Pachyderm

July – December 2003 Number 35

ISSN 1026 2881

Pachyderm

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

July–December 2003 No. 35

Cover: Forest elephant mother and baby, Central African Republic. Photo by Andrea Turkalo.

IUCN
The World Conservation Union

Species Survival Commission

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EUROPEAN COMMISSION

This document has been produced with the financial assistance of the European Commission. The views expressed herein are those of the authors and can therefore in no way be taken to reflect the official opinion of the European Commission.

Production of this issue of *Pachyderm* is also supported by the International Elephant Foundation.

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July–December 2003 **No. 35**

CHAIR REPORTS
RAPPORTS DES PRESIDENTS

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

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At the time of writing this report, the AfESG Secretariat is busy preparing for the sixth AfESG Members' Meeting, which is to take place at Mokuti Lodge, Namibia, 4–8 December 2003. Members' meetings provide an ideal opportunity for the group to discuss priority issues in elephant conservation and management and to share lessons learned. In addition to presentations on cutting-edge elephant research activities, at this year's meeting the group will be reviewing progress made on a variety of initiatives since the last meeting in early 2002. The members are to be brought up to date on AfESG work, including publication of the *African elephant status report 2002* and the completion of the 'Guidelines for in situ translocation of the African elephant for conservation purposes'. Emerging problems such as sourcing wild elephants for captivity are also on the agenda. As always, a full report summarizing the outcome of the meeting will appear in a subsequent issue of *Pachyderm*.

In the midst of all the preparations for the upcoming meeting, our progress has been steady on a number of important initiatives.

A l'heure de rédiger ce rapport, le secrétariat du GSEAf est occupé à préparer la Sixième Réunion de ses membres qui aura lieu à Mokuti Lodge, en Namibie, de 4 au 8 décembre 2003. Les réunions des membres donnent au groupe l'occasion idéale de discuter des sujets prioritaires de la conservation et de la gestion des éléphants et de partager les leçons apprises. En plus des présentations sur les toutes dernières activités de recherche sur les éléphants, lors de la réunion de cette année, le groupe passera en revue les progrès réalisés dans le cadre de toute une variété d'initiatives, depuis la dernière réunion du début de 2002. Les membres seront mis au courant de tout le travail réalisé par le GSEAf, y compris la publication du *African elephant status report 2002* et la version finale des « Directives pour la translocation *in situ* de l'éléphant africain, à des fins de conservation ». De nouveaux problèmes, tels que la sélection des éléphants sauvages destinés à la captivité, sont aussi à l'ordre du jour. Comme d'habitude, un rapport complet résumant les résultats de la réunion paraîtra dans une prochaine édition de *Pachyderm.*

Malgré l'agitation de tous les préparatifs de cette prochaine réunion, nos progrès ont été continus dans un certain nombre d'initiatives importantes.

African elephant translocation guidelines

After months of dedicated effort by the joint AfESG/RSG Reintroduction Task Force (RTF), a near-final draft of the 'Guidelines for in situ translocation of the African elephant for conservation purposes' was completed, and in April 2003 a special Web page was created on the AfESG's Web site to host the draft. This special Web page provided instructions for our members and the public at large to read it and send us comments on the document. In addition, comments were invited from selected technical reviewers. The Reintroduction and Veterinary Specialist groups also distributed the draft guidelines to potential reviewers through their respective networks of experts.

The RTF met for a second time in Nairobi in May 2003 to discuss the feedback received from the review process. In addition to improving the text, the RTF decided that the guidelines should be illustrated, professionally copyedited and translated into Portuguese. This will make them particularly useful for practitioners in the Portuguese-speaking range states of Angola and Mozambique, where elephant translocations and reintroductions are being planned in the near future.

African elephant status report 2002

As I write this, the *African elephant status report 2002* is being printed and should be available for distribution in hard copy and electronic format in the coming weeks. Like its predecessors, the *African elephant database 1995* and the 1998 update, this report is expected to become the standard global reference on the status of elephants in Africa. The report has gone through several major revisions and contains a number of useful innovations and improvements, such as categorizing range data in terms of reliability; including point range data, data quality tables for range and estimates alike, and new historical sections; expanding regional and continental sections; and improving cartographic quality and layout. The 2002 report will also go up on the Web site soon. We look forward to constructive feedback on it from one and all.

Human–elephant conflict

Update on the site-based human–elephant conflict mitigation project

AfESG's Human–Elephant Conflict Working Group is continuing its efforts to help implement the WWF-

Directives pour la translocation d'éléphants d'Afrique

Après des mois d'efforts consciencieux, l'équipe spéciale chargée de la Réintroduction (RTF), équipe conjointe du GSR et du GSEAf, a terminé un avant-projet presque définitif des « Directives pour la translocation *in situ* de l'éléphant d'Afrique à des fins de conservation » et en avril 2003, une page spéciale a été créée sur le site Web du GSEAf pour présenter ce projet. Cette page spéciale fournissait des instructions pour nos membres et pour le public en général, en leur demandant de la lire et de nous envoyer leurs commentaires sur ce document. On a aussi demandé des commentaires à certains réviseurs techniques sélectionnés. Les groupes de Réintroduction et des Spécialistes Vétérinaires ont aussi distribué le projet de directives à des réviseurs potentiels par l'intermédiaire de leurs réseaux d'experts respectifs.

La RTF s'est réunie une seconde fois à Nairobi en mai 2003 pour discuter le feedback reçu suite au processus de révision. Non contente d'améliorer le texte, la RTF a aussi décidé qu'il faudrait illustrer les directives, les éditer de manière professionnelle et les traduire en portugais. Ceci les rendra particulièrement utiles pour ceux qui travaillent dans les États lusophones de l'aire de répartition, l'Angola et le Mozambique, où l'on prévoit de pratiquer des translocations et des réintroductions d'éléphants dans un proche avenir.

Rapport 2002 sur le statut de l'éléphant africain

Au moment où j'écris ces lignes, le *Rapport 2002 sur le statut de l'éléphant africain* est sous presse et il devrait être disponible dans ses versions imprimée et électronique dans les semaines qui viennent. Comme pour ses prédécesseurs, les mises à jours de 1995 et de 1998 de la Base de données de l'éléphant africain, on s'attend à ce que ce rapport devienne la référence mondiale pour le statut des éléphants en Afrique. Ce rapport a connu plusieurs révisions majeures et il renferme un certain nombre d'innovations et d'améliorations très utiles, comme le classement des données de répartition en termes de fiabilité ; l'intégration de données ponctuelles de répartition, des tables de la qualité tant pour la répartition que pour les estimations, et de nouvelles sections historiques ; une extension des sections

funded, site-based, human–elephant conflict (HEC) mitigation project. A training workshop for enumerators was recently held at the South Luangwa NP site in Zambia, which was attended by the relevant Zambian Wildlife Authority professional staff. This resulted in a clear institutional set-up being established to deal with HEC in the Lupande Game Management Area neighbouring the park. The Luangwa site and Niassa, in Mozambique, have been further integrated into an initiative by the WWF Southern Africa Regional Office (SARPO) to provide greater support in low-cost local mitigation of human–wildlife conflict and institutional support for community-based natural resource management. Several meetings and the review of a SARPO funding proposal to WWF International have taken place in this regard. Data on HEC in the Selous in Tanzania are being collected and collecting will commence shortly at the Gamba site in Gabon.

Transferring responsibility for mitigating human–elephant conflict to local communities

In addition to testing and improving its practical tools and products, AfESG is investigating the potential benefits of transferring responsibility for mitigating HEC from centralized wildlife agencies to local communities themselves, in both institutional and practical terms. For example, the formation of conflict-resolution committees that acknowledge the responsibility for HEC to be 1) mandated to and 2) shared by a local partnership of stakeholders appears to be a good way of beginning to mitigate HEC. Such approaches have proven locally successful in Burkina Faso, Guinea Conakry, Kenya, Mozambique and Tanzania and are being introduced in many other range states as well.

Recent meetings to discuss human–wildlife conflict

It is clear that AfESG's pioneering work on practical tools and products, such as the Decision Support System and the standardized Data Collection Protocol, are not only valuable in helping HEC managers to design site-specific mitigation strategies but are also helping other practitioners in resolving human–wildlife conflict to develop solutions to local conflicts. This benefit has been amply demonstrated during dis-

régionales et continentale ; et une amélioration de la qualité des cartes et de la présentation. Le rapport 2002 sera aussi bientôt sur le Web. Nous attendons un feedback constructif de chacun d'entre vous.

Conflits hommes-éléphants

Mise à jour du projet de mitigation des conflits hommes–éléphants basé sur site

Le Groupe de travail du GSEAf chargé des conflits hommes–éléphants poursuit ses efforts pour aider à mettre au point le projet de mitigation des conflits hommes–éléphants (HEC) basé sur site, financé par le WWF. Il y a eu récemment un atelier de formation pour les énumérateurs dans le Parc National de Luangwa-sud, en Zambie, auquel a assisté le personnel professionnel concerné de l'Autorité Zambienne de la Faune. Ceci a abouti à l'établissement d'un organe institutionnel bien défini, chargé de gérer les HEC dans l'Aire de Gestion de la Faune de Lupande, voisine du parc. Le site de Luangwa et Niassa, au Mozambique, ont aussi été intégrés dans une initiative du Bureau régional du WWF-Afrique australe (SARPO) afin de pouvoir mieux soutenir une mitigation locale moins chère des conflits hommes–faune sauvage et apporter un support institutionnel à la gestion communautaire des ressources naturelles. A ce sujet, il y a eu plusieurs réunions et une révision d'une proposition de financement adressée par le SARPO au WWF International. On est en train de récolter des données sur les HEC dans le Selous, en Tanzanie, et la même opération va bientÙt commencer sur le site de Gamba, au Gabon.

Le transfert des responsabilités en matière de gestion des conflits hommes–éléphants vers les communautés locales

Non content de tester et d'améliorer ses outils pratiques, le GSEAf étudie les avantages potentiels qu'il y aurait à transférer la responsabilité de la mitigation des HEC des organes centraux de la faune vers les communautés locales elles-mêmes, tant au point de vue pratique qu'institutionnel. Par exemple, la formation de comités de résolution des conflits qui reconnaissent que la responsabilité des HEC doit 1) faire l'objet de rapports et 2) être partagée par des partenaires locaux, semble une bonne façon de commencer à gérer ces conflits.

cussions with colleagues from around the world at two recent conferences.

The first of these was the workshop 'Creating coexistence between humans and wildlife: a global perspective on addressing human–wildlife conflict locally', which was convened at the World Parks Congress in Durban, South Africa, in September 2003. There I had the opportunity to give a paper entitled 'Searching for solutions: the evolution of an integrated approach to understanding and mitigating human–elephant conflict in Africa'. The paper traced the history of our work on mitigating human–elephant conflict and provided a synopsis of lessons learned to date. While I was the only one presenting on elephant-related conflict, there were many other interesting speakers and a number of commonalities and synergies emerged. Of special interest were the potential opportunities to collaborate with highly experienced practitioners who have developed interesting methodologies for assessing the human dimension of conflict.

Shortly after the Durban meeting, a symposium on 'Human–elephant relationships and conflicts' took place in Sri Lanka. The symposium was attended by a number of AfESG members including Mr Patrick Omondi, a member of the AfESG's Human–Elephant Conflict Working Group, who gave a short presentation on the group's work. The talk generated a lot of interest and enquiries from the participants. Mr Omondi will be giving a short report on the outcome of the symposium at the Members' Meeting in December.

Central Africa

Central African Elephant Conservation Strategy

In central Africa, efforts are continuing to facilitate the development of a Central Africa Elephant Conservation Strategy. Funds are being sought for a workshop to design a strategic framework for the strategy, and a substantive background document has been compiled to prepare for it.

Elephants and the bushmeat trade

The bushmeat trade is now perceived as one of the most persistent threats to the survival of many wildlife species in the forests of central Africa, including

De telles approches se sont avérées positives au Burkina Faso, en Guinée Conakry, au Kenya, au Mozambique et en Tanzanie et sont en voie d'être introduites dans de nombreux autres États de l'aire de répartition.

Les dernières réunions pour discuter des conflits hommes–faune sauvage

Il est évident que le travail de pionnier accompli par le GSEAf sur des outils et des instruments pratiques tels que le *Decision Support System* et le Protocole standardisé de récolte des données, n'a pas uniquement l'intérêt d'aider les gestion-naires des HEC à concevoir des stratégies de mitigation spécifiques, mais qu'il aide aussi d'autres personnes impliquées à mettre au point des solutions pour des conflits locaux. Cet intérêt a été largement démontré au cours de discussions avec des collègues venus du monde entier pour deux récentes conférences.

La première des deux fut l'atelier « Créer la coexistence entre les hommes et la faune sauvage : perspective globale sur la gestion locale des conflits hommes-faune sauvage », qui s'est tenu lors du Congrès Mondial des Parcs, à Durban, Afrique du Sud, en septembre. J'y ai eu l'occasion de diffuser un article (en anglais) sur la « Recherche de solutions : l'évolution d'une approche intégrée pour comprendre et gérer les conflits hommes-éléphants en Afrique ». Cet article retrace l'historique de notre travail sur la mitigation de conflits hommes–éléphants et apporte un synopsis des leçons apprises à ce jour. Si j'ai été la seule à parler des conflits impliquant des éléphants, il y eut de nombreux autres orateurs intéressants, et un grand nombre de cas similaires et de synergies sont apparus. Les possibilités de collaborer avec des praticiens très expérimentés qui ont mis au point des méthodologies intéres-santes pour évaluer la dimension humaine des conflits étaient particulièrement stimulantes.

Peu après la réunion de Durban, un symposium s'est tenu au Sri Lanka sur les relations et les conflits hommes–éléphants. Le symposium a reçu la participation d'un certain nombre de membres du GSEAf, y compris M. Patrick Omondi, un membre du Groupe de travail du GSEAf pour les conflits hommes–éléphants, qui a fait une brève présentation du travail du groupe. Ce communiqué a suscité beaucoup d'intérêt et de questions de la part des participants. M. Omondi fera un court rapport sur le résultat du symposium à la réunion des membres, en décembre.

elephants. However, while killing elephants for meat has been widely reported, few data exist on the extent and impact of this form of killing and commercial trade. In an attempt to shed more light on this issue, AfESG is planning to initiate a series of studies to lay the groundwork for developing practical recommendations for wildlife authorities and other relevant practitioners in the subregion. It is likely that the initial pilot studies on the use of elephant meat will be carried out in Cameroon in close collaboration with the activities of the CITES system for Monitoring the Illegal Killing of Elephants (MIKE) and other strategic partner organizations.

West Africa

Promoting the West African Elephant Conservation Strategy

In June 2003, the AfESG West African programme officer and I met with representatives from the Bonn Convention on Migratory Species (CMS) and the Economic Community of West African States (ECOWAS) to discuss the development of a formal, ministerial-level memorandum of understanding to accompany the West African Elephant Conservation Strategy, which we helped to articulate in 1999. Since that time, AfESG, together with the IUCN Regional Office for West Africa, has also been engaged in a process to secure ministerial level approval of the strategy through ECOWAS. In the meantime, the Parties to CMS also expressed a desire to see such an agreement put into place, and this seems like a good opportunity to join forces towards a common vision.

With this intent, it was agreed at the June meeting that AfESG would work with the CMS secretariat to prepare a memorandum of understanding for signature by the relevant ministers of the West African elephant range states. The West African Elephant Conservation Strategy will form an integral part of this memorandum. Once a sufficient number of range states have signed it, it can be taken to ECOWAS for formal adoption.

Conservation and management of cross-border elephant populations in West Africa

The protection of elephant habitat, and especially the need to establish and manage several important

Afrique centrale

La Stratégie centrafricaine pour la Conservation des éléphants

En Afrique centrale, les efforts se poursuivent afin de faciliter le développement d'une Stratégie de conservation pour l'éléphant. On recherche les fonds pour organiser un atelier qui a pour but la conception d'un cadre stratégique pour cette stratégie, et on a consulté une abondante bibliographie pour le préparer.

Les éléphants et le commerce de viande de brousse

Le commerce de viande de brousse est maintenant considéré comme une des menaces les plus persistantes qui pèsent sur la survie de nombreuses espèces sauvages des forêts d'Afrique centrale, y compris les éléphants. Pourtant, bien qu'on ait souvent rapporté des cas d'éléphants tués pour la viande, il existe peu de données sur l'étendue et l'impact de cette forme de massacre et sur ce commerce. Pour tenter de mettre ce problème plus en lumière, le GSEAf prévoit de lancer une série d'études afin de poser les bases de futures recommandations pratiques destinées aux autorités concernées et aux autres gestionnaires intéressés de la sous-région. Il est probable que les premières études pilotes sur l'utilisation de la viande d'éléphant auront lieu au Cameroun, en étroite collaboration avec les activités du système de la CITES pour la Surveillance continue des Massacres illégaux d'éléphants (MIKE), et avec d'autres organisations partenaires stratégiques.

Afrique de l'Ouest

Promouvoir la Stratégie de Conservation de l'éléphant d'Afrique de l'Ouest

En juin 2003, le responsable du programme ouest-africain du GSEAf et moi-même avons rencontré des représentants de la Convention de Bonn sur les espèces migratrices (CMS) et de la communauté économique des États d'Afrique de l'Ouest (ECOWAS) pour discuter du développement, au niveau ministériel, d'un protocole destiné à accompagner la Stratégie ouest-africaine de Conservation de l'éléphant que nous avons aidé à mettre au point en1999. Depuis lors, le GSEAf, en collaboration avec le Bureau régional de l'UICN en Afrique

transfrontier conservation areas, constitutes a primary objective of the West African Elephant Conservation Strategy. Indeed, a number of the most important elephant populations in West Africa straddle international borders, which in turn create special conservation problems for wildlife management authorities and their partners. To respond to such challenges, AfESG's West Africa Programme Office organized a workshop in Ouagadougou, Burkina Faso, on 9–11 June 2003 to develop action plans for five key areas harbouring the largest remaining transfrontier elephant populations in West Africa. These include 1) the Pendjari, Parc West and East Burkina Faso complex (shared by Benin, Burkina Faso and Niger); 2) the Gourma area (Burkina Faso and Mali); 3) Zabré, NE Ghana and Doung area (Burkina Faso, Ghana and Togo); 4) Bia-Goaso and Djam (Côte d'Ivoire and Ghana) and 5) Grebo North Forest and Taï Forest (Côte d'Ivoire and Liberia). Taken together, the elephants of these five areas represent more than 20% of the total number of elephants estimated for West Africa.

The meeting, funded by Conservation International's Critical Ecosystems Partnership Fund, was attended by technical experts in elephant conservation, protected-area management and land-use planning from Benin, Burkina Faso, Côte d'Ivoire, Ghana, Liberia, Mali and Niger. The CMS secretariat, their West African focal point for elephants and ECOWAS were also represented. The workshop consisted of presentations, plenary discussions and working group sessions culminating in a series of draft action plans for the five areas. For each area, major threats to elephant conservation and management, priorities and objectives were identified and activities required to meet these objectives were outlined. Focal points were appointed for each of the five areas and AfESG will be working with them closely in the coming months to provide the necessary technical support to help secure funding to implement the action plans. A surprising degree of interest has already been confirmed.

Update on the CITES MIKE programme

AfESG continues to provide a significant level of technical support to the MIKE programme. In fact, the Technical Advisory Group (TAG) that oversees all technical aspects of the MIKE programme still largely comprise AfESG members. As MIKE be-

de l'Ouest, s'est aussi engagé dans un processus destiné à garantir l'approbation de la Stratégie, au niveau ministériel, par l'intermédiaire d'ECOWAS. Pendant ce temps, les Parties à la CMS ont aussi exprimé le souhait de voir un tel accord mis en place, et ceci semble une bonne occasion de réunir toutes les forces dans un même objectif.

Dans ce but, il fut décidé lors de la réunion de juin que le GSEAf travaillerait avec le Secrétariat de la CMS pour préparer un protocole qui serait soumis à la signature des ministres concernés des États ouest-africains de l'aire de répartition de l'éléphant. La Stratégie ouest-africaine de Conservation des éléphants fera intégralement partie de ce mémorandum. Dès qu'un nombre suffisant d'États de l'aire de répartition l'auront signé, il pourra être présenté à ECOWAS pour être officiellement adopté.

Conservation et gestion des populations transfrontières d'éléphants en Afrique de l'Ouest

La protection de l'habitat des éléphants — et spécialement la nécessité d'établir et de gérer plusieurs importantes aires de conservation transfrontières — constitue un des objectifs premiers de la Stratégie de Conservation de l'éléphant d'Afrique de l'Ouest. En effet, un certain nombre des plus importantes populations d'éléphants d'Afrique de l'Ouest franchissent des frontières internationales, ce qui soulève des problèmes de conservation particuliers pour les autorités de gestion de la faune et pour leurs partenaires. Pour répondre à de tels défis, le Bureau ouest-africain du Programme du GSEAf a organisé un atelier à Ouagadougou, au Burkina Faso, du 9 au 11 juin 2003, pour développer des plans d'action pour cinq zones clés hébergeant les plus grandes populations restantes d'éléphants en Afrique de l'Ouest. Celles-ci comprennent 1) le complexe Pendjari Parc est et ouest Burkina Faso (que se partagent le Bénin, le Burkina Faso et le Niger) ; 2) l'aire de Gourma (Burkina Faso et Mali) ; 3) l'aire de Zabré, N-E Ghana et Doung (Burkina Faso, Ghana et Togo; 4) Bia-Goaso et Djam (Côte d'Ivoire et Ghana ; 5) Forêt de Grebo-nord et Forêt de Taï (Côte d'Ivoire et Liberia). Ensemble, les éléphants de ces cinq zones représentent plus de 20% du nombre total estimé des éléphants d'Afrique de l'Ouest.

La réunion, financée par le Fonds de Partenariat pour les écosystèmes en danger de *Conservation In-*

comes implemented in Africa and Asia, the inputs it requires from TAG are growing. For instance, evidence from Asia suggests that the application of some approaches for surveying forest elephants, such as the line-transect dung-count method, may differ between African and Asian conditions. To better understand the differences and to promote dialogue between key players in Africa and Asia, several AfESG and TAG members attended the MIKE Dung Count Task Force meeting in October to discuss alternative approaches. This was followed in early November by a workshop sponsored by the Wildlife Conservation Society on monitoring elephants in the forest and assessing threats. The outcome of both meetings will be on the agenda at the next MIKE TAG meeting, to be held in Windhoek, Namibia, immediately after the AfESG Meeting. In addition to considering issues relating to elephant survey methods, the further development of the analytical strategy for MIKE and the best way to measure patrol effort are to be discussed at the meeting.

Securing funds for the future

All these activities are taking place against the backdrop of continuing efforts to raise funds to support AfESG's core activities. I am pleased to announce that the UK Department for Environment and Rural Development, a loyal donor to AfESG over the past several years, has already pledged additional funds, and hopefully by the time I write the next report we will have secured more from our other supporters. In the wake of the severe downturn in the global economy, our planned fund-raising trip to the United States was postponed. We await the advice of others on more auspicious times in the future.

ternational, a rassemblé des experts techniques de la conservation des éléphants, de la gestion des aires protégées et la planification de l'utilisation des terres du Bénin, du Burkina Faso, de Côte d'Ivoire, du Ghana, du Liberia, du Mali et du Niger. Le Secrétariat du CMS, leur point focal pour les éléphants en Afrique de l'Ouest et ECOWAS étaient aussi représentés. L'atelier consistait en présentations, en discussions plénières et en sessions de groupes de travail qui ont trouvé leur point culminant dans une série de projets de plans d'action pour les cinq zones. Pour chaque zone, on a identifié les principales menaces sur la conservation et la gestion des éléphants, ainsi que les priorités et les objectifs, et on a dessiné les activités requises pour atteindre ces objectifs. On a nommé des points focaux pour chacun des cinq zones ; le GSEAF travaillera avec eux durant les mois qui viennent et leur apportera le support technique nécessaire pour les aider à garantir le financement indispensable à la réalisation de ces plans d'actions. L'intérêt manifesté s'est avéré vraiment surprenant.

Mise à jour du programme MIKE de la CITES

Le GSEAf continue à fournir un support significatif au programme MIKE. En fait, le Groupe de support technique (TAG) qui supervise tous les aspects techniques du programme MIKE reste en grande partie composé de membres du GSEAf. Au moment où MIKE commence à être appliqué en Afrique et en Asie, les apports qu'il attend du TAG vont croissant. Par exemple, l'expérience asiatique montre que l'application de certaines approches pour étudier les éléphants de forêt, telle la méthode de comptage des crottes par transects, peut varier selon les conditions africaines ou asiatiques. Afin de mieux comprendre les différences et de promouvoir le dialogue entre les acteurs clés africains et asiatiques, plusieurs membres du GSEAf et du TAG assisteront à la réunion du Groupe de travail MIKE sur le comptage des crottes en octobre pour discuter d'approches alternatives. Ensuite, début novembre, aura lieu un atelier sponsorisé par la *Wildlife Conservation Society* sur la surveillance continue des éléphants en forêt et l'évaluation des menaces. Les résultats des deux réunions seront à l'agenda de la prochaine réunion du TAG de MIKE qui se tiendra à Windhoek, en Namibie, immédiatement après la Réunion des Membres du GSEAf. On devrait y discuter non

seulement des questions relatives aux méthodes de contrôle des éléphants mais aussi de la suite du développement de la stratégie analytique pour MIKE et de la meilleure façon de mesurer les efforts des patrouilles.

Garantir des financements pour l'avenir

Toutes ces activités ont lieu avec, en toile de fond, la poursuite des efforts destinés à lever des fonds pour soutenir les activités fondamentales du GSEAf. J'ai le plaisir de vous annoncer que le Département britannique de l'Environnement et du Développement rural, donateur fidèle du GSEAf depuis plusieurs années, a déjà promis des fonds supplémentaires et, espérons-le, au moment où je rédigerai le prochain rapport, nous aurons reçu des engagements de nos autres supporters. Suite aux difficultés économiques mondiales, le voyage que nous projetions de faire aux Etats Unis pour récolter des fonds a été postposé. Nous attendons l'avis d'autres personnes sur un timing plus favorable.

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

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Over the last year or so rhino poaching seems to have increased in some range states. Of particular concern is the increased threat now facing the world's only wild population of the *Critically Endangered* northern white rhino (*Ceratotherium simum simum*) in Garamba National Park in the north-east of the Democratic Republic of Congo. Two animals were poached around July and horns from another animal were recovered in June. A minimum of 22 northern white rhino were confirmed to be still alive on a recent aerial survey, but more intensive survey work is required to determine how many more still exist. An emergency plan is being put into operation to further improve protection efforts. Field conservation efforts continue to be supported by the International Rhino Foundation.

In Zimbabwe, some rhino in areas affected by the resettlement programme have been caught and moved to safer areas while others have been treated for snare wounds. The recent poaching of a number of rhinos in an Intensive Protection Zone (IPZ) in one of the major national parks is of particular concern as this is rated as a continentally *Key* population.

A major multidisciplinary workshop to review the ecology and conservation of Ngorongoro and its black rhinos was coordinated by Frankfurt Zoological Society's rhino coordinator Dr Pete Morkel. The workshop was held in August 2003 with financial support from the US Fish and Wildlife Service's Rhinoceros and Tiger Conservation Fund and the African Wildlife Foundation. Topics examined included the demography and performance of the crater rhino population, the nature and possible impact of habitat changes (especially in the Lerai forest), soil salinity, native weeds, changes in numbers of potentially competing species, the impact of the increasing human population in the Ngorongoro Conservation Area, past fire policy, predation, alien plants, ticks, vegetation monitoring, hydrology and the need for a metapopulation approach.

Cette dernière année, le braconnage des rhinos semble avoir augmenté dans certains États de l'aire de répartition. Ce qui nous inquiète particulièrement, c'est la menace croissante que connaît aujourd'hui la seule population sauvage,*gravement en danger,* de rhinos blancs du Nord (*Ceratotherium simum simum*) dans le Parc National de la Garamba, au nord-est de la République Démocratique du Congo. Deux animaux ont été braconnés aux environs de juillet et on avait retrouvé les cornes d'un autre en juin. On a confirmé, gr,ce à un contrôle aérien, l'existence d'au moins 22 rhinos blancs du Nord, mais il faut faire des recherches plus approfondies pour déterminer combien il y en a en tout. On est en train de mettre en œuvre un plan d'urgence pour améliorer encore les efforts de protection. Sur le terrain, les efforts sont toujours supportés par la *International Rhino Foundation*.

Au Zimbabwe, certains rhinos qui se trouvaient dans des zones affectées par le programme de redistribution des terres ont été attrapés et déplacés vers des endroits plus sûrs tandis que d'autres étaient soignées pour des blessures dues aux pièges. Le récent braconnage d'un certain nombre de rhinos dans une Zone de protection intensive (IPZ), à l'intérieur d'un des parcs les plus importants, est particulièrement inquiétant dans la mesure où il touche une population classée *population clé* à l'échelle du continent.

Le Dr Pete Morkel, coordinateur pour les rhinos de la Société Zoologique de Francfort, a coordonné un atelier multidisciplinaire majeur pour réviser l'écologie et la conservation du Ngorongoro et de ses rhinos noirs. Cet atelier s'est tenu en août 2003, avec le support financier du Fonds pour la Conservation du Tigre et du Rhino du *US Fish and Wildlife Service* et de l'*African Wildilfe Foundation.* On y a examiné des sujets tels que la démographie et les performances de la population de rhinos du cratère, la nature et les impacts éventuels des changements de l'habitat (spécialement dans la forêt de Lerai), la salinité du

During the reporting period the 5 black rhinos that had been donated by South African National Parks to Zambia, were reintroduced into the fenced sanctuary in North Luangwa National Park as planned. I am pleased to report that these rhinos have all settled in well in their new home. The challenge now is to augment the initial founders with the introduction of a further 15 animals to bring the founder number up to the recommended minimum of 20.

In another encouraging cross-border initiative, additional white rhinos from South Africa have also been introduced into the Mombo area of Moremi Game Reserve, Botswana, thus increasing the founder number.

As a consortium partner, the African Rhino Specialist Group (AfRSG) continues to give technical direction and input to the SADC Regional Programme for Rhino Conservation (RPRC). With SADC funding the Scientific Officer attended a workshop in July to help develop a national rhino policy for Zambia, and SADC RPRC provided some technical support for post-release monitoring of the black rhinos in North Luangwa. On the security side, a version of the Law Database has been completed and is currently undergoing field testing. Simon Milledge of TRAFFIC has also developed a database to help agencies manage and monitor their horn stockpiles. Following the successful Scene of the Crime Investigation training course held in Namibia in the last reporting period, courses have also been held in Kenya (funded by WWF) and Zimbabwe (funded by SADC RPRC).

The rapid visual assessment procedure for estimating of browse availability, which forms part of the SADC Rhino Management Group's Carrying Capacity Estimation model, has been developed further with the production of a series of reference photographs. This procedure will be tested for inter-observer repeatability during the next reporting period. Sets of laminated educational cards have also been produced to create better awareness for rhino conservation in rural schools. These are being tested in Zimbabwe and will be tested in at least one other range state. The WILDb rhino database also continues to be refined and is being made compatible with the new RHINO-2 population estimation software.

AfRSG has again updated its successful modified Sandwith course for training field rangers in rhino monitoring. A trainer's course was recently held in Pilanesberg with joint funding from the US Fish and

sol, les herbes indigènes, le changement du nombre d'espèces potentiellement concurrentes, l'impact de la croissance de la population humaine dans l'Aire de Conservation du Ngorongoro, la politique en matière de feux, la prédation, les plantes exotiques, les tiques, le contrôle de la végétation, l'hydrologie et la nécessité d'une approche en tant que métapopulation.

Durant la période qui fait l'objet de ce rapport, cinq rhinos noirs ont été donnés par les Parcs Nationaux sud-africains à la Zambie ; ils ont été réintroduits comme prévu dans le Sanctuaire clôturé du Parc National de Luangwa-nord. Je suis heureux de pouvoir vous dire que ces rhinos se sont tous bien adaptés à leur nouvel habitat. Le défi consiste désormais à augmenter la population fondatrice gr,ce à l'introduction de 15 animaux supplémentaires, pour atteindre le nombre de 20 qui est le minimum recommandé.

Dans une autre initiative transfrontière encourageante, de nouveaux rhinos blancs venus d'Afrique du Sud ont aussi été introduits dans la zone de Mombo, dans la Réserve de Faune de Moremi, au Botswana, augmentant ainsi la population reproductrice.

En tant que partenaire du consortium, le Groupe des Spécialistes des Rhinos d'Afrique (GSRAf) continue à donner des conseils et un apport techniques au Programme régional SADC pour la Conservation des rhinos (RPRC). Grâce à un financement du SADC, le responsable scientifique a assisté en juillet à un atelier destiné à aider au développement d'une politique nationale pour les rhinos en Zambie, et le RPRC du SADC a apporté un support technique pour la surveillance continue des rhinos noirs après leur lâcher dans le Luangwa-nord. Côté sécurité, on a terminé une version de la Base de données juridiques qui est actuellement testée sur le terrain. Simon Milledge, de TRAFFIC, a aussi mis au point une base de données pour aider les différents organismes à gérer et à contrôler leurs stocks de cornes. Suite au succès de la formation « Enquête sur les lieux du crime » qui s'est donnée en Namibie au cours de la période qui faisait l'objet du rapport précédent, on a aussi donné ces cours au Kenya (financés par le WWF) et au Zimbabwe (financés par le RPRC du SADC).

La procédure d'évaluation visuelle rapide de la capacité de broutage, qui fait partie du modèle d'Estimation de la Capacité de charge du Groupe de gestion des rhinos du SADC, a été développée

Wildlife Service's Rhinoceros and Tiger Conservation Fund and SADC RPRC, 19 trainers were accredited at the course from nine different conservation organizations in Botswana, Malawi, Namibia, South Africa, Tanzania and Zambia. The new materials, and especially the new trainees' booklet and laminated field pocket cards for assessing black rhino age and condition, were well received. The SADC RPRC also plans to hold additional courses in rhino monitoring in Zimbabwe by mid-2004.

The UK's Darwin Initiative project in Kenya to build rhino monitoring capacity has begun. It is to assist the Kenya Wildlife Service's Rhino Programme implement and institutionalize a system of reporting black rhino status annually. The project started with a training-of-trainers course in ID rhino monitoring methods using the AfRSG modified Sandwith course, with 18 of those attending qualifying as accredated rhino monitoring instructors. A special Swahili edition of the new trainees booklet was produced for this course, and it is planned to translate this booklet into more languages soon. Darwin Fellows are currently providing on-site support to the newly qualified instructors, and assisting with setting up rhino master ID files in each area as well as promoting good data-quality control. A revised version of the Kenyan rhino database system is also being installed in the different reserves and training provided in its use.

During the reporting period the SADC Rhino Management Group, comprising Namibia, South Africa, Swaziland and Zimbabwe, met at Palmwag, Namibia, in June 2003. Progress was made during a workshop at this meeting with the revision of the South African National Black Rhino Plan. This should be completed by the end of the year.

The joint WWF Netherlands/Ezemvelo KZN Wildlife project which aims to expand black rhino range and re-establish black rhinos using recommended AfRSG best practice has started in South Africa. Experienced rhino vet Dr Jacques Flamand has been appointed as the programme coordinator. The programme seeks, through landowner partnerships, to facilitate the setting up of founder populations with recommended minimum founder numbers of 20 in areas with the potential to hold in excess of 67 black rhinos. This project has also been actively promoting the importance of good biological management with the aim of increasing and maintaining high metapopulation growth rates. Thus the results and recommendations to emerge from the

davantage grâce à la production d'une série de photographies de références. La reproductibilité de cette procédure entre observateurs sera testée au cours de la période qui vient. Des sets de cartes éducatives plastifiées ont aussi été édités à destination des écoles rurales pour les sensibiliser davantage à la conservation des rhinos. On est en train de les tester au Zimbabwe et on le fera aussi dans au moins un autre État de l'aire de répartition. La base de données sur les rhinos WILDb continue à être peaufinée et on est occupé à la rendre compatible avec le nouveau logiciel RHINO-2 pour l'estimation des populations.

Le GSRAf a de nouveau mis à jour son excellent cours de formation Sandwith modifié sur la surveillance continue des rhinos, destiné aux gardes de terrain. Un cours pour formateurs s'est donné récemment au Pilanesberg, avec le financement conjoint du Fonds de Conservation du Tigre et du Rhino du *US Fish and Wildlife Service* et du RPRC du SADC. 19 formateurs y ont été accrédités par neuf organisations de conservation différentes du Botswana, du Malawi, de Namibie, d'Afrique du Sud, de Tanzanie et de Zambie. On y a fait bon accueil au nouveau matériel, et spécialement au nouveau fascicule pour les jeunes recrues et aux nouvelles cartes plastifiées de terrain, de format poche, qui permettent d'évaluer l'âge et la bonne condition des rhinos noirs. Le RPRC du SADC prévoit aussi de donner des cours supplémentaires sur la surveillance continue des rhinos au Zimbabwe vers le milieu de 2004.

Le projet de l'Initiative britannique de Darwin, consistant'à établir une capacité de contrôle continu des rhinos au Kenya, a commencé. Il doit aider le Programme Rhino du *Kenya Wildlife Service* à réaliser et à institutionnaliser un système de rapport annuel sur le statut du rhino noir. Le projet a débuté par un cours d'initiation des formateurs aux méthodes de contrôle et d'identification des rhinos en utilisant la version modifiée du cours Sandwith du GSRAf. 18 participants se sont qualifiés pour devenir des instructeurs accrédités en surveillance continue des rhinos. Une version spéciale du fascicule a été éditée en swahili pour ce cours, et on prévoit de le traduire bientÙt en d'autres langues. Les *Darwin Fellows* apportent actuellement un support sur site aux nouveaux instructeurs et ils aident à établir des fichiers d'identification des rhinos dans chaque zone tout en insistant sur la qualité du contrôle des données. On est aussi occupé à installer dans les différentes

SADC RPRC-funded RMG Workshop on Biological Management of Black Rhinos continue to make an impact.

The next meeting of the AfRSG has been scheduled for 6–11 June 2004 in Tsavo National Park, Kenya. These meetings are critical for capacity building and strategy development. Planning for this is under way, although the AfRSG Secretariat is currently busy seeking the additional funding required to be able to hold the meeting.

Interested readers can find more information on many of these initiatives in the Notes from the AfRSG section in this issue of *Pachyderm*.

Once again the AfRSG would like to thank WWF US through WWF's Africa Rhino Programme and WWF-SA for their support, which continues to allow the AfRSG Secretariat to function.

réserves une version révisée du système kenyan de la base de données sur les rhinos et à apprendre comment l'utiliser.

Au cours des mois qui font l'objet de ce rapport, le Groupe de gestion des rhinos du SADC, comprenant la Namibie, l'Afrique du Sud, le Swaziland et le Zimbabwe, s'est réuni à Palmwag, en Namibie, en juin 2003. Au cours d'un des ateliers, on a fait des progrès dans la révision du Plan National sud-africain pour le rhino noir. Celui-ci devrait être terminé à la fin de l'année.

Le projet conjoint WWF-Hollande/*Ezemvelo KZN Wildlife*, qui vise à étendre l'aire de répartition des rhinos noirs et à en réinstaller en se servant des « bons usages » recommandés par le GSRAf, a démarré en Afrique du Sud. Le Dr Jacques Flamand, qui est un vétérinaire spécialisé dans les rhinos, a été nommé coordinateur du programme. Celui-ci veut, grâce au partenariat avec des propriétaires terriens, faciliter la création de populations reproductrices qui comprennent un minimum de 20 rhinos noirs, dans des aires qui peuvent éventuellement en accueillir jusqu'à 67. Ce projet insiste aussi sur l'importance d'une bonne gestion biologique, en vue d'augmenter et de conserver un fort taux de croissance dans la métapopulation. C'est pourquoi les résultats et les recommandations qui émergent de l'atelier du RMG sur la Gestion biologique des rhinos noirs, financé par le SADC RPRC, continuent à avoir un impact.

La prochaine réunion du GSRAf est prévue du 6 au 11 juin 2004, au Parc National du Tsavo, au Kenya. Ces réunions sont vitales pour l'élaboration de capacités et le développement de stratégies. On est en train de préparer la prochaine réunion, bien que le Secrétariat du GSRAf soit actuellement encore occupé à rechercher le financement nécessaire à sa tenue.

Les lecteurs que cela intéresse peuvent trouver plus d'informations sur de nombreuses initiatives dans les Notes de la section du GSRAf de ce numéro de *Pachyderm*.

Une fois de plus, le GSRAf aimerait remercier le WWF-US, le Programme pour le Rhino d'Afrique du WWF, le WWF-SA pour leur soutien qui permet au Secrétaiat du GSRAf de continuer à fonctionner.

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 Nico van Strien, Programme Officers/Responsables de Programme

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Peninsula Malaysia

A more massive field operation than previously conducted was mounted on 2–15 October 2003 along 21 routes in Taman Negara National Park to search for and capture poachers. In addition to the protective action of the operation, an inventory was conducted of the Sumatran rhino and other species including tiger, elephant, tapir, gaur, bear, leopard and deer.

Each of the 21 teams had 12 members comprising wildlife rangers, part-time workers and soldiers. All teams entered the forest at almost the same time. Travel by boat to various entry points into the park required one to two days, and immediately upon arrival the teams started tracking. All but one made their way to their destinations by 15 October. A kneecap injury slowed down this one team, which came out a few days behind schedule.

Three groups of poachers were apprehended. The first comprised 2 Thai poachers from a group of 5; 3 got away. The 2 were produced in court by the Department of Wildlife and National Parks and fined 8000 Malaysian ringgit (RM) each or one-year imprisonment. They chose the latter. Charges from the police and immigration are pending. From a second group, 10 Thai poachers were captured one at a time as they returned from their outing. Wildlife rangers went back to the second Thai camp for further investigation and apprehended 14 local poachers, making a total of 26 poachers caught in one operation. These results indicate the urgent need to continuously enforce the law to discourage poachers.

Wildlife as recorded are in good numbers and are well distributed. The Sumatran rhino has been recorded in 16 different places including previous records. A tentative and conservative estimate of the population is 21 to 37 rhinos. A more conclusive estimate is being evaluated by further collection and analysis of data.

