux de germination de l'ensemble des espèces (fig. 6) dont les graines ont germé épouse assez fidèlement celle du taux de germination des deux espèces.

Discussion

Les fruits constituent une source assez importante de nourriture pour les éléphants, en particulier pendant la saison sèche. Ceci est exprimé par la densité moyenne de 56 graines par tas de crottes. Cette densité est nettement plus élevée que celle de 15,7 obtenue par Feer (1995) dans son étude sur la dispersion des fruits par des éléphants de forêt au Gabon. Cette différence est probablement due à la différence des espèces dont les fruits sont consommés, la grande quantité de graines obtenues à Nazinga provenant des gousses de *Bauhinia thonningii* et de *Cassia sieberiana.* En revanche un faible nombre d'espèces (16 au moins) a été noté dans la présente étude en comparaison avec las 55 espèces obtenues par Feer

Tableau 1. Comparaisons inter-mensuelles des densités moyennes de graines par le test de Student pour chaque paire

Mois	Avr.	Mar.	Fév.	Jan.	Déc.	Nov.	Mai	Oct.	Juin	Juil.	Août	Sept.
Avr.	–6,0	10,3	33,1	70,8	105,4	131,3	137,7	143,5	147,0	160,6	160,6	160,6
Mar.	10,3	–6,0	16,7	54,4	89,0	114,9	121,3	127,1	130,6	144,2	144,2	144,2
Fév.	33,1	16,7	–6,0	31,6	66,2	92,1	98,5	104,3	107,8	121,4	121,4	121,4
Jan.	70,8	54,4	31,6	–6,0	28,5	54,4	60,8	66,6	70,1	8,7	83,7	83,7
Déc.	105,4	89,08	66,2	28,5	–6,0	19,8	26,2	32,0	35,5	49,1	49,1	49,1
Nov.	131,3	114,9	92,1	54,4	19,8	–6,0	0,3	6,1	9,6	23,2	23,2	23,2
Mai	137,7	121,3	98,5	60,8	26,2	0,3	–6,0	–0,2	3,3	16,8	16,8	16,8
Oct.	143,5	127,1	104,3	66,6	32,0	6,1	–0,2	–6,0	–2,,4	11,0	11,0	11,0
Juin	147,0	130,6	107,8	70,1	35,5	9,6	3,3	–2,4	–6,0	7,5	7,5	7,5
Juil.	160,6	144,2	121,4	83,7	49,1	23,2	16,8	11,0	7,5	–6,0	–6,0	–6,0
Août	160,6	144,2	121,4	83,7	49,1	23,2	16,8	11,0	7,5	–6,0	–6,0	–6,0
Sept.	160,6	144,2	121,4	83,7	49,1	23,2	16,88	11,0	7,5	–6,0	–6,0	–6,0

(1995) et celles (au moins 72 espèces dans 311 tas de crottes examinés) également obtenues au Gabon par White *et al.* (1993). Ce résultat représentant environ 20% des espèces est en deçà des 30% obtenus par Alexandre (1978) dans la forêt de Taï en Côte d'Ivoire. Il convient toutefois de faire remarquer que seules des graines de taille perceptible ont été recherchées dans les crottes.

La recherche de fruits par les éléphants est notable pendant la saison sèche et semble atteindre son point culminant en avril, c'est à dire en pleine saison sèche. Ceci serait lié au manque accru de fourrage vert marquant cette saison. Des résultats similaires ont été trouvés par Devineau (1999) dans son étude sur la dispersion des graines par le bétail dans l'ouest du Burkina. A Nazinga, cette situation est très difficile, non seulement pour les éléphants dans leur quête de nourriture, mais aussi pour l'ensemble des autres espèces animales du parc. Le passage des feux de brousse est un facteur qui aggrave ce manque de fourrage vert. En effet après le passage des feux, tardifs notamment, seuls quelques fruits subsistent encore sur quelques arbres et arbustes. Les éléphants à cette période se déplacent pour faire la cueillette à travers les peuplements ciblés des espèces fruitières. Ces résultats suggèrent que les fruits de ces espèces interviennent comme nourriture d'appoint pour les éléphants en saison sèche.

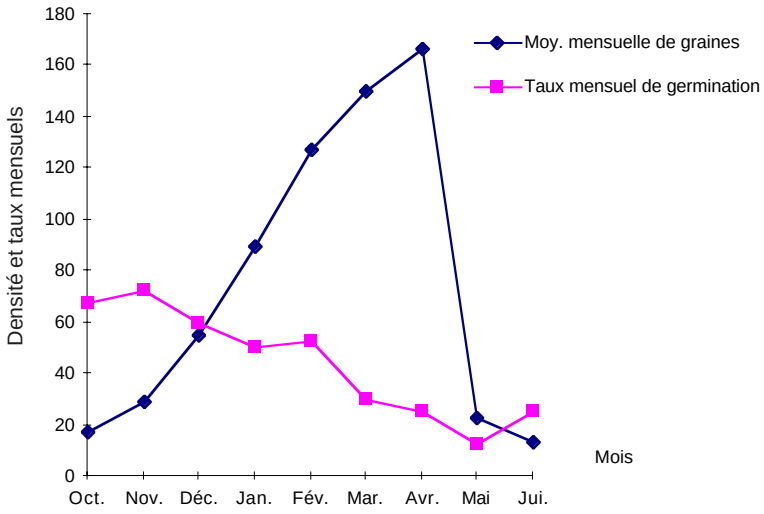

Figure 5. Densité moyenne mensuelle de graines dans les tas de crottes et leur taux de germination.

Le taux général de germination des graines est nettement plus élevé au début de saison sèche qu'en fin de saison sèche. En outre, la dissémination précoce des graines de certaines espèces par l'éléphant favorise la conservation et la germination de celles-ci. Ceci suggère que plus les fruits restent dans les arbres, plus la viabilité des graines décroît. C'est le cas des espèces telles que *Bauhinia thonningii* et

Photo n° 1 : Des jeunes plantules de *Saba senegalensis* ayant germé naturellement dans ce tas de crottes ont vu certaines de leurs feuilles mangées par des insectes (all photos by author).

Photo n° 2 : Tas de crottes renfermant des graines de *Balanites aegyptiaca* dont une est en début de germination naturelle.

Photo n°3 : Diverses espèces dont les graines en germination dans ce tas de crottes, ne sont pas identifiables à ces stades.

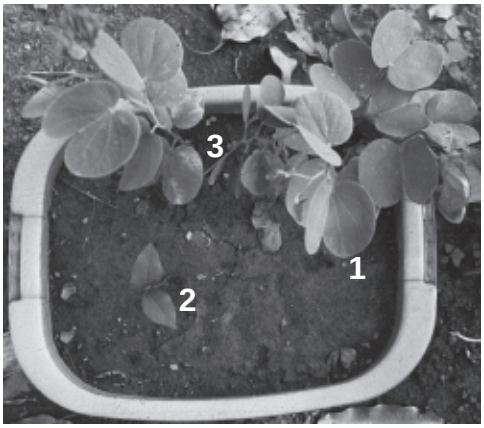

Photo n°4 : Essai de germination des graines issues des croittes. L'on distingue des plantules de *Bauhinia thonningii* (1) bien développées, *Diospyros mespiliformis* (2) et *Cassia sieberiana* (3) en train d'apparaitre.

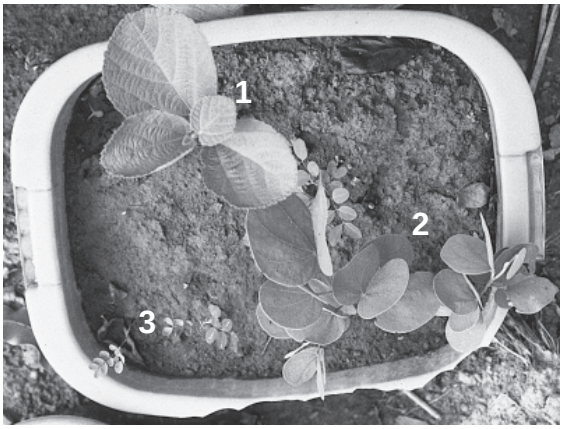

Photo n° 5 : Essai de germination des graines issues des crottes, montrant *Grewia cissoides* (1), *Bauhinia thonningii* (2) et *Cassia sieberiana* (3).

Photo n°6 : Les tas de crottes sont également un bon milieu du culture pour les champignons qui ont poussé ici en poquet.

Photo n°7 : Les céréales cultivées sont souvent la proie des éléphants, ici une graine de *Sorghum bicolor* a germé de façon naturelle dans ce tas de bouse.