Péninsule malaise

Du 2 au 15 octobre 2003, on a entrepris une opération de terrain de plus grande envergure que d'habitude, le long de 21 routes du Parc National de Taman Negara, afin de chercher et de capturer des braconniers. En plus de son volet protection, on a profité de l'opération pour réaliser aussi un inventaire des rhinos de Sumatra et d'autres espèces, comme le tigre, l'éléphant, le tapir, le gaur, l'ours, le léopard et le cerf.

Chacune des 21 équipes comptait 12 membres parmi lesquels il y avait des gardes, des travailleurs à temps partiel et des soldats. Toutes les équipes ont pénétré dans la forêt pratiquement en même temps. Le trajet en bateau jusqu'à différents points d'entrée dans le parc a demandé un à deux jours, et les équipes ont commencé la traque dès leur arrivée. Toutes sauf une étaient arrivées à destination le 15 octobre. Cette dernière avait été ralentie par une blessure au genou et elle est arrivée avec quelques jours de retard.

On a appréhendé trois groupes de braconniers. Le premier se composait de deux braconniers Thaïs faisant partie d'un groupe de cinq dont trois se sont échappés. Les deux autres ont été présentés au tribunal par le Département de la Faune et des Parcs Nationaux et condamnés à une amende de 8000 ringgit malais (RM) chacun ou à une peine d'un an de prison. Ils ont choisi l'emprisonnement. Les accusations de la police et de l'immigration sont en attente. D'un deuxième groupe, on a capturé dix braconniers Thaïs, un à la fois, alors qu'ils rentraient de leur expédition. Les gardes sont retournés au deuxième campement Thaï pour des recherches plus poussées et ils y ont appréhendé 14 braconniers locaux, ce qui représente un total de 26 braconniers attrapés en une seule opération. Ces résultats montrent qu'il est indispensable de poursuivre sans cesse l'application de la loi pour décourager les braconniers.

Sabah

The Malaysian state of Sabah on the island of Borneo is the only area where the eastern subspecies of the Sumatran rhino (*Dicerorhinus sumatrensis harrissoni*) is definitely known to survive. In collaboration with the Sabah Department of Wildlife and with support from SOS-Rhino, based in the United States, SOS-Rhino Borneo is continuing to conduct conservation activities for the Sumatran rhino in the Tabin Wildlife Reserve, one of the last refuges for this subspecies. Based on the study of tracks, the latest estimate of the number of rhinos in Tabin is between 19 and 32 individuals. It is further estimated that with adequate protection, the carrying capacity of Tabin is 56 rhinos. However, many challenges confront the rhino in Sabah: the legal status of their habitat is uncertain, poaching still occurs and encroachment of habitat continues, and the present area allotted to wildlife is fragmented and inadequate for sustaining a viable population of 500 or more. SOS-Rhino Borneo intends to continue to conduct surveys to determine the presence, distribution and density of all the rhinos in Sabah. It will also continue its activities to promote conservation efforts for this species. Moreover, two major research projects are under way in Tabin: one on nutrition and the other on the genetics of the population. These activities are sponsored by the US-based SOS-Rhino. Further information on this programme is available at http://www.sosrhino.org.

India

The Assam Forest Department reports that protection of the Indian rhino (*Rhinoceros unicornis*) in Kaziranga National Park, Assam, India, has improved and been very successful in the last two years. In 2002, only 4 of the estimated 1600 rhinos in the park were lost to poachers, and so far in 2003 only 1 animal has been killed.

On another front, the Wildlife Areas Development and Welfare Trust, a non-governmental organization authorized by the Forest Department to conduct activities in support of the department's conservation efforts, is moving to expand its capacity through a grant from the US Fish and Wildlife Service's Rhinoceros and Tiger Conservation Fund (RTCF), with supplemental support from the International Rhino Foundation.

Les chiffres rapportés pour la faune sont satisfaisants et montrent qu'elle est bien distribuée. On a rapporté la présence de rhinos de Sumatra à 16 endroits différents, y compris ceux relevés antérieurement. Une tentative d'estimation prudente situerait la population de rhinos entre 21 et 37 individus. Une évaluation plus solide est en cours, avec une récolte et une analyse de nouvelles données.

Sabah

L'État malais de Sabah, sur l'île de Bornéo, est la seule région où l'on est certain que la sous-espèce de l'est du rhino de Sumatra (*Dicerorhinus sumatrensis harrissoni*) survit encore. En collaboration avec le Département de la Faune de Sabah et avec le soutien du bureau américain de SOS-Rhino, SOS-Rhino Bornéo poursuit ses activités de conservation du rhino de Sumatra dans la Réserve de Faune de Tabin, qui est un des derniers refuges de cette sous-espèce. Sur la base de l'étude des traces, la dernière estimation du nombre de rhinos sur Tabin se situe entre 19 et 32 individus. On estime aussi qu'avec une protection adéquate, la capacité de charge de Tabin est de 56 rhinos. Cependant, le rhino de Sabah doit relever de nombreux défis : le statut légal de son habitat est incertain, il y a encore du braconnage et les empiètements sur l'habitat se poursuivent alors que la zone allouée actuellement à la faune sauvage est morcelée et se prête mal à la présence d'une population viable de 500 animaux, ou plus. SOS-Rhino Bornéo a l'intention de poursuivre les opérations de surveillance pour déterminer la présence, la distribution et la densité de tous les rhinos de Sabah. Il va aussi continuer à promouvoir les efforts de conservation de cette espèce. De plus, deux importants projets de recherche sont en cours à Tabin : un porte sur la nutrition et l'autre sur la génétique de la population. Ces activités sont sponsorisées par le bureau américain de SOS-Rhino. Vous pouvez trouver plus d'informations sur ce programme sur http://www.sosrhino.org.

Inde

Le Département des Forêts d'Assam rapporte que la protection du Rhino indien ou unicorne (*Rhinoceros unicornis*) s'est améliorée dans le Parc National de Kaziranga, en Assam, Inde, et qu'elle a connu beaucoup de réussite ces deux dernières années. En

Cincinnati Zoo

The female Sumatran rhino Emi that produced a calf at the Cincinnati Zoo in 2001 is again pregnant. As of 28 October 2003, Emi was in her 201st day of pregnancy. The gestation period for the last calf was 475 days.

2002, sur les 1600 rhinos estimés du parc, seuls 4 ont été tués par des braconniers et jusqu'à présent, seul un animal a été tué en 2003.

Sur un autre front, le *Wildlife Areas Development and Welfare Trust*, une organisation non gouvernementale autorisée par le Département des Forêts à mener des activités en soutien des efforts de conservation du Département, va déménager pour augmenter sa capacité grâce à un financement du *Rhinoceros and Tiger Conservation Fund* du *US Fish and Wildlife Service*, avec un support supplémentaire de la *International Rhino Foundation*.

Zoo de Cincinnati

Emi, le rhino de Sumatra femelle qui a eu un jeune au zoo de Cincinnati en 2001, en attend un second. Le 28 octobre 2003, Emi en était à son 201ème jour de gestation. La durée de gestation du premier petit avait été de 475 jours.

RESEARCH

Law enforcement, illegal activity and elephant status in Mago and Omo National Parks and adjacent areas, Ethiopia

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Abstract

A project to monitor the strength of law-enforcement effort and the extent of illegal activities was undertaken in Mago and Omo National Parks and the surrounding areas in south-west Ethiopia from July to December 2002. The study was also aimed at collecting data to estimate total elephant populations, based on observations and indirect signs. Information on the nature of movements and distribution was gathered. Twelve sightings of elephants and signs of their presence were recorded in Mago National Park. By field observation, a maximum of 167 elephants was counted in one day. The present educated guess for the number of elephants in Mago National Park is about 200. A decline of 33% was observed in elephant numbers as compared with the1997/98 estimate. It is estimated that only about 48% of the park area was occupied by elephants. In Omo National Park, only three signs indicating the presence of elephants were noted and only one big group was observed, estimated to number 324. No elephants were seen as permanent residents in this park. In Mago National Park, the number of scouts deployed increased from 8 (270 km^2 per scout) in 1996 to a maximum of 23 (94 km^2 per scout) for the year 2002. The number of scouts in Omo National Park declined from about 40 (152 km^2 per scout) in the 1970s to 11 (370 km^2 per scout) in 2002. Following the killing of two wildlife scouts by poachers in 1998 and 2002, patrols in both parks have become irregular. Severe shortage of scouts in the study areas is caused by an insufficient operational budget. The high number of offenders in both parks suggests that the number of field scouts needs to be increased. The minimum number of patrol hours per day in four sample areas of both parks was 14 and the maximum 96. Sentences for arrested offenders in district and zonal courts are very lenient. Only 17 cases were recorded in the files of the Bako-Gazer District Judiciary Office. Almost 85% of the cases were acquitted for various reasons. The penal acts currently working in Ethiopia do not sufficiently deter wildlife offenders.

Résumé

De juillet à décembre 2002, on a voulu contrôler l'efficacité de l'effort d'application des lois et l'étendue des activités illégales dans les Parcs nationaux de Mago et d'Omo et dans les régions environnantes, dans le sud-ouest de l'Éthiopie. Cette étude visait aussi à récolter des données pour estimer la population totale d'éléphants, en se basant sur des observations et des signes indirects. On a rassemblé toutes les informations possibles sur la nature des déplacements et sur la distribution des éléphants. On a rapporté douze observations et signes de la présence d'éléphants dans le Parc National de Mago. Un *maximum* de 167 éléphants furent dénombrés en

un seul jour par des observations de terrain. Une supposition raisonnable situe le nombre actuel d'éléphants dans le Parc National de Mago aux environs de 200 individus. On a observé une diminution de 33 % du nombre d'éléphants par rapport aux estimations de 1997/1998. On estime que les éléphants occupent seulement 48 % environ de la superficie du parc. Dans le Parc national d'Omo, on n'a relevé que trois signes de la présence d'éléphants, et on n'a observé qu'un grand groupe dont on a estimé la taille à 324 individus. On n'a vu aucun éléphant qui réside de façon permanente dans ce parc. Dans le Parc national de Mago, le nombre d'éclaireurs est passé de 8 (270km^2 par éclaireur) en 1996, à un maximum de 23 (94km^2 par éclaireur) en 2002. Le nombre d'éclaireurs du Parc national d'Omo est, par contre, passé d'environ 40 (152km^2 par éclaireur) dans les années 1970, à 11 (370km^2 par éclaireur) en 2002. Suite au massacre de deux éclaireurs par des braconniers en 1998 et en 2002, les patrouilles sont devenues irrégulières dans les deux parcs. Le manque sévère d'éclaireurs dans les zones'étudiées est dû à un budget nettement insuffisant pour couvrir ces opérations et les frais généraux. Le grand nombre de contrevenants dans les deux parcs laisse entendre que le nombre d'éclaireurs sur le terrain devrait'être augmenté. Le nombre minimum d'heures de patrouille par jour dans les quatre zones échantillons des deux parcs était de 14, et le maximum, de 96. Les peines que les contrevenants reçoivent dans les tribunaux du District ou de la zone sont très légères. On n'a relevé que 17 cas dans les dossiers du Bureau Judiciaire du District de Bako-Gazer. Environ 85 % des cas se sont soldés par un acquittement, pour des raisons diverses. Les lois actuellement en vigueur en Éthiopie ne sont pas assez dissuasives pour les coupables en matière de faune sauvage.

Introduction

The African elephant is under threat and is listed in Appendix 1 of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) (WCMC 1993). Many African nations including Ethiopia have prescribed legislation to protect their elephants, with strict hunting regulations and compensation mechanisms in place for the damage elephants may cause to human life and property.

Elephant conservation is closely linked to the effectiveness of law enforcement in combating illegal activities. Unfortunately, law enforcement is not well developed in Ethiopia. Despite the presence of field staff, the necessary resources required to equip them to carry out law-enforcement activities are not available. This lack has had negative repercussions on developing sound elephant conservation strategies and management plans.

There is still a diversity of large animals living in Omo and Mago National Parks, but expanding human activity is threatening the parks.

Human settlements are spreading and agriculture is continuously expanding unchecked. Local people living both inside and outside these conservation areas practise different types of illegal activities that encourage uncontrolled poaching. Moreover, pastoralists periodically encroach on these protected areas with several thousand head of livestock. Collecting honey and the disturbances associated with it and deliberately setting fires are other forms of threat. As a result of these factors, the population of larger wild animals, particularly mammals, has declined dramatically in recent years (Graham et al. 1996).

A lot of research has been conducted on elephants, but information on law enforcement and illegal killings has not been systematically collected over sufficient time in most areas of Africa (Dublin and Jachmann 1992; Barnes et al. 1999; MIKE 1999). This information is vital for the success of important management actions such as regulating the trade in ivory and other elephant products. Attempts are now under way under the auspices of the CITES Monitoring of Illegal Killing of Elephants (MIKE) programme to address this gap by training law-enforcement personnel in how to collect data at selected sites across Africa. The objective of this site-based programme is to monitor elephant populations and establish trends in the illegal killing of elephants. Data collection and analysis methods have been standardized for all range states (Hunter 2002) to facilitate comparison of the results.

Information collected so far suggests that the ivory trade in south-western Ethiopia forms a long chain that extends from the hunter killing the elephant to the retailer selling a finished ivory product (Largen and Yalden 1987). Owing largely to poor law enforcement, minimal efforts have been made both regionally and nationally to keep this domestic ivory trade within

legal bounds and at sustainable levels. National legislation in Ethiopia has various decrees to protect wildlife areas that have existed since 1909. However, these are often out of date and not in harmony with modern realities and complexities.

Like in many other African elephant range states, the need for monitoring the illegal killing of elephants in south-western Ethiopia is real and is necessary to strengthen existing policies and develop new policies and management actions. This may in turn help with the larger objective of determining the effectiveness of international legislation on African elephants. This project was designed to generate data and information that will provide guidelines for monitoring the effect of law-enforcement efforts on the elephants of Mago and Omo National Parks and the extent of illegal activities concerning them. The duration of the project was six months—July to December 2002.

Objectives

The main objectives of this study were to

- assess and evaluate the current extent of law-enforcement efforts in both conservation sites and at federal and Southern Peoples' regional govern-ments
- identify the types of illegal activities and the forms of punishment given to arrested offenders and to record tusks seized at check points
- estimate the total elephant population in Mago and Omo National Parks, based on observations and indirect signs
- suggest possible baseline conservation strategies to protect the species further from extermination

Study areas

The project areas, Omo and Mago National Parks, are located in the Southern Nations Nationalities and Peoples Region, covering about 19% of the total area of the region (ABSR undated). Mago covers an area of 2161 km^2 and Omo 4068 km^2. These areas lie between latitudes 05°15' and 06°40' N and longitudes 35°20' and 36°35' E in the Lower Omo trough to the west of the main Rift Valley. They lie adjacently on both sides of the Omo River, Omo to the west and Mago to the east. Four small towns—Turmi, Jinka, Key Afer and Gazer—found to the eastern side of these parks are important points for checking to see if ivory is being transferred to the central part of the country and are considered part of the project areas (fig. 1).

The climate of both parks is semi-arid with a high mean annual temperature and moderate rainfall. The two defined rainy seasons are March to April and August to September, with light rains in October and November. The greater part of the areas is bush and the rest is forest, savannah bushland, savannah grassland and open grassland. The bush vegetation consists of *Acacia horrida*, *A. mellifera*, *Grewia bicolor, G. villosa, Combretum aculeatum* and *Cordia gharaf*. *Tamarindus indicus, Terminalia brownii* and *Ficus sycomorus* are important components of the forest, which is mainly riverine. The fauna of both parks is diverse with at least 82 species of mammals, over 350 species of birds, 24 species of reptiles, 14 species of fish (Stephenson and Mizuno 1978; Hillman 1993; Yirmed 1996, 1997) and an unknown number of amphibians and invertebrates. Omo National Park has historically served as a corridor for elephant movements between south-western Ethiopia and south-eastern Sudan. Elephants frequently visit the Murle Controlled Hunting Area and the Tama Wildlife Reserve, south and west of Mago National Park respectively, the Omo West Controlled Hunting Area, and the area north of Omo National Park.

Six distinct ethnic groups reside in the areas bordering Mago National Park, most of whom preserve their traditional ways of life and have direct contact with the park. Similarly, four major distinct peoples with their own distinct culture and lifestyle live bordering Omo National Park (fig. 1).

Methods

Monitoring law-enforcement efforts and illegal activities

Data on law enforcement and illegal activity were collected from various sources following the work of Bell (1986) and Jachmann (1998). Methods used for data and information collection during this study were as follows:

The current extent of illegal activities was assessed mainly by park scouts regularly patrolling both national parks. Encounter rates per effective patrol days were used as the standard unit of patrol effort to make the encounter rates equivalent to 'catch per unit effort' indices. Therefore, for each day out on foot patrol, each scout recorded encounters. The collective record provides accurate information of events, and the success of anti-poaching patrols undertaking routine law-

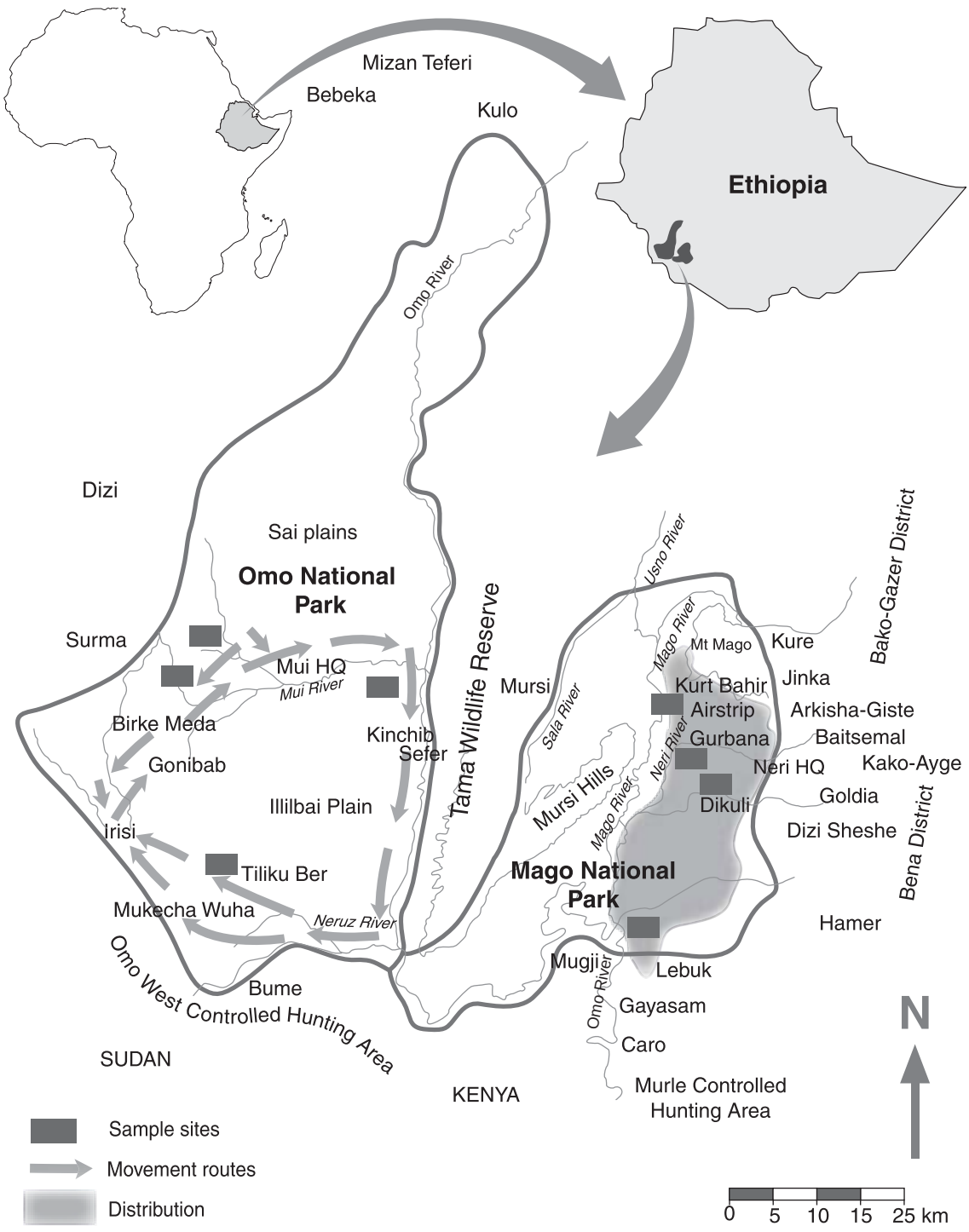

Figure 1. Mago and Omo National Parks, showing sample sites and locations cited in the text.

enforcement duties becomes the focal point. The parameters used included number of patrol days per month, average distance and time the patrol team travelled per patrol day, number of offenders detected or arrested, number of tusks recovered, number of poachers encountered, presence of camps as indication of recent illegal activities, time spent on patrol by each patrol group (to measure the commitment of anti-poaching units) and number of guns recovered or confiscated. Only three visits to the areas adjacent to the park were undertaken during the project. For patrol reports, the standard recording forms developed by the CITES MlKE programme were used.

When recording illegal activities, efforts were made to distinguish between 'serious' and 'minor' offences. Offences considered to be in the serious category were those directly related to illegally killing wild animals. These included sighting and arresting poachers, confiscating firearms, tusks, skins and snares, and hearing gunshots. Minor offences included those that may or may not have been related to poaching, indicated by sighting human footprints and fires and discovering snares.

Information was documented on the number of seizures of tusks at four neighbouring checkpoints. The punishment given to arrested offenders was also noted. Four sample sites were selected in each national park, each 5 x 5 km^2 in area (fig. 1), within which the nature of illegal activities was monitored systematically through regular patrols. Patrolling intensity was the same for all sites as the anti-poaching team monitored each site once a month for six consecutive months.

Elephant population estimates, distribution and age structure

In addition to law-enforcement activities, routine trips were made to record live elephant sightings. Estimates of elephants were made from direct observation and through indirect signs, particularly elephant tracks. To determine the distribution and movement patterns of elephants, their visible tracks were recorded in different habitats. Any signs of the presence of animals and the location and direction of movement were made using the techniques outlined by Whyte (1993). Signs of elephants on dirt roads and game paths were recorded at two-week intervals between July and December 2002. Because there were no serviceable roads, most of the fieldwork was carried out on foot.

To estimate the age structure of the elephant herds, measurements of impressions of hind footprints left in the mud or dust were taken using the techniques employed by Western et al. (1983).

Questionnaires

We followed the approach of Cumming et al. (1984) and used questionnaires to obtain additional information on elephant deaths, poacher activities, the presence or absence of elephants in areas close to villages, elephant distribution, movements and population sizes.

Results

Law-enforcement personnel, patrol effort and scout efficiency

In Mago National Park, the number of scouts deployed increased from 8 (270.3 km^2 per scout) in 1996 to a maximum of 23 (94 km^2 per scout) for the year 2002. Twelve wildlife scouts were recruited in late 2001 and were trained in the main quarter of the park. The number of scouts in Omo National Park, however, declined from about 40 (152 km^2 per scout) in the 1970s to 11 (370 km^2 per scout) in 2002. Consequently, the area covered per scout in 2002 in Mago National Park was reduced to approximately a third of that in 1996 while the area covered per scout in Omo National Park doubled in the period from 1970 to 2002. The increase in the number of scouts in Mago was made possible by a project funded by the US Fish and Wildlife Service, which stipulated the increase of scout numbers as one of its conditions for support to the park.

Until 1998, patrolling in both national parks was conducted almost regularly. However, after two scouts were killed (in 1998 and 2002) during anti-poaching patrols, patrols became irregular and were dependent on the number of poachers inside the park and the level of threat that they were perceived to bring to bear on the scouts.

The minimum number of effective patrol days per month of patrol conducted in both project areas during the study period was 16 and the maximum 32. This is about 31% of the maximum sustainable effective patrol days per scout per month. The minimum patrol hours per day in four sample areas of both parks was 14 and the maximum 96 (fig. 2). The average minimum hours spent for a day patrol in Mago were 4.20 and the maximum 8.25. Much effort was made in

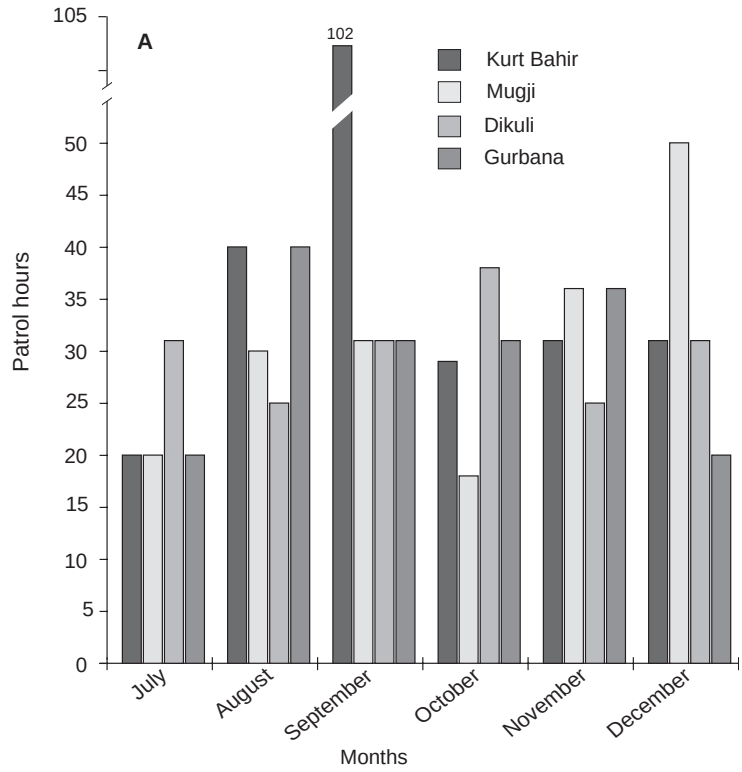

Figure 2. Patrol effort in hours per month in sample patrol areas in Mago National Park, 2002.

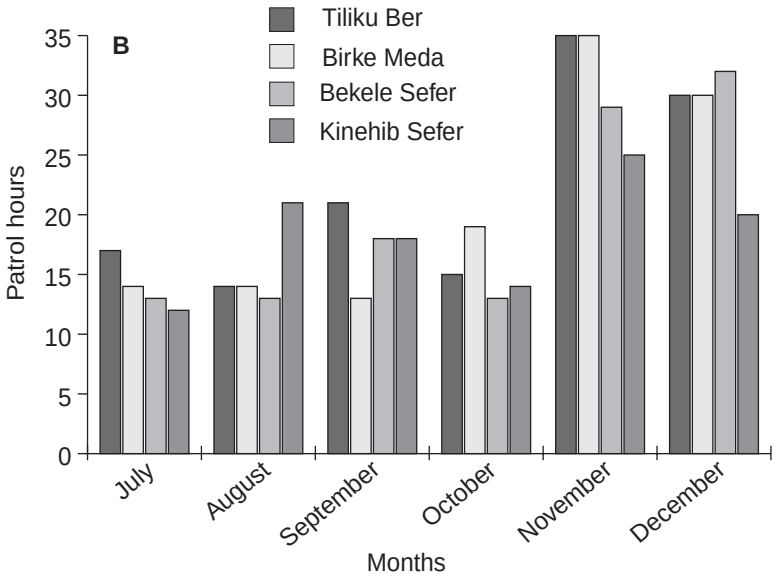

Figure 2. Patrol effort in hours per month in sample patrol areas in A) Mago and B) Omo National Parks, 2002.

Gurbana and Kurt Bahir localities, both of which are a considerable distance from park headquarters. In Omo National Park, maximum efforts were made at Tiliku Ber. The average maximum number of hours spent on patrol was in November and the minimum in December. The length of stay of the patrol team varied depending on the relative distance of the given patrol area from the main headquarters. The shortest patrol distance in any patrol area was 5 km.

No scout camps (outposts) exist in either park, and the scouts are therefore limited to patrol activities in the relative vicinity of the park headquarters, where they are housed, which means less than optimal coverage of more distant areas.

Illegal activities and sentences for wildlife offenders

Patrols recorded different kinds of illegal activities during the study period. The level of illegal activities was high in both parks. Only two firearms were confiscated during the project. These came from offenders in Gurbana locality, Mago National Park, in September 2002. Four offenders were caught in the field by a patrolling team—in Mago National Park, one was from Mursi District and two from Bena; the offender in Omo National Park was from Surma District. These offenders are currently facing prosecution in court. However, only three of the offences were recorded as 'serious', involving hunting with firearms. Evidence was found that heavily armed groups from areas to the east and west of the parks were hunting.

In Mago National Park gunshots, recorded mainly in September, constituted the largest number of indicators of illegal activity. There were also exchanges of fire between

poachers and park scouts (fig. 3). In October, 27% of the total number of human footprints were recorded, suggesting a peak in illegal activities. In July, 34% of the confrontations with offenders took place. The highest number of animals killed (9) was in August. No illegal hunting with wire snares was detected. However, this was probably because the patrolling team did not easily detect them. Data obtained from the judiciary office of Bako-Gazer District show that only one elephant killing was recorded in 2002. The corresponding punishment was recorded as USD 175—a maximum punishment recorded by this office. However, reliable information on elephant killing during the study period was not available.

Encounter rates of illegal activities were high in Mago National Park during the study period, recorded as encounters with armed groups; the discovery of poaching camps, human footprints and dead animals; and gunshots heard.

Indicators of illegal activities were abundant in all study localities of Omo National Park. In Omo, many gunshots were heard, 49% of which were recorded in September. Most of the footprints noticed were in August and November (fig. 4). Few poachers were encountered in the field, however, because few patrol scouts were available to cover large areas and support from district and zonal offices was lacking.

The high number of offenders in both parks suggests that the need is urgent to increase the number of field scouts required to maintain large patrol groups.

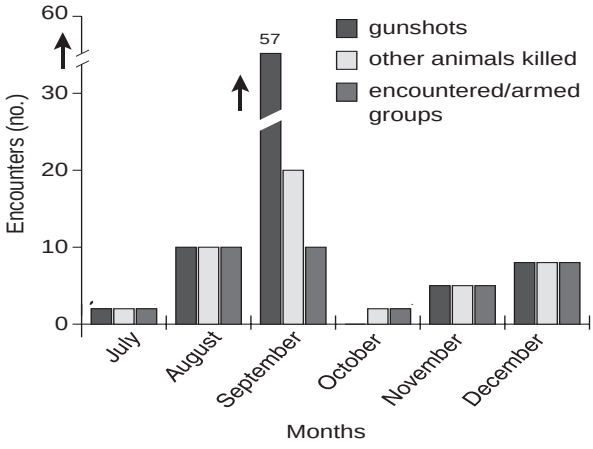

Figure 3. Serious offences recorded in sample sites in Mago National Park, 2002.

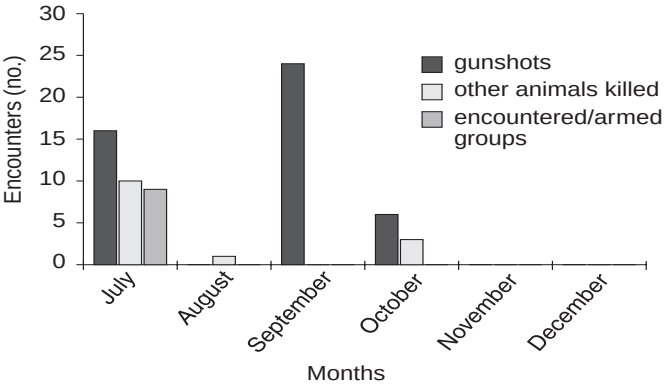

Figure 4. Serious offences recorded in sample sites in Omo National Park, 2002.

Poaching and the origin of offenders

During this assessment, no direct evidence was obtained of elephants being killed. However, unconfirmed reports were received of three elephants killed in Bena District, Mago National Park. Among other species of wildlife, lesser kudus have been subjected to poaching in Mago National Park and tiangs (a hartebeest) in Omo. These species of large ungulates are generally numerous. Because of an anthrax epidemic in Mago National Park, however, the population of lesser kudus is declining. Records of poached animals for the three years from 1999 to 2002 are given in figure 5; they indicate that most animals were killed in 2000/01. According to these figures, nine elephants were killed by poachers from Bena and Hamer Districts in 2000/01.

About 57% of the offenders in Mago National Park came from Bena District, 25% from Bako-Gazer and the remaining 18% from Hamer and Sala-Mago (fig. 7).

Wildlife offenders arrested in the study areas were usually tried by appearing in court in the district where they were captured. The origin of intruders into the park is verified by patrol teams by following their footprints to the villages they come from. The only available information was for wild-life offenders prosecuted in Bako-Gazer District but most of the poachers originated from Bena District. During the period from 2000 to 2002, there seemed to be a relative increase in the number of offenders coming from Bena District, with the highest increase in 2002. The number of offences in 2002 were 33% more than in 1998 and 11% more than in 2001. This corresponds to an increase in the number of offenders and poachers originating from four districts from 1998 to 2002 (fig. 6). This trend was mainly because the agriculture bureau of the regional

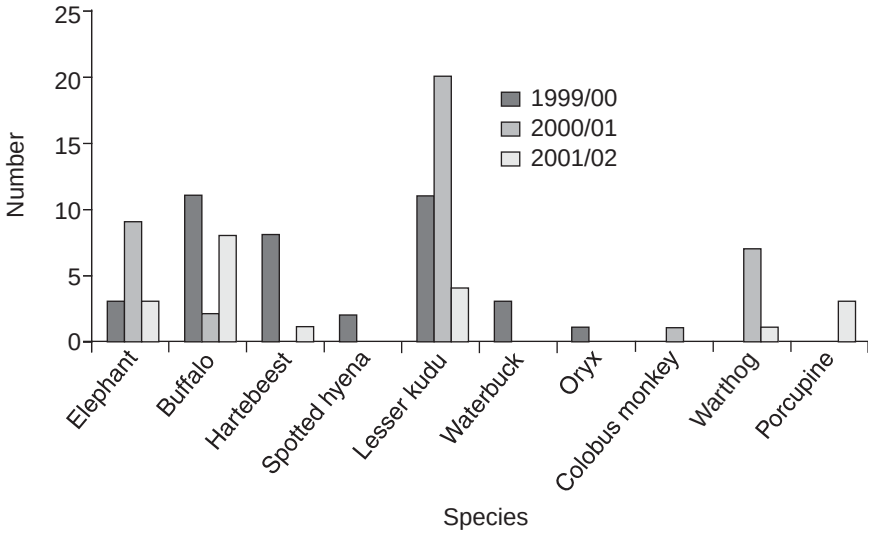

Figure 5. Records of illegal hunting in Mago National Park (1999/00–2001/02, annual park report).

government was scarcely aware of the problem and thus the law-enforcement efforts it undertook were weak. Offenders captured in the field by conventional patrols most frequently came from the two surrounding districts of Bena and Bako-Gazer.

The most aggressive intruders into Omo National Park (fig. 7) are of the Surma ethnic group, who enter the park from the west during the dry season. These people, hunters by tradition, are said to be responsible for exterminating large animals from areas in the north-west and west, where the intensity of intrusion has been highest. The Surma are also reported to have settled in the vitally important elephant corridor connecting Sudan and Omo National Park.

Four-year comparisons made on the number of offenders recorded in seven localities found in Mago National Park (fig. 6) show that in 2002 the Goldia area had the highest number. However in 2001, the Arkisha-Giste area had the highest number of encounters with offenders.

In Omo National Park, 67% of the offenders captured came from Kuraz District (fig. 7); 70% were equipped with modern automatic weapons. In particular, the Surma exhibited high levels of aggression towards law-enforcement personnel, and anti-poaching patrols deliberately avoided contact with them.

Records of elephant ivory were obtained at five localities—four district police offices neighbouring Mago National Park and the park office (fig. 8). The tusks had been confiscated from either poachers or merchants in communities adjacent to the park. Similar information collected from the district offices of agriculture revealed that 64% of tusks were confiscated or kept by the park office.

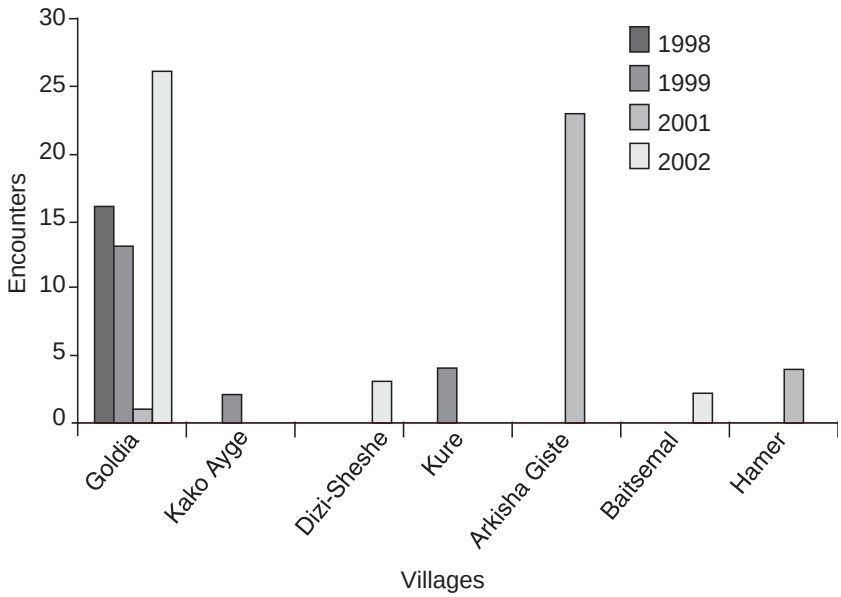

Figure 6. Confronted offenders in Mago National Park. The first three are in Bena District, the next three in Bako-Gazer, the last in Hamer.

Existing proclamations and sentences for wildlife offenders

Few of the offenders arrested by anti-poaching patrols are actually sentenced in district

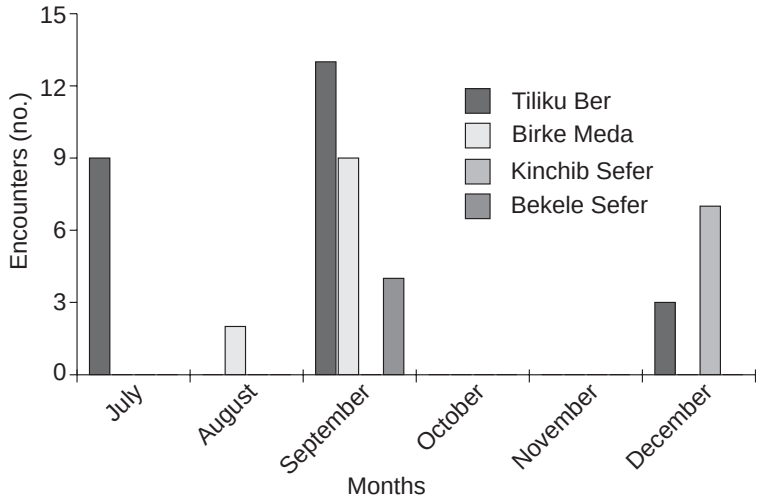

Figure 7. Confronted offenders in Omo National Park.

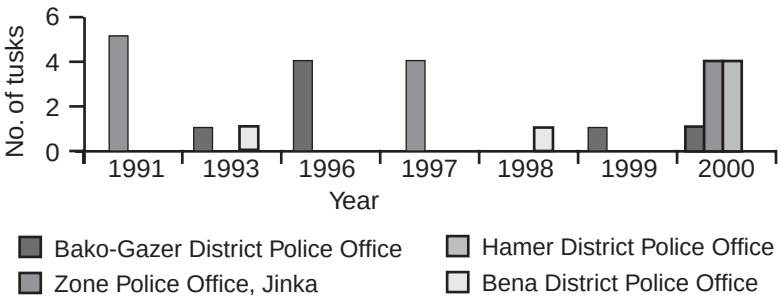

Figure 8. Confiscated elephant ivory, as recorded by district police offices and the Mago National Park office. Some 16 to 18 tusks were also stored in the park store.

and zonal courts. The files of the Bako-Gazer District Judiciary Office mentioned only 17 cases, in which almost 85% of the offenders were acquitted for various reasons, such as inadmissible evidence or loss of trophies. The court outcome ranged from having the case heard in court but without a fine to fine with 'in default' imprisonment and custodial prison sentence. During the time of this project, only one Mursi hunter was given a prison sentence, which was for four months, and only one offender was charged with a wildlife-related offence, which involved smugglers attempting to transfer ivory to merchants. The offender was charged USD 175 by the zonal court at South Omo. This was the maximum fine ever imposed in the entire region for a wildlife-related crime.

Fines and punishments in the Ethiopian Wildlife Act are summarized as follows:

Proclamation No. 416 of 1972 is a wildlife conservation regulation, issued pursuant to the Game Proclamation of 1944 and the Wildlife Conservation Order of 1970. It describes categories of conservation areas—national parks, game reserves, sanctuaries and controlled hunting areas. Under chapter 2 of this proclamation, no. 5(2) prohibits residence, hunting and other human occupation in a national park. No person shall reside, hunt, cultivate, graze livestock, fell trees, burn vegetation or exploit the natural resources in any manner within a national park unless such activities are purely to develop and manage the park. Any person who contravenes or fails to comply with any provision of these regulations shall upon conviction be punishable in accordance with the provision of article 364 and other relevant provisions of the penal code. The court shall in addition to any penalty hereunder order the confiscation of any weapon with which the offence has been committed.

Proclamation No. 94 of 1994 is a forestry conservation, development and utilization proclamation. Part 2 no. 7(d) of the proclamation states that the ministry or the appropriate regional body is responsible for protecting rare or endangered endemic plants, animals and bird species, and genetic resources in general. Part 4 of Article 13(2d) of this proclamation prohibits hunting of wildlife within a state forest.

In both national parks, a distinction is made between people caught hunting and those simply entering and moving about within protected area boundaries. For lack of a better option at present, honey collectors are given access to both parks, in spite of the likelihood of disturbing animals. Unlawful entry into a national park is limited to offenders captured in the park committing illegal activities. Unlawful hunting and unlawful possession of trophies are related to offenders who are arrested while hunting in national parks. According to Proclamation 416/72, the fine can be up to USD 581 or 2 years of imprisonment or both. In practice, however, the minimum sentence for illegal killing of wildlife and

the unlawful possession of trophies is dependent on the goodwill of the court.

In general, these penal acts are not efficient in protecting the country's wildlife resources, as the penalty structure for wildlife protection in Ethiopia is not a sufficient deterrent for wildlife offenders. There is no sentence for unlawful possession of firearms in a national park as long as one has not been caught engaging in hunting activities. People are free to hold different types of weapons, and traditionally even children tending livestock carry arms. In both national parks, the chance of arresting poachers in the field is small. When an anti-poaching team encounters poachers, the team tries to capture them peacefully, but if this fails the team may give chase and even open fire.

Population estimates

During this study only four elephant sightings were made, three in Mago National Park where six separate sets of elephant tracks were also found. The highest number of elephants the park staff in Mago National Park counted by direct observation during a single day (14 September 2002) was 167 (112 from Neri and 55 from Mugji). The educated guess of the park staff during the study period for the total number of elephants believed to exist was about 200. In Omo National Park there were only two signs of elephants. A small herd of one family unit visited the area close to park headquarters in August 2002, and in September 2002, a group of 324 elephants entered the park following the usual route.

The elephant population estimate was 200 for Mago and 324 for Omo; density estimates were 0.092/km^2 for Mago and 0.079/km^2 for Omo.

Age structure of elephant population

Only 45 elephant footprints were seen in Mago National Park and 54 in Omo. The populations of both parks fall into two main age groups: subadult and adult. Over 38% of the measurements for Mago were adult male elephants and 34% for Omo. Estimates from this figure would make the proportion of adult to young nearly 11:1.

Distribution and movement routes

At the time of the study, elephants occupied only about 48% of the Mago National Park area. Signs of ele-phant presence were common only in the central and southern portion of the park along the Neri and Omo Rivers. In these areas, however, the animals are found year round with a peak occurrence during the rainy season (March to May). During the study period there was unusual rain in November and December, and signs of elephants were confirmed only in the south and adjacent areas lying outside the park. Judged by the evidence, elephants spent almost two months at the southern edge of the parks including the Gayasam area, the area located between Lebuk and Caro villages. Elephants visited the three sample sites more commonly than other sections of the park. During this project period, elephants completely abandoned areas to the north because the Mursi made incursions into this section of the park. Only one migratory route was identified between Mago National Park and the Gayasam area, where the elephants stay for no longer than one month. This movement may take them about 16 km outside the park boundary. In general, elephants in both parks roam more widely during the rainy season, including into the plains south of the foothills of Mt Mago (fig. 1). The elephants generally feed at night and shelter in dense riverine forests during the day. These movement patterns are believed to be related to increased disturbance by people during the rainy season.

No resident elephants were observed in Omo National Park. During the study period, only three signs of elephant presence were noted. Live elephants were observed only once, in September 2002. The other two signs were tracks. Elephants in Omo normally cross the Mui River through park headquarters during dry seasons. However, they were also observed crossing the same river in September 2002 during the wet season. Two new migratory routes have recently been identified from local reports. The first starts from Irisi (fig. 1), a forested and stable area on the west border of Ethiopia. Information gathered suggests that poachers do not use this remote area, which is considered unsafe. The migration corridor continues eastward to the park and crosses the Mui River, heading down towards the Omo River. As it approaches the Omo, it turns south towards the Neruz River (Gim Wuha), and runs parallel to the Omo. From here, the route proceeds westward to Irisi via Mukecha Wuha. No information exists on whether the elephants ever venture farther west into Sudan. There is also no evidence of an established wet-season movement in this park. The second route also starts from Irisi. According to the Bume people, elephants move from Irisi to the Neruz River in search of water and return to Irisi following the same route. Mukecha Wuha,

situated between Irisi and Neruz (Gim Wuha), is used as a corridor for moving back and forth between the two areas. There is no reliable information as to whether the elephant population occurring north of Omo National Park in Kulo Konta District is connected with elephant groups that move between Irisi and Omo National Park.

Discussion

Law-enforcement efforts (scout forces and running costs)

The number of scouts deployed in both national parks is too few in areas with serious poaching activities to provide adequate protection against illegal activities—23 scouts for Mago, 94 km^2 per scout, and 11 scouts with 370 km^2 per scout for Omo National Park in 2002. Unlike the Ethiopian situation, the number of scouts employed in Zambia in the Luangwa Integrated Resource Development Project (LIRDP) in 1992 was 286 with staffing density of one scout per 33.3 km^2 (Jachmann 1998), which was a successful period for law enforcement and elephant conservation in that area. Hence, considering the current situation in Ethiopia, 42 additional scouts need to be recruited for Mago National Park and 110 for Omo for law enforcement to be effective in the two parks.

The severe lack of workforce is linked to insufficient operational budget allocated to these areas. The total annual recurrent budget allotted for the year 2002/03 for Mago National Park was only about USD 23,343, and only USD 25,969 was allotted for Omo National Park. This means only USD 11 per km^2 a year for Mago and USD 6 for Omo. In contrast, law-enforcement expenditure allocated for elephant conservation in LIRDP for the year 1992 was USD 651,605 or USD 46.50 per km^2 a year (Jachmann 1998). Therefore, to attain the required level of law enforcement, considering such aspects as the country's economy and security situation, it is recommended that an annual operational budget of USD 100,533 be allocated for Mago National Park and USD 189,115 for Omo.

In addition to the obvious inability to prevent illegal killing, the lack of workforce also contributes to the lack of data necessary for any kind of action to conserve and manage elephants. A minimum of three scouts at each park should be trained to collect and analyse data. The presence of these trained investigators would further help shed light on the exact type and level of effort required to reduce illegal killing. An informer network should be nurtured to help find out more about the nature of the illegal activities in the area, but this requires a proper incentive scheme. Through such a system informers can be paid rewards for bringing about positive law-enforcement actions, such as arrests and confiscations of firearms and trophies, or for information that eventually leads to arrest or confiscation of firearms and trophies (Jachmann 1998).

In the project areas, the total absence of outposts and the consequent lack of regular patrolling in the more remote areas have contributed to the extremely low performance of the scouts and the overall decline in law-enforcement effort. The longest patrol organized in Mago National Park during 2002 took four consecutive days. Patrols of equal duration were never conducted in Omo National Park during the period covered in this project. Security of the patrols is poor and poachers often possess more modern weapons than the law-enforcement staff.

The ability of patrol teams to carry out long-distance movements is further hampered by the lack of porters who have in the absence of vehicles traditionally helped to carry supplies and materials necessary for longer-term anti-poaching operations. The porters were all dismissed in 1998 due to budgetary constraints. This has clearly had a negative effect on the motivation and morale of law-enforcement personnel.

The parks' own patrolling records show a great deal of variability between the two parks and the different areas. In Mago National Park, more poaching has been observed in Gurbana along the Neri River, and in the Kurt Bahir and Dikule localities. Patrol activities in the Mago and Mugji areas were, however, erratic because of the high expenses and large number of scouts required. Since 2002 patrolling in Omo National Park has been limited primarily to within a 10-km radius from park headquarters.

Illilbai Plain and Tiliku Ber, the areas of this national park farthest from park headquarters, were the least patrolled (fig. 3).

Penalties for wildlife offenders and existing proclamations

Court cases relating to illegal killing of wildlife in the areas in question have been inadequately documented because of the lack of prosecution personnel and the

general insufficiency of the Wildlife Act of Ethiopia. All activities in national parks except those related to park management and photographic tourism are illegal. To protect these areas the government of Ethiopia has issued proclamations and regulations (Negarit Gazeta 1972, 1980, 1994). However, these are out of date and crude in form and no longer efficiently protect the country's wildlife resources. The penalties for wildlife crimes are insufficient. For example, a poacher who kills an elephant is punishable with imprisonment not exceeding two years or a fine not exceeding USD 581 or both. Proclamation No. 416 of 1972 sets an additional penalty for offenders such as the confiscation of any weapon with which the offence has been committed. In comparison, in Zambia illegal entrants into national parks are charged a fine of USD 113 plus imprisonment amounting to an average of 14.6 months (Jachmann 1998). The punishment is much more severe if one is proved guilty of killing an elephant.

Illegal activities

The number of patrol days per month deployed in this project was significantly lower than the normally accepted minimum required to detect a significant number of illegal activities, including detection of elephant carcasses. As recommended by Jachmann (1998), an acceptable minimum is between 10 and 13 effective patrol days per scout per month. Therefore efforts should be made to increase the patrol efficiency and frequency in both parks. During the study period, daily 24-hour guarding duties were recorded at the headquarters of both parks. The main gate was guarded 24 hours a day in Mago National Park only.

In Mago National Park, it was common to hear gunshots on more than 66% of the patrol days. September, August and December were the months with the highest number of illegal incidents (illegal hunting and high presence of offenders). In Omo National Park, most of the illegal activities were greatest in September and July. These activities were particularly gunshots, which relate to illegal killing of wild animals. Minor offences like illegal entry into the parks, as indicated by footprints, highest in August and December. The reason for the presence of many footprints but fewer poaching activities during August may be explained by the fact that August is the peak honey-collecting season.

In Mago National Park over 50% of the offences originated from poachers based in Bena District; next were those based in Bako-Gazer and Hamer Districts. Most of the wildlife-related court cases were also recorded in these districts. Hence the allocation of resources and efforts should be directed towards these areas. The Kuraz, Surma and Mursi were found to be the ethnic groups most actively engaged in illegal activities in Omo National Park, and therefore law-enforcement efforts should perhaps best be focused in areas frequented by these tribes. One of the scouts engaged in investigation duties at Mago National Park was attacked and seriously beaten by Bena tribespeople.

The security situation in both parks is precarious, and the small and isolated anti-poaching teams are constantly at risk of being attacked, especially in the more remote parts of the area. Moreover, the present infrastructure is not adequate to give distant patrols efficient support. Experience from the Luangwa Integrated Resource Development Project in Zambia has shown that concerted law-enforcement efforts over several weeks in a given area act as a strong deterrent to poaching as they give the impression of a constant presence of patrols in the area (Jachmann 1998). In addition to normal daytime patrols, we strongly urge that the anti-poaching patrols conduct overnight patrols, at least to the areas with the highest rate of illegal incidents.

Poaching of large wild animals in Ethiopia dates back to the early 1900s (Largen and Yalden 1987). During the early period when the first conservation areas were established in Ethiopia, local people did not possess modern firearms, and thus poaching constituted a fairly insignificant threat to the wildlife in the country. Without firearms, poaching, particularly of elephants, was a risky and time-consuming activity. Even though the wildlife conservation and management activities implemented during the *derg* regime were blamed for lacking a participatory approach, the protection awarded to national parks and the attention given to wildlife resources were comparatively high. Not only were wildlife conservation activities forcefully implemented but also the punitive measures were so serious that they suppressed the amount of illegal killing. Following the fall of the derg regime, and during and after the transition to the present government, however, people living adjacent to areas with wildlife started to practise destructive hunting techniques using modern automatic weapons. The demand for and supply of such weapons is large scale and facilitates rampant smuggling. This wors

ening trend is continuing and will rapidly lead to the extinction of Ethiopia's elephants if left unchecked.

Unless the Surma and Bume people who live adjacent to Omo National Park are disarmed and also the Hamer, Bena, Mursi and Caro people surrounding Mago National Park, the very survival of these parks and their wildlife is highly questionable. It should become a compelling imperative for the Ethiopian government to halt the massive illegal killing of wildlife in these areas. This report confirms that Surma hunters have almost exterminated small- to large-sized animals from the north-west and western portions of Omo National Park. For example, within the past 10 years the populations of giraffes and Burchell's zebras, which were once plentiful in Omo National Park, have declined to a level at which it is virtually impossible to see these animals. In Mago National Park and the surrounding areas, Grevy's zebras and black rhinos have become extinct. As reported by Graham et al. (1997), the population of many species of large mammals is drastically declining in both national parks.

Livestock encroachment into Mago National Park is continuing to increase at an alarming rate. At present, livestock occupy about 12% of the area. Although comparable data for Omo National Park are not available, livestock encroachment into the park area is common. This invasion is much more severe in the southern and western areas of the park, which Bume and Surma pastoralists and their livestock periodically invade.

The Mago National Park office intermittently permits honey gathering, although this activity is illegal, strictly speaking, and not officially recognized or endorsed by the federal government. This disparity makes it difficult in the field for law-enforcement staff to distinguish between the honey collectors and those intruding illegally for other purposes. Collecting honey is also associated with devastating the vegetative cover. Information obtained from the staff of Mago National Park indicates that the number and distribution of beehives in the park has increased drastically from the approximately 10,000 hives estimated by Yirmed and Afework (2000a) in 1997/98.

Population estimates, distribution and movement

Estimates by the staff of Mago National Park made in 1997/98 indicate that the number of elephants existing in the park then were about 300, while the present estimate indicates only 200. This study compares with estimates made by Yirmed and Afework (2000b), and the number of elephants in the park has declined by 33%. In this study, the maximum number of elephants counted was 167 whereas in 1997/98 the maximum was 182. This again supports what has been said about the decline of Mago elephants.

The only sighting of elephants in Omo National Park was near park headquarters, where the elephants stayed for a maximum of one week. In some years it is estimated that elephants do not visit the park at all. The 1994 estimate of Cherie (1996) suggested the presence of about 350 elephants, and the present observation does not show significant deviation from this estimate. As people nearby have exerted high pressures on both parks, particularly poaching, elephant activities have been restricted to night-time—a fact that has complicated team efforts geared towards identifying sex and age.

Harassment of elephants in Mago National Park is severe; as a result elephants are always moving from place to place within the parks and in adjacent areas. There is evidence of illegal human presence at any time of the year, but the frequency is highest during the dry season as people are free from agricultural work.

Honey collectors hang their beehives and search for wild honey in the elephants' preferred riverine habitats along the Mago, Omo and Neri Rivers. These activities displace the elephants and force them to wander from place to place. Since the 1980s, the situation has worsened, as settlements and cultivated lands have closed their traditional route (Yirmed and Afework 2000a). Because of this, the range of elephant distribution shrank by 18% as compared with 1997/98 estimates, which were 1597 km^2 (0.3/km^2).

The regularly used previous route to the north-west of Bekele Sefer at Omo National Park has now been closed as Surma people have occupied the highland area of this site. There is no tangible evidence to show whether elephants found north of this park at Kulo move south-west into the park. Elephants have totally abandoned their former site north-west of Omo, around Bebeka and Mizan Teferi, as farming communities now occupy these areas and the south-western side of these areas is also occupied by Surma people.

Facts about the project areas and recommendations

Decades ago, it was said that the viewing of large animals in Omo and Mago National Parks and the variety of vegetation of the areas was exceptional in its diversity. Eland were counted in their thousands, and the world's largest population of tiang are still found here (Stephenson and Mizuno 1978; Graham et al. 1997). The areas' habitats are typical for elephants that move between Sudan and south-west Ethiopia.

The importance of Mago National Park is noted by the IUCN/SSC Antelope Specialist Group, which ranked Mago as extremely important for protecting the many antelope species, notably tiang and lesser kudu (Thouless 1995). The Mago management plan (Mago National Park 1998) and Yirmed and Afework (2000b) also confirm that this park is the only protected area in the country where the remaining small number of elephants has a reasonable chance of surviving into the future.

Unfortunately, conservation areas have faced high pressure from poaching and from settlements and cultivated lands that are expanding into both areas. Pressures are inevitable, with more than 170,000 people living in or near Mago National Park and 54,000 around Omo. Hence, it is strongly urged that present threats to large animals in the parks be minimized.

Appropriate law-enforcement measures taken to mitigate the existing serious illegal activities have been minimal, both federally and regionally. Although the extent of illegal activities varies from one conservation area to the other, the law-enforcement effort overall is similar and poor in virtually all federal and regional parks. Hence, both states should maximize law-enforcement programmes by allocating an adequate budget, increasing the number of anti-poaching wildlife scouts, and strengthening serious law-enforcement measures.

As the result of Proclamation 4/1993, which dictates the duties and responsibilities of regions and the federal system, the Ethiopian Wildlife Conservation Organization (EWCO) handed over the management of all national parks and wildlife sanctuaries to regions when these areas are located specifically within a single region. Those lying in more than one region are managed by the federal government and are under the direct control of EWCO. However, some regions, which include the Southern Nations, Nationalities and Peoples, do not have sufficient conservation measures. As a result, wildlife conservation in Ethiopia has deteriorated to the point that the larger animals are seriously threatened. Hence it is recommended that management of wildlife conservation areas like Mago and Omo National Parks be returned to EWCO in the federal government. As neither of these conservation areas has yet been gazetted, the government should do this.

Sustainable conservation of elephants in Ethiopia, particularly in Mago and Omo National Parks, should be put into practice. Hunting elephants, for example, can be permitted in the Murle Controlled Hunting Area, an area adjacent to Mago National Park, if the hunting is well controlled. Before elephant hunting in Ethiopia was banned in the late 1990s, an elephant was legally hunted for USD 10,000. Thus, selling permits to hunt two elephants could cover the cost of putting into place two health clinics or four boreholes or two elementary schools for a community located near the parks. Protecting elephants also has the advantage that it promotes the tourist industry. The number of tourists has grown in Mago National Park. Tourists go to see wild animals and the unique cultures and traditions of the nearby people. If the two parks develop facilities for accommodating tourists, they will receive considerable income from this enterprise, which will in turn open job opportunities for people living near the parks. This again will enable the park offices to initiate social services for nearby communities like building health and education facilities and supplying water. Such efforts should be sustained collaboratively for long-term, sustainable conservation.

Acknowledgements

The major portion of this research fund came from the European Commission, through the African Elephant Specialist Group, and cofunding was obtained from the Wildlife Conservation Society. I would like to thank the Mago and Omo National Parks offices for assigning field staff and providing vehicles. I am grateful to the Agriculture Bureau of the Southern Nations, Nationalities and Peoples and the Ethiopian Wildlife and Natural History Society for encouraging the successful completion of this work. My sincere gratitude goes to Leo Niskanen, project officer of AfESG, for his valuable editorial comments. Finally, I would like to express my heartfelt sorrow over the death of Shenife Dulla, warden of Mago National Park, who was shot by poachers while he was on anti-poaching duty.

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The status of elephants in Kasungu National Park, Malawi, in 2003

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Abstract

Two tasks were undertaken in this study due to the steady decline in savannah elephant (*Loxodonta africana africana*) numbers within Kasungu National Park in Malawi, in both previous censuses and sightings. The first was to conduct an elephant dung-count survey to obtain a density and abundance estimate for two separate areas of the park. The second was to determine the extent of elephant poaching and the steps necessary to ensure protection of the Kasungu elephants. A density estimate for one area of the park was 0.146 elephants/km^2, giving an abundance of between 120 and 177 elephants. The other area was devoid of elephant dung and thus an estimate was impossible to make. We discuss elephant distribution and poaching and compare our results with previous studies. This study shows that elephants are confined in their distribution within the park and that they have declined dramatically over the past 25 years and appear to be continuing to do so. Poaching may be controlled by increasing law enforcement activities.

Résumé

Cette étude a deux objectifs, suscités par le déclin rapide du nombre d'éléphants de savane (*Loxodonta africana africana*) dans le Parc National de Kasungu, au Malawi, déclin constaté tant lors des recensements que dans les observations directes. Le premier consistait à réaliser un comptage des crottes d'éléphant pour en déduire une estimation de la densité et de l'abondance de ces animaux dans deux zones séparées du parc. Le second était destiné à déterminer l'étendue du braconnage des'éléphants et les démarches nécessaires pour garantir la protection des éléphants de Kasungu. La densité a été estimée à 0,146 éléphants/km^2 dans une des zones, pour une abondance totale comprise entre 120 et 170 animaux. On n'a trouvé aucune crotte d'éléphant dans la seconde zone, l'estimation était donc impossible à faire. Nous discutons de la distribution et du braconnage des éléphants et nous comparons nos résultats aux études antérieures. Cette étude montre que la distribution des éléphants est confinée au sein du parc, que leur nombre a terriblement chuté au cours des 25 dernières années et qu'il continue à le faire. On peut contrôler le braconnage en renforçant les activités d'application des lois.

Introduction

The elephant population in Kasungu National Park, Malawi, has been in decline for many years. This is seen from the findings of poached animals, for example, 19 in 1977 (Jachmann 1979), 167 from 1985 to 1992 (Mkanda 1993), counts by different observers as indicated in table 1, and the reduction in actual elephant sightings by patrols as well as tourists. Because the last census had been carried out in 1995/96, it was necessary to perform a further census now to determine the state of the population. It was also necessary to ascertain the effectiveness of the present park patrols and the park's overall anti-poaching record and to discover the major problem areas. The study was done within a short time and due to limited human and transport resources, our survey had to be designed to take these factors into account.

Study area

The survey was conducted within the Kasungu National Park, in central Malawi (fig. 1). The park is approximately 2300 km^2 in area and encompasses a large part of the Kasungu plateau. The altitude ranges between 1000 and 1500 m. Plateau areas are covered predominately by closed canopy *Brachystegia* woodland (Jachmann and Bell 1985). Three main rivers flow through the area, the Dwangwa, the Lingadzi

Table 1. Previous elephant densities from estimates by different observers using different methods, showing an overall declining trend from the 1970s to date

Year	Census	No. of elephants	Density (no./km^2)	Observers
1969	estimate	650	–	Zimmerman (1969)[a]
1972	aerial	1380 ± 150	0.60	Kasungu Research Unit[a]
1975	estimate	2000	0.87	Morris (1977)[a]
1977	aerial	2000 ± 200	0.87	Bell (1978)[a]
1978	droppings	2500 ± 400	1.57	Jachmann and Bell (1978)[a]
1992	aerial	926	0.40	Mkanda (1992)
1996	aerial	391	0.17	Bhima (1996)

No figures are available for the period between 1978 and 1992.
[a]These figures are taken from Jachmann (1979)

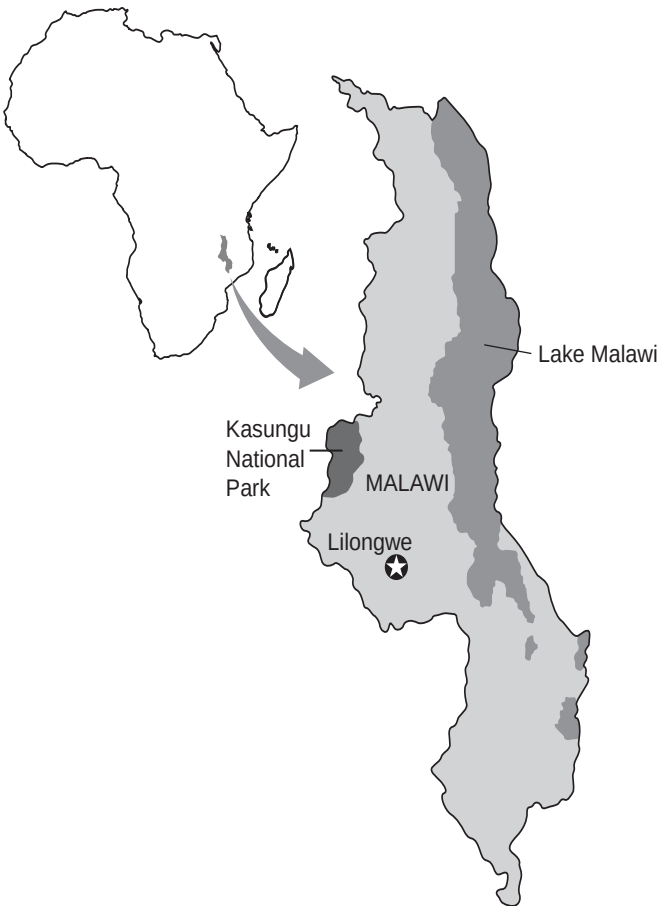

Figure 1. Map of Malawi showing Kasungu National Park.

and the Liziwazi, forming an extensive river network. This drainage system provides better-quality soils with *Combretum* and *Terminalia* woodland on the colluvial soils on the slopes and *Acacia* species on the alluvial soils in the troughs. Mean annual rainfall for the region is 780 mm.

Methods

Elephant survey

A count of droppings was conducted to determine an estimate of both the density and the abundance of elephants in the park. This was done following the line transect sampling theory of Buckland et al. (1993). This method was used due to the dense vegetation, which is characteristic of most of the park. It is also a relatively cheap method and produces results within a short time. The standard error and confidence interval produced show the precision of the estimate.

The park was stratified into two areas based on previous observations: a northern area and a central and southern section. Within the central section five transects were sampled covering a distance of 98.1 km. Four transects covering 49.3 km were sampled in the northern section. As only four persons were available to carry out the survey work in the northern area, the survey effort there was less (Jachmann 1979; Bhima 1996). The survey effort was more intense in the central and southern area as previous studies had shown that the concentrations of elephants were higher in it. We altered the design from straight-line transects to rectangular transects. This allowed survey teams to return to the same point on the road from where they had started and thus minimized time wasted travelling between transects on foot. The idea was taken from Buckland et al. (1993), who suggested implementing rectangular transects along a road network in the study area. These rectangular transects

of varying length were randomly placed along the road. A group of boli was considered as one observation (dropping). These boli groupings were easily identifiable even when boli had been dropped apart while an elephant was walking (Jachmann 1996).

Two teams of six people each carried out the dung counts. One compass and one portable GPS per group were used to maintain a certain heading and straight lines. At every dung pile seen, the distance covered along the transect was measured using the GPS. The perpendicular distance from the line to the centre of the dropping was measured using a 30-m measuring tape. The number of boli in each dropping was recorded. Only dung that observers in the group could see from the line was recorded.

The daily decay rate of elephant dung in the park could not be calculated due to the lack of time. Our dry-season decay rate of 0.0059 per day is taken from Jachmann (1991). Jachmann and Bell (1984) calculated the dry-season defecation rate as 15.7 droppings per elephant per day within Kasungu National Park, and we have used this figure as well.

The data were entered into the program DISTANCE version 3.5 for analysis. Using the indirect method of dung counts, this program calculates density and an abundance value of elephants for the area specified. Outliers of the observation data were truncated to allow for a more comprehensive model to be fitted to the data. The program used some models to fit to the available data to estimate the true detection function *g(y)*. The true value of *g(y)* is not known; furthermore, it varies due to numerous factors such as observer's effectiveness and environment (Buckland et al. 1993). Three properties for a model for *g(y)* are, in order of importance, 1) model robustness, 2) shape criterion and 3) efficiency. The best model was selected by various criteria, including the likelihood ratio test, the Akaike information criterion (AIC), and the chi-squared goodness-of-fit test. A bootstrap method was used to calculate variance to select the best model among similar and good models (Buckland et al. 1993; Laake et al. 1994.

Law enforcement

There are nine scout camps in Kasungu National Park. As the park area is about 2300 km^2, each camp is supposed to cover an area of 230 km^2 in its patrol activities to control poaching.

Each patrol camp is supposed to have at least five armed men who are meant to conduct three long patrols of seven days each per month in their area. The chances of this happening are slim, however, as the scouts tend to patrol areas near the camp and never venture too far out, returning each night to the camp. They take note of illegal incidents and animal sightings in their patrol area. In this study, we reviewed all patrol reports from 1997 to date for each camp. We looked at the area each camp covered and issues affecting this, elephant sightings during patrols and elephant poaching—that is, animals discovered killed, location of most poaching and the implication of this to the distribution of the elephants.

Results

Elephant survey

We obtained an elephant density estimate for the central and southern region of the park. The density estimated for the location was 0.146 elephants/km^2, with a 95% confidence interval of 0.12 and 0.177 or an abudance estimate of 117 elephants and a 95% confidence interval of 96 and 142. The DISTANCE program selected the key function model 'Uniform' + cosine (the series expansion) based on the minimum AIC value. However, we were unable to obtain an estimate for the northern area. No elephant dung was seen while we walked our four transects in that area. This absence of dung in the northern area of the park and the higher number of sightings in the central area correlates with the scout patrol reports in these areas.

Law enforcement

Table 2 shows the staffing levels at each camp. All but Lifupa camp, which is the main camp, were below required staffing levels. This makes patrolling difficult, particularly for the six camps with only two and three men, because as they go out on patrol, one must remain in camp to guard the remaining family members. Patrols in these camps tend to be short and concentrated around the camps.

The scout reports of the last five years were analysed for patterns of where elephants were seen most frequently and where the majority of elephant carcasses were found as well as the number ofgunshots heard by scouts on patrol. The main camp, Lifupa, recorded elephant sightings throughout the year. This was followed by Lisitu camp. Khalango and Miondwe

camps recorded elephant sightings in the wet and early dry seasons while Dwangwa camp recorded elephants only once, in July. The rest of the camps, Kangwa, Kapusi and Mpayakwe, all located in the north of the park, and Chipiri in the south, did not see any elephants during their patrols.

Lifupa camp also discovered the highest number of poached elephants—19 from 1997 to August 2003. Most of these were shot just east of Lifupa Dam. Also killed were 8 in the Lisitu area, 3 in the Miondwe area and 1 in the Khalango area. No poached animals were recorded in the Chipiri, Dwangwa, Kangwa, Kapusi and Mpayakwe areas. Miondwe camp recorded the highest number of gunshots. Shooting in this area is mostly for antelopes.

Discussion

The number of elephants in the entire park estimated from this study is extremely low in comparison with previous census and survey work (table 1). Jachmann and Bell (1979) performed dung count surveys in 1978 that indicated a mean density of 1.57 elephants/km^2. An aerial census in 1984 estimated elephant density at 3.1 elephants/km^2 in the central area of the park, but an overall density of 0.52 elephants/km^2. In a further aerial census carried out in 1996, elephant densities in the park were estimated as approximately 0.2 elephants/km^2. The 1996 count had very wide confidence limits and so could have been an underestimation. The reason for this was the poor stratification of the area, and this study addressed this shortcoming by having one stratum over the central region around Lifupa camp, which is where the vast majority of elephants are known to congregate (Jachmann and Bell 1979; Bhima 1996). This aggregation of elephants has been attributed to poaching pressure and the relative safety of the area near the tourist camp and park offices where most of the park officials live and work. Poaching is a key external factor in determining differential use of habitat elsewhere (Douglas-Hamilton 1987). In contrast, the northern area of the park and the western boundary, bordering Zambia, have continued to have low numbers (Bhima 1996). Only vegetation can be a constricting factor as permanent water supplies are abundant and not far apart. The most nutritious vegetation is around the Lingadzi and Lisanthu river systems in the central area and around the lower part of the Dwangwa river system in the northern area (Jachmann 1979). Yet elephants are not often seen at some of these sites, suggesting that a factor such as poaching is deflecting them from these areas.

A count in 1992 estimated the total population at 926 elephants, a density of approximately 0.3 elephants/km^2 (Mkanda 1993). This number would have been reduced by 1996 as carcass counts were carried out in the aerial count of 1996 and a high carcass ratio of 12.8% was estimated, showing that this elephant population is definitely decreasing. Although we narrowed the confidence limits in our study, a density of 0.15 elephants/km^2 in the central region of the park is still very low. Elephant mortality due to poaching in earlier years was higher than we recorded. Jachmann (1979) recorded 19 elephants poached in 1977 and Mkanda (1993) recorded 167 from 1985 to 1992. These high levels of poaching have led to a decline in elephant numbers.

Table 2. Law enforcement situation and elephant distribution and poaching in Kasungu National Park from 1997 to 2003

Camp	Number of scouts	Elephant sightings	Gunshots heard and guns confiscated	Elephants discovered killed
Chipiri	4	none	0	0
Dwangwa	3	in early dry season	6	0
Kangwa	2	none	6	0
Kapusi	3	none	4	0
Khalango	3	in wet and early dry seasons	29	1
Lifupa	5	throughout the year	69	19
Lisitu	3	in wet and most of dry season	34	8
Miondwe	3	in wet and early dry seasons	121	3
Mpayakwe	4	none	0	0

The dung count method, however, has been proved in various studies to be one of the most, if not the most, accurate method of counting animal numbers, especially in densely vegetated areas. Barnes (2001) has shown the accuracy of dung counts in comparison with aerial counts for counting elephants and has proved that dung counts give more precise estimates and thus better results. Jachmann (1991) even believes they should be the preferred method for counting elephants in most situations.

The scout patrols in the park are known to be fewer than adequate. With a total of about 50 scouts operating in the park, this means each scout should cover 40 km^2, an area that is impossible to cover well and regularly. Only nine scout camps exist in various areas of the park (fig. 2). Usually three scouts patrol from one of these camps and this number is often as low as two. This number is not only dangerous in terms of encountering animals but is also inadequate in dealing with any groups of poachers, possibly heavily armed, that they may encounter. Consequently, the scouts do not patrol far from camp. Vast areas of the park are not patrolled at all. To resolve this issue a strategy can be considered of regularly teaming up the scouts of two to three camps to patrol areas together that have not been covered for long periods. An immediate senior supervisor must lead such a patrol.

A major reason for elephant poaching is simply for food for people in the many surrounding villages. A lot of elephant meat has been confiscated in the past. Human settlements are encroaching on the park along many of its borders. The real solution to reducing poaching is to develop these rural areas so that people no longer need to hunt and forage in the park. Bell (1983) reported progress in this regard back in 1982 when a combination of intensified patrols and public relations activity with the government and local leaders produced significant results. Arrested in and around the park were 239 poachers, and 30 muzzle-loading guns, 5 short guns and 1 semi-automatic rifle were confiscated. It seems that initiatives of this kind need to be stepped up once again.

Another future prospect for the area is to develop a transfrontier park between Malawi and Zambia, as Lukusuzi National Park in Zambia is situated across the border from the western boundary of Kasungu. The gap between the two parks, however, is populated with villages. The people here are possibly poaching in the parks or simply poaching animals moving between these two reserves. By forming one larger park, a more cooperative effort can be adopted to minimize poaching and co-manage the park. This will allow resources to be shared and animals to move unhindered in their natural range.

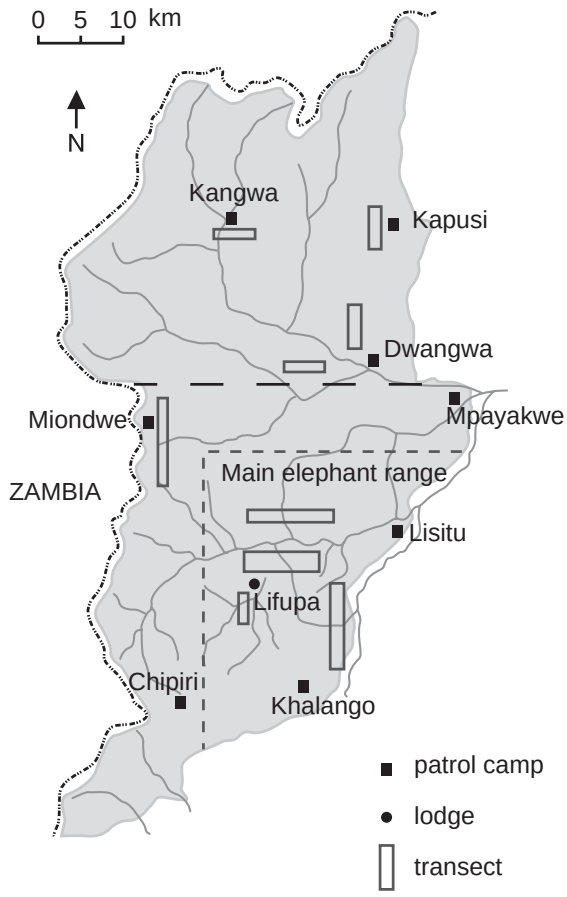

Figure 2. Map of Kasungu National Park showing locations of scout camps and rectangular transects of dung surveys.

Acknowledgements

We thank the African Elephant Specialist Group for providing funding with which to conduct the study. We would also like to thank all those involved in collecting the data.

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Forest elephant density and distribution in the southern part of Campo Ma'an National Park, Cameroon

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Abstract

An elephant census was carried out in Campo Ma'an National Park, which is situated in the extreme south-west of Cameroon. Dung was counted for 8 months in 2000–2001. The elephant density was calculated as 0.8 km^{-2} (n = 29, se = 0.2) in the 649-km^2 study area—a relatively high number compared with known elephant population densities in the region. No seasonal differences in density were detected, nor were densities site dependent. The concern is rising that elephants are trapped or compressed within the national park.

Résumé

Dans le Parc National Campo Ma'an, situé dans l'extrême sud-ouest de Cameroun, un recensement des éléphants était fait. Les crottes ont été comptées pendant 8 mois en 2000–2001. La densité d'éléphant était calculée avec comme résultat 0,8/km^2 (n = 29, se = 0.2) dans le région de l'étude conté 649 km^2, un chiffre relativement haut comparé avec les densités connues des populations d'éléphants environnants. Aucune difference en densité saisonnière ne pouvait être déterminée non plus était les densités dépendant du site. Vraisemblablement il se pose un problème que les éléphants sont capturés ou compressés dans le Parc National Campo Ma'an.

Introduction

The Campo Ma'an area, situated in the extreme south-west of Cameroon, is part of the West Equatorial Refuge, a tropical lowland rainforest tremendously rich in species. The area, formerly known as the Campo Reserve, has recently been expanded and re-organized. A national park covering 2640 km^2 was gazetted within the Campo Ma'an project area in January 2000. Part of the area around the national park is considered a buffer zone, in which several activities take place (Tropenbos International 2002).

Accurate baseline data were gathered on density and distribution of forest elephants as one of the focal points in an ongoing ecological monitoring programme. Because a reconnaissance survey showed that most of the elephants were found in the southern part of the new national park, this study focused there. Data collected will contribute to the conservation and management of elephants and other large mammals in the Campo Ma'an area.

Study area

The southern part of Campo Ma'an National Park covers 648 km^2. It is bordered in the west by the Atlantic Ocean, in the east and south by the Ntem River, and to the north by the Bongola River and the road between Mvini and Ebianemeyong (fig. 1). It is habitat to numerous primates including gorilla, chimpanzee, mandrill, and other large mammals such as duikers, sitatunga, hippopotamus, forest buffalo and forest elephant. The study area consists of two parts: Dipikar Island (359 km^2) and the southern corridor (289 km^2). The Bongola separates the two parts. Numerous streams and river branches make the study

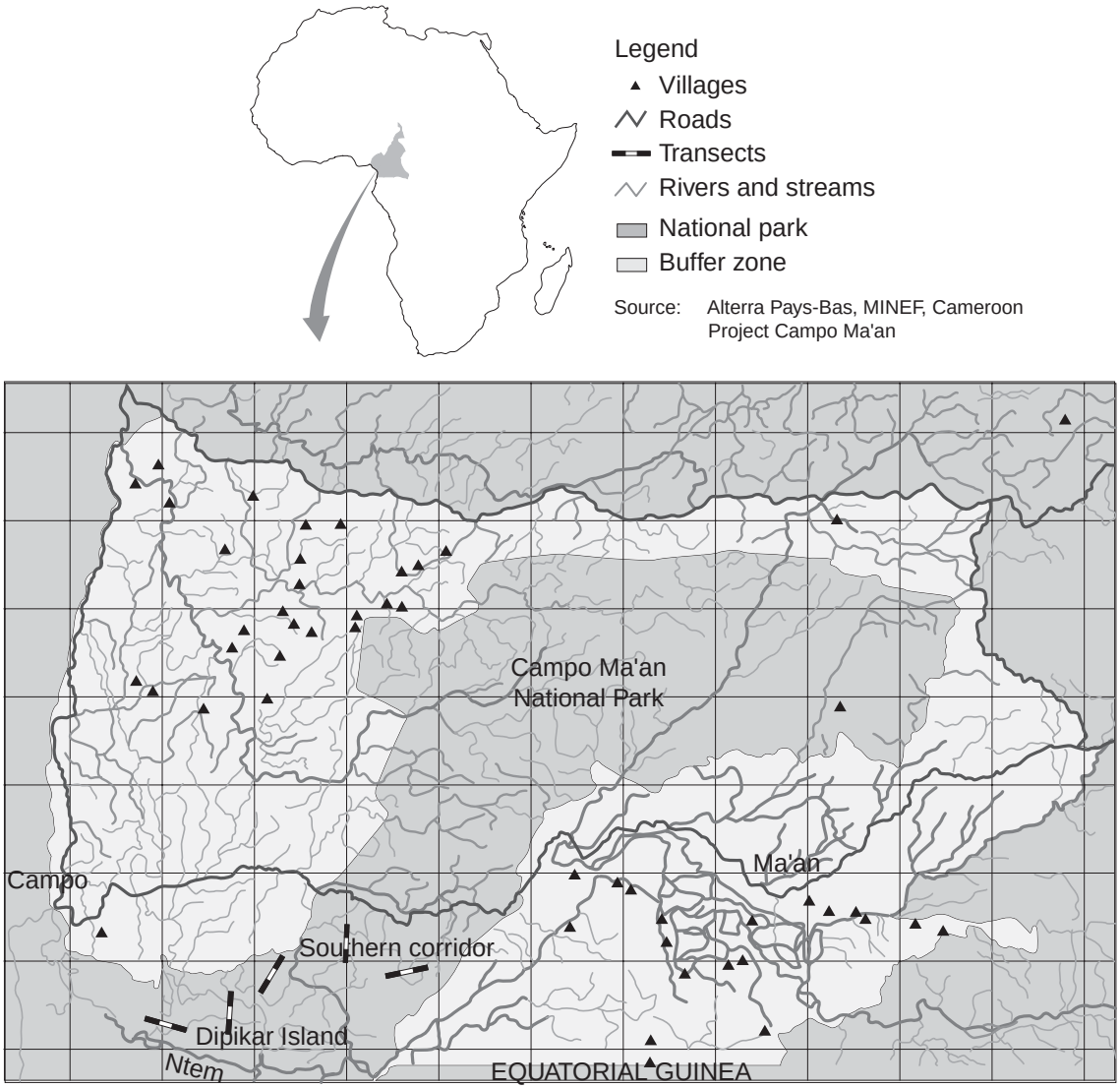

Figure 1. Map of the study area. One square is 12,100 ha.

area abundant in water, and swamps occur locally. Within the area the landscape changes from low-altitude plains in the west (principally Dipikar Island) to a hilly and mountainous zone rising above 700 m in the east (east of the southern corridor).

The vegetation consists mainly of old secondary forest, but patches of dense, humid, evergreen primary forest still occur, mostly closely related with the steep topography of the area. Selective logging took place in the area's level zones around 1994, leaving an infrastructure of logging roads. Nowadays elephants pushing over the young secondary trees maintain the human-created disturbed areas on and next to abandoned logging roads. All transects surveyed include parts of the secondary forest.