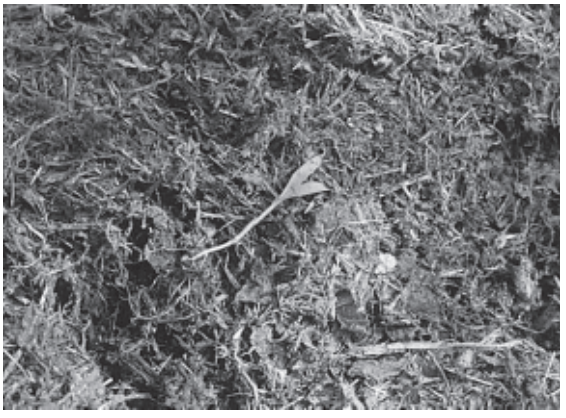

Tableau 2. Liste mensuelle des espèces dont les fruits consommés par les éléphants sont potentiellement disséminés à Nazinga

Espèces	Mois								
	O	N	D	J	F	M	A	M	J
Adansonia digitata L.		✓							
Balanites aegyptiaca (L.) Del.	✓	✓	✓	✓					
Bauhinia thonningii Schum.	✓	✓	✓	✓	✓	✓	✓	✓	
Cassia sieberiana DC.	✓	✓	✓	✓	✓	✓	✓	✓	
Detarium microcarpum Guill. et Perr.				✓	✓	✓	✓	✓	✓
Diospyros mespiliformis. Hochst ex A. DC.			✓						
Grewia cissoides Hutch. et Dalz.	✓								
Grewia lasiodiscus K. Schum.				✓	✓	✓			
Grewia mollis Juss.			✓	✓	✓				
Grewia villosa Willd.			✓	✓	✓				
Lannea acida A. Rich						✓	✓	✓	
Lannea kerstingii Engl. et K. Krause							✓	✓	✓
Lannea microcarpa Engl. et K. Krause							✓	✓	✓
Lannea velutina A. Rich.							✓	✓	✓
Oncoba spinosa Forssk.		✓	✓	✓					
Saba senegalensis Pichon							✓	✓	✓
Sorghum caudatum Stapf	✓	✓	✓	✓					
Sorghum durra Stapf	✓	✓	✓	✓					
Sorghum subglabrescens Schweinf.et Aschers.	✓	✓	✓	✓					
Strychnos innocua Del			✓	✓	✓	✓	✓		
Strychnos spinosa Lam.		✓	✓	✓	✓	✓			
Tamarindus indica L.		✓	✓	✓					
Triumfetta lepidota K. Schum.		✓	✓	✓					
Vitellaria paradoxa Gaertn. f.							✓	✓	✓
Ximenia americana L.				✓	✓	✓	✓	✓	✓

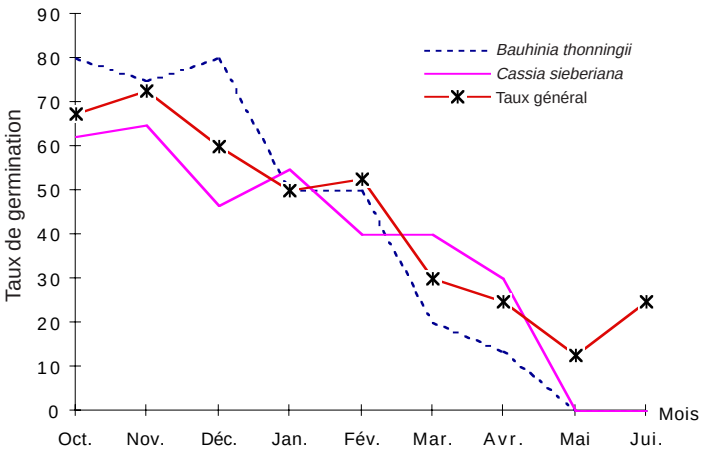

Figure 6. Taux de germination de *Bauhinia thonningii,* de *Cassia sieberiana* comparé au taux général de germination.

Cassia sieberiana qui ont fourni l'essentiel des graines retrouvées dans les crottes. Leurs fruits nombreux sur les branches renferment un nombre impressionnant de graines. Il faut noter que ces espèces se caractérisent par une présence prolongée des fruits sur le site (entre octobre et mai), par l'abondance de ces derniers ainsi que par l'abondance des graines dans les gousses. Il n'est donc pas rare de trouver certains pieds de ces deux espèces en plus de ceux de *Balanites aegyptiaca* entourés par des pistes circulaires «tracées» par les éléphants récoltant des fruits. La détérioration des graines serait liée à l'action de certaines larves d'insectes les ciblant pour hôtes, détruisant les graines au fur et à mesure qu'elles se développent. En effet, des fruits de plusieurs espèces de légumineuses passent pour être des hôtes privilégiés des larves d'insectes qui les rendent finalement inaptes à la germination. Ce qui expliquerait la baisse du taux de germination constatée pour les mois de mars et avril.

Des graines de certaines espèces amorcent la germination au cours du transit intestinal ou en séjournant dans les crottes : c'est le cas de *Detarium microcarpum, Saba senegalensis, Vitellaria paradoxa* et *Sorghum* spp. D'autres graines encore, bien que présentes et identifiées, n'ont pu germer par la méthode simulée. Ce sont celles de *Oncoba spinosa, Strychnos* spp., *Ximenia americana* et *Lannea* spp. Ces graines, si elles ne sont pas endommagées pendant le transit intestinal, auraient besoin d'un prétraitement spécifique pour bien germer. En revanche, les graines qui germent bien après séchage sont celles de *Bauhinia thonningii, Cassia sieberiana, Balanites aegyptiaca, Adansonia digitata, Diospyros mespiliformis* et *Grewia cissoides*. Ces espèces passent pour être les plus favorisées par la « loxodontochorie » dans la région de Nazinga.

Conclusion

A Nazinga, il est clairement établi que les fruits constituent une part importante du régime alimentaire des éléphants. Cet intérêt notable des éléphants pour les fruits constitue une action utile en termes de dispersion de graines à travers les habitats. En outre, cet intérêt des éléphants de Nazinga pour les fruits (remarquable pour les éléphants de forêt) semble supporter l'hypothèse que les populations d'éléphant de Nazinga seraient mixtes ou intermédiaires entre les deux races de savane et de forêt (Pfeffer 1989). Au vu de ce qui précède, l'on peut affirmer que l'éléphant joue un rôle primordial dans la chorologie des espèces puisque des centaines de graines traversent son tube digestif sans être endommagées, donc aptes à germer. Ce rôle combien utile de dissémination de graines est, le plus souvent, masqué par la destruction du couvert végétal dont il est toujours accusé à tort ou à raison.

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The current state of rhino in Assam and threats in the 21st century

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Additional key words: poaching, habitat conservation

Abstract

Assam, India, is one of the last remaining strongholds of the Indian rhino, an animal that is dependent on conservation because of threats from poaching and destruction of habitat. Field research was carried out in Assam to ascertain the current state of the rhino and to evaluate various threats. This paper highlights the latest status of rhino in Assam after the census of 1999, and the intense fieldwork carried out between January 1998 and September 2000. Poaching and floods are both named as major problems that greatly hamper conservation. The rhino population in Pabitora Wildlife Sanctuary had increased from 54 in 1987 to 74 in 1999; in Kaziranga National Park it increased from 1164 in 1993 to 1552 in 1999. However, in Orang National Park, the rhino population decreased from 97 in 1991 to only 46 in 1999, mainly because of unabated poaching. In the anti-poaching operation in Pabitora since November 1997, large numbers of poachers were arrested and arms and ammunition were recovered. Kaziranga witnessed the lowest poaching in 1999 with only 4 rhino killed by poachers, down from 8 in 1998. Anti-poaching staff of Kaziranga arrested 18 rhino poachers in 1999, a marked increase from 2 in 1998. To ensure the future of the rhino in Assam, forest anti-poaching staff need further government support. Habitat conservation and protection need to be given priority. Forest officials, the various collaborating NGOs and local people need to work together to conserve the rhino in the 21st century.

Résumé

L'Etat d'Assam en Inde est un des derniers bastions du rhinocéros de l'Inde, un animal dont la survie dépend de la conservation en raison des menaces que représentent le braconnage et la destruction de l'habitat. On a effectué des recherches sur le terrain en Assam pour connaître le statut actuel du rhino et évaluer les différentes menaces qui le concernent. Cet article décrit le statut récent du rhino dand l'Assam après le recensement de 1999 et le travail de terrain intense entrepris entre janvier 1998 et septembre 2000. Tant le braconnage que les inondations sont reconnus comme des problèmes majeurs affectant grandement la conservation. La population de rhinos du Pabitora Wildlife Sanctuary a augmenté de 54 en 1987 à 74 en 1999. Au Parc National de Kaziranga, elle a augmenté de 1164 en 1993 à 1552 en 1999. Cependant, au Parc National d'Orang, la population de rhino a baissé de 97 en 1991 à 46 seulement en 1999 en raison, principalement, d'un braconnage permanent. Lors des opérations anti-braconnage menées à Pabitora depuis 1997, on a arrêté un grand nombre de braconniers et récupéré armes et munitions. Kaziranga a connu le plus faible taux de braconnage en 1999, avec seulement 4 rhinos tués par des braconniers, contre 8 en 1998. Le personnel anti-braconnage de Kaziranga a arrêté 18 braconniers de rhinos en 1999, deux de plus qu'en 1998. Pour assurer l'avenir du rhino en Assam, les efforts

incessants du staff anti-braconnage forestier doivent recevoir les encouragements et le soutien du gouvernement. La poursuite de la conservation et de la protection devrait être de la première importance pour garantir aux rhinos ce dont ils ont besoin pour survivre. Les responsables des forêts, les ONG et les populations locales doivent s'unir pour accomplir cette tâche ardue que sera la conservation du rhino au 21ième siècle.

Mots clés supplémentaires: braconnage, conservation des habitats

Introduction

The state of Assam in India has successfully set aside areas for conserving and protecting the great Indian one-horned rhino, *Rhinoceros unicornis,* in its distribution range. Rhino numbers have increased from about 20 at the beginning of this century to 1700 animals in 2000. This success has been achieved through the dedicated efforts of the governments of Assam and India, supported by the local people. Vigne and Martin (1998), in updating information on the state of the rhino in Assam in 1997, put the number at 1406. This paper highlights the latest status of rhino in Assam, especially after the census of 1999, examines current threats to rhino from poaching, and looks at other factors. The paper also details statistics on the rhino population and poaching of rhinos from January 1998 to September 2000 in various protected areas of Assam. The study analyses the rhino census data of 1999 and details the intense fieldwork carried out between January 1998 and September 2000.

Rhino status in Pabitora Wildlife Sanctuary

Although it is commonly believed that rhinos came to Pabitora only during the 1970s, history reveals that they have been present there and in the Mayong area since 1925. According to the local people, during the tenure of King Rohan Singha, a rhino calf was brought to the palace as a pet; however, after a few months it died from diarrhoea. Past records also show that 3 rhinos were found dead, at Raja Mayong, Sildubi and Barhampur. The villagers handed over the rhino horns to the Nagaon police.

According to the census conducted in March 1999 in the Pabitora Wildlife Sanctuary, there are 43 adult rhinos, which is 58.11% of the total rhino population; 12 subadults, 16.22%; and 19 calves, 25.68% (table 1). The 24 adult male rhinos make up 30.43% of the population, the 31 females 41.89%, and calves the balance. The male-to-female ratio stands at 1:1.29. Only 8 rhinos were found in 1971 when the government of Assam declared Pabitora a forest reserve. In a span of about 28 years, the rhino population in Pabitora increased from 8 to 74. However, poaching remains the major threat to these rhinos. Poachers have used various methods to kill rhinos; those used since 1987 are summarized in table 2.

From 1987 to March 2000, poachers killed 45 rhinos—22 males and 23 females, 21 inside the sanctuary and 24 outside it. Talukdar (1999) discussed factors affecting the status and conservation of rhinos in Pabitora. It has been monitored that 25 to 30 rhinos strayed out of the sanctuary during winter from November until March and raided crops of the adjacent villages. To solve this problem, the government of Assam expanded the area of Pabitora from 16 km^2 to 38.84 km^2 in 1999 to provide the rhinos with more grazing area. The success of the present range officer in Pabitora, who joined the

Table 1. Census figures of rhino in the Pabitora Wildlife Sanctuary

Year	Adult			Sub-adult			Calf	Total
	Male	Female	Not sexed	Male	Female	Not sexed		
1987	17	19	—	5	8	—	5	54
1993	18	21	1	1	2	2	11	56
1995	11	28	3	3	1	13	9	68
1999	17	26	—	7	5	—	19	74

Source: Forest Department, Assam

Table 2. Rhino poaching and anti-poaching results in Pabitora Wildlife Sanctuary

Year	Poached inside PWLS	Poached outside PWLS	Total poached	Horns recovered	Poacher arrested	Arms recovered	Ammunition recovered
1987	2p	nil	2	nil	1	1	nil
1988	1b	2b	3	nil	nil	nil	nil
1989	1e	1e, 2b	4	nil	nil	1	nil
1990	1b	1b	2	nil	nil	nil	nil
1991	nil	1b	1	nil	nil	nil	nil
1992	nil	2e, 1b	3	nil	nil	1	2
1993	1b	3b	4	nil	nil	nil	nil
1994	1e	3e	4	2	5	nil	nil
1995	2b	nil	2	nil	nil	nil	nil
1996	2e, 1b	2e	5	nil	nil	nil	nil
1997	2b	1b	3	nil	nil	nil	nil
1998	1e, 1b	2b	4	1	2	1	2
1999	3b	3e	6	1	28	20	102
2000*	2b	0	2	0	6	2	nil
	2p, 5e, 14b	11e, 13b	45	4	42	26	106

e = electrocution, b = bullet, p = poisoning, * to September 2000

sanctuary in 1997 to control poaching and whose work has been recognized and lauded (Vigne and Martin 1998), is summarized in table 3.

Flood is another major problem that greatly hampers rhino conservation. During the flood of 1998, two rhino calves died in Pabitora. Flooding also increases silt deposition in the existing wetlands, making water scarce for the rhinos. This may have caused the rhinos to stray out of the sanctuary during winter, exposing themselves to danger from poachers. Livestock grazing inside the sanctuary is another cause of concern for Pabitora. According to the Forest Department of Assam, more than 50% of the grasslands have degenerated because livestock have overgrazed it. To solve this problem, the Pabitora range officer has constructed a pound—a temporary enclosure where the livestock are confined to prevent them from grazing in the sanctuary. Now livestock owners are fined if their animals are found inside the sanctuary. During patrol, the forest guards herd the livestock that they find inside the sanctuary into the pound.

Table 3. Anti-poaching success in Pabitora

Date	Activity
1997: November–December	Arrested a poacher with handmade ammunition; arrested another inside the sanctuary.
1998: October	Recovered rhino horn from a rhino poacher; after questioning him, arrested 3 other poachers and took 4 muzzle-loading guns from them. Also recovered a .315 rifle, which had been seized in 1994 from the forest guard of Kamarpur Camp, Pabitora, whom the poachers had killed.
1999: January	Arrested 2 poachers and recovered 2 rifles, a .500 and a .303, with ammunition.
1999: May	Arrested 8 poachers and recovered 1 carbine, 1 self-loaded rifle, 3 rifles .500 bore, 5 muzzle-loading guns, 2 pistols, 2 single-barrel and 3 double-barrel shotguns, with huge amounts of ammunition.
1999: September	Arrested a poacher and recovered a double-barrel shotgun with ammunition.
2000: February	Led an anti-poaching party and arrested a poacher in Santipur village, near Pabitora, recovering a muzzle-loading gun from his house. One associate was arrested from Marigaon District and 2 were arrested in Kuthuri village, near Nelli. Recovered a .500-bore rifle.

Anti-poaching activities have been under the leadership of Range Officer Mrigen Barua

The author with a rhino calf rescued during flood at Kaziranga National Park (photo: Nilam Bora).

Poachers with a rhino horn arrested by the anti-poaching staff of Pabitora Wildlife Service (photo: Bibhab Kumar Talukdar).

Highway patrolling in Kaziranga to stop speeding vehicles from killing wildlife in floodtime (photo: Bibhab Kumar Talukdar).

Electric wire and gunpowder used to kill rhinos, recovered from poachers by Pabitora anti-poaching staff (photo: Bibhab Kumar Talukdar).

Legal orientation camp held in rhino-bearing protected areas of Assam, organized by the NGO Aaranyak for forest staff (photo: Bibhab Kumar Talukdar).

Rhino status in Orang National Park

The status of rhino in Orang has been of great concern of late because of the increased number of incidents of poaching. As a result of the conservation efforts made since Orang was declared a wildlife sanctuary in 1985, its rhino population increased from 65 in 1985 to 97 in 1991 (Talukdar 1995). However, Vigne and Martin (1998) showed that the number of poaching incidents increased during 1994 to 1997, when poachers killed 36 rhinos. The current study shows that from January 1998 to September 2000, 25 more rhinos were killed by poachers in Orang, resulting in only 46 rhinos counted during the 1999 rhino census there.

The local NGOs and officials from the forest department considered the seriousness of the situation and proposed that the Assam government upgrade the Orang Wildlife Sanctuary to a national park. In April 1999, the government finally declared Orang a national park. A number of NGOs, mainly Aaranyak, supported by the David Shepherd Conservation Foundation, have donated 18 walkie-talkies and 10 solar panels to Orang to enhance the anti-poaching efforts of the forest staff. The Rhino Foundation, supported by the US Fish and Wildlife Service, has donated two base stations for wireless communication and more walkie-talkies, thus strengthening the wireless network system to a great extent. A Gypsy 4-wheel-drive vehicle was donated to Orang by Care for the Wild, a local NGO, and Aaranyak and the David Shepherd Conservation Foundation donated a locally made metal speed boat to improve the mobility of the forest staff and allow them to carry out their duties effectively. The improved wireless network in Orang has led to fewer rhinos being poached—from 12 in 1998 to 7 in 1999 and 6 in 2000 by the end of September. The forest guards of Orang killed a poacher in an encounter in 1999.

Local NGOs in Assam like the Rhino Foundation, Aaranyak and Early Birds fully supported Orang during those years of heavy poaching, helping staff to bring the situation under control. Aaranyak organized two legal awareness camps for range officers, forest guards and officials, which the divisional forest officer also attended. An advocate of the Gauhati High Court who was also the Aaranyak legal consultant conducted the orientation camps. The participants learned various aspects of existing law and law enforcement to protect endangered species.

The Rhino Foundation repaired the boat used in the anti-poaching efforts, and Early Birds held vaccination camps for the domestic cattle in the villages bordering the park to stop the transmission of the deadly anthrax from domestic cattle to wild rhinos. The Early Birds' plan of creating an immune belt to stop the spread of anthrax is aimed to have a long-term effect in reducing rhino death from the disease in the national park. Most deaths that are termed natural are caused by anthrax or related diseases.

Although flood is one of the major disasters in Kaziranga National Park and the Pabitora Wildlife Sanctuary, its impact on Orang National Park is negligible. Not a single rhino in Orang has been killed by flood. Although some areas of Orang are flooded, the higher northern terrace remains dry, and rhinos migrate to these areas when floodwaters are high.

Protection measures need to be improved to further strengthen the anti-poaching network and reduce rhino poaching in Orang. The NGOs continue to improve their support.

Rhino status in Kaziranga National Park

The Kaziranga National Park (KNP) is one of the most successful stories of conservation of *Rhinoceros unicornis* in the world. From a population of a mere dozen rhinos in 1908, when the Kaziranga was declared a forest reserve, the population has grown to 1500 over 90 years of conservation. The rhino census conducted in Kaziranga in April 1999 recorded a population of 1552 compared with 1164 in 1993. The population figures by block that were recorded during the 1999 census are summarized in table 4.