The climate of south-west Cameroon is equatorial. Although rainfall occurs throughout the year, two humid seasons and two drier seasons can be distinguished. The heaviest rainy season is from August to November and another rainy season is from April until the beginning of June (estimated average total yearly precipitation is 3000 mm). Drier seasons occur from December to March and from June to July (Gemerden and Hazeu 1997). The area has been officially desig-

nated a national park, providing full protection to flora and fauna. Moderate poaching still goes on but is focused mainly on small duikers and the smaller primates rather than on elephants (Cameroonian Ministry of Environment and Forest, personal information). The area has no human habitation except for a small army base at the extreme western end.

Method

To estimate elephant density, we sampled elephant dung density along five transects over a period of 8 months. Each transect was 5 km long and 1 m wide. Three transects (S1, S2, S3) were positioned at random on Dipikar Island, and two (S4, S5) in the southern corridor. Between September 2000 and April 2001, four strip transects (S1, S2, S3, S4) were surveyed 6 times and one transect (S5) was surveyed 5 times. This way the main part of the rainy season and the major dry season have been included. The narrow strip width was applied because of the high abundance of elephant dung, while the narrowness of the transects made observations more accurate. Every dung pile encountered was marked to prevent double counting. All five transects were investigated by the same team consisting of three persons: one local assistant and one eco-guard from the Cameroonian Ministry of Environment and Forest, both with excellent knowledge of the forest, helped the observer look for dung.

To estimate elephant density (no./km^2) from dung counts, we slightly adapted the equation of Tutin and Fernandez (1984):

Elephant density = $n / flwd$
where
- n = number of dung piles encountered
- f = defecation rate (day^{-1})
- l = transect length (km)
- w = transect width (km)
- d = dung accumulation period (days)

Defecation rate (mean number of dung piles an elephant discharges per day) is taken as 14, after Powell (1998), and the maximum accumulation period (number of days in which the dung could have been deposited) is taken as 65, after White and Edwards (2000). The maximum dung accumulation period equals the dung decay time and was taken into account only when the time lapse between observations was large (like for the first observation). The dung accumulation period was mostly taken as the number of days between observations, since this number was less than the dung decay time (mean number of days in which a dung pile disappeared). Sequential inspection of 146 dung piles during the whole fieldwork period validated this. No difference in dung decay rates was found between seasons (Bekhuis 2002).

A two-way ANOVA, with season and site as fixed factors, was applied to log-transformed elephant density values used to distinguish possible density differences between sample areas and seasons.

Results

Sixty-nine individual elephant dung piles were counted within the transects, 40 on Dipikar Island and 29 within the corridor zone. From this number densities were calculated per transect and per field trip to adjust for the different lengths of dung accumulation periods (fig. 2).

During the main part of the rainy season the mean elephant density over the whole study area was calculated as 0.6/km^2, while during the major dry season the mean density calculation resulted in an estimate of 1.1/km^2. The mean density during the dry season tended to be higher in the corridor (0.9 and 1.3 elephant/km^2 for the rainy and the dry season, respectively) as well as on Dipikar Island (0.4 and 1.0 elephant/km^2, respectively), but differences among seasons and sites were not significant (2-way ANOVA on transformed densities, $P > 0.05$) (table 1).

For Dipikar Island mean elephant densities over the whole study period were 0.3/km^2 in the western region, 0.6/km^2 in the central region and 1.2/km^2 in the eastern region. A significant difference in elephant density was not detected between the areas (ANOVA on transformed densities, $P > 0.05$), possibly due to the low sample size. For the southern corridor the densities were 1.1/km^2 in both the low-lying level meadows and the mountainous zone.

For this reason the entire study site is taken as a whole. The mean density for the study area is 0.8 elephants/km^2 (n = 29, se = 0.2), suggesting that with simple extrapolation and an area of 648 km^2 the study area is holding an average of 548 elephant individuals (table 2).

Figure 2. Elephant densities per transect and per field trip; differences are not significant.

Table 1. Mean elephant density (km^2) and number in rainy and dry seasons in Dipikar Island and the corridor; differences among sites and seasons are not significant

Season	Dipikar Island (no.)	Corridor (no.)	Total study area (no.)	Mean elephant (no.)
Rainy season	0.4	0.9	0.6	389
Dry season	1.0	1.3	1.1	713
Average	0.7	1.1	0.8	548

Table 2. Mean elephant density per square kilometre and number of transect observations for different sites in this study; differences among sites and transects are not significant

Location	Mean elephant density (per km^2)	Transect observations (no.)	Mean elephant number
Dipikar Island	0.7	18	251
Western transect	0.3	6	
Central transect	0.6	6	
Eastern transect	1.2	6	
Southern corridor	1.1	11	318
Lower transect	1.1	6	
Mountainous transect	1.1	5	
Total study area	0.8	29	548

Discussion

In this study we found an average forest elephant density of 0.8 elephants/km^2 for the southern part of the Campo Ma'an National Park.

According to Wanzie (1993) the Mount Cameroon area holds an elephant density of 0.15/km^2, while for Dja Reserve an informed guess leads to an estimate of 0.29/km^2 (Tchamba 1998). The relatively high elephant density in the southern region of the Campo

Ma'an National Park might be because it is located much farther away from human activity (villages, fields and roads) than are the two surrounding reserves.

In south-western Cameroon the main threat to elephant was poaching and not habitat disturbance by selective logging (Bekhuis 1997). According to Bekhuis, three habitat requirements account for significant differences in suitability among the various landscapes in south-western Cameroon: food availability, water availability and distance from human activity. A questionnaire given to villagers showed that they considered a suitable distance from human activity was at least 8 km. A field study revealed that sufficient water and food were available in all the landscapes within the area, making distance to human activity the main factor determining elephant presence. Barnes et al. (1995) in Gabon and Blom et al. (2001) in Central African Republic have also reported that human density had a greater effect on elephant density than vegetation type.

These inferences also appear valid in explaining elephant distribution in the Campo Ma'an area. A rapid survey among villagers from different sides of the Campo Ma'an region disclosed elephant presence in and outside the national park but mostly at large distance from villages (> 10 km). No evidence at all has been found of elephants crossing or even approaching the well-used road bordering the Campo Ma'an region in the north and east. From interviews and field sightings it is clear that most of the elephants are located in the southern part of the national park.

Van der Hoeven (2001) carried out a study in the Campo Ma'an region using a classified, more detailed questionnaire to determine densities of nearly all animal species present, among them the elephant. He found that elephants were still present outside the national park (in the buffer zone) but not as numerous as inside it. Both areas have nearly the same abundance of food and water; their difference is mainly the intensity of human activity.

The wide confidence limits (about 25% deviation from means) to the different mean densities found in the corridor and on the island during the two seasons preclude making a statement about more accurate seasonal and site-specific mean densities. The trend in the data suggests to us, as a working hypothesis, that at the beginning of the dry season (December), elephants move from outside the study area into the southern corridor, and elephants from the southern corridor move to Dipikar Island. Elephants then move back from Dipikar Island into the southern corridor zone at the beginning of the rainy season, and also from the southern corridor zone northwards outside the study area.

Attempts have been made to track elephant movement by mapping elephant paths. During the dry season, elephant paths in the study area covered only short distances, with lengths of approximately 3 km, and connected fruiting trees (Bekhuis, unpubl. data). During the rainy season no fresh elephant paths were identified; in general, only during this season do animal tracks show. This lack of tracks may indicate a change in the pattern of elephant activity in different seasons. Tracks do not show movement over long distances.

African elephant movements have always been the subject of much speculation. However, elephants are nowadays unlikely to move far outside of the national park. Around the park in Cameroon, as human activity (villages, roads, fields and hunting activity) increases, it increasingly keeps elephants at a distance. We even suggest that elephants discovered the safety of Campo Ma'an National Park and moved into it.

No information is available yet on forest elephant density or elephant movement in Equatorial Guinea, just south of the study area. The estimated number of the elephants in the Campo Ma'an National Park is most probably a large enough population to be sustainable. But is it possible for these elephants to meet individuals from other populations? Ongoing research is necessary to reveal whether the Campo Ma'an populations of elephants are trapped or compressed in the park.

Acknowledgments

The Campo Ma'an Project, financed by the World Bank and Tropenbos International, supported this work. Special thanks are due to the Cameroonian Ministry of Environment and Forest for facilitating this project. The Tropical Nature Conservation and Vertebrate Ecology Group of Wageningen University provided content and moral support. Dr Ignas Heitkönig commented on an earlier draft. We feel much gratitude also to our two field assistants, Mr Innocent Medjo and Mr Justin E. Menye Menye, for their perseverance in the field and for sharing their field knowledge, and to all cooks and drivers who supported us in the bush. Appreciation goes out to all

Campo Ma'an colleagues, especially of the GIS section, and finally yet importantly to the principal technical adviser of the project, Mr Tinus de Kam.

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Les éléphants du Ranch de Gibier de Nazinga (Burkina Faso) : données passées, situation actuelle, perspectives de conservation

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Résumé

Depuis la fin des années 1980 une recherche diversifiée a été menée au Ranch de Gibier de Nazinga (RGN) sur les éléphants. Elle s'est surtout focalisée sur la détermination de la structure d'âge, l'estimation des effectifs et l'utilisation de la végétation. Cette recherche a connu un net ralentissement ces dix dernières années si bien que la connaissance de la situation actuelle reste imprécise et constituée de données fragmentées. A la faveur du projet GEF–Nazinga un programme monitoring éléphant a été initié en Avril 2002 avec pour objectif la réactualisation des données écologiques sur l'éléphant, et l'appréhension des conflits homme–éléphant. Les résultats des deux recensements terrestres par zonage indiquent ainsi que ces opérations trimestriels doivent se poursuivre pour mieux cerner les effectifs actuels. Les éléphants sortent en effet de Nazinga en saison pluvieuse pour n'y revenir qu'en saison sèche. Les femelles ont représenté 36 % de la population recensée contre 23,5 % pour les mâles. Le sexe de 40,5 % n'a pu'être déterminé par les recenseurs. Il s'agit d'éléphants juvéniles ou d'individus farouches difficiles à approcher. Les éléphants de Nazinga ne sont pas distribués sur l'entièreté du ranch ; la distribution semble être en corrélation spatiale inverse avec les indices de braconnage et d'empiètement relevés. Les conflits homme–éléphant sont réels et croissants. Le phénomène des dégâts aux cultures est décrié dans tous les villages ; les paysans se sentent inoffensifs, bien que certains n'hésitent pas à tirer à bout portant sur les pachydermes. Le braconnage bien que par moment intense a rarement pour cible l'éléphant. Les principales pressions sur l'espèce sont alors la pression démographique et l'empiètement des habitats. Les perspectives en matière de conservation seront alors la collaboration transfrontalière (Burkina Faso–Ghana), la sécurisation des domaines vitaux et des parcours, la réconciliation de l'espèce et des victimes de ses dégâts, sa valorisation économique au profit des populations, et la constitution d'une base de données scientifiques régulièrement actualisée.

Abstract

Since the end of the 1980s there has been an intensive study on the elephants of Nazinga Game Ranch, particularly on their age structure, numbers and the plants they use. This research has slowed down during the last decade and the actual status of the species remains unknown because data on elephants is fragmented. Through the financial support of the Nazinga GEF (Global Environment Facility) project, an elephant-monitoring programme was implemented in 2002. The main objectives were to get precise information on elephant ecological data and to study the human–elephant conflict in the area. Results of two elephant ground surveys show that censuses need to be carried out regularly to ascertain the actual number of individuals. Indeed, some elephant herds are known to go out of the ranch area during the rainy season and come back during the dry season. Females represent 36% of the population and males 23.5%. The sex of 40.5% of the elephants could not be determined. These consisted mainly of juvenile elephants or ferocious animals that could not be approached. Elephants are not distributed throughout the ranch area. Their distribution seem to be inversely correlated to poaching activities. Human–elephant conflicts are real and are increasing. Crop raiding is a frequent phenomenon. Farmers still think elephants are not offensive even though some of them are obliged to shoot the pachyderms when necessary. Though poaching levels are high, elephants are rarely poached. The main pressure on elephants is the high human population and fragmented habitats. Future conservation strategies should concentrate on beefing up security in the important areas, collaborating efforts between Burkina Faso and Ghana, reducing human–elephant conflict, and creating a database of information that has been scientifically proven.

Introduction

Le Burkina Faso malgré les aléas climatiques et la pression humaine abrite encore une population éléphantine relativement importante. Pour une superficie totale de 274 200 km^2 que couvre le pays, l'aire de répartition des éléphants représente 7 % soit 18.198 km^2 (IUCN 1998). Le complexe écologique (fig. 1) qui couvre le Parc national Kaboré Tambi (PNKT), le Ranch de Gibier de Nazinga (RGN) et la Zone cynégétique de la Sissili (ZCS) est une des principales zone de répartition de l'espèce se caractérisant par sa situation frontalière avec la République du Ghana.

Depuis quelques années, le développement du réseau routier, dans la zone, la pression démographique, l'intensification du braconnage dans le PNKT, la progression des fronts agricoles ont considérablement empiété les espaces disponibles pour la faune et significativement réduits le parcours des éléphants. Le RGN où existe une certaine stratégie de protection de l'aire et de lutte anti-braconnage contrairement aux deux autres zones, se trouve alors être l'ultime réfuge pour la population éléphantine du complexe écologique.

Cette situation lui confère l'une des densités les plus élevées en Afrique occidentale soit 0,52 ind/km^2 (Nganga 1998) et justifie que l'éléphant soit l'espèce emblématique du tourisme de vision à Nazinga avec la plus grande contribution spécifique aux observations animales (Hien 2001). Compte tenu de son importance sociale économique et écologique, l'espèce a depuis la fin des années 1980 fait l'objet d'une recherche diversifiée au RGN. Cette recherche a connu un net ralentissement ces douze dernières années si bien que la connaissance de la situation présente reste imprécise et constituée de données fragmentées (Vermulen et Hien 2001).

A la faveur d'un projet financé par le GEF par l'entremise du PNUD, un programme monitoring éléphant a été initié en avril 2002 avec pour objectif :

- étudier la dynamique des populations éléphantines du complexe écologique ;
- analyser leur distribution saisonnière ;
- identifier et caractériser les habitats clés de l'éléphant ;

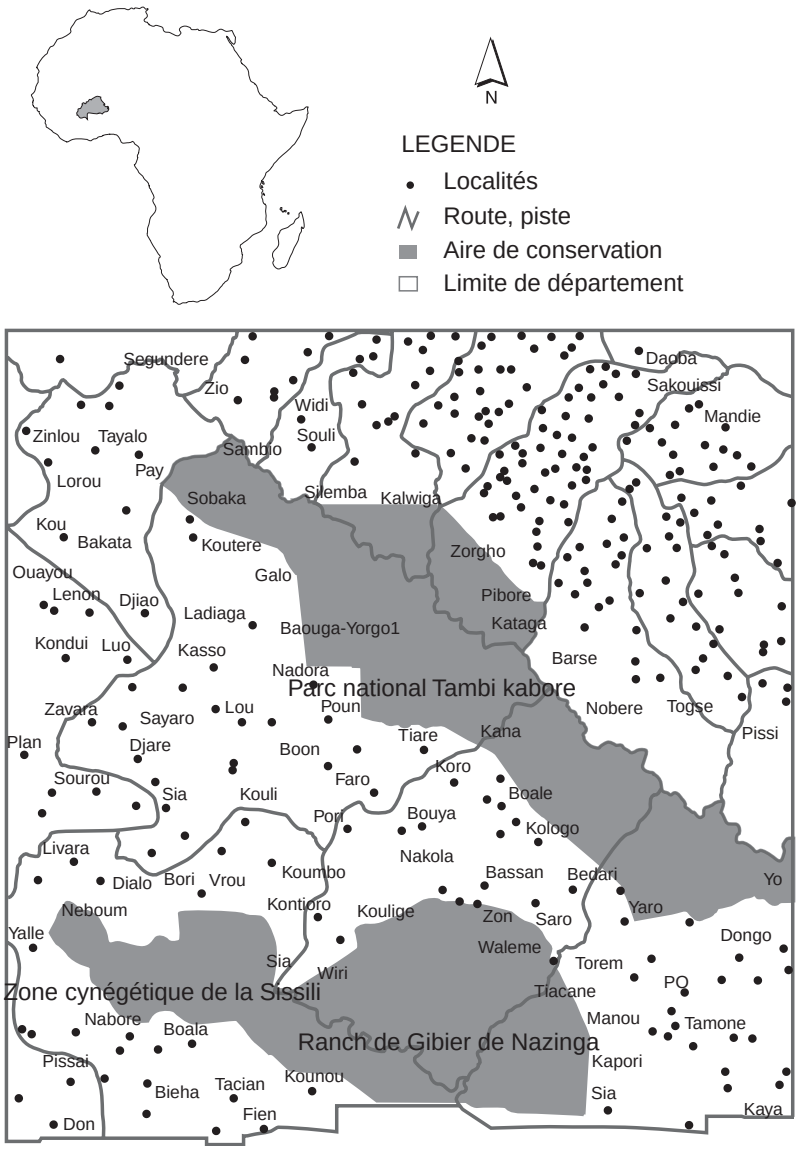

Figure 1. Localisation des aires protégées du complexe écologique.

- étudier les mouvements des éléphants ;
- appréhender l'ampleur des dégâts occasionnés par les éléphants aux cultures ;
- élaborer un modèle d'aménagement et de gestion en vue d'optimiser la diversité biologique et réduire les conflits homme–éléphant.

Le présent article fait l'état de la recherche passée et présente de façon succincte et globale, les résultats d'une première année de monitoring.

Présentation du ranch

Le Ranch de Gibier de Nazinga se situe au sud du Burkina Faso, à cheval sur les provinces du Nahouri et de la Sissili entre 11°01′ et 11°18′ de latitude Nord et entre 1°18′ et 1°43′ de longitude Ouest. Il a une superficie de 970 km^2 et est par la route à 200 km de Ouagadougou la capitale. Sa limite sud fait frontière avec la République du Ghana (fig. 1).

Le relief est peu marqué avec une altitude moyenne de 280 m comprise entre des extrêmes allant de 270 à 325 m. Les sols, développés sur un substrat granitique sont de type ferrugineux tropical. Le climat est sud-soudanien (Guinko 1984) ; les pluviométries moyennes de ces deux dernières années indiquent une hauteur d'eau de 793,6 mm repartie sur six mois (avril'à octobre). Les températures moyennes mensuelles varient dans l'année entre 18,1° et 38,4°C. Le ranch est traversé par trois principaux cours d'eau que sont la Sissili et ses deux affluents, le Dawévélé et le Nazinga.

La faune est assez variée avec 290 espèces d'oiseaux (Portier 2000), 26 espèces de poissons (Ouedraogo 1987), 10 genres et 11 espèces d'ongulés à savoir : le buffle (*Syncerus caffer brachyceros*), l'hippotrague (*Hippotragus equinus*), le bubale (*Alcelaphus buselaphus*), le cobe defassa (*Kobus ellipsiprymnus defassa*), le cobe de buffon (*Kobus kob)*, le cobe redunca (*Redunca redunca)*, le guib harnaché (*Tragelaphus scriptus)*, le céphalophe à flancs roux (*Cephalophus rufilatus*), le céphalophe de Grimm (*Sylvicapra grimmia)*, l'ourébi (*Ourebia ourebi)*, le phacochère (*Phacochoerus africanus)*. L'éléphant (*Loxondonta africana africana*) et l'orycterope (*Orycteropus afer*) sont les uniques représentants des Proboscidiens et Tubilidentés. Les primates sont représentés par le babouin doguera (*Papio anubis)*, le singe vert (*Cercopithecus aethiops)* et le singe rouge (*Erythrocebus patas)*. Les carnivores comprennent essentiellement l'hyène tachetée (*Hyeana hyeana*) et l'hyène rayée (*Crocuta crocuta)*.

La végétation est composée en grande partie de savane arbustive à *Combretum* et *Terminalia*. Six unités de paysages (Dekker 1984 et Decker 1988 cités par Yameogo 1999) correspondant à des portions de territoire caractérisées par une densité ligneuse et une position topographique donnée ont été définies. Il s'agit de :

- la forêt galerie (9,5 % de la superficie du ranch)
- la savane arborée (26,9 % de la superficie du ranch)
- la savane arborée dense (1,1 % de la superficie du ranch)
- la savane arbustive claire (45,3 % de la superficie du ranch)
- la savane arbustive dense (0,2 % de la superficie du ranch)
- la savane boisée (15,66 % de la superficie du ranch).

Au plan socio-économique, le ranch compte dix villages situés en sa périphérie avec lesquels il entretient un partenariat actif. La densité de la population est faible (10 hbts/km^2) avec un équilibre relatif entre hommes (48 % de la population) et femmes (52 %) (Ndecky 2002). Elle augmente de façon remarquable avec l'installation croissante de migrants venant d'une part du nord et du centre du pays et d'autre part de la Côte d'Ivoire. La moitié de la population de ces villages a moins de 18 ans. Les principales activités sont l'agriculture, l'élevage et la pêche.

Données passées

Depuis la fin des années 1980 une recherche diversifiée a été menée au Ranch de Gibier de Nazinga (RGN) sur les éléphants. Les paragraphes ci dessous présentent les principaux sujets développés ainsi que les conclusions auxquelles les auteurs ont abouti à l'époque.

En 1986, Sebogo cite dans la bibliographie étudie durant cinq mois la structure d'âge de la population d'éléphants à Nazinga. Il révèle, à l'examen des classes d'âge, que la population d'éléphants du RGN est relativement jeune. Bien que les deux méthodes employées (mesure des circonférences des crottes et photogrammétrie) se révèlent comparables, l'auteur recommande de poursuivre les études afin d'affiner les comparaisons.

En 1987, Jachmann estime le nombre d'éléphants présents sur Nazinga entre 350 à 400 individus pendant la saison sèche et 420 individus pendant la saison

des pluies, à l'aide de la méthode basée sur l'échantillonnage des matières fécales. Ses travaux sur la répartition spatiale de l'espèce dans le ranch montrent en outre une distribution saisonnière de l'espèce dans le ranch : d'une part un domaine relativement restreint en saison sèche, se situant près des rivières Sissili et Dawévélé, et d'autre part une dispersion en saison des pluies sur l'ensemble du ranch.

Croes (1987) montre cette même année dans son étude sur l'utilisation de la végétation ligneuse par les éléphants que ces derniers ont une préférence pour les espèces ligneuses et qu'il existe une corrélation entre le diamètre des arbres et l'occurrence des dégâts causés par les pachydermes. Il montre également une corrélation entre les dégâts d'éléphant et la densité de végétation. En caractérisant les dégâts selon la nature des zones (brûlées ou non brûlées) et selon les saisons, il aboutit aux conclusions suivantes :

- les zones brûlées sont moins endommagées que les zones non brûlées
- les dégâts sont plus importants dans les formations végétales à proximité des rivières
- les dégâts sont plus importants en saison sèche qu'en saison pluvieuse.

Toujours en 1987, Jachmann et al. étudient l'influence du feu sur l'utilisation par les éléphants des zones boisées à *Combretum* et *Terminalia*. Ils montrent que les éléphants préfèrent les zones non brûlées pendant la saison sèche. Des comparaisons avec d'autres travaux menés ailleurs en Afrique leur permettent d'établir que, sous régime de feux précoces, la repousse de la végétation est le principal facteur déterminant l'utilisation d'une zone par les'éléphants. Selon les auteurs, les feux précoces entraîneraient une moindre disponibilité en p,turage durant la saison sèche, comparativement aux feux de mi-saison et aux feux tardifs.

En 1988, Demmer et Van Der Val exposent quelques aspects écologiques des éléphants de Nazinga. La digestion différentielle, la composition des crottes, les taux de défécation journaliers (17,5 crottes/jour) sont abordés. L'étude de la taille et de la structure des groupes leur permet de caractériser la population d'éléphants de l'époque comme une population jeune comprenant environ 26,2 % d'individus immatures. La taille des groupes variait entre 2 et 120 individus, avec une moyenne de 13,8 individus.

L'année suivante, en 1989, Jachmann présente les résultats d'un important travail comparatif de différentes méthodes d'échantillonnage. Il effectue un recensement aérien par recouvrement total de 100 % pour déterminer avec précision l'effectif de la popula-tion d'éléphants afin de la comparer aux résultats des différentes autres méthodes, et notamment le dénombrement par crottes. Le tableau 1 indique les résultats de cet inventaire et présente les estimations de l'effectif d'éléphants par les autres méthodes depuis 1980.

L'étude montre que les recensements par'échantillonnage aériens, pédestres ou par véhicules fournissent une estimation assortie d'un intervalle de confiance

Tableau 1. Résultats synthétiques des recensements d'éléphants entre 1980 et 1989.

Année	Type d'inventaire	Effectifs estimés	IC (95 %)	Source
1980	empirique	40	–	Lungren (com. pers)
1982	aérien échantillon	300	0 – 669	Bousquet (1982)
1985	pédestre	325	0 – 725	O'Donoghue (1985)
1985	pédestre	630	304 – 956	O'Donoghue (1985)
1987	pédestre	487	210 – 774	Jachmann (1987)
1987	crottes (saison sèche)	396	323 – 469	Jachmann (1987)
1987	crottes (saison sèche)	353	276 – 430	Jachmann (1987)
1987	crottes (saison pluies)	420	0 – 910	Jachmann (1987)
1988	pédestre	306	0 – 952	Jachmann (1988)
1988	automobile	293	71 – 575	Jachmann (1988)
1988	aérien échantillon	610	0 – 1270	Jachmann (1988)
1989	aérien total	366		Jachmann (1989)

Source : Jachmann 1989
IC : Intervalle de confiance

assez large, et sont donc d'une faible précision. Il en est de même pour la méthode des crottes en saison des pluies. La technique de comptage des crottes en saison sèche présente cependant des résultats satisfaisants.

Sur sa lancée, Jachmann produit encore un document en 1990 relatif aux mouvements des éléphants de Nazinga à l'intérieur et à l'extérieur du Ranch. Il étudie les espaces utilisés par trois éléphants équipés de colliers émetteurs. Il ressort de ces travaux que les zones d'activité des éléphants sont approximativement de 40 km^2 en saison sèche et de 100 km^2 en saison pluvieuse. En fin de saison pluvieuse, la zone d'activité du mâle est de 34 km^2 (au Nord du Ranch) contre 206 km^2 au sud-est pour les deux femelles. L'auteur pense que dans la dernière semaine de septembre, les deux femelles ont suivi la rivière Sissili jusqu'au-delà de la frontière du Ghana. En saison pluvieuse, les éléphants se déplaceraient donc entre le Burkina Faso et le nord du Ghana et du Togo.

A partir de 1990 les travaux se sont faits plus rares. Hien et al. (2000) réalisent une thèse en 2001 sur le régime alimentaire des éléphants dans *Pachyderm,* un article sur la dissémination de quelques espèces végétales par les éléphants dans le Ranch de Gibier de Nazinga.

La recherche sur les éléphants de Nazinga a en conclusion connu un net ralentissements ces dix dernières années.

Données actuelles

La connaissance de la situation actuelle reste imprécise et constituée de données provenant des inventaires annuels de la faune et du récent monitoring de l'espèce initié par le ranch.

Effectifs

L'estimation des effectifs d'éléphants à partir des inventaires pédestres sur transects à largeur variable habituellement menés au ranch est peu précise. Elle requiert un nombre minimal de 60 contacts et une distribution aléatoire des animaux. L'éléphant est cependant reconnu être une espèce grégaire. Les données des neuf derniers inventaires annuels montrent que ces conditions sont difficilement remplies, le maximum des rencontres n'étant jusque là que de 28 contacts réalisés en 2002 (tableau 2).

Deux recensements spécifiques terrestres totaux réalisés respectivement en septembre 2002 et Janvier 2003 dans le cadre du programme monitoring éléphant donnent respectivement des effectifs de 87 et 230 individus.

On note dès lors un écart entre les résultats obtenus qui reste lié au fait que les éléphants sortent du ranch en saison pluvieuse pour y revenir en saison sèche d'où la nécessité de couvrir tout le complexe Nazinga–Sissili, et aussi de répéter les opérations pour mieux cerner les effectifs, la structure des groupes ainsi que la distribution saisonnière.

L'inventaire aérien très récent mené par le programme MIKE laisse augurer en effet un effectif de plus de 500 individus.

Structure des âges et des sexes

La structure des âges et des sexes obtenues à partir des recensements dont mention vient d'être fait indique que 55 % des éléphants sont adultes, 20 % sub-adultes, 24,5 % jeunes et 0,5 % indeterminés. Le sexe d'un bon nombre d'individus (40,5 %) n'a pu'être déterminé, ce qui correspond quelque peu aux individus sub-adultes et juvéniles dont les caractères distinctifs ne sont pas tout à fait apparents (tableau 3). Les femelles (36 % de la population) se révèlent plus abondants que les mâles rencontrés surtout en solitaire et qui ne représentent que 23,5 % de la population dénombrée.

Distribution

La distribution récente des éléphants est connue grâce aux inventaires annuels de la faune sur transects à largeur

Tableau 2. Nombre de contacts et effectifs observés lors des 9 dernières années d'inventaires sur transects à largeurs variables (aucun éléphant n'était obervé en 1999).

Années	1994	1995	1996	1997	1998	2000	2001	2002	2003
Nombre de contacts	17	5	1	3	13	15	19	28	19
Effective observés	122	32	2	16	119	132	159	180	193

il n'y avait pas d'éléphants observés en 1999.

Tableau 3. Taille des groupes, âges et sexes

Période	GROUPE			AGES (%)				SEXES (%)		
	Nombre	Moyenne	Plus grand	Adultes	Sub-adultes	Juveniles	Indeterminés	Mâles	Femelles	Indeterminés
Sep 02	11	8,1 ± 4,8	30	52	22	26		21	41	38
Jan 03	37	6,2 ± 1,6	23	58	18	23	1	26	31	43
Cumul	48	6,6 ± 1,6	30	55	20	24,5	0,5	23,5	36	40,5

variable. Les cartes de distribution qui en résultent n'ont qu'une valeur limitée en ce sens qu'il s'agit de photographies instantanées réalisées à partir de comptages par échantillonnage systématique (fig. 2).

Les récents inventaires terrestres totaux par zonage permettent de disposer d'une distribution plus récente obtenue selon un protocole différent (fig. 3).

De façon générale, toutes ces cartes concourent à montrer d'une part que les'éléphants de Nazinga ne sont pas distribués sur l'entièreté du ranch. Cornelis (2002) a montré d'autre part que la distribution des éléphants est en corrélation spatiale inverse avec les indices de braconnage et d'empiètement relevés dans le ranch.

Mouvements

Les éléphants de Nazinga se déplaceraient vers le Parc National Kaboré Tambi (PNKT) bien qu'aucune étude ne l'aie montré jusque là. Les zones de Saro, Boassan, Koumbili seraient dans le temps empruntées par les

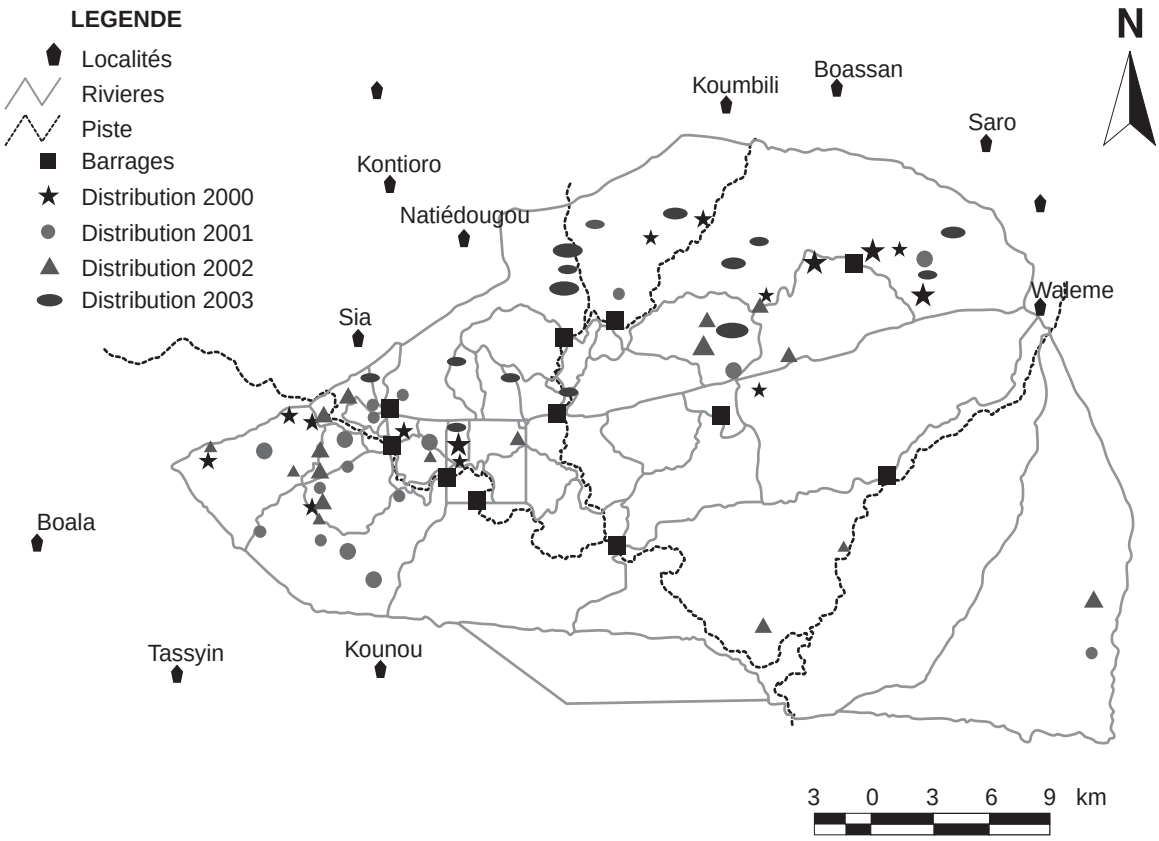

Figure 2. Distribution des éléphants entre 2000 à 2004 dans la Ranch Gibier de Nazinga.

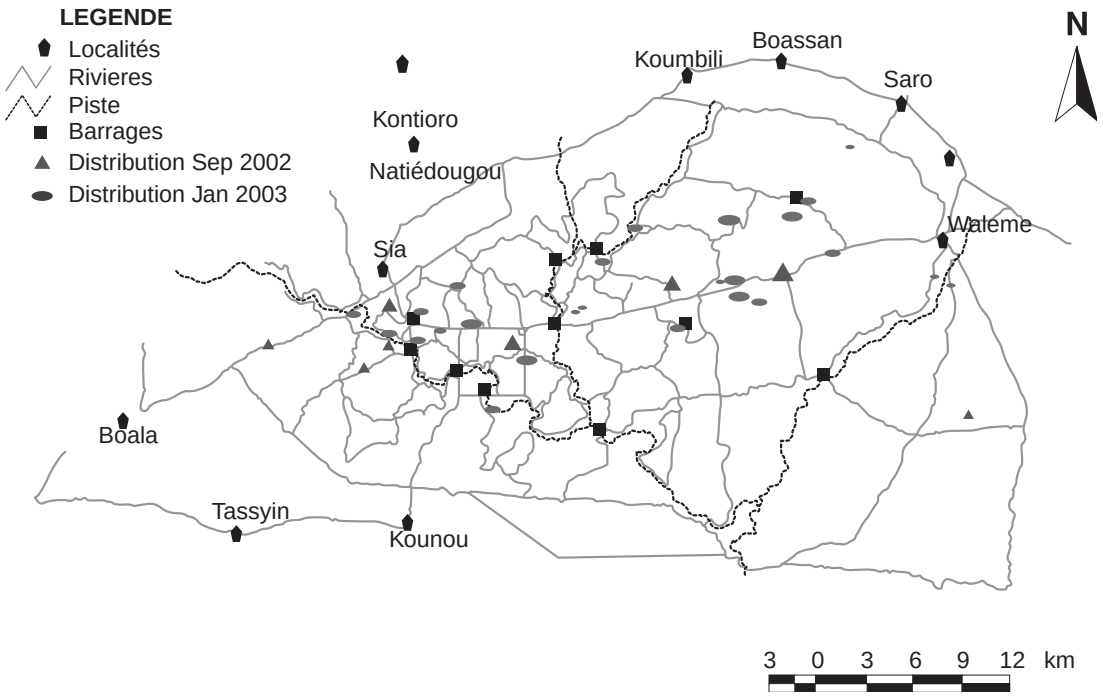

Figure 3. Distribution des éléphants en Septembre 2002 et Janvier 2003.

éléphants pour leur traversée vers le PNKT. Le suivi des dégâts a indiqué que des groupes de 6,4, 3 et 2 individus ont séjourné dans ces zones entre le 5 et le 11 Novembre 2002. Un victime de Koumbili, affirme que les éléphants après leur forfait nocturne, ont traversé la route Po-Nebbou se dirigeant vers le nord.

Les mouvements des éléphants vers la zone cynégétique de la Sissili voisin sont certains au regard des nombreuses observations directes et des multiples indices de présence entre ces deux zones contiguÎs.

Les mouvements des éléphants de Nazinga vers le Ghana sont possibles, mais il n'existe aucune donnée à ce sujet, excepté l'hypothèse de Jachmann en 1989.

Conflits homme–éléphant

Le ranch réalise depuis mai 2002 à travers son programme monitoring éléphant, un constat systématique des dégâts occasionnés par les éléphants dans les champs. Des informateurs parcourent régulièrement les villages pour relever les coordonnées GPS des champs endommagés et évaluer l' ampleur des dégâts.

Les données indiquent que le conflit est réel (fig. 4). Les fréquences d'incursions les plus élevées sont notées dans les villages de Sia, Walème, Kounou, Tassyan et Boala. Les cultures affectées sont surtout le maïs (*Zea mays*) d'août à décembre, le sorgho (*Sorghum bicolor*) de juillet à décembre, les boutures et les tubercules d'ignames (*Dioscorea alata*) de février à novembre.

Tandis que les mois de décembre et janvier sont des moments de déprédation à l'intérieur mÍme des greniers, ceux de février–avril sont des périodes de relatives accalmie où les éléphants se déportent sur les arbres fruitiers.

Le phénomène est décrié dans tous les villages, et les paysans se sentent inoffensifs, bien que certains n'hésitent pas à tirer à bout portant sur les pachydermes.

Différentes pressions sur les éléphants

La pression démographique

Selon Ndecky (op cit), dans les années 1950, l'onchocercose et la trypanosomiase qui sévissaient le long des cours d'eau, ont entraîné une forte mortalité au sein des populations de la région de Nazinga, allant

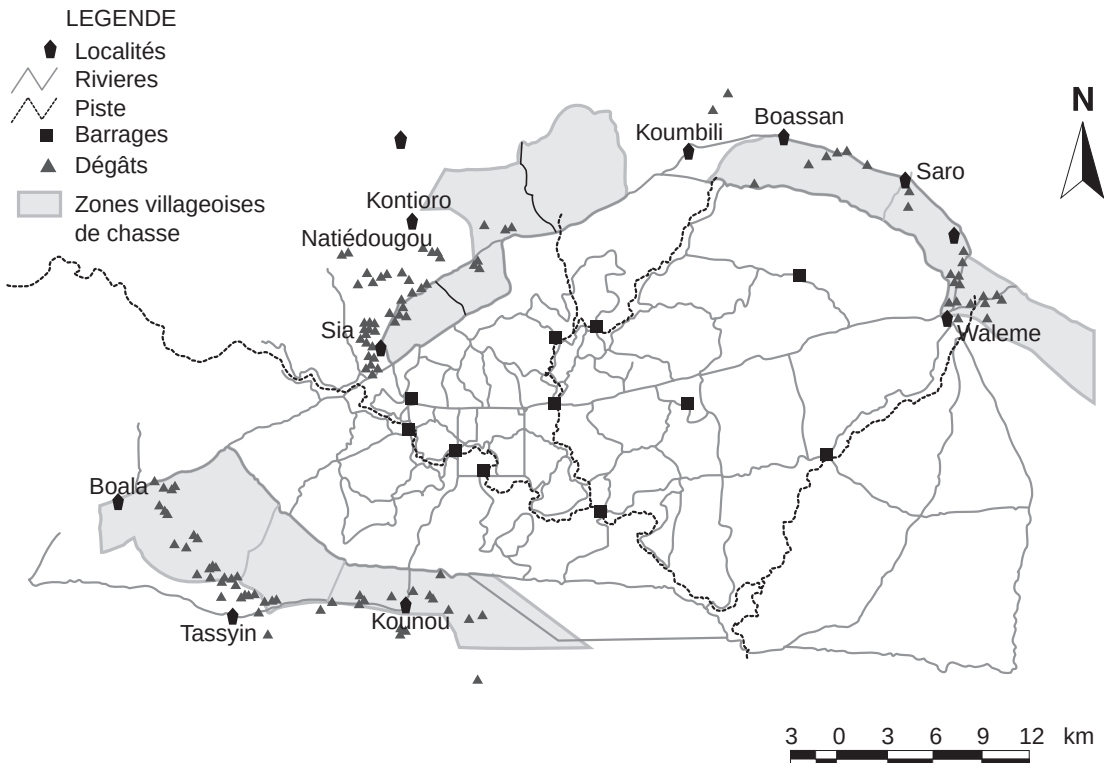

Figure 4. Distribution des dégâts aux cultures en 2002.

même jusqu'à l'extinction de certains villages (Doua, Koum, Sakaro, Yaro). Ce poids de l'histoire permet de comprendre les résultats du recensement général de 1998 qui indique pour les dix villages, une population humaine de 2565 habitants, soit une densité assez faible de 10 hbts/km^2 comparativement à la moyenne nationale de 38 hbts/km^2.

Cependant, depuis quelques années, l'éradication de ces fléaux, le recul des isohyètes, la faible pluviométrie couplée à la pauvreté des sols dans le nord et le centre du pays, les conflits armés en Côte d'Ivoire avec pour conséquence le retour massif de burkinabé, ont fait de la région de Nazinga une zone d'accueil de migrants et de rapatriés. A cela, si l'on ajoute le fort taux de croissance au niveau national qui est de 2,6 %, il est'à craindre que les éléphants de la région ne perdent une importante portion de leur territoire d'antan utilisé pour se mouvoir et se nourrir.