The park (fig. 1) is situated on the floodplains of the river Brahmaputra. The terrain is flat, with a gentle slope running down from east to west. The soil is rich in alluvial deposit that the annual floods lay down. Park location on the floodplain eases the task of demarcating blocks for the rhino census. The census used the direct visual total count method. It was conducted over two days, 8 and 9 April 1999, because it was not possible to cover the entire area in a single day. The park was divided into eight major blocks, as listed in table 4. These blocks were further divided into compartments: the Baguri block into 12

Table 4. Rhino population at Kaziranga National Park during the 1999 census, by block

Block	Area (km²)	Adult			Sub-adult			Calf	Total
		Male	Female	Not sexed	Male	Female	Not sexed		
Baguri	74.30	224	212	45	31	34	18	120	684
Bhawani	72.90	45	41	13	3	7	2	21	132
Boralimora	31.00	7	12	3	1	1	–	8	32
Charighoria	55.50	29	28	4	3	1	1	11	77
Haldibari	48.00	88	121	3	6	9	13	44	284
Kaziranga	44.70	37	50	10	–	1	12	20	130
Panbari	51.50	42	26	10	2	4	8	13	105
Tamulipathar	51.40	26	26	8	3	1	3	13	80
Total	429.30	498	516	96	49	58	57	250	1524
Addition area	479.56	9	12	–	–	–	–	7	28
Grand total	908.86	507	528	96	49	58	57	257	1552

Source: Forest Department of Assam

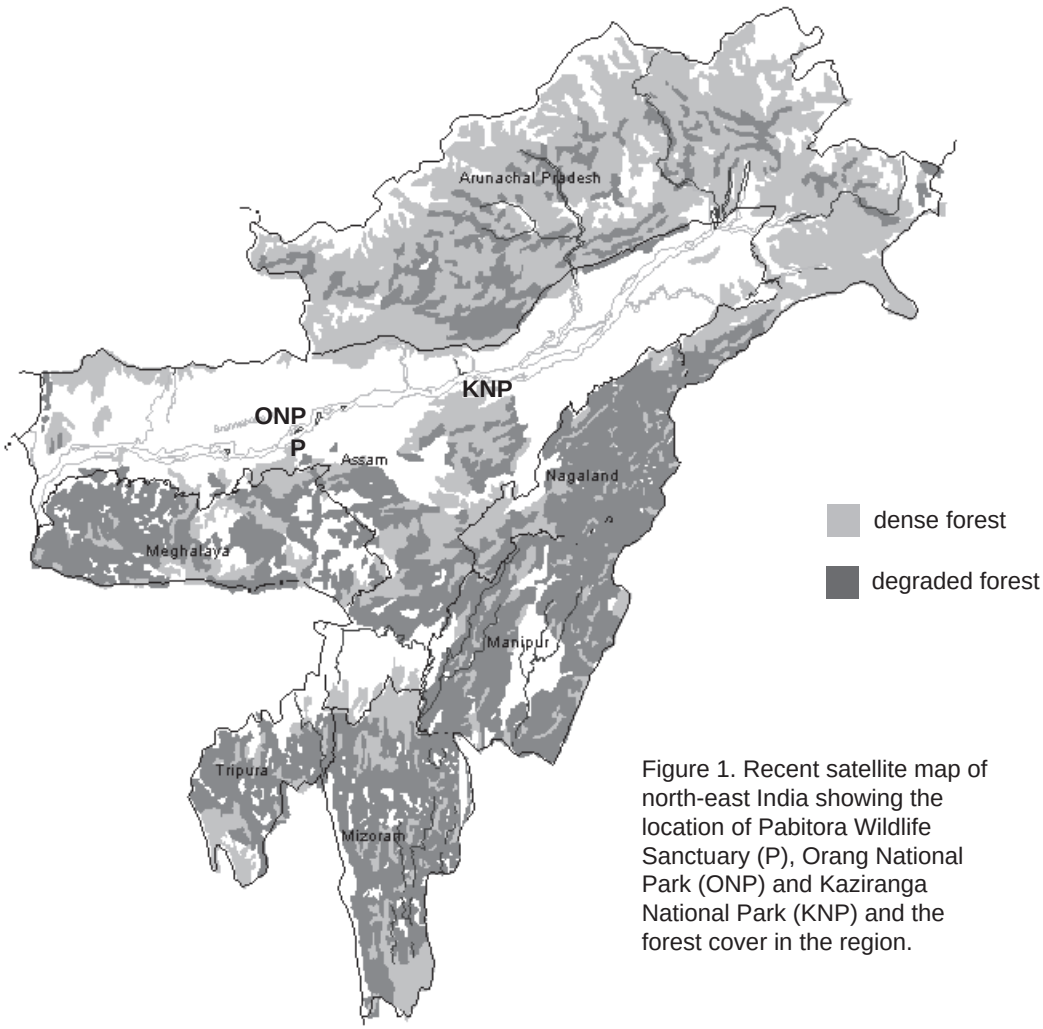

Figure 1. Recent satellite map of north-east India showing the location of Pabitora Wildlife Sanctuary (P), Orang National Park (ONP) and Kaziranga National Park (KNP) and the forest cover in the region.

compartments, the Bhawani, Charighoria, Haldibari, Kaziranga, Panbari, Tamulipathar blocks into 5 each, and the Boralimora block into 3, totaling 45 compartments in the eight blocks within the 429.3 km^2 of KNP. Eight more areas were included in the census: the first addition to KNP, Burapahar, with an area of 43.70 km^2; the second addition, Sildubi, 47 km^2; the third addition, Panbari, 0.69 km^2; the fourth addition, Kanchanjuri, 0.89 km^2; the fifth addition, 1.15 km^2; the sixth addition, the shore areas of Brahmaputra, 376.05 km^2; the Panbari Reserved Forest, 5.08 km^2; and the Moriahola area in the northern part of KNP, 5.00 km^2.

The census of 25 compartments was completed on the first day, 8 April; it included the first, second, third, fourth and fifth additions to KNP and the Panbari Reserved Forest. The remaining 20 compartments, the sixth addition and the Moriahola area were covered on the second day, 9 April. River Diffalu, which bisects the national park roughly into half, was taken as the dividing line for each day's count. The rhinos south of the river, including those in the addition areas, were counted on the day 1, and those north of the river were counted on day 2. Since the river is deep, with well-defined high banks, the chance of rhino crossing it on any one day was considered almost negligible.

The tall grass in KNP is burned every year as a management practice. In 1999, to assure a clear view for sighting the rhino, the grassland was burned before the April census was taken. After completing the pilot field survey, the Forest Department prepared a map of each compartment showing such features as the wetlands ('beels'), channels ('nallahs'), roads and patrolling paths. The starting point and the end point for the census in each compartment were clearly shown to avoid any confusion the enumerators might have in identifying their respective areas of census. Each enumeration party consisted of one enumerator in charge of the party; one assistant enumerator, usually from the media or an NGO; one guide, usually a forester or a forest guard with thorough knowledge of the area; and a mahut with an elephant. The park has four rangers.

The rhino population as recorded in the 1999 rhino census operation is shown in table 5.

Rhinos in KNP die from natural causes or poaching. The natural deaths come from floods, predation, old age or disease. Death by poaching comes from gunshot, pit poaching, electrocution or poisoning. The total death of rhinos in KNP in six years, between January 1993 and December 1998, stands at 462; 335 animals died of natural causes and 127 died from poaching. That means an average of 56 rhinos died a natural death each year during the six-year period of 1993 to 1996 and 21 died from poaching. Thus the average net annual mortality from 1993 until 1998 is 4.11% from natural death and 1.55% from poaching.

From January 1998 to September 2000, poachers killed 16 rhinos (table 6), but a fairly large number of poachers have been arrested or killed and firearms and ammunition seized. In 1999, poachers killed only

Table 5. Rhino population in Kaziranga National Park as recorded during the 1999 census

Range	Block	Rhino	
		no.	%
Western Range (Banguri)	Baguri	684	
	Bhawani (part)	53	47.55
	4th addition area	1	
	Total	738	
Central Range (Kohora)	Bhawani (part)	79	
	Charighoria	77	44.27
	Haldibari	284	
	Kaziranga	130	
	Panbari	105	
	2nd addition area	12	
	Total	687	
Eastern Range (Agoratoli)	Boralimora	32	
	Tamulipathar	80	7.22
	Total	112	
Burapahar Range	1st addition area	9	
	6th addition area	5	0.90
	Total	14	
Bokakhat Beat	Moriahola	1	0.06
Grand total		1552	100.00

Table 6. Details of rhino poaching and encounters in Kaziranga National Park, January 1998 to September 2000

Year	Rhino poached	Poachers killed	Poachers arrested	Arms recovered	Ammunition recovered
1998	8	3	2	2	435
1999	4	2	18	5	0
2000	4	0	15	na	na

4 rhinos, which is an all-time low for the history of Kaziranga since it became a national park in 1974.

Flood is another threat to the rhino population, especially the calves. In the devastating flood of 1998 about 39 rhinos were drowned in KNP, of which 18 were adult, 5 subadult and 16 calves. In the 1988 flood also, 38 rhinos were drowned of which 9 were adult, 10 subadult and 19 calves. Some of the KNP rhinos were found migrating to the adjoining hills of Karbi-Anglong through certain paths, but most of the rhinos remained inside the park. They were found taking shelter on the high land within the park in the flood of 1998. After the flood of 1998, the Forest Department and the Indian Army constructed more highlands to reduce the loss of wildlife, particularly the rhinos, because of high floods. It is hoped that in future floods the newly constructed highlands will offer some relief to the wildlife.

Threats to rhino in Assam in the 21st century

Conserving and protecting rhino in the 21st century in Assam will depend on continued relentless efforts by the forest staff to save the rhinos from poachers. Poaching will remain a major threat to the rhino population. Therefore, anti-poaching efforts have to be improved and maintained. Receiving information in advance on the movement of poachers and wildlife smugglers is extremely crucial in apprehending illegal wildlife traders and disrupting their activities. It is therefore imperative that clandestine channels of information are developed and a collection system is maintained to assist anti-poaching staff. In addition to the hazards caused by rhino poachers, natural floods and diseases, the state of Assam is likely to experience a further increase in human population. Weakly protected rhino sanctuaries would easily fall prey to encroachers, especially around the Brahmaputra Valley. Unless the government of Assam expands its rhino sanctuaries in the next two years, the increased human population pressure will threaten the future of the rhino living in the few existing pockets like Kaziranga, Orang, Pabitora and Manas.