L'empiètement des habitats

De ce qui précède, se développe aujourd'hui dans la région à la faveur du développement de la culture cotonnière, un défrichement incontrôlé, source d'une avancée inquiétante du front agricole. La réhabilitation de l'axe Po–Nebbou–Léo a par ailleurs occasionné en sus des migrants, l'installation avec la bénédiction de certains chefs de villages, d'un nouveau type d'agriculteurs, les agro-businessmen, hauts fonctionnaires basés à Ouagadougou bénéficiant de dizaines d'hectares parfois méme à l'intérieur des zones villageoises de chasse. Tous ces défrichements ne permettent pas un développement conséquent d'une végétation ligneuse et herbacée à même de satisfaire les besoins nutritionnels des éléphants qui ne manquent pas d'aller par endroit varier leur menu avec du maïs (*Zea mays*) ou du sorgho (*Sorghum bicolor*).

A cela il faut ajouter une forte pression pastorale, du côté de la Zone cynégétique de la Sissili, oû une zone pastorale à été aménagée de façon contiguë à l'aire protégée. L'incursion du bétail crée ainsi une compétition faune–bétail dans la zone de chasse qui pourtant accueille par moment une bonne partie de la population éléphantine de Nazinga.

Le braconnage

Le braconnage à l'intérieur du ranch, bien que par moment intense à rarement eu pour cible l'éléphant. Le braconnage est à but commercial et de subsistance, visant surtout les grandes, moyennes et petites antilopes. Un cas de braconnage sur l'éléphant a néanmoins été noté en juin 2002, où l'équipe de terrain, a découvert le cadavre démuni de ses défenses alors que le forfait était très fraîchement commis.

Huit cas de mortalités ont été relevées ces trois dernières années dont 4 en 2001, 2 en 2002 et 2 en 2003. Excepté le cas dont mention vient d'être fait, ces mortalités font souvent suite à des abattages par mesure de représailles, ou des actions d'hostilité suite aux dégâts occasionnés dans les champs.

Difficultés de gestion

Comme on a pu le constater, l'éléphant de Nazinga a comparativement à d'autres zones, fait l'objet de beaucoup de travaux dont la plupart datent de plus de 13 ans. Une première difficulté de gestion est donc l'insuffisance de données actuelles surtout sur la dynamique des populations (taux d'accroissement, taux de natalité, de mortalité…) et sur les mouvements, lesquelles données, collectées selon une rigueur scientifique, sont un préliminaire pour toute gestion qui se veut efficiente.

Une seconde difficulté est l'inexistence de mécanismes de compensation des dégâts au niveau local couplée à une insuffisance au niveau national des politiques de gestion des conflits homme–éléphant. Les dédommagements ayant montré leur limite dans certains pays notamment au Zimbabwé (UICN et GSEAF 2001), une option possible est l'aménagement des terroirs villageois et la valorisation effective de la faune en général et de l'espèce en particulier en vue de la réconcilier avec les paysans. L'éléphant, espèce phare du tourisme de vision à Nazinga détient en effet la plus grande contribution spécifique aux observations de faune réalisées par les visiteurs (Hien, op cit).

Onze retenues d'eau aménagées à l'intérieur du ranch dans le cadre de l'hydraulique faunique permettent lorsque le milieu est sécurisé, une distribution plus ou moins homogène de la faune. Celles situées en périphérie s'asséchant de façon précoce, occasionnent une concentration d'éléphants autour de la base centrale du ranch d'où des dégâts énormes sur les ligneux qui porteront à termes, préjudice à l'habitat dans lequel l'espèce se développe.

Enfin, la position frontalière du ranch et l'insuffisance de la collaboration en matière de gestion transfrontalière de la faune, rend difficile l'interpellation ou la poursuite de braconniers internationaux au delà des limites du Burkina.

Conclusion

A la lumière de ces éléments d'information, on retiendra que la situation de l'éléphant au Ranch de Gibier de Nazinga est loin d Ítre décevante malgré les difficultés de gestion et les pressions potentielles qui s'exercent sur l'espèce. La population est l'une des plus abondantes de la sous région avec une densité de 0,52 ind/km^2 (Nganga, op cit).

Des activités spécifiques de conservation et de gestion sont plus ou moins inexistantes, celles en cours s'inscrivant dans le cadre de projets aux objectifs plus globaux notamment le projet GEF-Nazinga dénommé « optimisation de la diversité biologique dans les systèmes d'élevage de la faune en milieu aride et semi aride.

Des actions dans le cadre de la gestion devraient prioritairement se pencher vers la collaboration transfrontalière (Burkina Faso–Ghana), la sécurisation des domaines vitaux et des parcours, la réconciliation de l'espèce et des victimes de ses dégâts, sa valorisation économique au profit des populations villageoises, et la constitution d'une base de données scientifiques régulièrement actualisée.

Remerciements

Nos vifs remerciements vont à l'endroit du PNUD qui a permis'à travers le projet GEF-Nazinga, la mise en oeuvre des activités du programme monitoring éléphant au Ranch de Gibier de Nazinga. Ces remerciements s'adressent en second lieu au personnel forestier et aux pisteurs qui n'ont ménagé aucun effort pour la réalisation des inventaires annuels et spécifiques permettant d'actualiser en partie les données sur les éléphants et d'appréhender l'état d'empiètement du milieu.

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Seasonal influence of rainfall and crops on home-range expansion by bull elephants

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Abstract

The movement patterns of bull elephants were monitored over two years in central Zimbabwe. Range sizes and crossing patterns out of a protected area were compared by season. Findings suggest that the concept of range expansion at the end of the wet season is correlated with the movement of elephants into agricultural lands. Knowing how and when crop-raiding elephants move into subsistence agricultural land that surrounds many protected areas is considered essential to identifying the reasons why elephants and people come into conflict.

Résumé

Pendant deux ans, on a surveillé de façon continue le schéma des déplacements des éléphants mâles au centre du Zimbabwe. La taille des territoires et les schémas de déplacements ont été comparés avec ce qui se passe en dehors d'une aire protégée. Les découvertes suggèrent que l'expansion du territoire à la fin de la saison des pluies est liée aux mouvements des éléphants dans des terres cultivées. On considère qu'il est essentiel de savoir comment et quand les éléphants qui dévastent les cultures se déplacent vers les terres cultivées qui entourent de nombreuses aires protégées, afin d'identifier les raisons pour lesquelles hommes et éléphants entrent en conflit.

Introduction

In Sanderson's (1966) review of methods for studying the movements of mammals he notes that understanding the patterns of how wild animals use resources is essential for developing programmes to 'control' pest species. Knowledge of distribution and movement patterns in relation to their environment is essential if elephants are to be effectively managed because crop raiding is spatial and temporal in nature. Sukumar (1989) and Hoare (1999) have suggested that seasonal movements of elephants bring them into contact with farmland that now occupies part of their former range.

The distribution and patterns of relative abundance of animals depend largely on the seasonal availability of food and water (Odum 1971). It is generally accepted that seasonal variations in food availability and quality affect elephant ranging patterns and migration (Leuthold 1977; Sukumar 1989; Viljoen and Bothma 1990), modified by water availability, which is in turn dictated by rainfall (Leuthold 1977; Afolayan and Ajayi 1980; Western and Lindsay 1984). In regions where water availability is highly seasonal, researchers have reported that elephants concentrate near water points in the dry season then expand their range in the wet season. In Zimbabwe, Taylor (1983) noted that elephants in the Sebungwe region dispersed in the wet season, and Conybeare (1991) noted similar dispersal in Hwange National Park.

Most studies of elephant movement in southern and eastern Africa report distinct seasonal variation in range size and use. Generally in areas with annual rainfall under 1000 mm, the pattern is that elephants move away from permanent water sources at the beginning of the rainy season as water becomes widely available. Elephants are able to move into less heavily used areas of their range to find seasonally ephemeral foods such as fresh grasses, forbs and climbers. As seasonally available water dries up, elephants

again start to concentrate near permanent water points (see Leuthold and Sale 1973; Poche 1974; Leuthold 1977; Western and Lindsay 1984; Viljoen 1989; Conybeare 1991). An obvious relationship exists between elephant movements and the pattern of rainfall in an area. Bull elephants may also be motivated to move when in musth. The objectives of this study were to obtain estimates of the home ranges of elephants in a protected area, to establish the seasonal crossing patterns into surrounding communal agriculture and to examine the concept of wet-season range expansion.

Study area

The study area was situated in and around the Sengwa Wildlife Research Area (SWRA) and the surrounding communal lands of Zimbabwe. The vegetation is generally deciduous and dry deciduous savannah woodland. The main vegetation associations are *Brachystegia–Julbernardia* woodland, *Colophospermum mopane* woodland, *Acacia* spp. riparian woodland, riverine grasslands and *Combretum* spp. thickets. A single rainy season usually occurs between November and April, but it is highly variable in timing and quantity. The mean annual rainfall is 668 mm (n = 30).

Methods

Ten male (7 adult, 3 subadult) elephants were immobilized and fitted with radio transmitters in October 1994. The transmitters were the MOD 665, high-powered, UHF design by Telonics (Mesa, Arizona, USA). These transmitters are a three-stage device using a timer, a quartz crystal oscillator and an amplifier powered by lithium batteries. The transmitter was cast into acrylic and attached by brass plates and rivets to a 1-metre section of plastic belting. The collars were made of the 1-metre plastic transmitter belt fastened to either end of an eight-ply section of machine belting. Animals were tracked every 3 hours for 10 days each month between January 1995 and June 1996 using three directional antennae. Directional tracking towers were situated at points from which the positions of the animals could be triangulated.

The minimum convex polygon (MCP) and the kernel methods were used to estimate home range. Although it is recognized that MCP has numerous drawbacks, it was used because it provided a comparison with previous studies (Worton 1989). Both methods were used to analyse the size and the structure of the ranges each season, and for all the fixes collected per animal during the study. MCPs were drawn to enclose 100% area estimation for analysis of the entire tracking study, and 95% and 100% MCPs were drawn for the seasonal analysis. The utilization distribution was estimated using the kernel method and a fixed bivariate normal density kernel to compare seasonal cores and outer contours of the elephant's range with the software package RANGES V (Kenward and Holder 1995).

A sandy section of the southern SWRA boundary was patrolled to identify the location where elephants left or entered the SWRA (fig. 1). The spoor of elephants crossing into communal lands was examined to determine the number of animals and the direction of travel. If the number could not be assessed at the boundary road, spoor was tracked into communal lands and an effort made to obtain a count at some other point. The number of crossings was assessed taking the mean number of elephants crossing out and back into the SWRA on any given day. Each crossing point was swept daily so that new spoor could be recorded the following morning.

The 'three-month running mean' (3MRM) of rainfall was used as an indicator of soil-water availability to plants. Du Toit (1993, 1995) found this measure correlated well with changes in browse-to-grass ratios for mixed feeders and with proportional use of riverine habitat by large browsers. The rainfall total for a particular month was added to the totals for the previous two months and divided by three. This procedure essentially shifts the rainfall pattern to represent more accurately the moisture in the soil available to plants. The mean number of elephants crossing per month was calculated by dividing the total number of elephants that crossed out of the SWRA by the total number of days patrolled.

The seasons used in the analysis were divided into two-month blocks and are as follows: early-wet, late-wet, early-dry, mid-dry, and late-dry.

Results

Two distinct cores are identified when fixes are analysed using the kernel method (fig. 1). The 100% totals are similar for both methods (table 1). A one-way ANOVA test for the area enclosed by the 100% MCP indicated that there was a significant difference be-

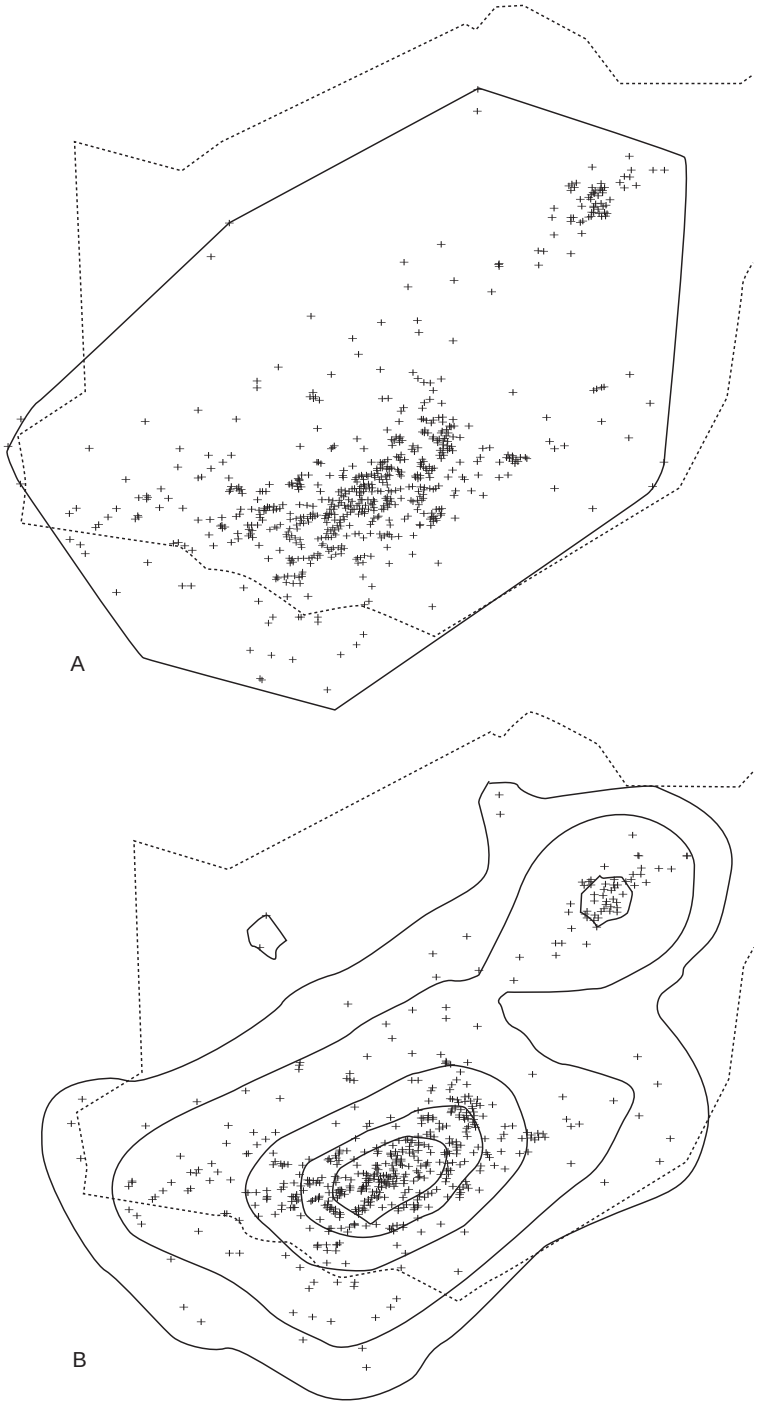

Figure 1. A) Map of the Sengwa Wildlife Research Area (outline in dotted line) showing the home range determined by the minimum convex polygon method (100% edges, solid line) for an elephant between December 1994 and June 1996. Each + represents one fix (n = 571) range size = 311.71 km^2. B) Map showing 25, 50, 75, 95 and 100% home-range contours using the kernel method (solid lines).

tween the seasonal ranges (F = 8.082, df = 51, P = 0.001) Note the marked rise in range size between the late-dry and early-wet season in 1996 (fig. 2). For the kernel analysis, a one-way ANOVA indicates that there was no significant difference between the four seasons in the area enclosed by the 25% (F = 1.902, df = 33, P = 0.15) and 50% (F = 2.85, df = 33, P = 0.053) contours. There was, however, a significant difference for the 75% (F = 3.4, df = 33, P = 0.03), 95% (F = 4.48, df = 33, P = 0.01) and 100% (F = 4.67, df = 33, P = 0.001) contours.

The contours of the kernel analysis for elephant no. 28 during the late-dry season 1995 to the early-dry season 1996 show the increase in range size in the late-wet season (fig. 3). There is a significant increase in range size between the early-wet and the late-wet seasons for the 95% and 100% contours. Also note that a considerable number of locations were outside the protected area.

The southern boundary of the SWRA was patrolled on 831 days between June 1993 and June 1996. Elephant crossings were recorded on 617 or 74% of the patrols. On only three occasions was the spoor of young elephants identified. If the assumption that young elephants would be present with female groups is correct, then it would appear that male elephants are responsible for most of the crossings and subsequent crop raiding in this area. The 3MRM of rainfall is plotted against the mean number of elephants crossing out of the SWRA per month over the period of the study (fig. 4), and figure 5 plots the 3MRM of rainfall and the mean number of elephants crossing out of the SWRA.

Table 1. Range size for nine bulls tracked between January 1995 and June 1996

Collar	N	MCP (km²)	Kernel (km²)				
		100%	25%	50%	75%	95%	100%
3	1006	392.76	5.06	25.58	61.17	148.97	329.83
8	571	311.71	8.20	21.68	54.91	181.90	322.36
13	776	372.75	6.57	30.35	74.32	203.05	393.57
18	782	391.75	16.77	43.36	100.06	230.66	477.81
28	531	292.80	8.77	24.31	59.82	160.65	267.67
33	776	331.37	8.11	28.03	65.45	147.88	294.83
48	498	322.00	13.07	35.25	92.36	207.39	372.57
53	366	224.04	7.67	19.26	44.26	125.00	226.00
55	702	260.46	11.76	29.71	64.52	156.00	320.00
Mean	668	322.18	9.55	28.61	68.54	173.50	333.85

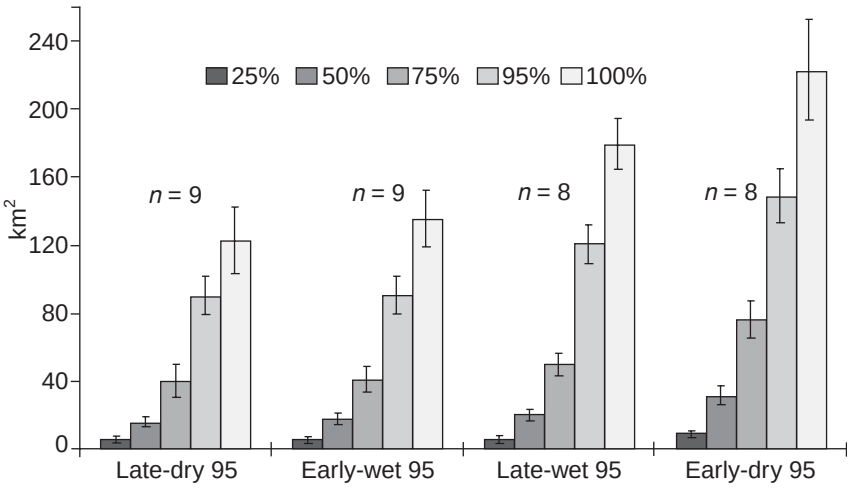

Figure 2. Seasonal variation in the area enclosed by 25, 50, 75, 95 and 100% contours as determined by the kernel method. The *n* indicates the number of elephants used in the analysis.

Discussion

The range expansion seen at the end of the wet season identified using the kernel method coincides with the onset of crop raiding. A possible explanation for the observed late-wet-season increase in range size may be due to grass growth. In the SWRA, elephants feed primarily on new grasses in the early-wet season and do not have to move large distances (Osborn 1998). They switch from a diet primarily of grass back to browse, and they may expand their range because they need to increase their area to forage. While no causal relationship was identified, this finding may be important for identifying an ultimate 'cause' for crop raiding.

Numerous natural and human-induced factors influence the movements and seasonal occupation by elephants in the different habitats available to them (Hoare 1999). Natural factors include distribution of water, either surface or in the vegetation, and seasonal changes in the quality and availability of food. In many semi-arid savannahs, surface water is more limited and forage is drier and lower in quality during the dry season. In places where surface water is abundant and perennial, this restriction is less inhibiting, but distribution of best-quality forage is still likely to change seasonally (Conybeare 1991). Human-induced factors include reducing and fragmenting traditional range, disturbing the animals through illegal hunting, and subsistence agriculture encroaching on their range.

Results from this study indicate that the pattern of range expansion at the beginning of the wet season, seen in other studies, occurs later with bulls in the SWRA (see Taylor 1983; Conybeare 1991). This may be due to the fact that the SWRA is comparatively well watered all year round and elephant movements are dictated by the availability of food rather than water. The super-abundant grass growth after the rains makes food readily available and there is no reason why these bulls need to expand their ranges to find food in the

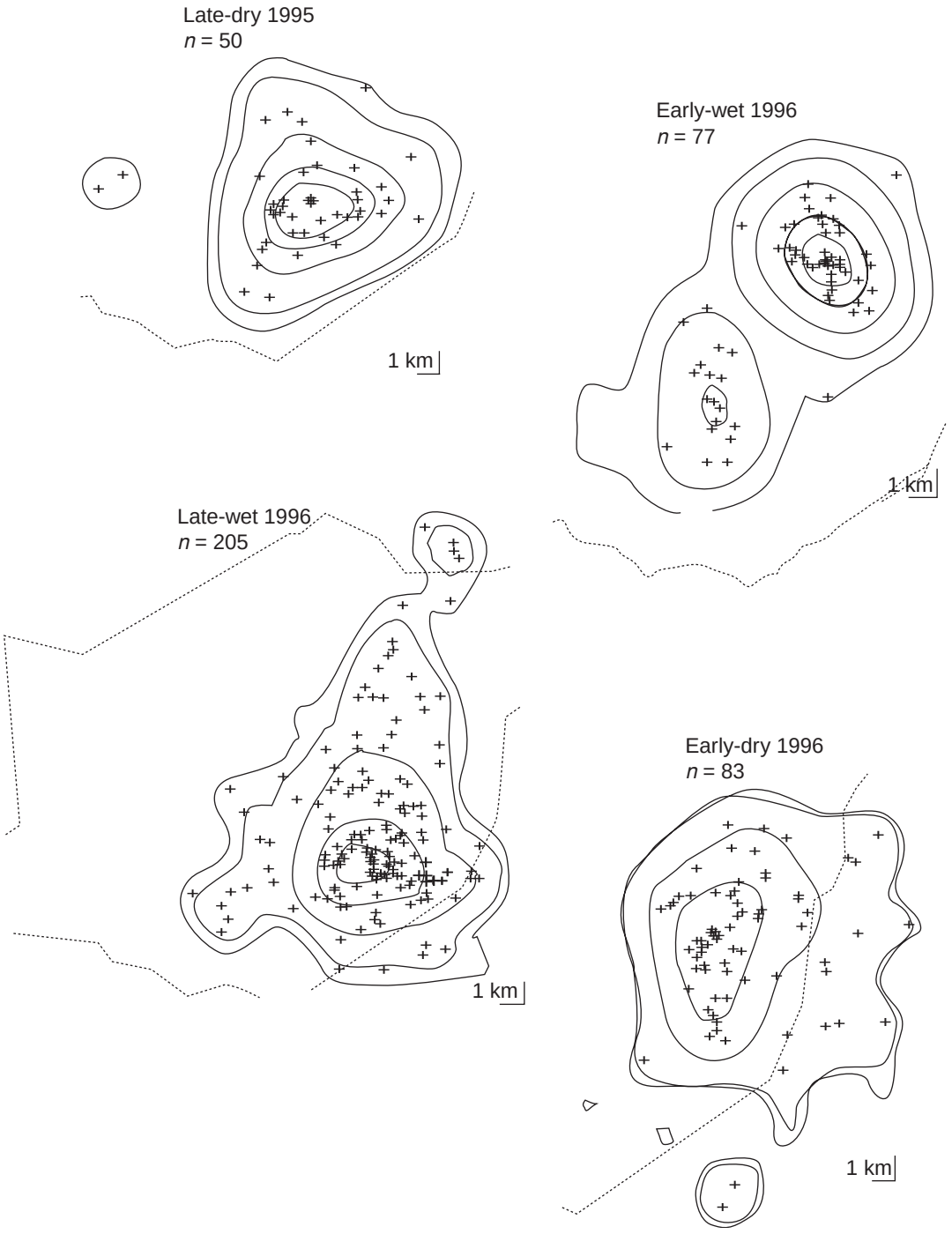

Figure 3. Range of an elephant in the late-dry season 1995 and the early-wet, late-wet and early-dry season 1996. Range determined using the kernel method; 25, 50, 75, 95 and 100% isolines shown. The light dotted line is the boundary of the SWRA.

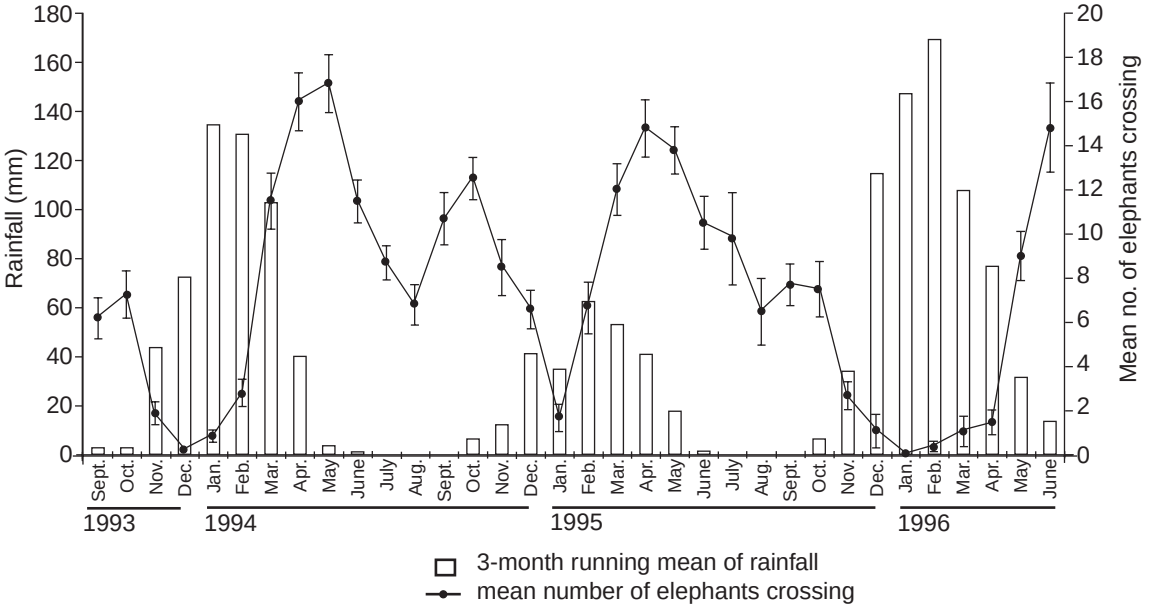

Figure 4. A plot of the three-month running mean of rainfall and the mean number of elephants crossing out of the SWRA.

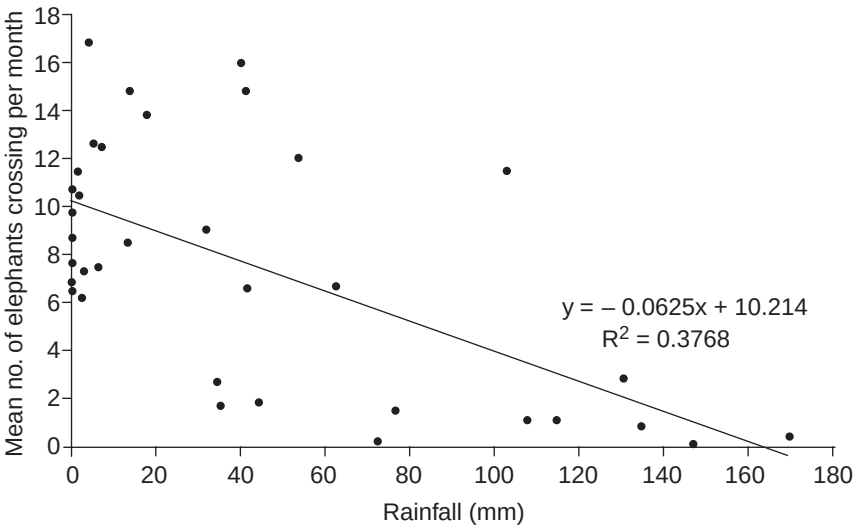

Figure 5. The three-month running mean of rainfall plotted against the mean number of elephants crossing out of the SWRA between September 1993 and June 1996 (Persons $R = 0.6138$, $P = 0.001$).

early-wet season. The expansion of range occurs at the end of the wet season when these elephants switch from feeding primarily on grass to feeding on browse. They may be attracted by a combination of late-maturing crops and wild browse species still abundant in the communal lands (Osborn 1998). This behaviour may have not been identified before due to the insensitivity of the MCP method.

Figures 4 and 5 indicate that a significant relationship exists between moisture in the soil available to the vegetation and movement of elephants into communal lands. Crossing of elephants out of the SWRA is inversely correlated with the 3MRM of rainfall. The peak crossing periods coincide with the range expansion. In wet years and months the crossings are low, and in dry years and months the level of crossing is high. While not tested, this finding suggests that elephants may be motivated to leave the SWRA when the moisture content of wild grasses within the SWRA declines. The variation between seasons also supports the contention that rainfall and plant moisture are factors that influence when elephants start to cross into the communal lands.

Acknowledgements

I thank the Department of National Parks and Wildlife, Zimbabwe, for permission to conduct this research; also the late I. Coulson; R. Hoare, K. Eltringham, R Taylor, R. Martin; and an anonymous reviewer. The Wildlife Conservation Society and the US Fish and Wildlife Service funded this study.

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Déterminisme des migrations des éléphants de la Forêt classée du Haut-Sassandra, Côte d'Ivoire

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Résumé

L'étude du déterminisme des migrations des éléphants de la Forêt classée du Haut-Sassandra (au centre-ouest de la Côte d'Ivoire) a été ménée d'octobre 1994 à octobre 1996. Elle s'est réalisée en faisant les études de la répartition des zones de densité et de la disponibilité des ressources alimentaires des éléphants. Les résultats obtenus révèlent une forte attraction des éléphants par une abondance de fruits en saison sèche dans la zone nord. Ils montrent aussi un abandon temporaire ou définitif par les éléphants des zones de fortes pressions anthropiques (zone en exploitation de bois de grumes, chasse, etc.). La réduction des migrations des éléphants dans cette forêt ne serait révélée possible que par la préservation des arbres aux fruits consommés par l'éléphant lors des futures exploitations forestières et traitements sylvicoles et par la réalisation de petites retenues d'eau à l'intérieur de la forêt.

Mots clés supplémentaires : fruits, pressions anthropiques, resources alimentaires

Abstract

A survey to determine factors affecting migration patterns of the elephants of Haut-Sassandra Forest Reserve (in the midwest of Côte-d'Ivoire) was carried out from October 1994 to October 1996. Studies were done on the different areas frequented by elephants and on the availability of food resources. Results show elephants were attracted to the northern area by the abundance of fruits in the dry season. Results also show that elephants avoided areas with high human activity, particularly where timber is exploited or hunting is carried out. Migration was strongly related to the presence of fruit trees left standing after lumbering and from agricultural practices, and availability of small water reserves deep in the forest.

Additional key words: fruits, human pressure, food resources

Introduction

L'étude du déterminisme des migrations des éléphants de la Forêt classée du Haut-Sassandra a été faite dans le cadre de l'aménagement des forêts classées de l'Ouest de la Côte d'Ivoire. Selon les années et les saisons, il a été constaté que les éléphants de cette forêt classée fréquentent différentes parties de cette forêt. Ces dernières années, leur présence a été très signalée en saison sèche dans le domaine rural, autour de la partie nord de la forêt où ils causent des dégâts aux cultures. Cette partie de la forêt est pourtant la plus sèche et ne renferme ni points d'eau, ni cours d'eau permanente. Le fleuve Sassandra qui contient de l'eau toute l'année a très souvent été évité par les éléphants au profit du nord-est de la forêt. Face aux nombreuses plaintes des paysans, la présente étude a été réalisée de 1994 à 1996 pour élucider les causes de l'abandon par les éléphants de certaines parties de la forêt pendant certaines périodes de l'année au profit d'autres. Pour mener à bien cette étude, l'emphase est mise sur la disponibilité des ressources alimentaires et les pressions anthropiques au sein de la forêt.

Milieu d'étude

La Forêt classée du Haut-Sassandra est située au Centre-Ouest de la Côte-d'Ivoire (fig. 1) entre 6°50 et 7°50 de latitude nord et entre 6°50 et 7°50 de longitude ouest. Elle s'étend en partie sur les départements de Daloa et de Vavoua. Elle a une superficie de 1024 km^2 dont 950 km^2 de forêt naturelle. Le climat est équatorial et caractérisé par quatre saisons plus ou moins bien marquées (hauteur moyenne des précipitations autour de 1200 mm). Cependant, le Nord de la forêt est plus sec et a deux grandes saisons : une longue saison de pluies de mars à octobre (huit mois) qui a deux maxima de pluies. Le premier (179 mm de pluies) se situe en avril et le second (128,7 mm de pluies) en septembre ; et une saison sèche allant de novembre à février (quatre mois) avec le minimum de pluies en janvier (7,2 mm).

Le sol est ferralitique et moyennement désaturé (Perraud et De la Souchere 1970). La formation végétale est essentielle-ment une forêt dense humide semi-décidue du type à *Celtis spp.* et *Triplochiton scleroxylon* (Guillaumet et Adjanohoun 1969). Cette forêt est de plus en plus dégradée par des installations agricoles et surtout par l'exploitation de bois de grumes qui s'y déroulent depuis des dizaines d'années.

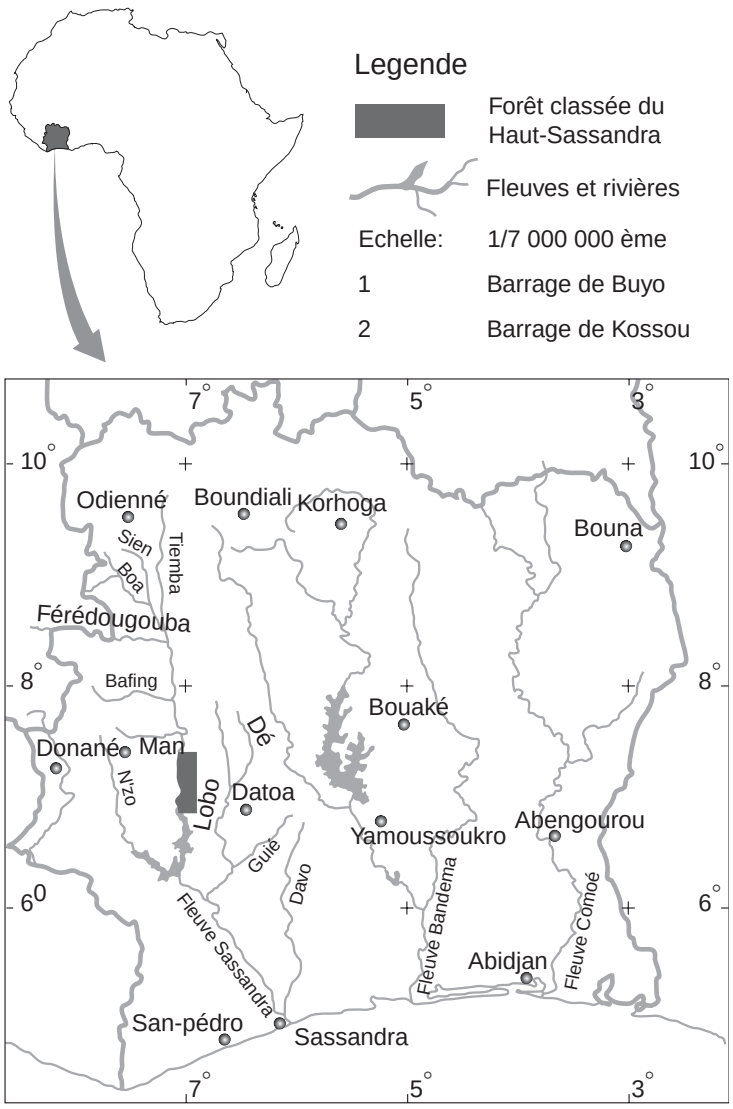

Figure 1. Situation géographique de la Forêt classée du Haut-Sassandra (Soulemane 2002).

Matériels et méthodes

Matériels

La réalisation de l'étude a nécessité l'utilisation de matériel technique divers, comprenant essentiellement une boussole 'Broussarde Chaix' pour l'orientation précise des layons, un topofil 'Chaix' et des bobines de topofil pour mesurer la longueur des layons et mentionner les distances auxquelles les observations sont faites, un ruban de 2 mètres pour la mesure des petites dimensions. Il faut noter que l'étude ne concerne que l'éléphant de forêt : *Loxodonta africana cyclotis* (Matschie 1900) de la famille des Eléphantidae (Soulemane 2000).

Méthodes

L'étude est basée sur l'identification des zones de répartition des éléphants en fonction des saisons et sur la détermination des causes des répartitions observées. L'étude de la répartition est faite par le

parcours de 29 layons (layons ouverts pour les inventaires forestiers) qui couvrent la forêt (fig. 2). Ces layons sont des chemins de 1,5 m de largeur et en moyenne 15 km de longueur. Une distance totale de 451 km à été parcourue. Ces layons sont orientés de l'est vers l'ouest et sont distants les uns des autres de 2 km. Ils sont jalonner à l'aide de piquets placés à tous les 50 m. Sur ces piquets sont marqués le numéro du layon et la distance.

Pour cerner les causes des différentes répartitions observées en fonction des saisons, l'emphase est mise sur la disponibilité des ressources alimentaires et l'influence des activités humaines sur les populations d'éléphants.

REPARTITION ET DENSITES DES ELEPHANTS

Les layons sont parcourus par deux enquêteurs qui y marchent silencieusement et lentement (à la vitesse moyenne d'un kilomètre à l'heure) en faisant les observations de part et d'autre du layon. Ils notent tous les signes de présence d'éléphant et d'autres animaux et la distance du piquet le plus proche. Ces observations sont complétées par le relevé de l'état d'ouverture de la canopée (dégradation de la forêt), des signes de présence humaine et des distances auxquelles les observations sont faites. Les informations recueillies sur ces layons sont complétées par celles provenant des pistes qui pénètrent en forêt et à des points d'attraction d'animaux (points d'eau, arbres fruitiers et salines naturelles).

Tous les signes de présence d'éléphants relevés sur les layons sont reportés sur une carte de la forêt au 1/100.000ème. La délimitation des zones d'activités des éléphants permet d'établir la carte de répartition de ceux-ci pendant la période d'inventaire. Ces layons ont été parcourus une fois en saison sèche et une fois en saison pluvieuse.

L'estimation des densités des populations d'éléphants est réalisée par la méthode de comptage des tas de crottes car, cet indice d'abondance peut être converti en une estimation du nombre d'individus. Cette méthode indirecte d'estimation des densités comprend quatre étapes qui sont les suivantes :

- l'estimation de la densité des tas de crottes ;
- l'estimation du nombre de tas de crottes produits par éléphant par jour, appelé taux de défécation. Les taux moyens de 16,50 tas de crottes par éléphant par jour en saison sèche et 17,87 tas de crottes par éléphant par jour en saison pluvieuse (Soulemane 2000), ont été utilisés. Soulemane (2000

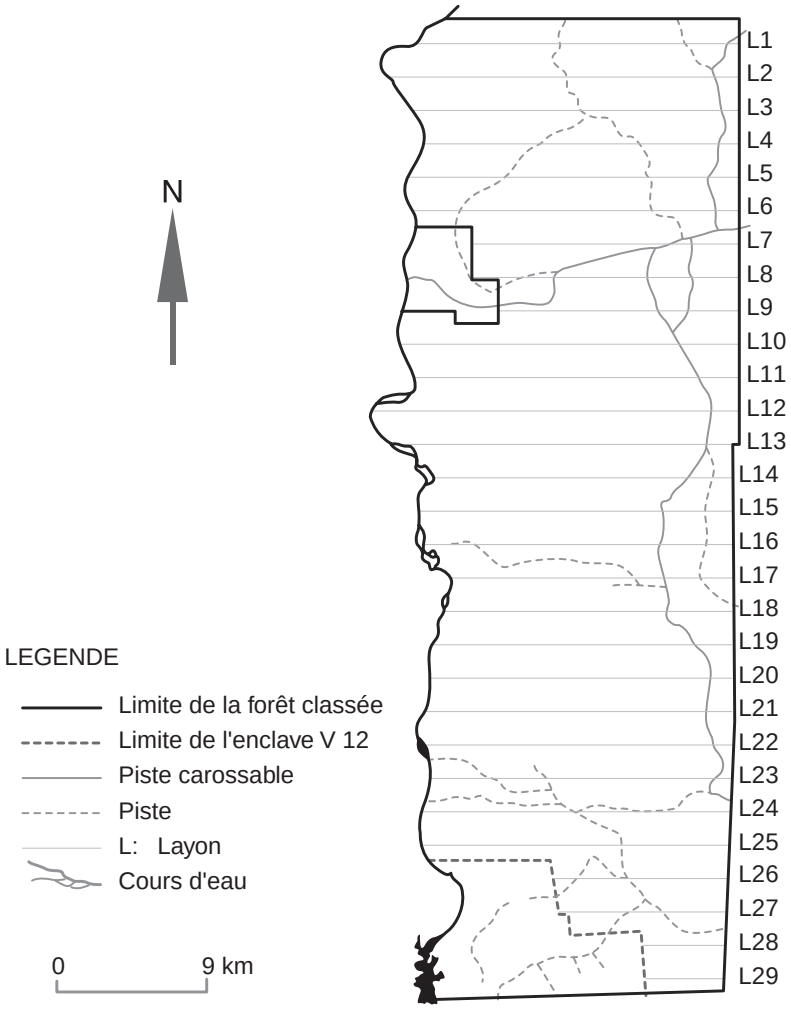

Figure 2. Carte des layons de la Forêt classée du Haut-Sassandra.

estime le taux moyen journalier dans l'année à 17,18 tas de crottes par éléphant par jour. Ce taux annuel obtenu sur des élé-phants de forêt semble proche de celui (17 tas de crottes par éléphant par jour) de Wing et Buss (1970) en Ouganda dans des forêts d'altitude (1000 à 3500 m).

- l'estimation du nombre de tas de crottes disparaissant par jour (taux de décomposition des crottes). Les taux moyens de 0,015 tas de crottes par jour en saison sèche et 0,036 en saison pluvieuse (Soulemane 2000), ont été retenus. Soulemane (2000) trouve un taux moyen annuel de 0,029 dans cette forêt proche de celui (0.03) obtenue par Barnes et Jensen (1987).