The six additions to KNP cover an area of 430 km^2. Some were handed over to KNP last year, but the government has not yet handed over the sixth addition, which covers an area of around 376 km^2. The expanded area to Pabitora Sanctuary also urgently needs to be handed over to provide more habitat for the increasing population of rhinos in Pabitora. It will also reduce the incidence of rhinos straying out of the sanctuary because habitat and food are in short supply. A number of water bodies in the rhino-bearing areas in Assam have shrunk in size and depth because of the siltation brought about by flooding. It is therefore imperative that these water bodies be desilted to maintain the wetland habitats for the rhinos. The future of the rhino will depend not only on ecological and natural factors but also on sociopolitical factors. The need is urgent to enhance the existing intelligence network and to initiate social welfare for the fringe villages with the aim of controlling village population explosion. If zero population growth could be achieved in the villages at the fringes of the rhino-bearing protected areas, the conflict between villagers and rhinos would be reduced. The Forest Department and the NGOs need to work together to achieve this uphill task.

Hence challenges before us are many, and only coordinated efforts will help us achieve our task of rhino conservation during the 21st century. Working in isolation will create more problems than solutions. With dedicated efforts, the Forest Department, which has nearly a hundred year of experience in rhino conservation, and with support from the NGOs and local people, the challenging task of conserving rhinos in Assam for next hundred years seems not a distant cry. Periodic evaluation of the successes and the failures of rhino conservation in various parts of Assam by the Forest Department and the NGOs will certainly make action at the appropriate time more possible.

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NOTE FROM THE FIELD

Population estimate of elephants in Arabuko-Sokoke Forest

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Additional key words: *Loxodonta africana,* dung decay rate, population density

Abstract

Elephant numbers in Arabuko-Sokoke Forest were in 1991 estimated to be between 78 and 90. With dung as an index of elephant abundance, an estimate was done in 1996 to determine present numbers and if the population had increased. Dung decay rate was estimated using two methods: reciprocal of the mean survival time and two points on the exponential curve. Density was estimated to be 0.34 km^2 by the former method and 0.46 km^2 by the latter. These densities projected an elephant population of 126 and 172, respectively.

Résumé

En 1991, on estimait que le nombre d'éléphants de la Forêt d'Arabuko-Sokoke était compris entre 78 et 90. En se servant des crottes comme d'un index de l'abondance des éléphants, on a réalisé en 1996 une estimation pour déterminer leur nombre et voir si la population avait augmenté. On a estimé le taux de décomposition des crottes par deux méthodes : la réciproque du temps de survie moyen et deux points sur la courbe exponentielle. La première méthode donnait une estimation de 0,34/km^2, et la seconde, une estimation de 0,46/km^2. Ces densités correspondent respectivement à des populations de 126 et de 172 individus.

Mots clés supplémentaires: *Loxodonta africana,* taux de désintégration des croftins, population densité

Introduction

Elephants have a major impact on the species richness of their habitat (Western 1989, Waithaka 1994, Kamanga 1997). At high densities, their feeding activities lead to habitat degradation (Glover 1963, Höft and Höft 1992, Kamanga 1997). Data on elephant numbers and their feeding activities are therefore essential for proper management of elephant populations, particularly in the increasingly fragmented and isolated habitats in which they occur. Gesicho (1991) estimated elephant numbers in Arabuko-Sokoke Forest to be between 78 and 90. Since there were no reports of elephant poaching in the forest from 1991 to 1996, the population was expected to increase. The aim of this study was to estimate the present elephant population size in the forest.

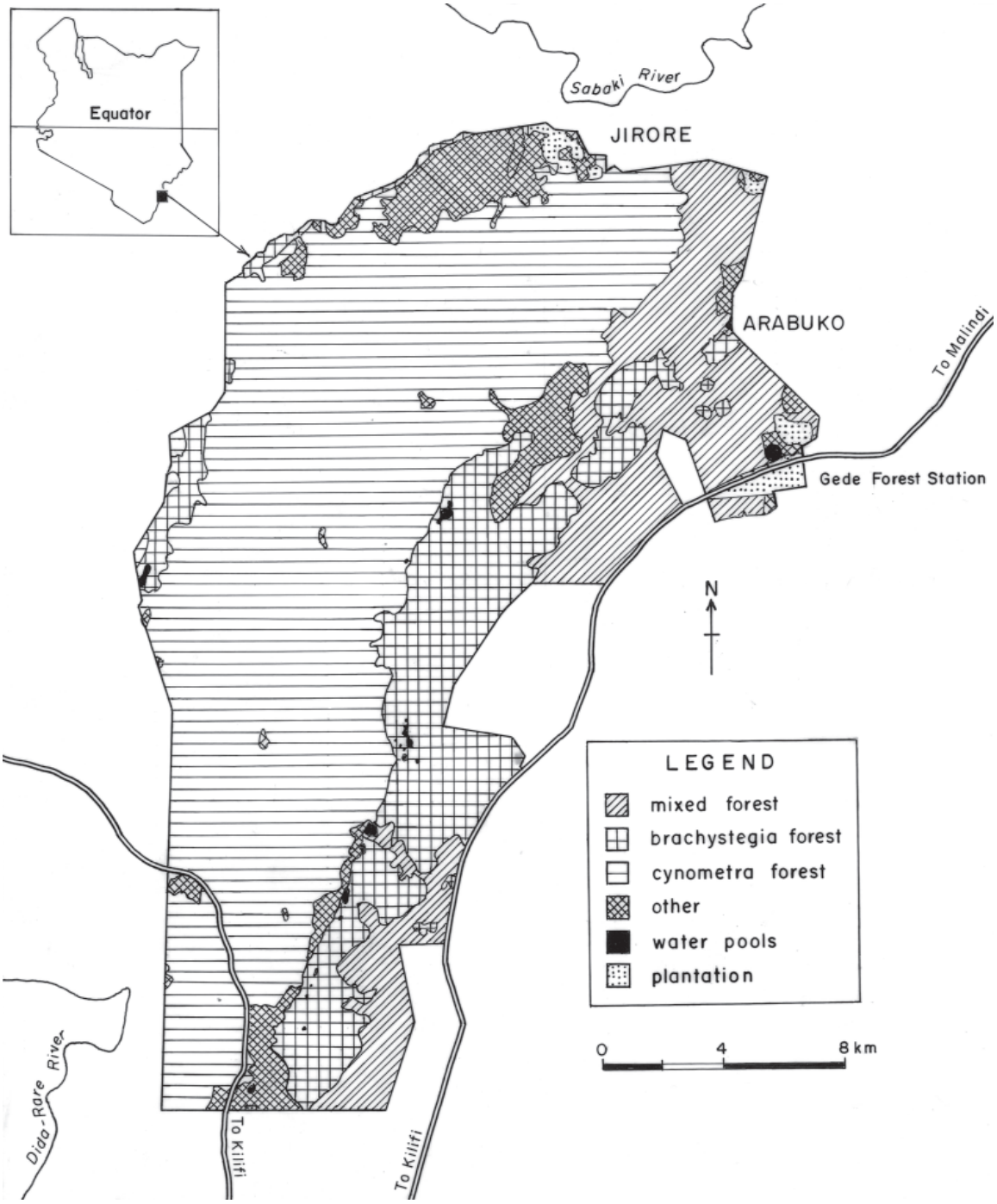

Figure 1. A map of Arabuko-Sokoke Forest showing the vegetation types and water sources. Inset shows where in Kenya the forest is located.

Materials and methods

Study area

Arabuko-Sokoke Forest (fig. 1) is in Kilifi and Malindi Districts, Coast Province, Kenya at 3°50' to 3°10' S and 39°50' to 40° E. It lies along the Mombasa–Malindi highway between Kilifi and Malindi towns and has an area of 372 km^2. Rainfall is bimodal with mean annual rainfall ranging from 900 mm to 1100 mm. Monthly average temperatures range from 27 to 30°C. The forest supports a diversity of fauna (Britton and Zimmerman 1979, Dreves 1992, Chira 1993, Fairclough *et al.* 1995).

Methods

The elephant population in Arabuko-Sokoke Forest was estimated using dung as the index of elephant abundance (McClanahan 1986, Barnes and Jensen 1987). This method requires three parameters: elephant dung decay rate (R), defecation rate (D) and dung density (Y).

To determine elephant dung decay rate (R) in the forest, 94 fresh elephant dung piles were marked and monitored regularly from November 1995 to December 1996 until they all decayed (Barnes and Barnes 1992). Dung decay rate was calculated using two methods: 1) the reciprocal of the mean survival time and 2) two points on the exponential curve (Barnes and Barnes 1992). The widely used figure of 17 dung piles per day (Wing and Buss 1970, Barnes and Jensen 1987) was used for the defecation rate. Litoroh and Mwathe (1996) estimated elephant dung density (Y) in Arabuko-Sokoke Forest in 1996 to be 869 dung piles per square kilometre. This figure was used to estimate elephant density (E) in the forest using the ratio $E = RY/D$.

Elephant population estimate was the product of elephant density and the forest area.

Results

The mean survival time for elephant dung piles in Arabuko-Sokoke Forest was 151.5 days (±98.5 SD). Dung decay rate was 0.0066 per day, using the reciprocal of the mean survival time method (Barnes and Barnes 1992). Elephant density was 0.337/km^2 (table 1). As the area is 372 km^2, calculations would indicate that there were 126 elephants in the forest. However, the method using two points on the exponential curve (Barnes and Barnes 1992) yielded an elephant dung decay rate of 0.0091, indicating an elephant density of 0.463/km^2 and an elephant population of 172 elephants (table 1).