La densité d'éléphants est calculée à partir de la combinaison des trois précédents paramètres (la densité de tas de crottes, le taux de défécation et le taux de décomposition des tas de crottes) selon l'équation de McClanahan (1986) :

$$ED = Yr \quad \text{ou} \quad E = (Yr)/D$$

Où :

E : nombre d'éléphants par km² ;
D : nombre de tas de crottes produites par éléphant et par jour (taux de défécation) ;
Y : nombre de tas de crottes par km² ;
r : taux journalier de décomposition des tas de crottes.

Les densités moyennes des tas de crottes d'éléphants sont obtenues selon les méthodes de Barnes (dans Fay 1991). Cette méthode préconise la prise en compte de tous les tas de crottes (quel que soit leur âge) repérés dans le calcul de la densité. Les distances perpendiculaires des tas de crottes par rapport au layon n'interviennent pas dans ce calcul. Les densités des tas de crottes sont ainsi obtenues par extrapolation des corrélations linéaires entre les densités réelles des tas de crottes et le nombre de segments de 0,5 km (le long du layon) qui contiennent des tas de crottes. Selon le pourcentage de segments contenant des tas de crottes, deux équations sont utilisées (Barnes dans Fay 1991) : pour les layons avec moins de 75% de segments contenant des tas de crottes, la densité (D) est donnée par la formule suivante :

$$D = 6 + 703P \ (r = 0.83, \pm 64\ \%)$$

où *D* est le nombre de tas de crottes par km² et *p* est la proportion de segments de 0,5 km de layon contenant au moins un tas de crottes ; pour les layons avec plus de 75 % de segments contenant des crottes, la densité (*D*) s'écrit

$$D = 110 + 1576p \ (r = 0.94, \pm 22\ \%)$$
$$D = 6 + 703p \ (r = 0.83, \pm 64\ \%)$$

Cette méthode bien que peu précise, donne suffisamment d'informations sur les densités (très faibles) et surtout sur la répartition des éléphants pour l'aménagement de cette forêt.

DISPONIBILITE DES RESSOURCES ALIMENTAIRES

La disponibilité des ressources alimentaires des éléphants de la Forêt classée du Haut-Sassandra est étudiée par le suivi de quelques aspects de la phénologie (fructification et chute de feuilles) des principaux arbres dont ils consomment les fruits et les feuilles. Pour ce faire, la surface correspondant à la projection verticale du houppier (voûte de feuilles et branches) au sol de quelques arbres fruitiers (arbres-mères) est nettoyée, débarrassée de tous les débris végétaux et une grappe ou 'attrape fruits' d'un mètre carré de surface d'ouverture, y est installée. Ces 'arbres-mères' sont visités une fois tous les quinze jours. Pendant ces visites, la présence de fruits et de feuilles dans les arbres sont notées. La présence de feuilles ou de fruits dans les arvres sont mentionnées. Les observations faites sur et sous les 'arbres-mères' sont complétées par celles faites sur les layons permanents.

INFLUENCE DES PRINCIPALES ACTIVITES HUMAINES SUR LES POPULATIONS D'ELEPHANTS

L'étude de l'influence des principales activités humaines sur les populations d'éléphants est basée essentiellement sur celle de l'abattage des arbres, de la chasse et de l'agriculture. Cet impact est estimé par la prise en compte des signes de présence humaine (traces de coupe de bois, plantations, pièges, douilles, coups de fusil, foyers et campements de braconniers) sur les layons.

Résultats

Zones de répartition

Le report des signes de présence des éléphants sur la carte de la forêt montre deux principales zones de répartition (fig. 3) : une, située dans la partie Nord de

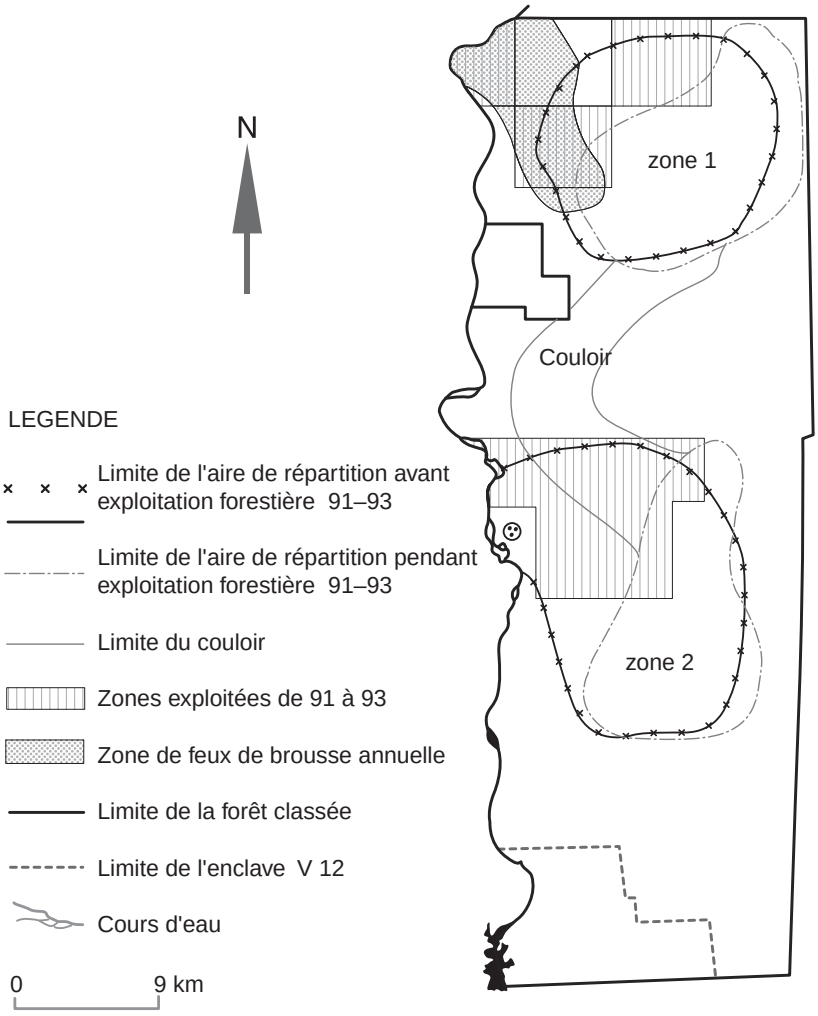

Figure 3. Zone d'activités de coupe de bois et principales zones de répartition des éléphants dans la Forêt classée du Haut-Sassandra.

la forêt, appelée zone 1 et, l'autre, vers le Sud de la forêt, appelée zone 2. Ces zones sont reliées par un couloir de migration.

Les noms de plantes con-sommées par les éléphants (sans les noms d'auteurs ni de familles) sont présentées dans le tableau 1.

Les données récoltées sur les layons et récapitulées dans le tableau 2 présentent des densités d'éléphants différentes selon les saisons.

En saison sèche, l'aire de répartition se limite essentiellement à la zone 1. Les éléphants fréquentent les parties Ouest (au bord du fleuve) et Est (aux abords des plantations) de cette zone. Souvent, quelques éléphants s'aven-turent même hors de la forêt. Des pêcheurs et paysans af-firment avoir vu des éléphants traverser le fleuve Sassandra vers le Nord-Ouest de la forêt pour rejoindre la Forêt classée du Mont Tia. D'autres témoignent qu'ils migraient autrefois dans le Parc National du Mont Péko en traversant le fleuve vers le centre de la forêt.

Les populations de Kadiokro et de Petitokro (campements au nord de la forêt) affirment qu'autrefois (quand il y avait encore de la forêt), pendant la saison sèche, ils voyaient fréquemment des éléphants faire la navette entre la Forêt classée du Haut-Sassandra et la Forêt classée de Séguéla. Ces faits ont été aussi confirmés par des vieux chasseurs qui ont ajouté que, pendant la même saison, les éléphants de la Forêt classée de Séguéla consommaient beaucoup les fruits et cela rendait leur abattage facile. Malheureusement, depuis la transformation de ces forêts et îlots de forêts en plantations, les éléphants n'atteignent plus la Forêt classée de Séguéla. Ils séjournent dans les plantations où ils causent des dégâts aux cultures.

Tableau 1. Liste des espèces végétales citées

Espèces	Famille
Balanites wilsoniana	Balanitaceae
Celtis spp.	Ulmaceae
Chrysophyllum africanum	Sapotaceae
Klainodoxa gabonensis	Irvingiaceae
Milicia excelsa	Moraceae
Milicia regia	Moraceae
Parinari excelsa	Chrysobalanaceae
Pouteria aningueri	Sapotaceae
Pycnanthus angolensis	Myristicaceae
Ricinodendron heudelotii	Euphorbiaceae
Strychnos sp.	Loganiaceae
Triplochiton scleroxylon	Sterculiaceae

Tableau 2. Proportion des aires de répartition et densités saisonnières moyennes des éléphants ; densités sensiblement égale à 0 éléphant par km^2

	Zone 1	Zone 2	Reste de la forêt
Superficie	11 %	9 %	80 %
Saison pluvieuse	0.140 ± 0.090	0.080 ± 0.051	0.010 ± 0.006
Saison sèche	0.450 ± 0.288	–	–

En saison pluvieuse, Il n'y a presque plus de fruits au nord de la forêt et les éléphants regagnent la partie sud (zone 2). Ces migrations des éléphants sont saisonnières. Elles se font en début de saison sèche du Sud vers le Nord de la forêt (zone 2 vers zone 1) et en début de saison pluvieuse du Nord vers le Sud.

Disponibilité des ressources alimentaires

EAU

Des données des inventaires, il ressort qu'en saison pluvieuse, l'eau est présente un peu partout dans la forêt. Pendant cette période, les éléphants sont plus localisés dans la forêt. Leurs aires de répartition sont essentiellement limitées aux zones 1 et 2 et au couloir de migration (fig. 3). En saison sèche, les cours d'eau et les principaux points d'eau de la forêt tarissent. Seul le fleuve Sassandra contient de l'eau toute l'année. Cependant, de fortes densités n'ont pas été enregis-trées le long du fleuve.

NOURRITURE

Fructification. A la figure 4 sont récapitulés les résultats des relevés des arbres portant des fruits pendant la période d'étude. Ils montrent qu'il existe des fruits tout le long de l'année dans la forêt et que le pourcentage des arbres en fruits varie considérable-ment selon les saisons. Ce pourcentage est maximal (56,1 %) de janvier à février (saison sèche) et minimal (17,9 %) de mai à juin (saison pluvieuse).

La Forêt classée du Haut-Sassandra présente donc un approvisionnement maximum en fruits au cours de la saison sèche. L'abondance et les périodes de fructification des arbres varient suivant les saisons mais aussi suivant les années (fig. 5) ; certaines essences, parmi lesquelles on cite *Chrysophyllum africanum*, ont un rythme de fructification abondante, bisannuel, et de ce fait, influencent considérablement la disponibilité des fruits (fig. 5).

Chute des feuilles. Comme le montre la figure 4, la chute des feuilles est importante en saison sèche (novembre à février) avec un maximum en décembre, mois au cours duquel 26,4 % des arbres perdent leurs feuilles. Elle connaît une légère croissance au mois de juillet (moins de 5 %) due à la petite saison sèche.

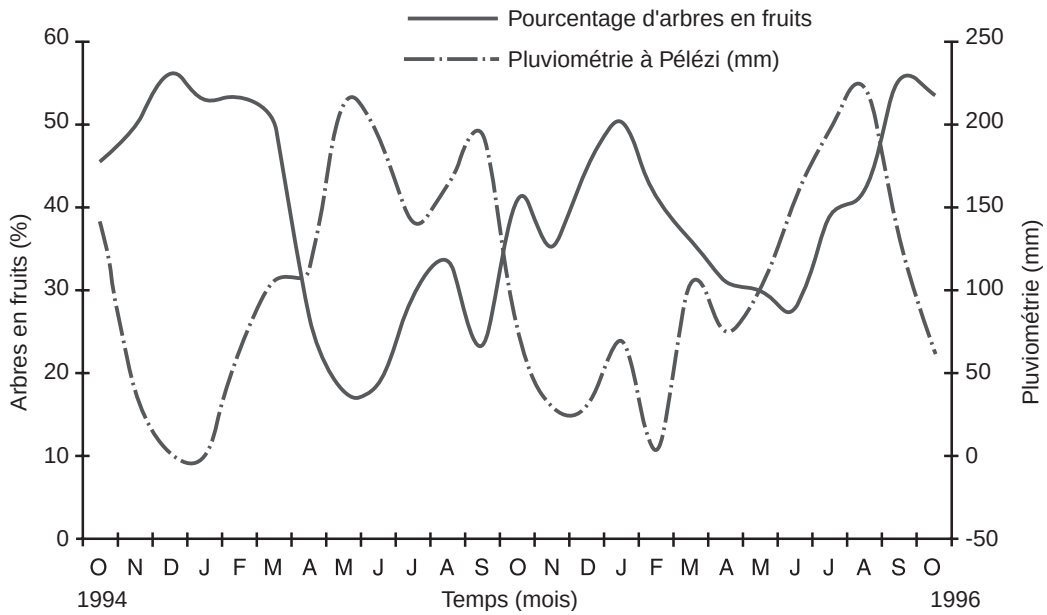

Figure 4. Pluviométrie à Pélézi et fructification des principales essences arborées de la Forêt classée du Haut-Sassandra dont les fruits sont consommés par l'éléphant (octobre 1994 à octobre 1996).

Les résultats du suivi de la phénologie des principaux arbres fruitiers (plus de 64 espèces d'arbres) présentés aux figures 4 et 5 montrent une variabilité de la disponibilité de la nourriture des éléphants dans la forêt. Les pourcentages mensuels d'arbres dans les différents états phénologiques (présence de fruits et chute de feuilles) sont fortement influencés par les saisons (pluviométrie). Les pluviométries enregistrées à Pélézi ont été retenues en raison de la proximité de ce village de la zone 1, plus riche en gros arbres et en éléphants.

Influence des principales activités humaines sur les populations d'éléphants

AGRICULTURE

La création des plantations de caféiers et de cacaoyers autour de la forêt classée a entraîné la réduction de la couverture forestière et de l'habitat de l'éléphant par de nouveaux défrichements (agrandissement des anciennes plantations ou création de nouvelles). Elle a favorisé l'abattage et la fuite des animaux de ces régions.

CHASSE

Les résultats des inventaires sur les grands layons montrent une distribution de douilles de cartouches de fusil de chasse calibre 12 sur toute la surface de la forêt. Ces douilles sont plus observées (0,78 douilles par km de layon) que les pièges (0,19 pièges par km de layon) qui sont localisés, pour la plupart, à proximité des campements. Le braconnage est donc pratiqué dans toute la forêt mais il est particulièrement intense aux abords des plantations. Par ailleurs, pendant la saison sèche, les braconniers assiègent pratiquement tous les points d'eau. Il en résulte une perturbation (dérangement) des populations d'éléphants par des détonations répétées et des feux de brousse qui éloignent les éléphants de ces régions.

EXPLOITATION DU BOIS DE GRUMES

Le Nord-Ouest des zones 1 et 2 où se déroulent des activités de coupe de bois est abandonné au profit du Nord-Est (fig. 3). En effet, l'exploitation du bois de grumes perturbe l'ambiance de la forêt par les bruits des moteurs et ceux des chutes des arbres.

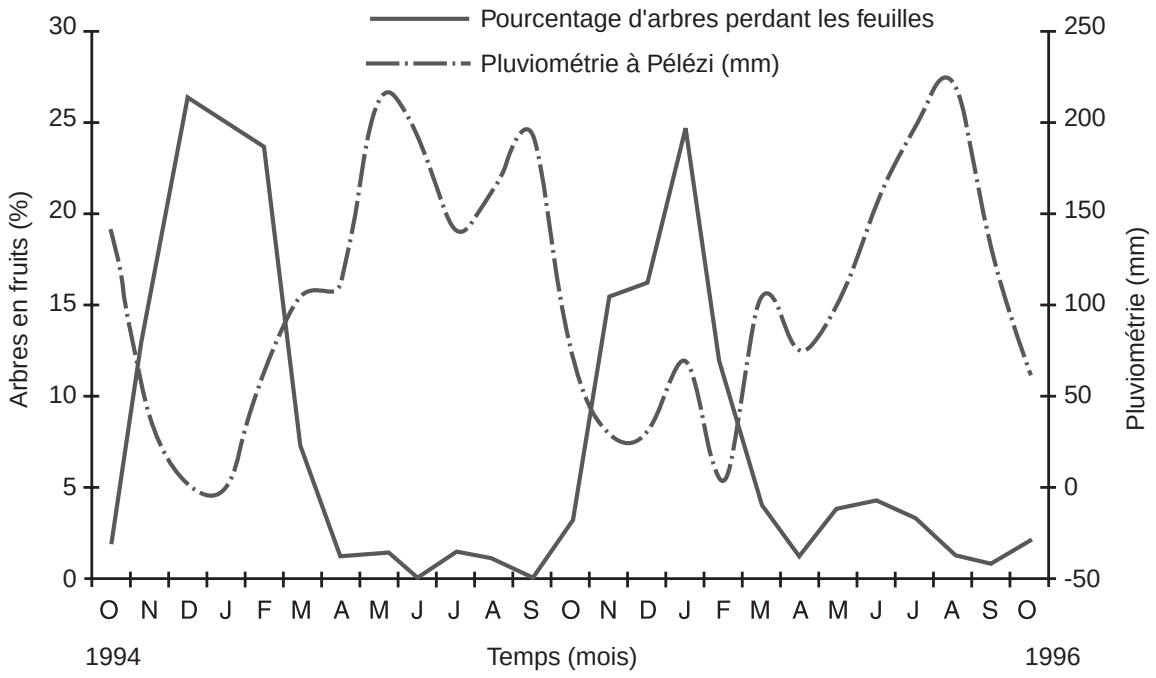

Figure 5. Pluviométrie à Pélézi et pourcentage des principaux arbres de la Forêt classée du Haut-Sassandra perdant leurs feuilles (octobre 1994 à octobre 1996.)

L'exploitation du bois de grumes chasse aussi d'autres animaux (buffle, chimpanzé, singe, etc.) à cause de la modification de la structure de la végétation et de la présence d'un personnel renfermant aussi bien des chasseurs que des planteurs.

La surexploitation de certaines essences d'arbres (dont les fruits sont très importants dans le régime alimentaire de l'éléphant) et la 'dévitalisation' d'autres espèces (lors des opérations d'éclaircies sélectives orientées vers l'optimalisation de la production de bois commercialisés) conduisent à l'élimination de certaines espèces végétales importantes du régime alimentaire de l'éléphant (*Balanites wilsoniana*, *Strychnos* sp., etc.).

Discussion

En saison des pluies, l'essentiel de la nourriture des éléphants est constitué de feuilles (Soulemane 2000). L'abondance de cette nourriture dans toute la forêt pendant cette période de l'année expliquerait les densités presque équilibrées (fig. 6) des éléphants dans leurs différentes zones de répartition.

Pendant la saison sèche, la plupart des arbres perdent leurs feuilles. Cette perte de feuilles est plus accentuée au Nord de la forêt car plus sec. Cependant, les données des inventaires montrent des densités d'éléphants plus élevées dans ces régions (fig. 6). Ces fortes densités d'éléphants s'expliquent par les fortes densités de fruits dans cette zone. En effet, la saison sèche est aussi la saison où de nombreux fruits consommés par les éléphants arrivent à maturité. Ces fruits dont les éléphants sont friands les attirent dans le Nord de la forêt : c'est le cas de *Chrysophyllum africanum*. Ces observations confirment celles de Alexandre (1978), Merz (1981), Janson (1983), Short (1983), White et al. (1993), Feer (1995) et Hien et al. (2000).

La production de fruits est déterminée par l'âge et la densité (nombre de tiges au km^2) des arbres fruitiers (figs. 7 et 8). L'analyse de la densité des différentes espèces d'arbres en fonction de leur âge (exprimé en classes de diamètre) permet d'estimer l'évolution de la qualité de l'habitat.

Les densités de 7 espèces d'arbres fruitiers (aux fruits consommés par les éléphants) pris en compte dans les inventaires d'aménagement de la SODEFOR (1995) et celles de certaines forêts sont présentées à la figure 7. La densité moyenne basse de ces 7 espèces d'arbres fruitiers dans la Forêt classée du Haut-Sassandra concorde avec celle de la plupart des arbres fruitiers.

La figure 7 montre que les densités des arbres fruitiers de la Forêt classée du Haut-Sassandra sont

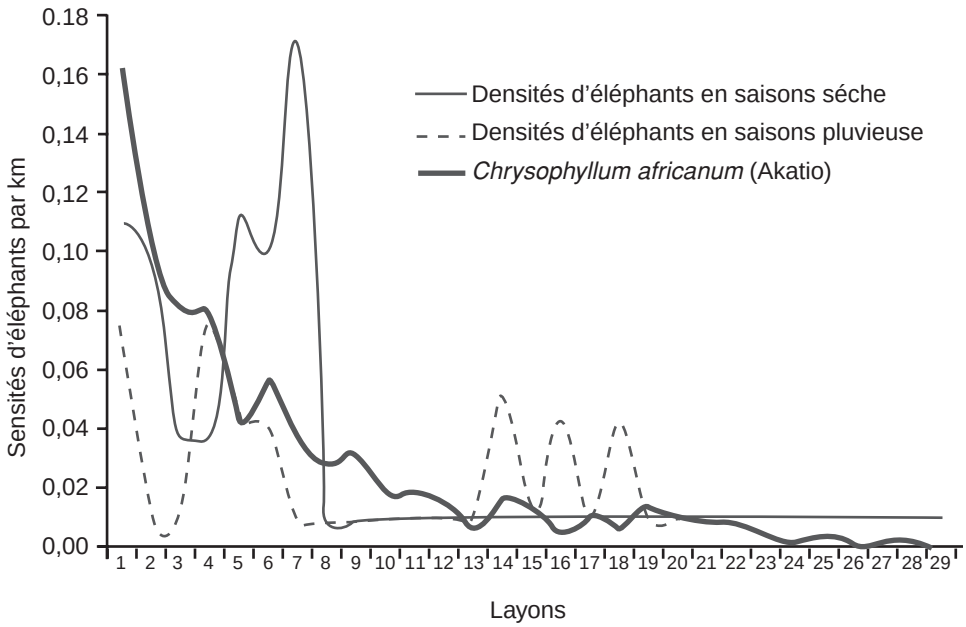

Figure 6. Variations saisonnières de la densité des éléphants dans la Forêt classée du Haut-Sassandra et distribution spatiale d'une espèce fruitière (*Chrysophyllum africanum*) qu'ils consomment beaucoup.

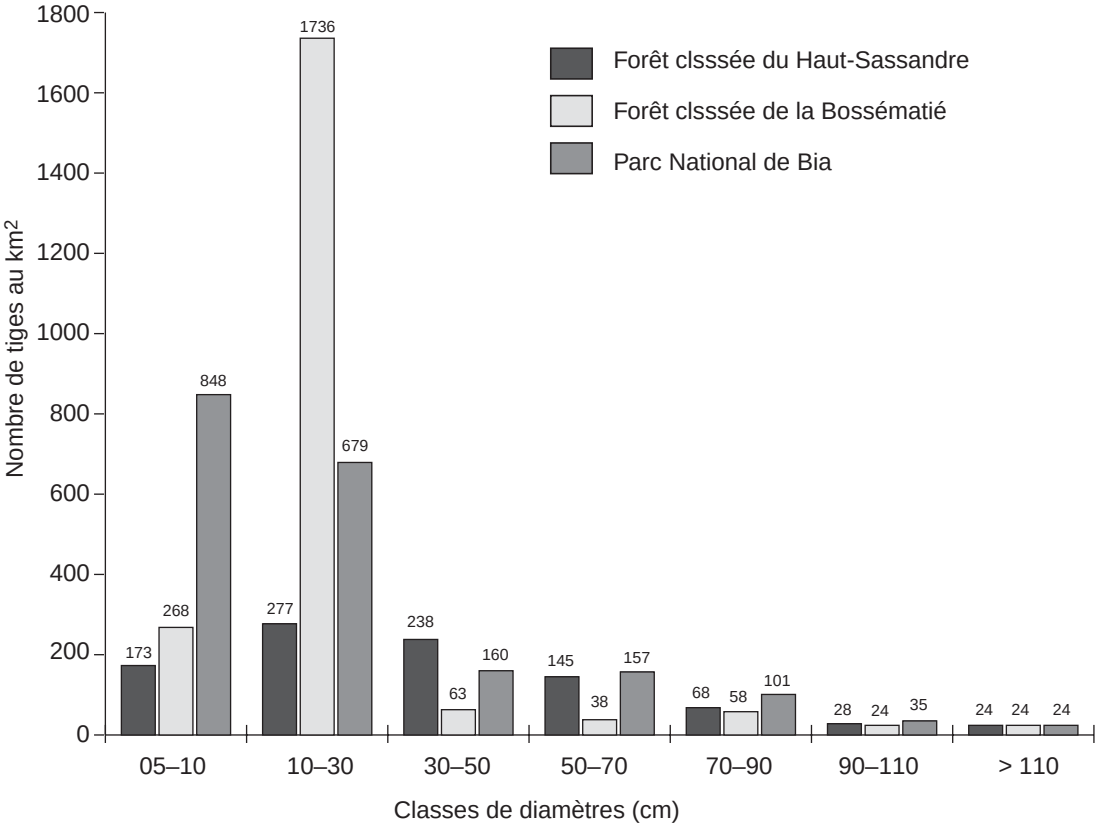

Figure 7. Densités moyennes (nombre de tiges au km^2) de 7 espèces d'arbres fruitiers (dont les fruits sont très consommés par l'éléphant) dans la Forêt classée du Haut-Sassandra (SODEFOR 1995), dans la Forêt classée de la Bossématié et dans le Parc National de Bia (Theurerkauf 1995) : *Pouteria robusta*, *Pycnanthus angolensis*, *Milicia excelsa Milicia regia*, *Ricinodendron heudelotii*, *Klainedoxa gabonensis* et *Parinari excelsa*.

en général faibles dans les deux premières classes d'âges (5 à 30 cm de diamètre) par rapport à celles de la Forêt classée de la Bossématié (à l'Est de la Côte d'Ivoire) et du Parc National de Bia (au Ghana). Ce dernier a les classes plus équilibrées car il est le seul site non exploité. Dans la Forêt classée de la Bossématié , les densités des arbres fruitiers sont plus élevées dans la classe des jeunes arbres de 10 à 30 cm de diamètre. Elles sont plus équilibrées dans le Parc National de Bia . Les densités des arbres de petits diamètres de 5 à 10 cm sont faibles dans la Forêt classée du Haut-Sassandra comme dans la Forêt classée de la Bossématié. Elles traduiraient un faible taux de germination des graines et une importante destruction des arbres en production à une période donnée. Cette destruction paraît plus importante et plus récente dans la Forêt classée du Haut-Sassandra car les densités des classes de diamètre compris entre 5 et 10 cm sont plus faibles que celles de la classe supérieure (10–30 cm).

De rares espèces, comme *Chrysophyllum africanum*, ont une densité moyenne élevée au nord de la forêt. Elles apportent ainsi une amélioration à la qualité nutritionnelle de la forêt (figure 8) et expliquent les fortes densités d'éléphants pendant la période de fructification dans cette région (tableau 2). En effet, *Chrysophyllum africanum* constitue, à lui seul, 77 % des effectifs de ces arbres.

La répartition inégale de ces essences n'est liée qu'à la surexploitation forestière effectuée dans certaines parties de la forêt. Le ratio entre les essences principales P1 et l'ensemble des autres essences principales exploitées (P2 + P3), pour les classes d'un diamètre supérieur ou égal à 50 cm, est de 69 % au nord et de 49 % au sud de la forêt (SODEFOR 1996). Ce qui traduirait un appauvrissement du sud de la

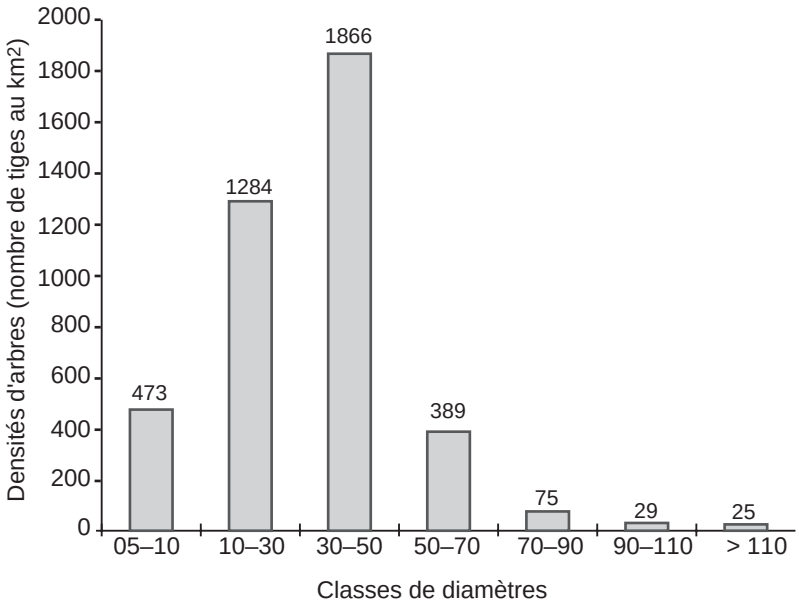

Figure 8. Densités moyennes (nombre de tiges au km²) des 8 espèces d'arbres fruitiers (dont les fruits sont les plus consommés par l'éléphant) dans la Forêt classée du Haut-Sassandra ; *Chrysophyllum africanum*, *Pouteria robusta*, *Pycnanthus angolensis*, *Milicia excelsa*, *Milicia regia*, *Ricinodendron heudelotii*, *Klainedoxa gabonensis*, *Parinari excelsa* (SODEFOR 1995).

forêt. L'appauvrissement en arbres de gros diamètres entraînerait une diminution de l'approvisionnement en fruits. L'amélioration de la qualité de cet habitat est incertaine à cause de l'exploitation forestière qui s'étend vers le nord de cette forêt. Quant à l'approvisionnement en feuilles, il ne soulève pas de problèmes majeurs car il est assuré par les trouées créées par les coupes de bois.

Il importe donc d'éviter de décimer les arbres fruitiers constituant des plantes fourragères des éléphants afin d'améliorer la future production de fruits. Ces arbres doivent être épargnés lors des futures exploitations forestières et traitements sylvicoles, pour assurer un approvisionnement optimal en fruits afin d'éviter les grands déplacements d'éléphants.

Conclusion

Les migrations des éléphants de la Forêt classée du Haut-Sassandra sont très influencées par les saisons qui déterminent la disponibilité de la nourriture et de l'eau. Cependant, la chasse, l'agriculture et l'exploitation du bois de grumes constituent des sources de perturbation (dérangement) qui éloignent les animaux, notamment l'éléphant.

L'aire de répartition des éléphants couvrait autrefois toute la forêt classée. Elle s'est rétrécie sous la pression de trois principaux facteurs : l'agriculture, la chasse et l'exploitation forestière.

Il existe deux types de migrations des éléphants dans la forêt :

- les migrations liées aux saisons ; elles s'effectuent du sud vers le nord en saison sèche et du nord vers le sud en saison pluvieuse ;
- les migrations liées aux activités humaines ; elles s'expriment par l'abandon temporaire des régions en exploitation forestière ou subissant des activités sylvicoles.

Cependant, l'abandon de certaines régions de la forêt par les éléphants peut être évité par :

- la préservation des arbres aux fruits consommés par ces animaux ;
- la réalisation de petites retenues d'eau à l'intérieur de la forêt ;
- la réduction du dérangement des éléphants en évitant de bloquer de grandes régions de la forêt par la mise en coupe de blocs adjacents la même année ;
- de régulières patrouilles de surveillance des Eaux et Forêts.

Remerciements

Je remercie la Société de Développement des Forêts (SODEFOR) qui a financé entièrement cette étude. J'exprime ma gratitude au Professeur Foua Bi Kouahou et au Dr. Dosso Henri pour leurs conseils bien avisés. Mes remerciements vont enfin au personnel de la division de la Forêt classée du Haut-Sassandra pour leur accueil et leur appui au cours des travaux de terrain.

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An elephant dung survey of the Shimba Hills ecosystem, Kenya, and implications for management

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Abstract

During September 2002, the Shimba Hills ecosystem was surveyed for elephants (*Loxodonta africana*) using the elephant dung count technique. An elephant density of 2.6/km^2 was obtained in an area of about 250 km^2. A dung decay rate of 0.008 per day was obtained from data collected in 1994 using the reciprocal of the median duration time. From this study, an estimate of 649 ± 77 elephants (95% CL 501–842) was obtained. Compared with previous elephant estimates, the current results indicate that elephant numbers have increased by about 43% over a period of seven years. This represents a 6% annual increase. These results are important in making decisions on managing elephants. Various management options are discussed.

Résumé

En septembre 2002, on a étudié les éléphants (*Loxodonta africana*) de l'écosystème des Shimba Hills en utilisant la technique du comptage des crottes. On a obtenu une densité d'éléphants de 2,6/km^2 sur une superficie d'environ 250 km^2. On a déduit, à partir des données récoltées en 1994, un taux de décomposition des crottes de 0,008 par jour, en utilisant la réciproque de la durée moyenne. À partir de là, on obtient une estimation de 649 ± 77 éléphants (95 % CL 501–842). Comparés aux estimations antérieures, les résultats actuels montrent que le nombre d'éléphants a augmenté d'environ 43 % sur une période de sept ans. Ceci représente un accroissement annuel de 6%. Ces résultats sont importants pour la prise de décisions dans la gestion des éléphants. On discute de différentes options possibles.

Introduction

The African elephant (*Loxodonta africana)* in the Shimba Hills ecosystem survived the poaching that affected Kenya in the mid-1970s (Poole et al. 1992). This was due to thick forest cover coupled with an elephant-tolerant attitude of the local people (Poole et al. 1992). Surveying this elephant population in the 1970s and 1980s using aerial techniques was difficult due to forest cover. However, in the late 1980s dung count became increasingly popular as the most practical method for calculating elephant numbers in the forest. Thus in 1992 an elephant dung survey was conducted for the first time in the Shimba Hills ecosystem (Reuling et al. 1992). Litoroh (2002) has documented the historical account of the Shimba elephant population and how it has been monitored since early 1990s. This elephant population appears to have increased in numbers over the past decade, and by the late 1990s destruction of the habitat by elephants at Shimba had reached crisis levels. As a result, 30 elephants were removed from the Shimba ecosystem in 1999. Since then no formal dung surveys have been done. This report provides an update of elephant estimates and their distribution in the Shimba Hills ecosystem and examines the implications for their management.

Study area

The Shimba Hills ecosystem (fig. 1) is situated in the south-eastern part of Kenya, stretching from 39°17' to 39°30' E and from 4°09' to 4°21' S. It has a total area of about 250 km^2 for wildlife use. The climatic

condition has been described by FAO/UNESCO (1977) as humid semi-hot equatorial with a mean annual temperature of 24.2°C (Braun 1977). The ecosystem experiences 'long rains' from mid-March to the end of June and 'short rains' in October and November. Annual rainfall averages 1150 mm (Jatzold and Schmidt 1983). Mist and fog contributed considerably to the total precipitation.

Vegetation of the Shimba Hills ecosystem consists of a mosaic of tropical seasonal evergreen rain forest, woodland (eight forest types) and fire-induced grassland. About 15% of the rare plants in Shimba Hills are coastal endemic (Schmidt 1991), and over 50% of the 159 rare plant species known to occur in Kenya are found in Shimba Hills (Beentje 1988). It is the habitat for globally threatened avian species and for endangered mammals with restricted range; it has an abundance of lepidopteran species (Blackett 1994; Bennun and Njoroge 1999). It is an important water catchment area (Blackett 1994). The forest holds spiritual significance for local people.

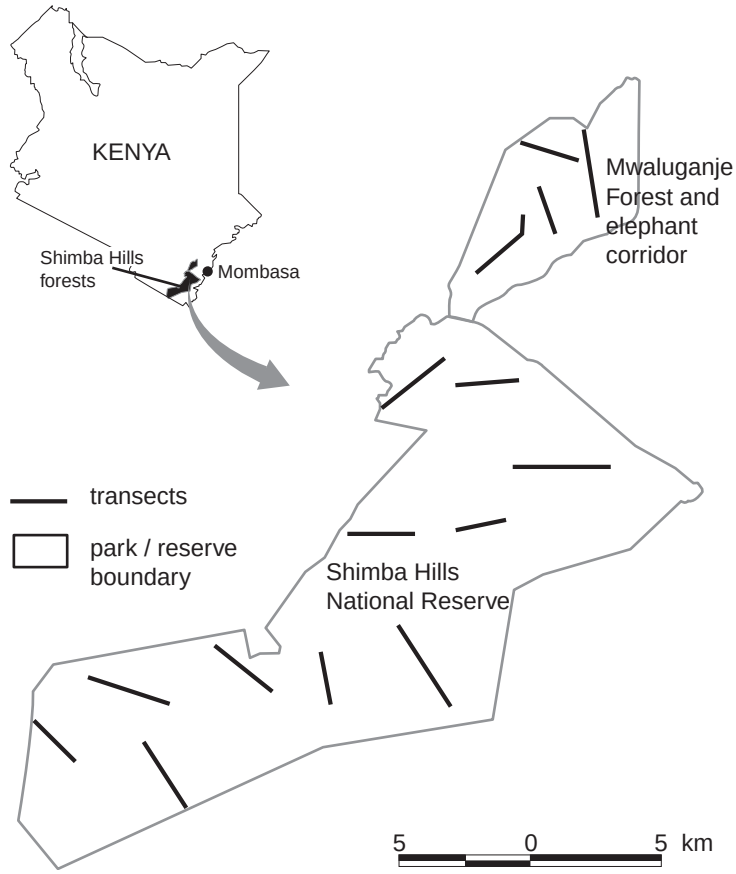

Figure 1. Map of the study of area showing distribution of transects.

Methods

Line transects (fig. 1) were randomly placed in the study area to sample for dung density as described by Barnes and Jensen (1987). Data on dung density have been analysed using the DISTANCE sampling program (Buckland et al. 1993). Dung density was converted into elephant density as described by Barnes (1993) using the following equation:

$$E = Y(r/D)$$

where E is the number of elephants per square kilometre, Y the number of droppings per square kilometre; r the rate of dung decay, and D the density of droppings produced per elephant per day. The 95% confidence limit was calculated using the Monte Carlo technique as described by Barnes and Barnes (1992). Data collected at Shimba Hills in 1994 (Mwathe 1995) were analysed using the reciprocal of the median duration time (Barnes et al.1994) to obtain the decay rate. The defecation rate of 19.0 droppings per elephant per day was used (Jachmann 2001). Although this introduces a potential source of error, it is not serious.

Results

A pooled dung density estimate for the entire area was 6172 dung piles per km^2. A mean dung decay rate of 0.008 was obtained for the entire ecosystem. The elephant-useable habitat is 250 km^2. Thus assuming a defecation rate of 19 droppings per elephant per day, we obtain an elephant density of 2.6. This translates into an estimate of 649 ± 77 elephants (95% CL 501–842). The estimated elephant numbers are 453 for 1995, 475 for 1997, 523 for 1998, 575 for

1999 and 649 for 2002. For the entire ecosystem, the general trend is a steady increase in elephant numbers from about 453 ± 181 in 1995 to 649 ± 77 elephants in 2002.

Elephant dung piles in all stages of decay were found in high concentrations on all transects. For example, a transect placed in Marere and another in Mwaluganje area recorded over 230 dung piles each within a distance of 2.4 km.

Discussion

The present results indicate that on a year-round basis there are definitely at least 501 elephants in the Shimba Hills ecosystem, possibly as many as 842, but the true population size is probably around 649. Compared with the 1995 analysis, the present result is probably more accurate because it has much narrower confidence limits.

Analysing dung count data and translating results of dung density, dung decay and defecation rates into elephant numbers should always be done with caution due to errors, as described by Barnes (1993) and Jachmann (2001). Defecation rate in the present study could be an important source of error because it is borrowed from another site. However, the amount of error is probably insignificant since the same rate has been applied in analysing all the data sets (except the 1994/95 data sets), and hence the error is probably constant.

Results from the present study are comparable with the results obtained in 1995, 1997, 1998 and 1999 (Litoroh et al. 2001), since the same method has been used in data analysis. This represents a general increase in estimates of elephant numbers by nearly 44% in a period of over seven years (since 1995) and is a 6% annual increase.

Occurrence of dung piles in all stages of decay all over the reserve indicates that elephants were well distributed over the Shimba Hills ecosystem. High concentrations were found in Marere and Mwaluganje areas, a similar coastal forest about 100 km to the north of Shimba, where over 230 dung piles were recorded on a 2.4-km transect. This concentration is considerable compared with Shimba Hills, where only 251 dung piles were recorded within a total distance sampled of 42.4 km.

The high dung pile concentration at Marere and Mwaluganje concurs with previous surveys. For instance, in 1997 a first helicopter count was done in which 150 elephants were counted in Mwaluganje Elephant Sanctuary alone (Litoroh 2002). After translocating 30 elephants out of Mwaluganje in 1999, another helicopter count was conducted in 2000 (Litoroh 2000; Kahumbu 2002), in which 200 elephants were counted in the sanctuary, representing a 33% increase in about three years. Since Mwaluganje is basically a dispersal area for Shimba Hills National Reserve, this increase was probably due to elephant dynamics within the ecosystem. According to the present study, the Shimba Hills elephant population has increased considerably. An overall elephant density of 0.5 elephants/km^2 has been recommended for Shimba (Litoroh 2002).

Implications for management

The high density of elephants living within a confined area causes increasingly serious management problems.

First, although the area outwardly appears to be flourishing, the habitat is under intense pressure from elephants. Results from elephant–habitat interaction studies of Mwathe (1995) and Litoroh et al. (2001) have shown a negative correlation between elephant density and various vegetation parameters. Litoroh et al. (2001) has shown that the overall diversity of plant species for the Shimba Hills ecosystem has declined over the period from 1997 to 1999. As the elephant numbers go up the plant species disappear. Additionally, the habitat is degraded through changes in plant community structure. Earlier studies (Schmidt 1991, 1992; Davis and Bennun 1993; Robertson and Luke 1993; Hoft and Hoft 1995) have expressed the need to take urgent conservation measures to protect biodiversity in Shimba Hills. The concerns are:

- The confinement of an increasing elephant population within a small area has resulted in serious destruction of trees, opening up of forests and erosion of biodiversity resources. As a result, some endemic species in the area are critically threatened.
- The size of the highly diverse natural forest is at its lowest critical margin, a factor contributing to a high fragility of the ecosystem. The resilience potential of the forest disturbance resulting from previous anthropogenic activities is high but the insulation of the reserve coupled with a high density of mega-herbivores has interfered with natural regeneration and processes of succession.