Discussion

Gesicho (1991) estimated the population to be between 78 and 90 elephants in 1991 using the method of two points on the exponential curve. Although estimating elephant numbers in forests by the three parameters of elephant dung decay rate, defecation rate and density (Barnes and Jensen 1987) is prone to error, the 1996 count was greater than the 1991 count made by the same method. These findings therefore indicate that the elephant population in the forest has been increasing. Dung decay rate is influenced by many factors including humidity, rainfall, exposure to sunshine, activity of organisms like dung beetles

Table 1. Elephant dung decay rate, density and population estimates at Arabuko-Sokoke Forest in 1996/97

Method	Dung decay rate (dung piles per day)		Elephant density (elephants/km^2)		Elephants (no.)	
	no.	range	no.	range	no.	range
Reciprocal of mean survival time	0.007	0.006–0.008	0.337	0.299–0.387	126	111–114
Two points on the exponential curve	0.009	0.005–0.012	0.463	0.278–0.633	172	104–235

Range was estimated using the standard error of the mean of the dung decay rate. Method according to Barnes and Barnes (1992).

and termites, and diet (Barnes 1993; White 1995). At Arabuko-Sokoke Forest dung beetles were very active during wet season (personal observation). Some of the dung piles monitored were marked at the beginning of November 1995 before the commencement of the wet period while others were marked in late November and December 1995 (a wet period). Therefore, the calculated dung decay rate is representative of climatic variations.

In my study, elephant density in Arabuko-Sokoke Forest was between 0.34 and 0.46/km^2, calculated on the method of estimating dung decay rate. In 1995, Shimba Hills, another Kenyan coastal forest, had an elephant population density of 2 elephants/km^2 (Kamanga 1997). This population density was higher than could be supported by that forest. Thus elephants were destroying the forest at an alarming rate by pulling down trees (Kamanga 1997 and personal observation). In that study, the elephant carrying capacity of Shimba Hills was estimated to be 1.4/km^2. Although Arabuko-Sokoke Forest has a relatively low elephant population density during my study, there is need to monitor the elephant population to safeguard the forest's biodiversity from increased elephant density. In addition, elephants in the forest raid crops on farms adjacent to the forest (Muoria, unpublished data). Thus further increase in elephant numbers might translate into higher crop-raiding intensities.

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NOTES FROM THE AFRICAN RHINO SPECIALIST GROUP

Conservation strategy for Cameroon's western black rhino, *Diceros bicornis longipes*

IUCN-SSC African Rhino Specialist Group, French Committee for IUCN-SSC, WWF

The western black rhino is the most critically endangered of all African rhinos. Time for its survival is running out, and without concerted action the subspecies is likely to go extinct in the near future. The scheduled high-level mission to Cameroon offers what is probably the last chance for the authorities, key stakeholders, rhino experts and potential donors to decide on funding and to implement an emergency strategy to save this subspecies from extinction.

Following discussions at the Lake Manyara IUCN–SSC African Rhino Specialist Group (AfRSG) meeting in May 2000, the group recommended that the mission choose and develop an appropriate recovery strategy—one which should consider the donor funds available. The mission also urgently needs to develop an action plan for the recovery strategy with a timetable and defined roles and responsibilities for all the stakeholders. This strategy should be implemented as soon as possible.

In recent years, potential options for conserving the few remaining western black rhinos have been debated and examined in detail. Discussions at AfRSG's 2000 meeting in Lake Manyara, Tanzania, built upon these options and additional background work done by the French Committee of IUCN, WWF Cameroon and the AfRSG Secretariat. A working group at the May 2000 AfRSG meeting examined the biological, security, financial and logistic implications of different options in detail.

The technical opinion of the IUCN–SSC AfRSG is that given the current low numbers and scattered distribution of the remaining western black rhinos, a number of options proposed in the past can now be discounted. The African Rhino Specialist Group believes that the only options with a reasonable chance of success involve consolidating and intensively protecting all remaining rhinos in one place in the wild. In time, as numbers build up, surplus animals can be translocated to set up additional populations. This translocation, however, will be many years in the future.

The background document prepared for the high-level mission to Cameroon examines the biological, security and cost implications of four potential options. It also provides comparative funding requirements to implement and run the various options over an initial five-year period.

The African Rhino Specialist Group strongly recommends consolidating the remaining rhinos within Cameroon as the best option. However, support for this idea depends on a number of conditions. Assuming that the Cameroon authorities will demonstrate a significant political will to conserve the few remaining rhinos, sufficient long-term funding will have to be secured to set up and run an effective fenced sanctuary or unfenced intensive protection zone. A number of fundamental security-related problems will have to be addressed. No option is likely to succeed in Cameroon if effective security measures are not implemented.

For security, AfRSG believes that conserving the remaining rhinos in a well-protected fenced sanctuary is preferable to consolidating the animals in an unfenced, intensive-protection zone. Building and running a very large sanctuary might be ideal, but it is also the most expensive option. As only a few rhinos are likely to be captured, AfRSG believes that the more practical and easier option to fund would be to start with a small sanctuary that can be expanded as rhino numbers increase.

If the funds are not available and insecurity persists, then no in-situ consolidation option is likely to

succeed in the short term. The African Rhino Specialist Group believes the preferred fallback option would be to move all the remaining animals to an ex-situ fenced sanctuary outside of Cameroon, where they could be looked after under temporary custodianship, as part of a negotiated bilateral agreement. This option would save the western black rhinos and give Cameroon more time to raise funds and create the necessary conditions for in-situ rhino conservation that will succeed in future. Once the authorities will have met the required conditions and rhino numbers will have built up in the ex-situ sanctuary, the rhinos could be reintroduced back into Cameroon.

SADC regional program for rhino conservation

Richard H. Emslie

IUCN-SSC AfRSG Scientific Officer

Dr Rob Brett has been appointed SADC rhino program coordinator and has taken up his position in Harare, Zimbabwe.

Reviews of rhino conservation in SADC range states were undertaken from June to September 2000. A key part of these reviews was to identify and solicit potential projects for funding by the SADC Regional Program for Rhino Conservation. At a meeting of the SADC rhino program consortium meeting scheduled for 9–10 October 2000, potential projects for funding were to be reviewed and program budgets and activity plans drawn up for the next six-month period.

African rhinos numbering 13,000 for first time since the mid-1980s

compiled by Richard H. Emslie

IUCN-SSC AfRSG Scientific Officer

White rhino

Southern white rhino *(Ceratotherium simum simum)* numbers have continued to increase to an estimated 10,377 in 1999, up from 8441 in 1997, 7532 in 1995 and 6784 in 1993.

Part of the big increase from 1997 to 1999 is because of the revised Kruger National Park figures that were based on a 15% aerial distance sampling estimate. To err on the side of caution, it was decided to take the lower 95% level as the Kruger population estimate.

All countries with wild white rhinos recorded increasing populations, with the exception of Zambia, which recorded a decline of one. Two white rhinos were seen alive in Mozambique, but whether they are escapees from Kruger Park in South Africa is unknown.

South Africa remains by far the most important range state, with 94% of the wild population, amounting to 9754 white rhinos; while Zimbabwe (208), Kenya (164) and Namibia (163) conserve most of the remainder. Just over 22% (2319) of the continental total is now privately owned.

Northern white rhinos remain limited to Garamba National Park in the Democratic Republic of Congo but have fared better in the second civil war. Surveys have confirmed at least 24 animals existing and quite possibly as many as 7 others. Subsequent information from Dr Kes Smith suggests the true population is towards the higher side of this range.

Black rhino

Continent-wide, black rhino numbers stabilized at about 2400 between 1992 and 1995, increasing up to 2600 by 1997. Encouragingly, the latest 1999 black rhino estimate of ~2700 indicates numbers continue to creep upwards. The major range states are still South Africa (1074), Namibia (695), Zimbabwe (435) and Kenya (420). While the increase is encouraging, some rated populations in a number of range states have been performing suboptimally and may be overstocked.

The most critically endangered subspecies remains the western subspecies, *Diceros bicornis longipes.* While there have not been any new surveys, remaining rhinos are still restricted to a small scattered population in northern Cameroon.

Overall numbers of the eastern *D. b. michaeli* were pretty stable, with the majority (86%) being conserved in Kenya.

Namibia remains the stronghold of the south-western black rhino, *D. b. bicornis*, conserving 94% of the estimated 737 animals in 1999.

The most numerous subspecies, the southern central *D. b. minor*, occurs in six range states, of which South Africa with 1000 (68%) and Zimbabwe with 435 (30%) are by far the most important. Some Zimbabwe populations in particular continue to show rapid growth. Overall numbers have increased from 1298 in 1995 to 1363 in 1997 to 1467 in 1999. The recent invasions of Zimbabwean conservancies by war veterans is, however, a cause for concern.

Numbers by country

Table 1 shows total numbers of African rhino, with the numbers broken down by country and subspecies. It should be noted that estimates based on speculation or old data are not included in the population totals given.