- An unknown number of plant and animal species is gradually disappearing. For instance, there are many fewer sightings of colobus monkeys at the Mwaluganje Forest Reserve where the high-canopy trees that they depend upon have been destroyed by elephants. The high density of elephants may result in a large-scale cascade of extinction that cannot be predicted; neither can the economic loss be quantified.

Second, human–elephant conflict around Shimba Hills is escalating. Before an electric fence was constructed around Shimba Hills between 1980 and 1994, about 58% (n = 2171) of the cases of human–wildlife conflict were caused by elephants (Mwathe and Waithaka 1995). Within the same period, there were 43 cases of human death and injury, 85% caused by elephants. Initially, the fence was effective, with few incidents of elephants breaking the fence, and people were able to cultivate close to the fence. Human–elephant conflict cases reduced by 33% between 1995 and 2000 while elephant-induced human death and injury reduced by 70% during the same period (Litoroh 2003). However, over the past two years the 120-km perimeter fence has been rendered nearly 60% ineffective and cases of human–elephant conflict are again on the increase (Litoroh 2003).

The principal reason for malfunctioning of the fence is poor to no maintenance due to insufficient funding to engage labour and purchase fence materials. There are only two fence attendants and one technician responsible for maintaining the fence, although the standard requirement is to have one fence attendant for every 4 km and one technician for every 16 km. An additional problem is that the earthing design of Mwaluganje fence is poor, which means that the fence does not provide enough electric shock to deter elephants. Since there is no compensation for crop damage, most elephant cases go unreported unless someone has been injured or killed. However, according to the occurrence book at the warden's office, over 200 cases of human–wildlife conflict were reported between 2001 and 2002, elephants accounting for 84% of the incidents. During the same period elephants killed seven people. Additionally, between January and May 2002, elephants broke wire and poles and destroyed 37 km of the fence. In one incident they broke 115 poles.

Thus the human–elephant conflict situation is again assuming alarming proportions. Some local people are retaliating by spearing elephants or shooting them with bow and arrows. Over the past seven months three elephants have been speared, two shot with arrows and one snared with a wire rope.

In view of the above, solutions urgently need to be found to stop the escalation of human–elephant conflict and diminish the high risk of losing biodiversity caused by elephant-induced destruction of habitat.

Elephant management interventions

Presently the Kenya Wildlife Service (KWS) is grappling to minimize these conflicts on a short-term basis by carrying out piecemeal fence repairs and shooting problem elephants as a control measure. For instance five elephants were shot on control between January and June 2003. However, this problem requires medium- and long-term interventions with varied approaches.

In March 1997, KWS convened a workshop at Tiwi near Shimba Hills in an effort to address the Shimba elephant problem. Although the workshop recommended culling as the immediate and short-term intervention management option to reduce the elephant density, the measure was not implemented because of controversy associated with it (Litoroh 2002).

Kenya does not subscribe to culling for ethical reasons. It is not a popular concept in Kenya as it is said to be inhumane and it disrupts the elephant social set-up. Additionally, the thinking in 1997, at the time of the workshop, was that only four years earlier Kenya had spearheaded the ban on ivory trade, and it would have been untenable for KWS to make an about-turn and resort to culling. Culling was therefore opposed but this thinking may have to change with time.

Elephant drives: We conducted two elephant drives in Narok, in south-western Kenya, in the recent past, but experience has shown that the elephants returned in a week's time. Thus an elephant drive is successful only on a very short term and therefore is not an efficient way of managing elephants.

Winning space: The Shimba Hills ecosystem is surrounded by a growing human population, which makes it an ecological island. Winning space would involve serious socio-political considerations, which appear insurmountable. Realistically, there is hardly any more space (as buffer zone) to be won for elephants after Mwaluganje Elephant Conservancy was created.

Fertility regulation: Immunocontraception has proven efficacious as a means of inducing sterility among African elephants. This method is more humane than culling; however, because immunocontraception has practical problems and takes a long time, it was not considered an immediate option, but the option may be revisited in future.

Elephant translocation: In a generally good terrain and open country, translocation has emerged as a common tool that KWS uses in managing wildlife populations. Shimba Hills and Mwaluganje present special difficulties due to rough terrain and relatively thick vegetation. Despite this, KWS took a bold step and successfully moved 29 elephants from Mwaluganje to Tsavo East National Park in November 1999. The decision to move elephants was based on the outcome of the Tiwi workshop and after taking into account socio-political considerations both at Shimba and at Tsavo. Since the above number is negligible, the Shimba Hills draft management plan (Litoroh et al. 2003) has proposed translocation of a further 200 over a period of five years to achieve the desired effect. However, translocation at Shimba is an expensive exercise (one elephant costs over USD 2500), which KWS cannot afford on its recurrent expenditure, and the agency would have to seek additional donor support. Translocation is expensive, but it is a short-term measure to reduce elephant density. However, on medium- and long-term bases, the elephant population needs to be stabilized through other means such as immunocontraception, if it is found acceptable.

Conclusion

- This survey shows that elephant numbers in the Shimba Hills have steadily increased since 1995 and monitoring of this population should be maintained.
- Construction of an electric fence coupled with human settlement around the reserve firmly curtailed elephant migration, resulting in localized destruction of the vegetation that is associated with compression.
- Elephant density in the Shimba Hills ecosystem needs to be reduced to acceptable levels. Translocation of 29 elephants from Shimba to Tsavo is thought to be an appropriate management intervention measure to address issues of habitat destruction on the short term, but more elephants need to be translocated to achieve the desired results.
- The remaining elephant population should then be stabilized through fertility regulation by immunocontraception, if it is found acceptable, or through further translocations on a recurrent basis.
- The electric fence at Shimba Hills should be properly maintained.

Acknowledgements

This survey would not have been possible without the sole financial support of the IUCN/SSC African Elephant Specialist Group (AfESG) through its small grants programme. The following people were very helpful in field data collection: Kimtai Korir, Julius Muriuki and Jim Nyamu, all from KWS headquarters, and Evans Nyamweya from Shimba Hills.

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Physiological and haematological findings in immobilized free-ranging African elephants

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Abstract

Fifty-six elephants (*Loxodonta africana***)** of mixed ages and of both sexes were immobilized to translocate them in Laikipia District, Kenya, in July 2001. The animals were immobilized with etorphine hydrochloride mixed with hyaluronidase through an intramuscular dart. The range, mean and standard deviations were analysed for all physiological and haematological parameters collected for each age group. The body temperature, mean corpuscular volume and total protein showed significant difference ($P < 0.05$) between adults and subadults while respiratory rate, pulse rate and total protein showed significant difference ($P < 0.05$) between subadults and juveniles. In addition to white blood cell counts, all the above-stated parameters showed significant difference ($P < 0.05$) between adults and juveniles. The range for haematological parameters compared well with those reported by other authors except for the white blood cell counts. These data from healthy free-ranging African elephants provide baseline information on parameters for monitoring during immobilization and in haematological analysis during disease investigation.

Résumé

On a immobilisé 65 éléphants (*Loxodonta africana*) d'âge divers et des deux sexes pour les transporter vers le District de Laikipia, au Kenya, en juillet 2001. Les animaux ont été immobilisés au moyen d'une seringue intramusculaire contenant de l'étorphine mélangée à de l'hyaluronidase. On a étudié l'étendue, les déviations standards et moyennes pour tous les paramètres physiologiques et hématologiques récoltés pour chaque groupe d'âge. La température corporelle, le volume corpuspulaire moyen et le total des protéines montraient des différences significatives ($P < 0,05$) entre les adultes et les subadultes, tandis que le rythme respiratoire, le pouls, et le total des protéines présentaient des différences significatives ($P < 0,05$) entre les subadultes et les juvéniles. La gamme des paramètres hématologiques était comparable à celle rapportée par d'autres auteurs sauf en ce qui concerne le comptage des globules blancs. Ces données, qui proviennent d'éléphants africains libres et en bonne santé, apportent des informations de base sur les paramètres à contrôler lors de l'immobilisation et dans les analyses hématologiques en cas de maladies.

Introduction

Elephants (*Loxodonta africana***)** have been routinely immobilized for various purposes. These include ecological and behavioural research (Thouless 1995; Elkan et al. 1998; Whyte and Grobler 1998) and translocation (Puterill 1993; Njumbi et al. 1996). They have also been immobilized for clinical examination and treatment, minor surgical procedures such as suturing wounds and removing snares as well as reproductive procedures such as electroejaculation (Kock RA et al. 1993).

Improvements in veterinary and other technology have encouraged intervention for diagnosis and treatment of diseases as well as for ecological monitoring and behavioural research. To successfully implement these interventions, elephants must be immobilized. Understanding the physiological dynamics in elephants

during immobilization will help to minimize mortalities. In managing elephant health, understanding the normal range of haematological parameters is useful.

The literature available on these parameters in free-ranging East African elephants is limited. Some data are available from southern Africa and from captive elephants (Brown and White 1980; Allen et al. 1985; Kock MD et al. 1993; Kock RA et al. 1993; Olsen and Byron 1993; Still 1996; Osofsky 1997; Whyte and Grobler 1998). This paper provides data from 56 African elephants immobilized for translocation in Laikipia District, Kenya, and compares the physiological and haematological parameters among the various age groups.

Materials and methods

The study was conducted during the capture of 56 African elephants for translocation from Laikipia District to Meru National Park, Kenya. The capture and release sites are 250 km apart. The translocation was undertaken to resolve a long-standing human–elephant conflict and to decrease habitat pressure in Ol Pejeta Ranch. Another objective was to restock Meru National Park, whose elephant population had been almost annihilated by poaching in the 1970s. Pretranslocation monitoring was done to identify suitable family groups and individual bulls for translocation.

The animals were darted from a helicopter after herding them to a low-canopy area. Small calves were darted from the ground. One calf that was about 1 m in height was physically restrained and sedated with 40 mg azaperone (Stresnil® 40 mg/ml, Jansen Phamaceutica (Pty) Ltd, South Africa). Darting was carried out using the Palmer Cap Chur® Long-Range projector (Palmer Cap-Chur Equipment, Inc., Douglasville, Georgia 30133 USA) with 3-ml darts. A side-bore collared elephant needle (Palmer Cap-Chur Equipment) was used, 5 mm wide and either 65 mm or 55 mm long, depending on animal size. A mixture of etorphine HCl (M99 9.8 mg/ml, Logos Agvet (Pty) Ltd, South Africa) and hyaluronidase (Kryon Laboratories, Benrose 2011, South Africa) was used. Dosage was 18 mg etorphine HCl and 5000 IU hyaluronidase for adults, 15 mg etorphine HCl and 3500 IU hyaluronidase for subadults, and 5 mg etorphine HCl and 1500 IU hyaluronidase for juveniles. Etorphine HCl at a quarter of the original dose was administered intravenously when anaesthesia became light. Neuroleptoanalgesia was judged to be ineffective when frequency and strength of trunk and ear movements increased.

Induction time was considered as the time from darting to the time when the animal became recumbent. Once the animal was recumbent, the trunk was straightened to ensure that airways were unobstructed. The pulse rate was obtained by palpating the middle ear artery for one minute. Respiratory rate was determined by counting for one minute the number of chest movements and expiratory movements at the tip of the trunk. Body temperature was determined by inserting a digital thermometer deep into the rectum. The three parameters were determined and recorded every 5 min. Blood for haematology was collected in ethylenediaminetetra-acetic acid (EDTA) bottles from the middle ear vein. It was then placed in a cool box and analysed within 6 hours with the use of a CBC-5 Coulter Counter (Coulter Electronics, Hialeah, Florida 88666, USA). The dart wound was treated with 1% tetracycline ophthalmic ointment (Sarabhai Chemicals, Wadi Wadi, Baroda, India). An intramuscular injection of oxytetracycline hydrochloride (Oxy-kel 20 L.A., Kela Laboratories, B-2320 Hoogstraten, Belgium) was given, 40,000 mg to adults, 20,000 mg to subadults and 10,000 mg to juveniles. Animal age was estimated as described by Laws (1966).

Etorphine HCl was reversed by diprenorphine HCl (M5050 12 mg/ml, Logos Agvet) intravenously at three times the dosage of etorphine used for each category of elephants.

Student's *t*-test was used to compare the means. Outliers were corrected by plotting normal distribution curves for the various age groups. In all statistical analysis a significant level of $P < 0.05$ was applied.

Results

Of the 56 elephants that were captured, 51 were successfully translocated and 5 (8.9%) died. Four died during transportation, two having manifested pink foam syndrome, a condition caused by lung oedema after prolonged recumbency. One died of suffocation due to obstruction of its trunk when it fell in the family crate and its tusks got locked into the sliding partition. The fourth died from pyloric obstruction present before immobilization and exacerbated by the capture stress. The fifth, a small calf, lay on its trunk after it was darted and suffocated before the veteri-

nary team arrived.

The captured elephants comprised nine bulls and seven family groups of between four and seven individuals. The age groups were divided into less than 3 years (juveniles), 3–10 years (subadults) and over 10 years (adults). There were 26 adults (10 males and 16 females), 14 subadults (5 females and 9 males) and 16 juveniles (7 males and 9 females).

Table 1 summarizes the range, mean and standard deviation of the various parameters in the three age groups, and any significant difference in the mean.

Discussion

The results of this study show that most physiologic parameters are different in the three age groups of elephants. The differences are statistically significant in some parameters and not in others.

The average induction time of 9.1 minutes in all age groups compares well with that previously reported (Kock MD et al. 1993; Osofsky 1997) at similar or slightly lower etorphine HCl and hyaluronidase dosages. However, when compared with the induction time reported by other authors (Kock RA et al. 1993), the time in this study was higher at equivalent drug dosages.

The respiratory and pulse rates were significantly different between adults and juveniles, and between subadults and juveniles. They are highest in juveniles and lowest in adults. This is attributed to the higher metabolic rate in younger animals. The average respiratory rate of 7.1 breaths per minute and pulse rate of 67.0 beats per minute in all age groups compares well with other reported work (Kock RA et al. 1993; Olsen and Byron 1993; Still et al. 1996).

The body temperature was significantly different between adults and subadults as well as between adults and juveniles. The difference between subadults and juveniles was not statistically significant. The average body temperature of the three age groups of 37.2°C compares well with previously reported work (Kock MD et al. 1993; Kock RA et al. 1993; Olsen and Byron 1993). Osofsky (1997) reported slightly higher value than the present study. This difference could have resulted from different environment conditions and elephant populations.

The packed cell volume (PCV) was significantly different between adults and juveniles. The juveniles had higher PCV than subadults and subadults higher than adults, but the differences were not statistically significant. The same trend was observed in red blood

Table 1. Anaesthesiologic and haematologic results of different age groups of free-ranging African elephants

Variables	Juveniles *n* = 16		Subadults *n* = 14		Adults *n* = 26	
	Range	Mean ± SD	Range	Mean ±SD	Range	Mean ± SD
Induction time	5.0 – 14.0	9.5 ± 6.36[a]	8.0–10.0	9.0 ± 1.41[a]	5.0 – 25.0	8.9 ± 2.34[a]
Respiratory rate	3.0 – 13.0	8.9 ± 3.09[a]	3.0–8.0	6.3 ± 1.38[b]	3.0 – 10.0	6.0 ± 1.45[b]
Pulse/min	51.0 – 97.0	74.3 ± 3.26[a]	52.0–79.0	65.4 ± 8.81[b]	44.0 – 79.0	61.5 ± 8.29[b]
Temperature (°C)	36.0 – 38.4	37.5 ± 0.77[a]	36.0–38.6	37.3 ± 0.75[a]	39.0 – 38.8	36.7 ± 0.65[b]
PCV (%)	30.9 – 46.7	39.7 ± 4.80[a]	27.6–46.1	36.4 ± 5.22[a,b]	27.0 – 46.5	36.1 ± 4.46[b]
RBC x 10^6/ml	2.2 – 4.0	3.3 ± 0.60[a]	2.5–4.0	3.2 ± 0.40[a]	2.2 – 3.7	3.0 ± 0.38[a]
MCV (fl)	111.0 – 21.0	111.8 ± 5.87[a]	102.0–118.0	111.8 ± 5.33[a]	102.0 – 126.0	117.9 ± 6.36[b]
Hb (g/dl)	10.7 – 14.1	12.0 ± 1.08[a]	11.0–14.1	12.2 ± 1.14[a]	10.6 – 16.7	13.0 ± 1.36[a]
WBC x 10^3/ml	8.6 – 40.1	20.1 ± 8.56[a]	9.7–23.5	17.3 ± 4.1[a,b]	4.1 – 21.4	15.4 ± 4.55[b]
Plasma proteins (g)	7.6 – 8.9	8.2 ± 0.47[a]	8.0–9.6	8.9 ± 0.44[b]	8.6 – 10.6	9.4 ± 0.64[c]
Neutrophils (%)	15.0 – 42.0	27.0 ± 9.32[a]	15.0–36.0	26.5 ± 6.83[a]	14.0 – 37.0	28.6 ± 7.76[a]
Band neutrophils (%)	0.0 – 2.0	0.3 ± 0.78[a]	0.0–2.0	0.57± 0.94[a]	0.0 – 2.0	0.25± 0.53[a]
Lymphocytes (%)	58.0 – 85.0	72.1 ± 9.49[a]	64.0–81.0	70.1 ± 5.22[a]	56.0 – 84.0	69.8 ± 7.60[a]
Eosinophils (%)	0.0 – 3.0	1.0 ± 1.04[a]	0.0–6.0	1.64± 2.20[a]	0.0 – 3.0	0.75± 1.03[a]
Monocytes (%)	0.0 – 2.0	0.33± 0.65[a]	0.0–1.0	0.09± 0.3[a]	0.0 – 2.0	0.2 ± 0.51[a]
Basophils (%)	0.0 – 1.0	0.2 ± 0.40[a]	0.0–2.0	0.21± 0.58[a]	0.0 – 3.0	0.3 ± 0.70[a]

Induction time; in minutes; respiratory rate – in breaths/min; PCV – packed cell volume; RBC – red blood cells; MCV – mean corpuscular volume; Hb – haemoglobin concentration; WBC – white blood cells

a, b, c – means with different superscripts are significantly different ($P < 0.05$).

cell (RBC) counts, in which the counts decreased from juveniles to subadults and to adults, but the differences were not statistically significant. The average value of PCV in the three age groups of 37.4% compares well with that previously reported (Kock MD et al. 1993) but is slightly higher than other reported work (Woodford 1979). However, the value is lower than that reported by other authors (White and Brown 1978; Brown and White 1980; Whyte and Grobler 1998). The average RBC count of 3.2 x 10^6 cells/μl in this study compares well with that previously reported (White and Brown 1978; Woodford 1979; Allen et al. 1985).

The mean corpuscular volume (MCV) showed significant differences between adults and subadults as well as between adults and juveniles. The difference between subadults and adults was not significant. The values were highest in adults and lowest in juveniles. The same trend is seen in haemoglobin (Hb) concentration that increases with age. The differences of Hb concentration between the age groups are statistically significant. The average MCV of 114.9 fl in the three age groups compares well with that previously reported (Woodford 1979; Allen et al. 1985). However, it differs from that reported by other authors (Young and Ombard 1967; Brown and White 1980). The average Hb concentration of 12.4 g/dl compares well with that previously reported (Woodford 1979; Brown and White 1980; Allen et al. 1985). However, it differs from that reported by another author (Young and Ombard 1967).

The white blood cell (WBC) count declines from juveniles through subadults to adults but the only significant difference occurs between juveniles and adults. In differential WBC counts no significant differences were observed among the different age groups and no clear pattern of increase or decrease could be seen across the age groups. The percentage of lymphocytes was highest followed by neutrophils, eosinophils, basophils, monocytes and band neutrophils, in that order. The average WBC count of 17.6 x 10^3 cells/μl for the three age groups was higher than those previously reported (White and Brown 1978; Woodford 1979; Brown and White 1980; Allen et al. 1985). Further, the range of WBC count was also lower than that reported by other authors. This is the only parameter where such a disparity in range was noted. These differences between the results in this study and those of the authors listed above could have arisen from bias caused by low numbers of animals sampled in these studies. However, some differential count results agreed with those reported by these authors: lymphocyte, neutrophil and monocyte counts, (White and Brown 1978), eosinophil counts (Brown and White 1980) and basophil counts (Woodford 1979; Allen et al. 1985). The differential counts differed from those reported by the rest of the authors.

The total plasma protein value showed significant differences between all age groups and was the only parameter that showed such a trend. It was highest in adults and lowest in juveniles. The average total plasma protein value of 8.8 g/ml in the three age groups agrees with that previously reported (Hill and Smith 1990) but is higher than that reported by Allen et al. (1985). Further, Hill and Smith (1990) categorized the values according to age groups and their reported values agreed with those observed in this study with the exception of juvenile values, which were higher in this study. These authors also reported significant differences in total plasma protein values between adults and calves, which were also observed in this study.

The results of this study compare well with other published work. However, most of the previously reported work involved a small number of sampled animals and no categorization was made according to age. This study has shown that major differences do occur in physiological parameters among different age groups. Therefore, pooling physiologic data of animals of different ages can complicate data interpretation and result in bias. The present study, like all studies previously reported, concentrated on collecting data from a population of elephants in the same geographic area. This could cause some bias in the findings. A study on comparison of physiologic parameters of elephants in different geographic areas and seasons should be undertaken in future.

The results in this study provide baseline data for reference of physiological and haematological parameters of different ages of immobilized free-ranging African elephants using etorphine HCl. The differences in various parameters in different age groups of elephants should be taken into consideration when monitoring neuroanalgesia during immobilization and during health assessment.

Acknowledgements

We thank the director of the Kenya Wildlife Service for allowing the publication of this work, and the Born

Free Foundation for sponsoring the translocation and supporting the publication of this article. We also thank Mr John Kariuki, Ms Else Wambui, Mr Joseph Maina, Dr Isaac Lekolool, Dr Shumpei Kambe, Dr Tom De Maar and Dr Francis Kingori for their assistance in sample collection and laboratory analysis.

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The trade in African and Asian ivory in East Asia

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Abstract

East Asia is the main destination of illegal ivory smuggled out of Africa. There is a positive correlation between elephant poaching and ivory demand. The scale of the ivory markets in this region gives an indication of the degree of demand for ivory, and therefore of the level of elephant killing needed to supply that demand. In 2002 Hong Kong displayed by far the most worked ivory for sale, but China has emerged as the largest illegal manufacturer and importer–exporter of ivory, most of it of African origin. Japan remains a relatively important market, but the size of the ivory industry has declined considerably since 1990. The ivory market of Taiwan is minor and the market is insignificant in South Korea. China and Japan are the only countries in East Asia with full-time ivory workshops. Most of China's ivory production is exported, while Japan's is bought by Japanese and remains in the country. Ivory law-enforcement efforts are improving in the region, but much more remains to be done to control the illegal movement and sale of ivory.

Résumé

L'Extrême-Orient est la principale destination de l'ivoire sorti illégalement d'Afrique. Il existe une corrélation positive entre le braconnage des éléphants et la demande d'ivoire. L'importance du marché de l'ivoire dans cette région donne une indication de l'intensité de la demande d'ivoire et dès lors, du niveau d'abattage des éléphants qui doit répondre à cette demande. En 2002, cétait Hongkong qui proposait à la vente le plus grand nombre d'objets en ivoire travaillé, mais la Chine émerge comme le plus gros fabricant et importateur-exportateur illégal d'ivoire, dont la plus grande partie vient d'Afrique. Le Japon reste un marché relativement important, mais l'industrie de l'ivoire y a considérablement diminué depuis 1990. Le commerce de l'ivoire est réduit à Taiwan et insignifiant en Corée du Sud. La Chine et le Japon sont les seuls pays d'Extrême-Orient où des ateliers travaillent l'ivoire à temps plein. La plus grande partie de la production chinoise est exportée alors que la production japonaise est achetée sur place et reste dans le pays. L'application des lois sur l'ivoire s'améliore dans la région, mais il reste beaucoup à faire pour contrôler la vente et les mouvements illégaux d'ivoire.

Introduction

We present here the results of our third survey that describes the status and trends of the ivory trade, this one in East Asia. The previous reports covered Africa (Martin and Stiles 2000; Stiles and Martin 2001) and South and South East Asia (Martin and Stiles 2002; Stiles and Martin 2002). The places surveyed for this report were China**,** Hong Kong, Japan, South Korea and Taiwan. The surveys were carried out in 2002.

The purpose of these trade surveys is to gather data on indicators that portray the scale of the ivory markets so that governments, wildlife conservation organizations and CITES representatives can appreciate the extent to which ivory is traded in selected countries. In this first round of surveys these data are compared to any existing data to assess any changes that have taken place from previous years, thus suggesting trends in the ivory markets. It is hoped that future surveys using the methodology employed here will enable standardized monitoring and assessment of country and regional ivory markets as called for by CITES Resolution Conf. 10.10 (Rev. CoP12).

Data presented in these reports will be instrumen-

tal in achieving this objective. Any changes in the trade indicators of key countries can be compared with elephant killing as signalled by the Monitoring of Illegal Killing of Elephants (MIKE) system and with ivory seizures as recorded by the Elephant Trade Information System (ETIS) to ascertain whether significant correlations occur. The data should also be useful in implementing CITES decision 12.39 on assessing internal ivory trade controls in 10 countries, including China and Japan.

The CITES policy related to elephants that is most in need of evaluation is that of permitting renewed but limited international sales of ivory. Three southern African states—Botswana, Namibia and Zimbabwe—sold ivory to Japan in 1999 and three —Botswana, Namibia and South Africa—are to be permitted to do so after May 2004 to as yet unnamed buyers.

The cities surveyed were Guangzhou, Shanghai and Beijing in China; Hong Kong; Tokyo and Osaka in Japan; Seoul in South Korea; and Taipei, Tamsui, Taichung and Kaohsiung in Taiwan.

The survey work collected indicator data: the prices of raw ivory, the number of ivory workshops and craftsmen in each city, the number of retail outlets selling ivory items, the number of ivory objects seen for retail sale and the prices of a standard representative set of worked items. Ivory not displayed openly was not counted, unless the vendor brought it out to show. The worked ivory prices came from price tags or salespersons. We give the asking price for the retail objects.

We asked each informant for the average prices of different weights of tusks of average good quality sold from the last middleman to the workshop or individual carver. We asked several informants the same question and when consistency of prices was obtained, it was accepted and reported. Details of the methodology can be found in Martin and Stiles (2003).

Results

Table 1 presents a summary of past and present ivory trade indicators in the East Asian places surveyed.

Table 1. Past and present ivory trade indicators for East Asia

Place	Year	Price/kg for 5–10-kg tusk[a] (USD)	GDP inflator index value 2002 (USD)	Workshops (no.)	Craftsmen[b] (no.)	Retail outlets (no.)	Items (min. no.)
China[c]	1985	63	94	> 20	1500	–	–
	1989	197–350	261–464	~ 15	900	–	–
	1990s	172–193	–	–	–	–	–
	2002	120–170[d]	120–170	~ 10	100–200	117	9096
Hong Kong	1960	6	30	–	1500	–	–
	1978	65	149	–	2200	–	–
	1988	180	248	–	600–1000	–	–
	2002	200–320	200–320	0	0	85	35884
Taiwan	1979	–	–	3+	10?	–	–
	1989	–	–	–	10	> 55	–
	1999	–	–	–	–	> 46	–
	2002	–	–	1	1	59	1849
Japan	1980	76	149	–	300	–	–
	1988/89	288	396	–	–	–	–
	2001/02	140–320	140–320	~ 73	~ 107	138	7565
South Korea	2002	–	–	0	0	14	36

– no data

[a] Tusks are raw. There are no data for Taiwan and South Korea because no tusks were for sale.

[b] The number of craftsmen excludes the makers of hallmarks on name seals.

[c] Estimates of the workshops and carvers are for the entire country, not just the three cities visited, because published sources in the past referred to the whole country.

[d] The weights for these prices were unknown, but the ivory was almost certainly in pieces smaller than tusks of 5–10 kg. However, since prices for them are the only recent ones available, they are included here.

Raw ivory sources and prices

CHINA

China imported legally an average of 32 tonnes of raw ivory a year from 1980 to 1989 (Martin 1988; Laurie 1989). This ivory originated in Africa. In addition, an unknown quantity of illegal Asian elephant raw ivory from Laos, Myanmar and Vietnam was smuggled overland across the border (Martin and Stiles 2002). Some illegal ivory also came from China's own few elephants in the early 1990s, but the poaching has been controlled (O'Connell-Rodwell and Parry-Jones 2002).

In 1989 Laurie (1989) estimated that China held 50 tonnes of raw ivory stocks. Caldwell and Luxmoore (1990) and Martin (1990a) stated that in 1990 the government import–export companies and ivory factories held more than 200 tonnes of ivory, most of it worked. Additional worked ivory was located in retail outlets.

Before 1990, government-owned corporations controlled the ivory processing factories and import and export of ivory. There were no privately owned ivory workshops (except individuals working secretly in their homes) and the government was the sole source of legal raw ivory.

A tusk of 5 to 10 kg sold for USD 200 to 350/kg in 1989 (Laurie 1989; Martin 1990b). In 1997 Lee and Parry-Jones (1997) reported that the main government ivory trading company was no longer selling ivory. Apparently its stocks were exhausted.

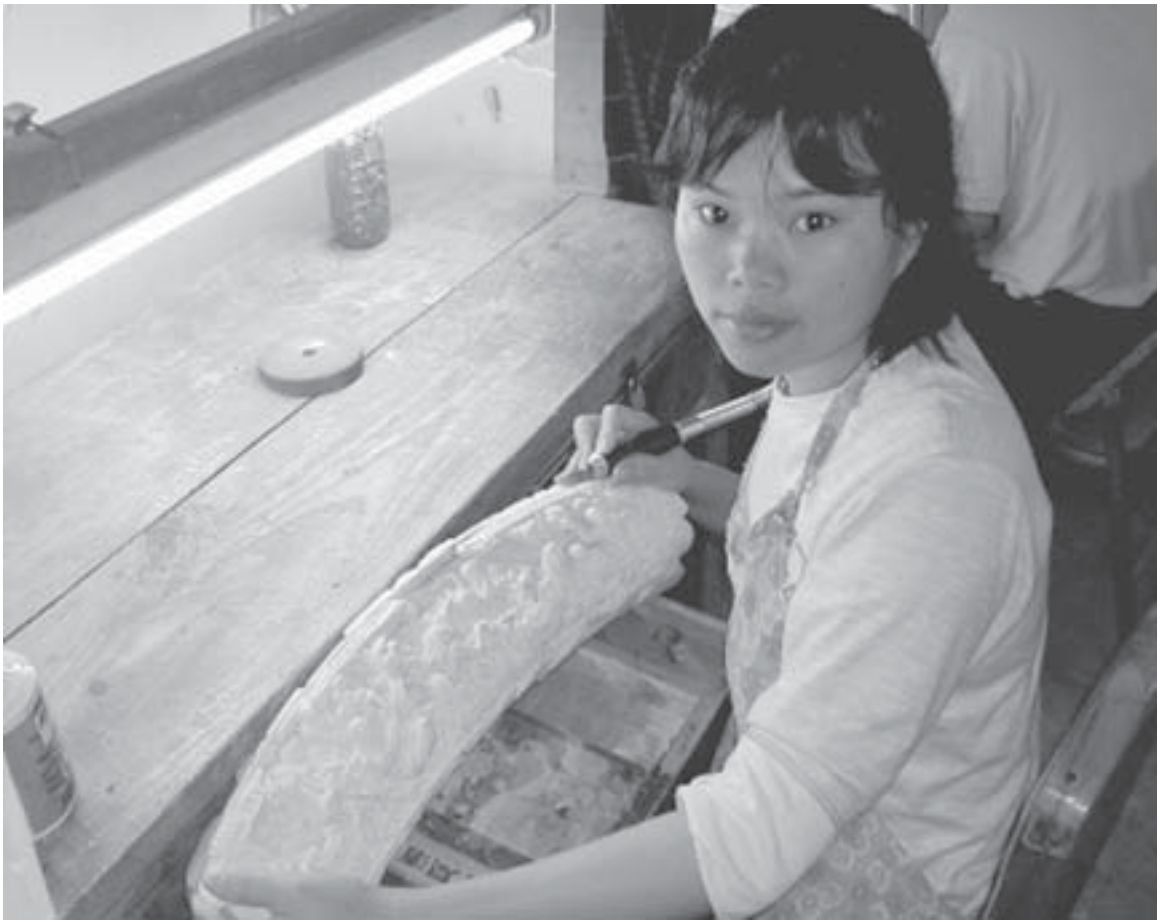
In the 1990s the average price of black market raw ivory was RMB (Chinese renminbi) 1500/kg (USD 186/kg) and Asian tusks sold for RMB 3000/kg (USD 372/kg) (O'Connell-Rodwell and Parry-Jones 2002). The 2002 price was USD 120 to 170/kg for seized raw ivory of unspecified weight (*China Daily* 10 May 2002).

The stockpiles of ivory held by private and government businesses listed in the 2002 government survey are so incomplete that no estimate of the national stockpile can be made (WWF China, pers. comm. June 2003). The China CITES Management Authority (CMA) did find, however, that since 1991 some 110 tonnes had gone missing from the national ivory stockpile. This suggests that illegal selling has taken place and the government has instigated an investigation (China CMA 2003). The results of the ivory stockpile survey showed that by the end of 2002 there were 26.15 tonnes and a further 11,012 pieces of seized raw and worked ivory held in various national and local government stores (WWF China, pers. comm. June 2003).

Daniel Stiles

Private ivory workshops in China work in assembly-line fashion. These women are painting carved items.

Daniel Stiles



High quality mammoth ivory can be as white and as well carved as elephant ivory.

The ivory processed in China in the private workshops today must be for the most part smuggled African ivory. Since the government cannot import legal ivory, and the private ivory companies are not going to admit that they are importing or buying illegal ivory, only seizure data can be used to assess new sources of raw ivory.

The raw data gathered from seizures as reported in Lee and Parry-Jones (1997), CITES (2000, 2002), the Environmental Investigation Agency (EIA 2000), the *People's Daily* (10 May 2002), O'Connell-Rodwell and Parry-Jones (2002), TRAFFIC (2002a, b), China CMA (2003) and Milliken et al. (2002a,b) indicate an increasing volume of ivory moving into China since 1996, totalling over 17 tonnes of tusks, 14.1 tonnes of unspecified pieces, 564 unweighed tusks and raw ivory pieces, about 8000 ivory items, and 11 cases containing unspecified amounts of ivory. TRAFFIC East Asia estimated that between January 1998 and September 2001 a minimum of between 30 and 45 tonnes of ivory was seized destined for or entering China (O'Connell-Rodwell and Parry-Jones 2002). The total amount of seized ivory intended for use between 1996 and 2002 in China would be roughly 40 to 50 tonnes.

TRAFFIC found 301 incidents of ivory seizures in China from other sources (Milliken et al. 2002b, table 1). The number has now grown to almost 400 (TRAFFIC, pers. comm. May 2003). China is the principal destination of seized raw ivory in the world.

HONG KONG

In mid-1989 the Agriculture and Fisheries Department, which later became the Agriculture, Fisheries and Conservation Department (AFCD), reported that Hong

Kong craftsmen and traders declared 497 tonnes of raw ivory and 168 tonnes of worked ivory (Milliken and Melville 1989). From July 1989 to July 1990, traders sold over 200 tonnes of raw and worked ivory. From July 1990 to April 2002, stockpiles of tusks and carved items, the majority of it raw ivory, fell from 463.4 tonnes to 256 tonnes (AFCD, pers. comm. 2002).

Since there were no legal exports of raw or worked ivory after July 1990, and Hong Kong Chinese bought very few ivory items for themselves, why did these stockpiles diminish so much? TRAFFIC East Asia suggested that 'the habitual use of the 5 kg personal effects exemption to carry ivory to Taiwan and Japan is of special concern and could constitute a significant means of illicit trade' (Lee et al. 1997). The AFCD (pers. comm. May 2002) said that the decline in stockpiles was due to sales within Hong Kong, loss and illicit exports.

The most likely recent export destination of tusks has been mainland China. Evidence for this smuggling is partly based on official seizures of ivory from Hong Kong destined for China.

According to two major ivory sellers, the wholesale price for raw ivory in early 2002 (registered before the CITES ban and thus legal) was around USD 200/kg for a 5-kg piece and USD 320/kg for a 10-kg piece. This compares with USD 270/kg for a 20-kg tusk in 1998 (manager, Nathan Ivory Factory, pers. comm. 1998). Since the demand for tusks is now so low there is no generally accepted price for raw ivory, and these prices are only an indication.

Daniel Stiles

This Hong Kong businessman has set up a large mammoth ivory factory in Guangzhou. Most of the output is exported to the USA and Europe, possibly reducing demand for elephant ivory.

JAPAN

Since 1990 there has been only one significant legal import of tusks into Japan, in 1999, when almost 50 tonnes were brought in from southern Africa. Since the Japanese had to pay for transport costs to Japan, the buyers claimed that the actual cost of this raw ivory was just under USD 200/kg (Japanese ivory traders, pers. comm. April 2002). Many of these tusks were sold soon after their import for an average price of around USD 244/kg, not an excessive mark-up.

Some tusks have been imported illegally, but for obvious reasons they are impossible to quantify. From 1990 to 1996 the TRAFFIC Bad Ivory Database System (BIDS) reported five seizures in Japan, two of them of raw tusks, totalling 1168.5 kg.

On 26 April 2000 the Tokyo Customs and Saitama Police confiscated 500 kg of raw ivory that had been shipped from Singapore to Kobe.

Esmond Martin

The most expensive tusks available wholesale in Japan in 2002 were those from the forest elephant weighing 30 to 35 kg and costing about USD 500 a kilogram.

Another source of tusks for ivory manufacturers is old stockpiles. The Japan General Merchandise Importers Association reported that at the end of 1989 its members held 114 tonnes in stockpiles (Kiyono 1997). A registration of tusks between June 1995 and November 1996 recorded 92 tonnes (5992 tusks). By late 1996 the stockpiles weighed 81 tonnes, but these two figures do not include all ivory stockpiles in the country, only those tusks owned by traders and intended for domestic trade (Kiyono 1997). With the legal import from southern Africa in 1999, stockpiles increased temporarily. In 2001 tusks registered by the dealers weighed 89.5 tonnes consisting of 7437 pieces (Kiyono 2002).

The Japan Ivory Association estimated the stockpiles owned by traders were around 100 tonnes in early 2002. Members believe that the annual consumption of tusks over the past few years has averaged from 10 to 15 tonnes. They buy the tusks at periodic auctions.

The wholesale price of tusks probably reached an all-time high in Japan in the mid-1990s. In late 2001 and early 2002 the average weight of a tusk sold was from 7 to 10 kg. The wholesale price for hard ivory weighing from 5 to 10 kg averaged USD 253/kg and for soft ivory USD 212/kg. A tusk weighing over 30 kg sold wholesale for about USD 504/kg. Small tusks weighing less than 5 kg were of little value.

SOUTH KOREA

Ivory stockpile figures for South Korea have never been published (Kang 1997). Between 1985 and 1990 Milliken (1991) reported there were 4.2 tonnes of raw ivory and 32.2 tonnes of worked ivory legally imported into the country. Nearly 29 tonnes of worked ivory were imported in 1989. Caldwell and Luxmoore (1990) stated that there were rumours that much of this ivory was from Hong Kong, probably intended for re-export as South Korea did not belong to CITES until 1993. Martin (1992) echoed this view. Milliken (1991), however, noted that the import-declared value implied that the weight of the 1989 ivory was actually 287 kg and not 28.7 tonnes. Export records for

South Korea do not indicate that much of this supposed ivory was re-exported in 1989; only 311 kg of worked ivory went to Japan. No South Korean ivory export statistics have been published after that.

Martin (1998) reported that in 1997 South Koreans were illegally exporting raw ivory that had come from Sudan, and Martin and Stiles (2000) were told of a Korean based in Kinshasa who was actively looking for raw ivory in 1999 in eastern Democratic Republic of Congo. A small source of worked ivory that went to shops came from students returning from trips abroad (Kang 1997). In our 2002 survey no evidence could be found that raw ivory was being smuggled.

TRAFFIC and newspapers have not reported any ivory seized going to or coming from South Korea since 1997. China reports no South Korean connection in ivory seizures between 1998 and 2001 and Japan reports none between 1994 and 1999 (O'Connell-Rodwell and Parry-Jones 2002; JWCS 2000; Sakamoto 2002). This leads to the conclusion that South Korea has ceased to be an important country for either consuming or transiting ivory. No prices for raw ivory in South Korea were reported by Caldwell and Luxmoore (1990), Milliken (1991) or Kang (1997). With no market currently, there is no price.

TAIWAN

Before 1980 Taiwan's role in the international ivory trade was modest. In the 1980s Taiwan began importing more raw ivory from Africa, stimulated by business relations with Hong Kong ivory dealers (Wang and Milliken 1989). Between 1980 and 1988, all categories combined (raw, worked and waste) of ivory imported into Taiwan totalled 231.4 tonnes. In 1987 imports spiked to almost 81 tonnes because mainly Hong Kong dealers moved ivory processing from Singapore to Taiwan after Singapore banned ivory imports and manufacturing. Demand in the Taiwan domestic market was only 1 to 2 tonnes of ivory a year, so most of the imports were re-exported. Large-scale ivory imports ceased in 1989 after Taiwan enacted ivory import curbs in 1987 and 1988 (Wang and Milliken 1989).

All raw ivory in Taiwan was registered with the government before the end of 1995 under the Supplementary Regulations for the Management of Ivory Stocks. According to the *China Times* (12 April 2000), 139 Taipei dealers registered 5101 tusks, which was probably the great majority of Taiwanese raw ivory.

Published seizure data report that all raw ivory entering Taiwan between 1991 and 2000 was of African origin (Phipps and Chen 1997; Wu and Phipps

Daniel Stiles

Very few, if any, ivory pieces are made in South Korea. These items in Seoul come from the Democratic Republic of Congo.

Daniel Stiles

Most of the ivory seen in Taiwan was found in market stalls for jade or antiques.

2002). Sakamoto (2002) reported that Singapore sold much of their raw ivory stocks to Taiwan and Japan in 1998 and 1999 and that Taiwanese ivory dealers go regularly to Singapore to buy name-seal blanks.