Table 1. Numbers of white and black rhinos in Africa in 1999: by country and subspecies

Species, subspecies	White rhino				Black rhino					
	C. s. cottoni (northern)	*C. s. simum* (southern]	Total	Trend[a]	*D. b. bicornis* (south-western)	*D. b. longipes* (western)	*D. b. michaeli* (eastern)	*D. b. minor* (south central)	Total	Trend[a]
Botswana	–	31	31	up	–	–	–	–	–	–
Cameroon	–	–	–	–	–	10	–	–	10	down?
Chad	–	–	–	–	–	temp	–	–	temp	–
D R Congo	28	–	28	up?	–	–	–	–	–	–
Kenya	–	164	164	up	–	–	420	–	420	stable
Malawi	–	–	–	–	–	–	–	7	7	up
Mozambique	–	2	2	down?	–	–	–	extinct?	0	–
Namibia	–	163	163	up	695	–	–	–	695	up
Rwanda	–	–	–	–	–	–	6	–	6	up
South Africa	–	9754	9754	up	42	–	32	1000	1074	up
Swaziland	–	50	50	up	–	–	–	10	10	up
Tanzania	–	–	–	–	–	–	32	15	47	up
Zambia	–	5	5	down	–	–	–	–	–	–
Zimbabwe	–	208	208	up	–	–	–	435	435	up
Totals	28	10377	10405	up	737	10	490	1467	2704	up

Compiled by the IUCN-SSC African Rhino Specialist Group

Table excludes speculative guesstimates. Ivory Coast southern white rhinos are excluded as these are semi-captive and out of range. Numbers were compiled at the 2000 AfRSG meeting held in Tanzania from 26 May to 1 June 2000, with some totals updated later. Countries listed with no rhinos may possibly have rhinos, but this needs confirmation. Exact Swaziland numbers were given to the AfRSG but are being kept confidential for security reasons. The table shows approximations to true number. Numbers of *D. b. minor* in Tanzania may well be higher, but this requires confirmation.

C. s. – Ceretotherium simum; D. b. – Diceros bicornis

[a] Trend refers to the underlying performance of populations and ignores changes in numbers caused by translocations.

Table 2. Number of *key* and *important* African rhinoceros populations by country in 1999

	Black rhino			White rhino			Rated populations
Rating	Key 1	Key 2	Important	Key 1	Key 2	Important	key & important
Cameroon	1	0	0	0	0	0	1
DR Congo	0	0	0	1	0	0	1
Kenya	0	2	7	0	1	2	12
Namibia	2	0	1	0	0	3	6
South Africa	2	1	6	4	5	25	43
Swaziland	0	0	0	0	0	1	1
Zimbabwe	0	3	4	0	0	5	12
Total	5	6	18	5	6	36	76

Terms as defined in the African Rhino Action Plan:
Key 1 – population increasing or stable, $n > 100$ or 50% of the subspecies
Key 2 – population increasing or stable and $n = 51–100$ or 26–50% of the subspecies
Important – population increasing or stable and $n = 20–50$

'Key' and 'important' populations

Table 2 shows that by 1999, continentally there were 76 AfRSG-rated *key*[1] or *important* rhino populations. In 1999, the 76 populations rated *key* and *important* conserved 84.2% and 83.3% of Africa's black and white rhinos respectively. Corresponding proportions of the subspecies conserved in AfRSG-rated populations varied from 76.1% (eastern black) to 83.3% (southern white) to 85.8% (south-western black) to 86% (south central black) to 100% for the two rarest subspecies (northern white and western black). The key-rated populations alone conserve just over three-quarters of both black and white rhinos in the wild. By way of contrast, the 47 unrated black and 197 unrated white rhino populations conserved 427 and 1736 rhinos respectively.

Breakdown of rhino numbers by management model

While three out of every four African rhinos are still conserved in state-run protected areas (75.6%), 18.27% are privately owned and a further 3.68% managed by the private sector on a custodianship basis for the state. Rhinos on communal land account for a further 1.22% with only 1.21% under other models.

The bulk of privately managed black rhinos are under custodianship on behalf of the state (17.86% of all black rhinos). Only 2.81% of black rhinos are privately owned. This differs from white rhinos, where 22.29% (2319) of all white rhinos are privately owned.

More black rhinos than white rhinos occur on communal land (160 vs 20), accounting for 5.18% of all black rhinos.

In 1999, of the 251 known discrete white rhino populations in Africa, 178 (70.9%) were privately owned, and 52 occurred in state-run protected areas. However, many of these privately owned white rhino populations are small with an average size of only 13 rhinos, compared with an average population of 153 in state-run protected areas.

Of the 84 discrete black rhino populations in 1999, 49 occurred on state-protected areas with an average size of 41 rhinos. Of those that are privately managed, 22 populations (roughly a quarter) were managed on a custodianship basis (average size, 22). In 1999 there were 8 privately owned black rhino populations, although all were small, averaging only 9.5 rhinos each.

In four of the white rhino range states (Botswana, Kenya, Namibia and Swaziland), more white rhinos occur on privately managed or owned or communal land than on land managed by the formal state conservation bodies. In Zimbabwe in 1999, approximately twice as many black rhinos were managed by the private sector on a custodianship basis (293) than were conserved in state-run protected areas (142). A further 190 black rhinos were also managed under custodianship in Kenya, Namibia and Swaziland with 76 being privately owned in South Africa.

[1] For a definition of *key* and *important* populations, see the IUCN AfRSG's African Rhino Action Plan.

In 1999, 4 out of the 11 AfRSG-rated *key* white rhino populations in the world and a further 17 of the 35 AfRSG-rated *important* white populations occurred on private land. One of the five *key* populations was a national park linked to adjacent private game reserves.

In contrast to the pattern with white rhinos, there are many black rhinos on private land in Kenya, Namibia, Swaziland and Zimbabwe that are managed on a custodianship basis for the state (as opposed to being privately owned). In 1999, the 11 AfRSG-rated *key* populations of black rhinos included 2 Zimbabwean conservancies and 1 Kenyan sanctuary; with a further 5 *important* custodianship populations. From 1997 to 1999, numbers of black rhino managed by the private sector on a custodianship basis increased from 394 to 483.

Black rhino numbers have in general declined markedly over the last decade on much of the communal land where they used to occur. At present, 17.64% of the south-western black rhinos and 2.04% of the eastern black rhinos are conserved on communal land. Overall, 5.18% of Africa's black rhinos were found on communal land in 1999, compared with only 0.19% of Africa's white rhinos. In South Africa and Kenya, local area or municipal authorities run a limited number of reserves and conservation areas. The Masai Mara National Reserve in Kenya is run by the local Narok and Trans Mara county councils, while in Tanzania the Ngorongoro Area Authority manages Ngorongoro and the surrounding area. South Africa also has seven small municipally owned and run parks that have a few white rhinos. In 1999 such municipal or county council or local-area-authority parks held 39 white rhinos and 42 black rhinos, accounting for about 0.62% of Africa's rhinos. All such black rhinos are of the eastern subspecies, making up 8.57% of this subspecies in the wild.

Progress with developing statistical models to determine the source and species of recovered illegal rhino horn in Africa based on analyses of its chemistry

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It is often said that 'you are what you eat'. Because elements and different isotopes present in food plants, affected by climate, geology and type of plant, can be absorbed into rhino horn through the digestive processes, chemical analysis of rhino horn offers the potential of determining both the source of the horn as well as the species of rhino that produced it.

Results of the WWF-funded AfRSG continental horn fingerprinting project, which aims to develop forensic techniques to determine the source and species of rhino horn based on analysis of its chemistry, have been written up in a detailed confidential final report submitted to WWF.

This report discusses the statistical analysis of rhino-horn chemistry data for samples of horn from populations holding approximately 70% of Africa's rhinos. After dealing with problems of high data dimensionality, multicolinearity and zero values, successful species and source-identification models were built using discriminant functions—often with 100% post-hoc classification success. Horn chemistry was also related to rainfall and primary productivity, and horn tips were found not to differ consistently chemically from the rest of the horn. The best source-determination models used data from all three labs and analysed data for the two species separately at the finer spatial scale of park or area within a park. Graphical presentation of the results (canonical plots, traces and icon plots) also enables them to be understood by laymen.

However, despite these successes, results should be treated as preliminary until they are validated

independently using jack-knifing, which requires the acquisition of more advanced statistical software. Further work is also required to improve identification of samples that have come from areas not yet covered by the horn fingerprint atlas.

As part of the process of taking the analyses further, with the ultimate aim of developing a routine forensic source-determination technique, the AfRSG Scientific Officer will inform the peer review of the work done at the Southern African Statistical Association Conference in November 2000. Dr Rajan Amin of the Zoological Society of London has offered to assist with further statistical analysis.

Sandwith's rhino identification training course for field rangers revised by the Africa Rhino Specialist Group

Richard H. Emslie

IUCN-SSC AfRSG Scientific Officer

A revised training course has been produced by Keryn Adcock and Richard Emslie. In revising the course, they consulted users of the original Sandwith ID training course and experts in adult environmental education and training methods to give feedback and suggest how the original course could be improved. The results are as follows:

- AfRSG should extensively revise the posters, manuals and videos.
- The training exercises should be made as participatory as possible.
- The terrain model should be scrapped.

The people who participated in the exercise recommended to the trainers how best to present the course. They suggested that the revised version be expanded to include information on the white rhino and the revised recommended rhino age-classification system. The standardized condition-scoring system was described in issue no. 26 of *Pachyderm*. The course has been made easier for trainers to conduct and for students to understand.

The African Rhino Specialist Group produced 25 revised training course sets, 23 of which have been distributed to the field in Kenya, Namibia, South Africa and Tanzania. Responses from the field to the revised course have been very positive.

The ID training course can lead to more game scouts and field rangers being able to collect quality ID data, which can be used to assess rhino population sizes, health and performance. With these data, better-informed metapopulation management decisions can be made. Such a course also plays a major role in standardizing rhino monitoring (for example, age classes, condition scoring), making it possible to compare results across countries and parks, for the benefit of rhinos.

With the exception of the video presentations, the course can be conducted under a tree in the bush. Once trained, observers need only a pencil, field data recording forms and a pair of binoculars to work. The technology being used is appropriate, given declining budgets for conservation in the field in Africa.

Acknowledgements. The production of the revised training course was made possible primarily by a grant from the US Fish and Wildlife's Rhino and Tiger Conservation Fund. WWF also helped cover much of the cost of distributing the sets. The production of the revised course was made possible by the many people who assisted by grossly undercharging for work done or by donating time free or facilities free. In particular, thanks are due to the consultant Keryn Adcock for providing so much additional time free of charge; Don Guy and Victor Hugo for charging so little for use of the video studio and editing facilities, and for giving their time without charge; the AfRSG Scientific Officer's sponsors (especially WWF, the International Rhino Foundation, the UK Department of Environment, Transport and the Regions, the US State Department) for covering the cost of his time; all the photographers and film producers (including SABC) who provided AfRSG with permission to use their material; Ecoscot Consultancy Services for provided computers, printers and software to produce master copies of the posters and manuals; and KwaZulu-Natal Nature Conservation Service, who kindly donated the time to allow Philip Brown to make the ear models.

African rhinos and CITES Conference of the Parties 11

Richard H. Emslie

IUCN-SSC AfRSG Scientific Officer

The implementation status of CITES Resolution 9.14 was difficult to evaluate, and it provided no reporting mechanism. It was therefore revised at the CITES Conference of the Parties in Nairobi (COP 11) as Com 11.19. The revision of Resolution Conf. 9.14 urges parties to identify, mark and register rhinoceros stock and to implement comprehensive legislation and enforcement controls. All range states, and other parties where applicable, are now strongly urged to submit a report, according to an agreed format, to the Secretariat six months before each CITES Conference of the Parties detailing the status of captive and wild populations. The report includes sections on legislation and enforcement. Com 11.19 also calls for engagement among parties and the IUCN-SSC Rhino Specialist Groups to achieve the resolution's aims.

Record rhino prices fetched at 2000 Hluhluwe game auction

Richard H. Emslie

IUCN-SSC AfRSG Scientific Officer

At this year's Hluhluwe game auction in KwaZulu-Natal, South Africa, the 42 white rhinos sold fetched record prices averaging 200,238 South African rand per rhino (~US$29,200) and ranging from 125,000 rand (~US$18,250) to 345,000 rand (~US$50,365) per animal. This represents a $4^{1}/_{2}$-fold increase in price since 1996 and an increase of almost 70% over last year's price.

The founder breeding group of six black rhinos also fetched the highest price since 1992 at 375,000 rand (US$54,750) each. The total turnover at the auction was 8.41 million rand (~US$1.23 m) for the 42 white rhinos and 2.25 million rand (~US$330,000) for six black rhinos. Rhinos accounted for 70.65% of the turnover.

PRODUCTS

Human–Elephant Taskforce products available for research collaborators

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A Human–Elephant Conflict Taskforce of the IUCN African Elephant Specialist Group (AfESG) has been working on this key issue for elephant conservation. It is now making available a number of products that it would like people to use and comment on. The plan is to establish a standardized approach with a feedback loop so that research results are comparable between vastly differing human–elephant conflict (HEC) sites.

Since we are a technical facilitation body, we welcome new people to this loose network, especially those who have their own field resources. This is an ongoing process, and you will see from the list below that additional management-oriented products are being produced. We are willing to establish formal memoranda of understanding with data providers who are willing to make their data available to the AfESG. We ask only that the use of any AfESG products is appropriately acknowledged in the output of your project and that you send us copies.

Available products

1 HEC bibliographic list for Africa (mostly English and kept updated)

2 A recommended standardized data collection and analysis protocol for HEC situations

3 A training package for enumerators of elephant damage

4 A synthesis of recent research into aspects of human–elephant conflict in Africa. This is a summary and synthesis of a set of eight studies done by consultants in 1998–1999. The synthesis is published in *Pachyderm* 28: 73–77 (January–June 2000). Titles of the studies with the authors and their contacts follow.

4.1 The social dimensions of HEC in Africa: a literature review and case studies from Uganda and Cameroon, by Lisa Naughton, Robert Rose and Adrian Treves; <naughton@geography.wisc.edu>

4.2 Elephant crop raiding in the Dzanga-Sangha Reserve, Central African Republic, by Andrea Turkalo and Ami Kamiss; <andrea@ssmail.net>

4.3 The distribution of elephants in relation to crop damage around the Bia Conservation Area of Ghana and Cote d'Ivoire during the 1999 rainy season, by Moses Kofi Sam; <osmo28@hotmail.com>

4.4 Assessing the evidence for the existence of 'habitual problem elephants', by Richard Hoare; <rhoare@mango.zw>

4.5 Data collection and analysis protocol for human–elephant conflict situations in Africa, by Richard Hoare; <rhoare@mango.zw>

4.6 A training package for enumerators of elephant damage, by Richard Hoare; <rhoare@mango.zw>

4.7 A spatial analysis of human–elephant conflict in the Tsavo ecosystem, Kenya, by Bob Smith and Sam Kasiki; <rjs1@ukc.ac.uk>

4.8 A review of problem elephant policies and

management options in southern Africa, by Russell Taylor; <rtaylor@wwf.org.zw>

Products under development

A Standardized hard-copy maps of HEC sites generated from LANDSAT imagery (trial being set up from Sept 2000)

B A decision support system (DSS) for HEC management aimed at wildlife authorities and conservation agencies (work commencing soon, scheduled completion June 2001). Note: Comments and input to this approach are most welcome.

C GIS analysis capability through the African Elephant Database of the AfESG, especially concentrating on stated recommendations of Phase 2: HEC site definition; HEC severity indices; HEC predictors, Testing hypotheses on causal factors of HEC (from 2001)

We hope to have 1, 2, 3 from the 'Available products' list on the AfESG Web site soon. All the currently available products are in Word 97. If you wish to receive them, let me know if you can receive attachments on your email and if you have a ZIP program (WinZip) so that I can send compressed files.

Queries to
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BOOK REVIEW

The Ivory Markets of Africa, by Esmond Martin and Daniel Stiles
(Save the Elephants, PO Box 54667, Nairobi, Kenya, and
7 New Square, Lincoln's Inn, London WC2A 3RA, England, 2000)

review by Kees Rookmaaker
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The two investigators, Drs Esmond Martin and Daniel Stiles, between them visited 17 cities in 13 African countries between May and November 1999 to establish a set of baseline data about the ivory trade. They tried to cover just about every angle relating to the market of ivory on the African continent, including the quantities of displayed retail worked ivory, the price of raw and worked ivory, and the number of retail outlets and workshops. Many other details are also included.

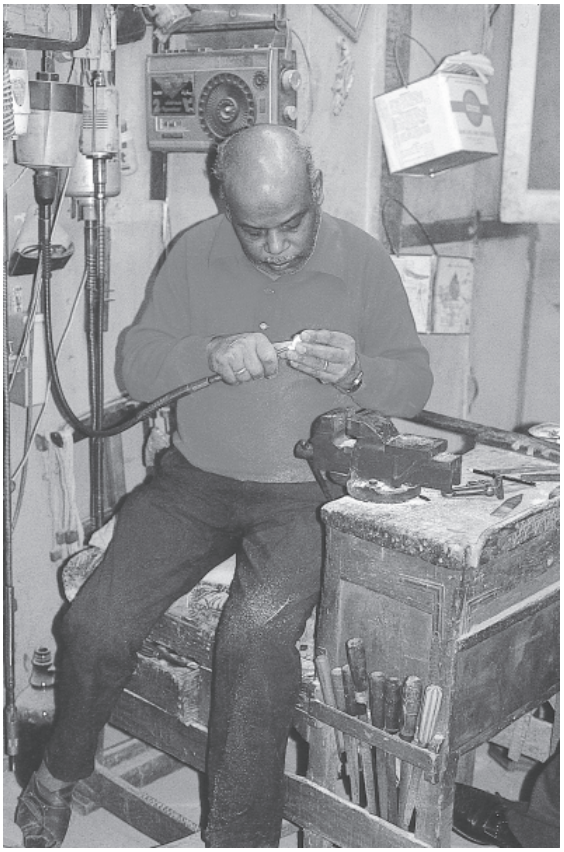
The result is an information-packed book of 84 closely printed pages, which should indeed be a starting point for any future research to be conducted along compatible lines. The methods that the two researchers used were not quite the same, and it would be advisable in future to use exactly the same questionnaire or methodology.

Just a line from the summary shows the mind-staggering amount of data collected: 110,000 ivory items were found displayed in 657 outlets in 15 countries (including two the authors had studied earlier). We all know that ivory trade is much restricted by CITES rules, to which all these 15 countries subscribe, even if sometimes more on paper than in reality, and to gather this kind of information is not always without personal danger.

I found it remarkable that the three East African states were excluded from the survey, but I was told in a letter from Dr Esmond Martin that presently there is no retail trade of ivory there. Maybe that should have been stated in this volume.

The trade in ivory has experienced a marked drop since the start of the CITES ban in 1990, in all cities except Lagos. Even so a great number of items are still on sale. It may not be surprising that these items are not meant for the local market, and that all worked ivory is bought by diplomats, personnel from international organizations like the UN, military personnel and foreign tourists from Europe, America and the Far East. This would suggest that even if the African governments are too financially stretched to actively enforce the CITES ban, the onus should lie on the customs officials of the importing nations as well as on conservation bodies to continue to educate the general public. The expatriate workforce in many African countries could even be approached more directly to tell them about the effects of the trade in ivory on elephant populations, and of course equally important the consequences of purchasing other wildlife items like cat skins and rhino horn.

The book is well produced, and the data are set out consistently and clearly. I think few people will study every detail. The introductions and discussions are quite enlightening and helpful. The authors are to be commended for the thoroughness of their survey. I for one appreciate greatly that this time the results are not relegated to an unobtainable internal report but published and accessible to all who are interested.



Cairo is the main centre for carving and selling ivory items in North Africa. The raw ivory comes mostly from Sudan (photo: Esmond Martin).

In Ethiopia today, the main buyers of ivory commodities are foreign diplomats, French and Italian tourists, and Chinese and Korean business-men and labourers (photo: Esmond Martin).

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Fifth African Rhino Specialist Group meeting

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27 May–1 June 2000

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