Up to 2000, Taiwan was an important destination for illegal raw ivory and name-seal blanks. The seizures reported to TRAFFIC between 1991 and 2002 totalled 87 incidents. ETIS found that an additional 69 ivory seizures involved Taiwan, totalling 156. Over 15 tonnes of ivory involving Taiwan were seized between 1991 and the end of 2000.

Since 2000 there have been no major seizures of ivory in Taiwan, perhaps indicating that ivory traders have ceased activities on the island in the face of increasing government vigilance.

No prices for raw ivory in Taiwan were reported by Phipps and Chen (1997) or Wu and Phipps (2002). We could find no informant who knew of raw ivory prices, and no ivory seemed to be for sale.

Ivory workhops

CHINA

Before 1990 all ivory factories were government owned. The largest in Guangzhou was the DaXin Ivory Carving Factory (ICF), with a reported 300 carvers in 1985 (Martin 1988) and 370 carvers in 1989 in two locations (Laurie 1989; Martin 1990a). The second ivory factory in Guangzhou, Yiguang ICF, had about 100 craftsmen (Laurie 1989).

In early 2000 DaXin claimed to have 50 ivory carvers (EIA 2000). TRAFFIC visited DaXin later in 2000 and reported that about 20 carvers worked there. The factory staff said that they were still using the one tonne of raw ivory they had from 1989 and that about 17 or 18 tonnes of worked ivory remained (O'Connell-Rodwell and Parry-Jones 2002). They reported to TRAFFIC investigators that they sold 30% of their production internationally. DaXin declared 11.5 tonnes of raw and worked ivory stocks to the Chinese government in late 2002 (WWF China, pers. comm. June 2003).

In 2002 the DaXin management did not allow us to visit the factory but said that 30 carvers were still employed. Other informants stated that the factory was not operating. The showrooms were open and worked ivory could be purchased.

EIA (2000) reported that Yue Ya, a private company, had an ivory workshop in Guangzhou, another in Beijing and three retail outlets in Guangzhou. In 2002 the owner of Yue Ya told us that he had closed his workshops due to a lack of raw material and business, but a vendor in his retail shop said that he still employed about 12 carvers. We found only a private one-man carving workshop on DaXin Street.

In 1985 the Shanghai Jade Carving Factory had about 120 ivory carvers and used 5 or 6 tonnes of ivory a year (Martin 1988). In 2002 we found no workshops, but EIA (2002) reported a retail outlet that sold ivory paintbrushes that were apparently manufactured in Shanghai from African ivory.

In 1985 Beijing had two large government-owned ivory carving factories (Martin 1988). The Beijing Ivory Carving Factory employed 550 carvers in 1985,

800 in 1986 and fewer than 400 in 1989. The Arts and Crafts Factory employed about 80 carvers in 1985 (Martin 1988). By 1990 the number of active ivory carvers in the Beijing ICF was down to 6. The Beijing ICF registered 3 tonnes of raw and 5 tonnes of worked ivory in 1989 (O'Connell-Rodwell and Parry-Jones 2002), although the *China Daily* in 1989 reported that the factory held 6.4 tonnes of worked ivory and 2.4 tonnes of tusks. By April 1990 the Beijing ICF had only 2 tonnes of raw ivory stock (Martin 1990a).

There were at least four other ivory workshops in Beijing in 1989, each employing 10 to 15 carvers (Laurie 1989). In 1989, therefore, Beijing had a total of 500 to 600 ivory carvers in about six factories (Laurie 1989).

In February 2001 the Beijing ICF still had over a tonne of raw ivory left and 5 tonnes of worked ivory, which means that they must have bought new stocks since 1989. TRAFFIC East Asia thought that it was the only legal ivory workshop in Beijing (O'Connell-Rodwell and Parry-Jones 2002). The Beijing ICF declared an ivory stockpile of 723 kg at the end of 2002 (WWF China, pers. comm. June 2003).

The Beijing ICF told us that they were closed at the time of this survey and several retail ivory vendors said that the company had gone bankrupt. Two informants said that the Beijing ICF was still operating, but that they were bankrupt and only made name seals now, employing only a few craftsmen. All ivory vendors asked in Beijing said that their new worked ivory came from Guangdong Province.

Ivory factories were also known in the 1980s in Fuzhou, Hangzhou, Harbin, Kunming, Nanjing, Shenzhen, Suzhou, Tianjin and Yangzhou, and there were probably others. Martin (1988) estimated that there were 1200 to 1500 ivory carvers in China processing about 30 tonnes of ivory a year in 1985.

Ivory workshops nowadays seem to be concentrated in Guangdong Province close to Hong Kong and Macau. Aside from DaXin, only one identifiable

Daniel Stiles

Ivory carvers specialize in certain items in Chinese workshops. This man crafts only swans.

Esmond Martin

Forest elephant ivory, being the hardest ivory, is used to make Japanese traditional musical instrument parts, such as bridges for the *koto.*

workshop was listed in Guangdong Province in the 2002 government survey (WWF China, pers. comm. June 2002).

Informants told of mammoth ivory factories in Fujian Province and that the artisans might also carve elephant ivory. EIA (2002) located a workshop in Tianjin that manufactured about 10,000 ivory paintbrushes a year, and informants in Beijing told EIA in 2002 of two ivory workshops in Henan Province, one in Nanyang and one in Zhengping (EIA, pers. comm. March 2003).

There seem to be no more than 30 ivory carvers still working in Guangzhou, if that, maybe one in Shanghai and about 5–10 in Beijing. There are perhaps 10 larger ivory workshops still operating in China, with fewer than 200 craftsmen, including the small family workshops (estimates confirmed by Wan Zeming, China CMA, pers. comm. December 2002).

HONG KONG

Hong Kong in the 1980s was one of the largest centres in the world for ivory production, with about 800 ivory craftsmen in 1988 (Milliken and Melville 1989). Due to the sharp decline in demand for ivory items from 1990, and the large stocks of worked ivory in many shops, by 2001 there were no full-time ivory workers left in Hong Kong and only 5 or 6 part-time ivory artisans.

JAPAN

Since the 1980s there has been a dramatic decline in the amount of tusks consumed and in the number of workshops and craftsmen using ivory in Japan. In some years in the 1980s the workshops consumed up to 300 tonnes of tusks a year, compared with 10–15 tonnes in 2000 and 2001. Excluding those people crafting hallmarks on ivory name seals (*hankos*), the number of craftsmen has decreased from 300 in 1980 (Martin 1985) to 70–120 in 2001. Tokyo had the largest number of workshops, 50, and the largest number of craftsmen, about 70, in 2001. Osaka followed with 23 ivory workshops employing about 37 craftsmen. Each workshop specialized in certain ivory items.

Over 80% of the raw ivory is used to make hankos,

but production, mostly by machine, has fallen from almost a million in 1988 (Milliken 1989) to perhaps 116,000 in 2001, due to the shortage of ivory and the decline in demand. Parts for traditional Japanese musical instruments, especially the *bachi* (a plectrum for the *shamisen*), are next in importance, consuming about 10% of the tusks used a year. Only a small amount of ivory is consumed for making statues and netsukes (ornamental toggles), but the artisans who carve them are the most skilled (and highly paid) in the world. Using mostly hand tools, they may take several months to carve a 25-cm human figure.

SOUTH KOREA

There are no previous descriptions of ivory workshops in South Korea. The only carved ivory that Milliken found for sale in 1990 was made in Hong Kong. Kang (1997) stated that there were a few ivory carvers in the country, but gave no details.

Illegal raw ivory seizures made in South Korea from the 1980s to 1997 suggest that ivory working was being carried out, and Kang saw at least one ivory workshop in 1997. The sudden end to ivory seizures after 1997 implies that raw ivory smuggling ceased and that ivory working would have stopped not long after that.

No ivory workshops were found in South Korea in this survey.

TAIWAN

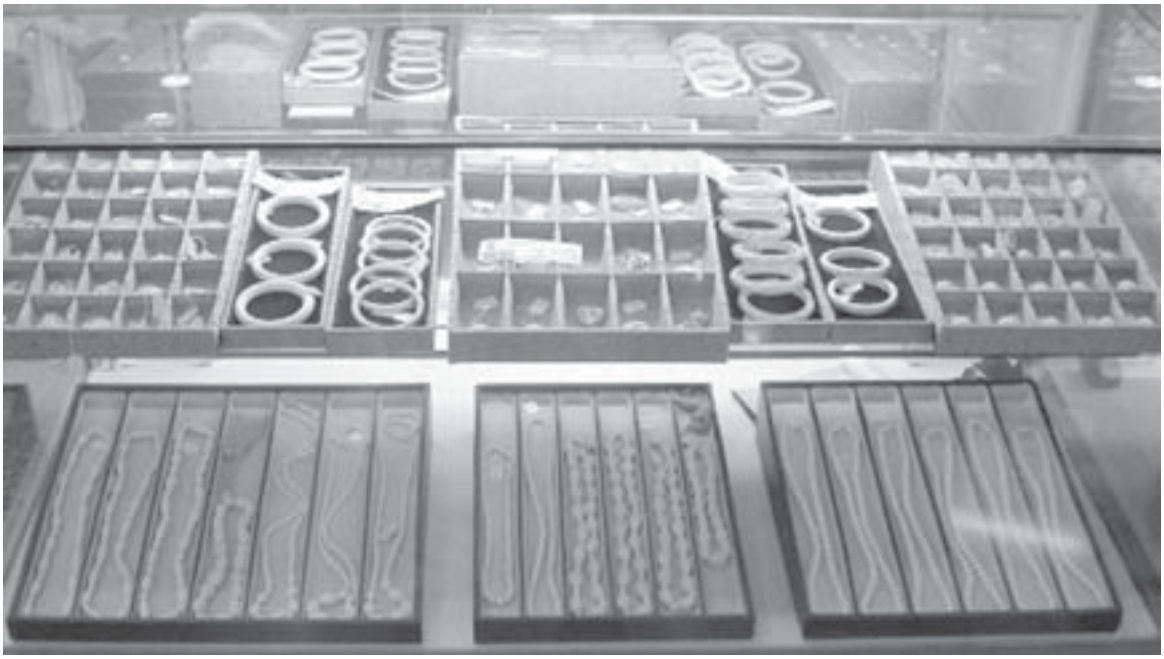
Before the 1970s only a few craftsmen in Taiwan occasionally made name seals out of ivory. About 50 to 100 ivory carvers came to Taiwan from Hong Kong in 1987 to work almost 81 tonnes of ivory that were imported that year (Wang and Milliken 1989). When Taiwan banned raw ivory imports in 1988, most of these carvers left. In 1989 only about 10 ivory carvers remained active (Wang and Milliken 1989). During the 1980s Taiwan was mainly an ivory processing and re-export locale. The USA and Hong Kong were the main wholesale destinations from 1986 to 1988 for worked ivory exports, followed by West Germany, Japan and Singapore. Worked ivory imports into Singapore were illegal after November 1986; nevertheless 4.5 tonnes from Taiwan were imported by Singapore in 1987 and 1988.

No reports mention ivory workshops in Taiwan after 1989. Much of the worked ivory sold there was imported previously from Hong Kong or China (Wu and Phipps 2002), a situation that probably increased after 1990. Taiwanese traders have been selling ivory name seals to Japan since the 1980s, and in 1990 and

Daniel Stiles

The Friendship Department Store in Shanghai had the most pieces of any single outlet seen in China, and also displayed the largest worked tusks.

Daniel Stiles



A significant proportion of African ivory is used to make jewellery in East Asia. Westerners tend to buy ivory jewellery as it is easy to smuggle home.

1994 Japanese Customs seized 12,222 of them (Sakamoto 2002).

Only ivory name seals were made in 2002 in Taiwan, according to ivory vendors and the TRAFFIC Taiwan office. Sakamoto (2002) reported that at least one carver manufactured ivory name-seal blanks in Taipei, although he usually carved cow horn. Some Taiwanese dealers smuggle the ivory name seals to Japan.

All ivory vendors interviewed during this survey said that no new ivory was being carved and that when the existing worked ivory stockpiles were exhausted, that would be the end of selling ivory. They also said that all of the former carvers were now retired.

Retail outlets and prices for worked ivory

CHINA

For past information on retail outlets in China**,** see Lee and Parry-Jones (1997), O'Connell-Rodwell and Parry-Jones (2002) and EIA (2000). None of the reports provides total numbers of ivory outlets or items on display.

This investigation found 9096 ivory items in 117 retail outlets in the three cities surveyed. Several vendors said that they had ivory stocks not on display, so the numbers reported here are a minimum. Only three African busts that could be identified as manufactured outside China were seen.

In Guangzhou, most of the 3855 ivory items we found were in and around the Jade Market, in hotel boutiques, in the DaXin ICF and in the Friendship Department Store.

From at least 1999 to 2002 the Guangzhou Trade Fair displayed carved ivory with carved jade (*China Daily* 26 October 2001; O'Connell-Rodwell and Parry-Jones 2002). The trade fair is largely aimed at exports to foreign countries.

In Shanghai, most of the 2045 retail ivory items found were in curio shops along the Fangbang Road Antique Market, in the contiguous area around the Yu Yuan Gardens, and in the Friendship Store, which with 1359 items held the most of any outlet seen in the three cities surveyed. The Dongtai Street Antique Market carried 154 small ivory items in 19 shops. The Hongqiao Airport displayed 28 ivory objects.

In Beijing, a large number of the 3196 ivory objects found were in four department stores. Five hotels displayed small amounts of worked ivory. Liulichang Street had 23 antique shops selling 1032 items, while the multistoried Hongqiao Market con

tained 183 items in 10 of its antique shops. The Panjiayuan Market had 84 objects displayed in 18 of its antique shops, with other ivory items kept out of view.

The biggest buyers of Chinese worked ivory from 1986 to 1989 were Japanese, followed by Taiwanese, Europeans and then Americans (Martin 1988, 1990a; Laurie 1989). In the 1980s local Chinese bought very little ivory (Martin 1988; Laurie 1989). Lee and Parry-Jones (1997) stated that the main buyers were tourists and that Chinese citizens seldom bought ivory.

In 1999 Leung (O'Connell-Rodwell and Parry-Jones 2002) reported that the main buyers in six cities in China were, in order, from Japan, China, Hong Kong, Taiwan and Thailand. From Europe, the main buyers were from Italy, Spain, France and England. By 2001 O'Connell-Rodwell and Parry-Jones (2002) thought that Chinese nationals had become the main retail ivory buyers.

In 2002 retailers told us that worked ivory buyers were mainly foreign Chinese and Japanese. In spite of the economic boom in China over the past decade, the average yearly per capita income in the three richest cities (Guangzhou, Shanghai and Beijing) was still under USD 3000 (*Shanghai Star*, 4 April 2002). Worked ivory is expensive in China and is well out of the reach of the average Chinese citizen, but the newly rich local Chinese are increasing their ivory buying and can be expected soon to eclipse foreigners.

HONG KONG

With 35,884 ivory items for sale in 85 outlets, Hong Kong retail shops had by far the largest number in any city in East Asia and also in Africa. In South and South East Asia only Bangkok and Phayuha Kiri had a few more. In Hong Kong, 14 ivory specialty shops had the great majority with 24,446, followed by 8 department stores with 7571 items. The most frequently seen were jewellery (43%), netsukes and figures (30%) and name seals (13%).

Japanese were the main customers, especially for netsukes, name seals and chopsticks. Europeans and Americans were also prominent buyers, for jewellery in particular. Retail prices are very competitive in Hong Kong. A bangle 1 to 1.5 cm wide was priced at USD

Esmond Martin

In Hong Kong, large mammoth ivory items such as this group of polar bears (labelled at the equivalent of USD 61,500) were being offered at half price in 2002 due to very slow sales.

23–44, the cheapest in this survey, as were small bead necklaces (USD 23–71) and chopsticks (USD 18–86).

JAPAN

In Tokyo, this survey found 96 retail outlets with 5358 ivory items for sale in early 2002. Of the different sorts of outlets, seven ivory specialty shops displayed the most: 2362; next were nine gift shops with 1524. The most commonly available were jewellery (28%), human figures (14%) and good luck charms (13%).

Osaka had 42 outlets displaying 2207 ivory items. One of these outlets, an ivory specialty shop, carried almost half. Name-seal shops followed, as Osaka is Japan's centre for hanko making. Name seals were the largest number of items on sale (44%), unlike in Tokyo, where they were the fourth most common ivory item.

It is the Japanese who buy almost all the ivory objects, because the prices are high compared with prices in other countries and some of the designs appeal only to the Japanese consumer. For example, in 2002 an average-size ivory name seal (1.5–2 x 6 cm) cost USD 144 to 488 compared with USD 15 to 112 in Hong Kong. A human figure (9–10 cm) cost USD 1600 to 8000 compared with USD 305 to 1463 in China.

Esmond Martin

This 28-cm high newly carved Japanese *jizo* (a bodhisattva) was priced at USD 65,000 in 2002, hence production and sales of such figures are extremely low.

SOUTH KOREA

Milliken (1991) found small quantities of ivory from Hong Kong for sale in a few shops in Seoul and Busan. Kang (1997) reported that 90% of the worked ivory sold in the country was in the form of name seals. Kang said that Seoul's black market displayed a few ivory name seals and trinkets. Kang (pers. comm. October 2002) said that in Seoul in 1997 she had seen a wholesale shop stocked with large quantities of ivory and two other shops with ivory in the Namdaemun Market.

In 2002 we found 14 outlets displaying 36 ivory items, especially in antique and gift shops. There were 13 name seals.

Vendors said that Koreans occasionally bought only a name seal. Other buyers are not known, as ivory sales are rare today.

TAIWAN

Wang and Milliken (1989) reported that there were more than 50 ivory retail outlets in Taipei and about 5 in Kaohsiung in 1989. They were geared towards tourists, and Japanese and Americans were the main buyers. Informants in China reported in 2002 that Taiwanese buy large items in China to carry home for themselves.

Wu and Phipps (2002) in 1999 found about 40 retail outlets selling ivory in Taipei, 4 in Tamsui, more than 6 in Taichung and 14 in Kaohsiung. They found some outlets that had sold ivory in 1997 (Phipps and Chen 1997) had stopped by 1999, and some vendors were complaining about declining ivory sales.

We found 1832 ivory items in 59 retail outlets in the four cities visited. In Taipei, 24 out of 36 ivory retail outlets found were stalls in the Antique Market.

In Tamsui we found only 17 ivory items, in Taichung 242 items were in the Lienmei and Wenhsin Jade Markets, and in Kaohsiung 329 items were mostly in the Shihchuan Jade Market.

The main buyers in the gift shops in Taipei were foreign tourists and businessmen, mainly Japanese and other Chinese. Prices for Taiwanese-worked ivory are cheaper than those in Japan and Singapore and comparable to those in China and Hong Kong. Taiwanese are the main ivory buyers in the antique and

jade markets, but resident and visiting foreigners also shop there. Westerners rarely buy ivory, and when they do it is usually a jewellery piece or small figurine. The main buyers in Tamsui, Taichung and Kaohsiung are Taiwanese.

Discussion

Law enforcement efforts in East Asia

China is the worst offender in the region for dealing in illegal ivory (Milliken et al. 2002a). We found in our survey in South and South East Asia that 'by far the largest amount of the foreign worked ivory in the countries visited is from China' (Martin and Stiles 2002). The great increase in ivory seizures since the Chinese State Forestry Administration 2001 *Notification 2001/234,* however, suggests that China is becoming more aware of the problem and is taking action. The China CMA (2002, 2003), TRAFFIC (pers. comm. May and June 2003) and WWF China (pers. comm. June 2003) all report that the Chinese government has been taking steps since 2001 to improve its ivory monitoring and enforcement activities.

Hong Kong traders contribute to the illegal ivory trade by organizing smuggling tusks from Africa to East Asia (EIA 2002). Raw ivory moves illicitly into China and worked ivory from there into Hong Kong. Tourists buy small items to take out of Hong Kong illegally.

Controls on the ivory industry within Japan are well regulated (Milliken et al. 2002a) and are the strongest in the region. Overall, government officials check the industry, and ivory traders have their own voluntary controls. However, moderate quantities of ivory have been seized on their way to or within Japan from 1996 to 2001 (Kiyono 2002). EIA (2002) and the Japan Wildlife Conservation Society (Sakamoto 2002) present evidence that a Singapore–Japan connection for illegal African ivory is larger than previously thought. For example, in mid-2002, 6.2 tonnes of ivory, including 40,000 name-seal blanks, were seized in Singapore, apparently destined for Japan (EIA 2002).

In South Korea, there has been no recent need for increased law enforcement as there are no major illegal ivory movements.

Taiwan has been cracking down on the ivory trade since 1995 with new laws and better enforcement. The number of ivory seizures has fallen in the country, and there has been no decrease in vigilance.

Esmond Martin

Ivory traders hold an annual celebration of the elephant at the Goko-Ku-ji Temple in Tokyo.

Sources and movement of tusks in East Asia

Chinese traders have been smuggling into China the largest quantity of tusks in the region since the mid-1990s. TRAFFIC estimates that from January 1998 to September 2001 'a minimum of 30 to 45 tonnes of ivory were seized destined for or entering China' (O'Connell-Rodwell and Parry-Jones 2002), and the present study has documented 40 to 50 tonnes seized between January 1996 and mid-2002. Almost all of it originated from Africa (CITES 2002; Milliken et al. 2002a; EIA 2002).

In Hong Kong it is unlikely that significant quantities of tusks have been recently smuggled in for the local market because there are still large stockpiles of tusks. There have been 375 seizures of raw and worked ivory weighing 13,574 kg destined for Hong Kong or seized within Hong Kong from 1990 to mid-2002 (Milliken et al. 2002b). The biggest haul of illegal tusks in 10 years, some 2 tonnes, was made in October 2003, originating in Tanzania (*South China Morning Post*, 15 October).

Several recent attempts have been made in Japan to import tusks and roughly made hankos illegally, the largest shipment known being the 6.2 tonnes confiscated in Singapore in 2002 (EIA 2002).

Few, if any, tusks appear to be entering South Korea because there are no craftsmen and no market for ivory items. From 1998 to 2002 no ivory was confiscated.

Taiwan appears to have been an entrepôt for tusks going to China. The ETIS report (Milliken et al. 2002a) postulates that tusks originating in Africa are shipped to Taiwan and then sent on to China. At least 6152 kg were seized by the Customs authorities in Taiwan from 1994 to May 2000 (Wu and Phipps 2002). No seizures were made in 2001 or 2002.

Movements of worked ivory in East Asia

In China there are wholesale illegal bulk exports to Asian, European and American markets, and tourists and businessmen buy personal items to take home. Some countries allow small quantities of carved ivory to be imported and exported for personal, non-commercial use, and ivory antiques with proper documentation are allowed into many countries. Bulk exports are often falsely described as mammoth ivory, hippo teeth or bone, or the items are hidden among other export products in sealed containers. The Humane Society of the United States uncovered many contacts among Hong Kong business people, ivory workshops located in China and markets in the USA (HSUS 2002).

For Chinese-worked ivory, Hong Kong and Taiwan have been both entrepôts for wholesale items and retail markets supplying foreign visitors. There are also dealers from the USA, Israel and Europe who buy ivory in Hong Kong to carry back to their home countries (HSUS 2002).

Japan and South Korea are not sources of significant movements of worked ivory across their respective borders.

Effects of the CITES 1999 auctions and views on reopening trade

Ivory industry personnel in China, Hong Kong and Taiwan did not believe that the 1999 southern African ivory auctions had a significant effect on either internal or external ivory demand. Most ivory vendors questioned were aware of the auctions and knew that the southern African ivory went to Japan. They did not feel that the renewed sales were relevant to their business. Japanese ivory vendors did not report any increase in business after the 1999 auctions.

The effects of the 1999 auctions and the future auctions approved by CITES at their 12th Conference of the Parties in November 2002 can best be assessed by repeat ivory trade surveys using the same indicators employed in this report in 2005 and 2006.

Ivory vendors in China, Hong Kong and Taiwan do not believe that CITES will ever approve the renewed international trade in ivory for their industries. Most ivory personnel seemed resigned to a collapse of the ivory industry, and they were already taking steps to carve or sell substitutes, or to change their business completely.

Japanese ivory industry workers believe that international ivory sales to them should be continued. Many thought that there was no crisis concerning African elephant populations and that some conservationists and the media had misrepresented the situation.

Conclusions

The main findings were the following:

- Over 54,000 ivory items were seen in 413 retail outlets in the 11 cities visited.
- Hong Kong has the most, followed by China and then Japan. South Korea and Taiwan have small quantities of worked ivory.

- Japan has the most active legal ivory carving industry in East Asia. Most ivory is used to make name seals (~80%), followed by musical instrument parts (10%).
- Almost all Japan's worked ivory is bought locally and stays in Japan.
- The most expensive raw and worked ivory is in Japan.
- China is the main ivory manufacturing centre in Asia. Often with the involvement of Hong Kong businessmen, smuggling rings import African ivory, process it, and re-export it through Hong Kong. China is also the only country in East Asia that has more worked ivory retail outlets now than in 1990.
- China has the largest illegal ivory industry in East Asia and was the main destination of illicit African ivory. Small private ivory workshops have replaced the larger government-owned factories since 1990. These are unlicensed to deal with ivory and are therefore illegal.
- Both South Korea and Taiwan are primarily transit or processing and re-export centres for ivory, or both, in the 1980s and 1990s. Today the ivory industry of South Korea is dead and Taiwan's is dying.
- The internal ivory markets of all the countries surveyed, except China, have declined considerably since the 1990 CITES ivory ban. The number of ivory craftsmen has plummeted in East Asia from about 2200 in 1989 to fewer than 300 in 2002. Hong Kong, South Korea and Taiwan have no full-time ivory carvers.
- The main buyers of East Asian–worked ivory are ethnic Chinese of various nationalities and Japanese. Europeans and Americans also continue to buy Asian–worked ivory. China nationals have been increasing their share of ivory purchases since 1990 as their economy grows.
- The CITES-approved raw ivory sales to Japan from southern Africa in 1999 are not seen as important to ivory dealers outside Japan. Non-Japanese interviewed do not think the sales heralded a relaxing of the international ivory trade ban. Most ivory business people are pessimistic about the future of the industry.
- In recent years East Asian governments have begun to pay more attention to controlling the ivory trade. China and Taiwan, in particular, have introduced new laws and have increased their efforts to stop illegal ivory imports and to prosecute smugglers.
- East Asian governments need to do more to control the ivory trade effectively and to implement recommendations made in CITES Resolution 10.10 (Rev. CoP12) and CITES Resolution 12.39.

The main conclusions are that the ivory markets of East Asia have declined considerably in volume since the CITES ivory trade ban that came into effect in 1990, but China shows signs of a growing internal market due to increasing economic prosperity in the country. Raw and worked ivory smuggling continues, with China the main instigator, followed by Hong Kong and Japan.

Acknowledgements

We would like to thank the following who financially supported this study: Born Free Foundation, Care for the Wild International, Friends of Howletts and Port Lympne, Phipps Foundation, Save the Elephants, Robert and Toland Sheriff, the Humane Society of the United States, and the US Fish and Wildlife Service.

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HISTORY

The last white rhinoceroses in Zimbabwe

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Abstract

Robert Coryndon shot two adult male white rhinoceroses (*Ceratotherium simum simum*) in northern Zimbabwe in 1893 for museum purposes, commissioned by Lord Walter Rothschild. The mounted hide of one of these specimens was added to Rothschild's museum in Tring and its skeleton was purchased by the Museum of Zoology of the University of Cambridge. Both skin and skeleton of the second specimen were added to the collection of the British Museum (Natural History) in London. As the species was considered to be on the verge of extinction, these white rhinoceroses created much interest among the educated public in England during the last decade of the 19th century.

Résumé

Robert Coryndon a tiré deux rhinocéros blancs mâles adultes (*Ceratotherium simum simum*) dans le nord du Zimbabwe en 1893, à la demande de Lord Walter Rothschild, pour un musée. La dépouille empaillée d'un de ces spécimens a été ajoutée à la collection du musée des Rothschild à Tring, et son squelette fut acquis par le musée de zoologie de l'Université de Cambridge. La peau et le squelette du second spécimen furent ajoutés à la collection du British Museum (Histoire naturelle) de Londres. Comme on considérait que l'espèce était au bord de l'extinction, ces rhinocéros suscitèrent beaucoup d'intérêt chez le public anglais cultivé pendant la dernière décennie du 19ème siècle.

Setting the scene

On 2 July 1892, the well-known paleontologist and zoologist Richard Lydekker (1849–1915) contributed an article on the general natural history of the African species of rhinoceros to *The Field*, the leading weekly magazine of the time for the country gentleman in England. Without elaborating about his sources, he lamented that the white rhinoceros, *Ceratotherium simum simum* (Burchell, 1817) occurring south of the Zambezi River, was hunted on such a scale that 'its destruction is but a matter of time, even if still unaccomplished' (Lydekker 1892). No example had ever been shown in a zoological garden, and material in English museums was very scarce, consisting of four skulls in the British Museum (Natural History) in London, one skull with horns in the Museum of the Royal College of Surgeons of England, also in London, and a stuffed head and skull in the Free Museum in Liverpool. The Zoo-

logical Society of London had made enquiries as early as 1882 to obtain a living white rhinoceros for their zoological gardens, but had been made to understand that any chance of capture was small indeed (Lydekker 1892).

First described in 1817 by the British explorer William John Burchell (1781–1863), the white rhinoceros had been hunted to near-extinction just 70 years later. The famous hunter and author Frederick Courteney Selous (1851–1917) had roamed the hunting grounds of southern Africa for about 10 years when he wrote his best-selling masterpiece, *A Hunter's Wanderings in Africa* (1881a). According to Selous, in 1878 and 1880 the white rhinoceros was still 'fairly numerous' between the Umniati and the Hanyane Rivers in north-eastern Mashonaland (Zimbabwe), while by 1879 it had disappeared from the area between the Chobe and the Botletlie Rivers (Botswana). As the known range was very limited, he predicted that 'their extermination in this portion of the country may therefore, I am afraid, be expected within a very few years' (Selous 1881a: 191–192). While Selous chose his words very carefully, his readers in England should be excused for concluding that the disappearance of the white rhinoceros was imminent. That certainly was the impression gained by the hunter-naturalist Henry Anderson Bryden (1854–1937), who travelled to Africa in 1890. In *The Field* of 16 July 1892, Bryden thanked Lydekker for his interesting comments, which were 'for naturalists full of melancholy interest' as the animal was 'now unhappily extinct, or all but extinct' (Bryden 1892). When Selous saw this article a few months later, he had to set the record straight, which he did in a letter written on 4 November 1892 in Cape Town and published in *The Field* on 26 November:

> I will take the opportunity of saying that I have never stated that the white rhinoceros was extinct, although I have often lately seen myself quoted as having done so. What I have said, and what I still say, is that this most interesting animal, the largest of terrestrial mammals after the elephant, is on the verge of extinction. (Selous 1892).

He estimated that in Mashonaland (now the northern part of Zimbabwe), there could still be 10, up to 20 perhaps, of these animals left. Another one or two had recently been reported in the Limuga, which is the country between the Umfuli and the Umzweswe Rivers, situated in the general region of Kadoma, 130 km south-west of Harare. He added some news:

> I have just heard from a reliable source that one of these animals (a female) has been killed lately about 100 miles NW of Salisbury, Mashunaland. This animal was one of six that were consorting together, and the two gentlemen who shot it—Messrs Eyre and Coryndon—have, I believe, preserved the skin and skeleton. (Selous 1892)

While Selous was acquainted with both Arthur Eyre and Robert Coryndon, his knowledge of their hunting feat was second hand, because he had left Salisbury in the middle of 1892 and was on his way back to England.

In this paper, I will trace the history of these events in 1892 and the subsequent commission to procure other specimens of the white rhinoceros in 1893. I have been able to use three collections of mainly unpublished papers. First, the Bodleian Library of Commonwealth and African Studies at Rhodes House in Oxford preserves the private papers of Robert Coryndon (documented by Gates 1966), which includes a scrapbook and a map relating to the hunt of the rhinoceros (MSS Afr. S 633, Box 12), referred to as 'MSS Afr'. Secondly, the correspondence of Lord Lionel Walter Rothschild (1868–1937) preserved in the archives of the Natural History Museum, London, contains a few letters by Coryndon, referred to as 'Rothschild Archives'. It may be noted that most of the papers relating to the life of Rothschild have been destroyed in the course of time (Rothschild 1983: 296–301). Thirdly, the Museum of Zoology at the University of Cambridge has seven bound volumes of historical documents relating to their acquisitions until 1910, which contain newspaper cuttings and correspondence about the purchase of the white rhinoceros (History, vol. 3, items 138 to 167), previously mentioned by Rothschild (1983: 167–169) and referred to as 'UMZC'. The main localities mentioned in the text are shown in figure 1.

An unexpected encounter in 1892

Robert Thorne Coryndon (1870–1925), brought up in the South African diamond town of Kimberley, loved the outdoors and spent much of his time and money on horses, dogs and guns (Youé 1986). At the end of 1889 he was among a dozen young men re

Figure 1. Map of Zimbabwe showing places mentioned in the text.

cruited by Cecil John Rhodes (1853–1902) to escort the pioneer column of new settlers to Rhodesia. Guided by Selous, they halted near Mount Hampden in Shona country in September 1890, where they founded Fort Salisbury (now Harare), initially a collection of mud shelters and thatched huts. Coryndon accepted a position in the personal clerical staff of Archibald Ross Colquhoun (1848–1914), the first resident commissioner of Rhodesia. He spent the next 17 years in the service of the British South Africa Company, moving from surveyor to Rhodes's private secretary to administrator of North-Western Rhodesia.

When Coryndon read the announcement in the open letter written by Selous (1892) about his hunt of the white rhinoceros, he wrote a full report about the events dated 23 January 1893, which was published in *The Field* of 20 May (Coryndon 1893). According to Coryndon, he was among a company of men returning from the Zambezi River to Fort Salisbury at the end of August 1892, together with Arthur Eyre and A.M. Graham. Although he did not provide a more precise locality, he seems to have been about halfway between Zumbo and Harare. Selous (1881b) had been in the same general region along the Umfuli River in July 1880 and had reported spoor of rhinoceroses as well as the presence of the black rhinoceros, *Diceros bicornis* (Linnaeus, 1758). Coryndon and his party unexpectedly sighted some rhinoceroses in the distance, and upon investigation these turned out to be a male, a female and a small calf of the white species. Although they fired a number of shots, none were fatal and the animals got away. Following the spoor during the afternoon, they lost the two adults, but they

had mortally wounded the calf by mistake and it died. Continuing their search early the next morning, they came across another female white rhinoceros accompanied by a half-grown animal and a small male calf. When Eyre shot the mother, the older calf disappeared into the bush, but the young one remained at her side. The latter was caught, put in a kraal, given piles of grass to eat and plenty of water to drink, and named 'Sloper'. Despite all care, Sloper died on the eighth day, 'apparently of a broken heart' (Coryndon 1893).

These events were confirmed by William Harvey Brown (1862–1913), who wrote about hunting big game in Mashonaland in a book of 1899. After shooting a black rhinoceros in the vicinity of Sinoia between the Angwa and Hanyani Rivers in September 1892, he accepted an invitation by Arthur Eyre and his brother Herbert to try his luck in the fly-infested country to the north. Brown arrived at their camp in Tchininga's (Chininga) in the evening of 24 September 1892. He found the party at work on the skin and skeleton of a female white rhinoceros and heard about the unfortunate fate of the calf Sloper (Brown 1899: 226). According to Brown, Eyre again tried to shoot a male white rhinoceros between 30 September and 3 October at Mount Domo, just north of Chininga, but failed. It is quite likely that Mount Domo was the place where the mother and calf had been shot. Although Brown stated that Eyre was preserving the remains as museum specimens, there is no trace of them. Coryndon (1893) gave the impression that they were able only to rescue the skull of the young one called Sloper and the skin and skeleton of his mother, which 'formed good loads for twelve boys.' Selous (in a letter to Dennis Lyell of 1906, printed in Lyell 1935: 8) later assumed that the skin had gone bad.

The commission of 1893

In England, Lord Lionel Walter Rothschild (1868–1937), the second Baron Rothschild of Tring, had opened his private menagerie and museum of natural history at his Tring estate to the public in 1892, when he was 24 years old. His collection had been his passion from at least the age of seven and he was to continue this interest throughout his life, buying specimens on the market and sending out collectors to various parts of the globe (Gunther 1975: 417; Rothschild 1983). We can easily imagine Rothschild perusing his copy of *The Field* at the end of November 1892, reading the letter by Selous, and wishing that he would be able to obtain the remains of the white rhinoceros shot by Coryndon and Eyre. He knew that this was going to be his last chance ever to add this great prize to his collection. Rothschild could have enquired at the London office of the British South Africa Company, or written to people in Salisbury, or discussed the matter with Selous, who had landed in Southampton just before Christmas 1892 (Taylor 1989). In any case, Rothschild approached Coryndon in an attempt to procure the white rhinoceros, but was informed that the specimens shot in August 1892 were not available. Coryndon was confident, however, that he could take leave to track down another one for Rothschild. While this exchange of letters during the first half of 1893 has not survived, it is certain that Coryndon set out from Salisbury in the first week of June 1893 hoping to shoot a white rhinoceros for Rothschild's museum in Tring. Rothschild was not the only one desiring to possess this rare rhinoceros. On 1 June 1893, Sidney Frederic Harmer (1862–1950), since 1892 superintendent of the Museum of Zoology in Cambridge, wrote to Coryndon on behalf of the museum with a similar request, but his letter arrived too late. In Coryndon's absence, it was opened by H. E. Caldecott, who replied from the Office of the Public Prosecutor in Salisbury on 17 July 1893:

> Mr Coryndon received a commission some little time ago to procure an adult skeleton of the white rhinoceros for Lord Rothschild, and he left Salisbury for that purpose about six weeks ago. He is going in the direction of the junction of the Umniati and Zambesi Rivers, and expects to be away about six months. . . . I do not fancy he would sell a white rhinoceros skeleton with skin &c. complete (if he got more than one) for less than £250 or perhaps £200. (UMZC 3: 138)

Soon after his return to Salisbury three months later, Coryndon sat down and wrote a letter to Rothschild, which is reproduced here, as it contains the most immediate reflections on the expedition. Dated Salisbury, Mashonaland, 3 September 1893, Coryndon wrote as follows:

> Sir, I have great pleasure in reporting the success of my expedition; I have shot and preserved two fine white rhinoceros bulls. I left camp in the beginning

of June and proceeded to the rhinoceros country, & there made a big camp & proceeded to look for spoor and to examine the country thoroughly. It was very evident that there were still one or two more of the animals left and about a week after I had formed camp, I found the two bulls. After a short stalk I got up to them & shot them both, using a double 10 bore Paradox gun—this was about four o'clock in the afternoon, so that the sun had set some time by the time I had gone to camp, got the loads and formed another camp by the dead rhinoceroses; I explain this because by next morning the bodies had swelled up considerably & stiffened so that it was a matter of great difficulty getting the few measurements I have; I succeeded besides in getting several photos with a small hand camera and some sketches which will be of considerable use to the taxidermist. The skinning & preserving of the two rhino at once was a severe & unpleasant piece of work; I used arsenical soap plentifully for the skins together with a good deal of powdered burnt alum, the bones I had carefully cleaned, tied up in bags and labelled. Upon my arrival in camp I consulted Mr Duncan, the acting administrator during Dr Jameson's absence in Victoria, and we decided that the best thing to be done was to have the skins & bones properly & safely packed and stored carefully here; and in view of the difficulty that would be experienced in setting up a rhinoceros skin merely from indistinct photos or sketches, and as I will have to go to England myself when the first of the Matabili campaign is over, I offered Mr Duncan to bring the skins & bones home myself rather than trust them to the usual heavy goods transport. Besides that, it is not safe to send anything home along the Tuli Road in the present state of affairs, the risk of it being interrupted & destroyed is far too great. I have to state with regard to the second rhinoceros that a hyaena got into my camp one night and succeeded in tearing open a bag in which were tied up the small bones of the two fore legs and the tail; these bones were scattered about in the morning; I was exceedingly careful however in collecting them and do not think that more than three or four of these bones are gone, the hyaena also gnawed away a small shoulder of one of the large knobs on one of the large bones of the fore leg. Should you be willing to purchase the second rhinoceros I would suggest the price I mentioned in my first letter, viz. £500 clear for both rhinoceroses; should you however be unwilling to purchase it I may mention I have several other offers. The day after tomorrow I leave here for Matabililand with the column and I shall take the first opportunity that offers itself to return to Salisbury, repack the bones and leave for England; I am convinced that from my intimate acquaintance with the white rhinoceros I can be of material service to your taxidermist & shall be happy to give you any help in my power. In the meantime, as my contract with you is complete and as I have handed the rhinoceroses to the Company as instructed, I shall be obliged if you would credit me with the sum of £250; the matter of the second rhinoceros may I think rest until I arrive in England. With regard to my expenses, I have drawn up a complete statement showing all expenses in detail and with all receipts attached which I shall show to Mr Duncan and take with me to England. I ought to have said that I have drawn the sum of £50 from Mr Duncan on account. I regret that I have been unable to procure for you any specimens of butterflies or insects as owing to the Matabili scare my trip was cut very short. (Rothschild Archives)

Coryndon had shot two adult male white rhinoceroses and preserved their hides and skeletons. His notes with measurements, sketches and photographs done on the spot have not been found again, with the exception of a rough sketch of the heads published in *The Field* of 14 April 1894 (fig. 2). Having returned to Salisbury with the trophies at the end of August 1893, he joined a volunteer burgher force under Major P.W. Forbes in the Matabele campaign and left Salisbury on 5 September 1893 (Fox 1915). The conflict was brief and ended with an encounter at Bembisi on 1 November 1893, which Coryndon described in the *Illustrated London News* for 17 March 1894 (Youé 1986: 13–14). Although the precise actions taken by Coryndon afterwards are unknown, he probably went to Salisbury, where he found that the remains of the rhinoceroses had been packed and sent off, and continued to travel to England, arriving in February or March 1894. Selous had also been back in Africa to fight in the campaign against the Matabele and returned to England in time to marry Gladys Maddy (1874–1951) at Down Hatherly, near Gloucester on 4 April 1894 (Millais 1919: 205, Taylor 1989: 222). Coryndon may have been among the guests, because he knew Selous from the days of Rhodes's pioneer column and had tried to emulate his skills in big game hunting. (Youé 1986: 12)

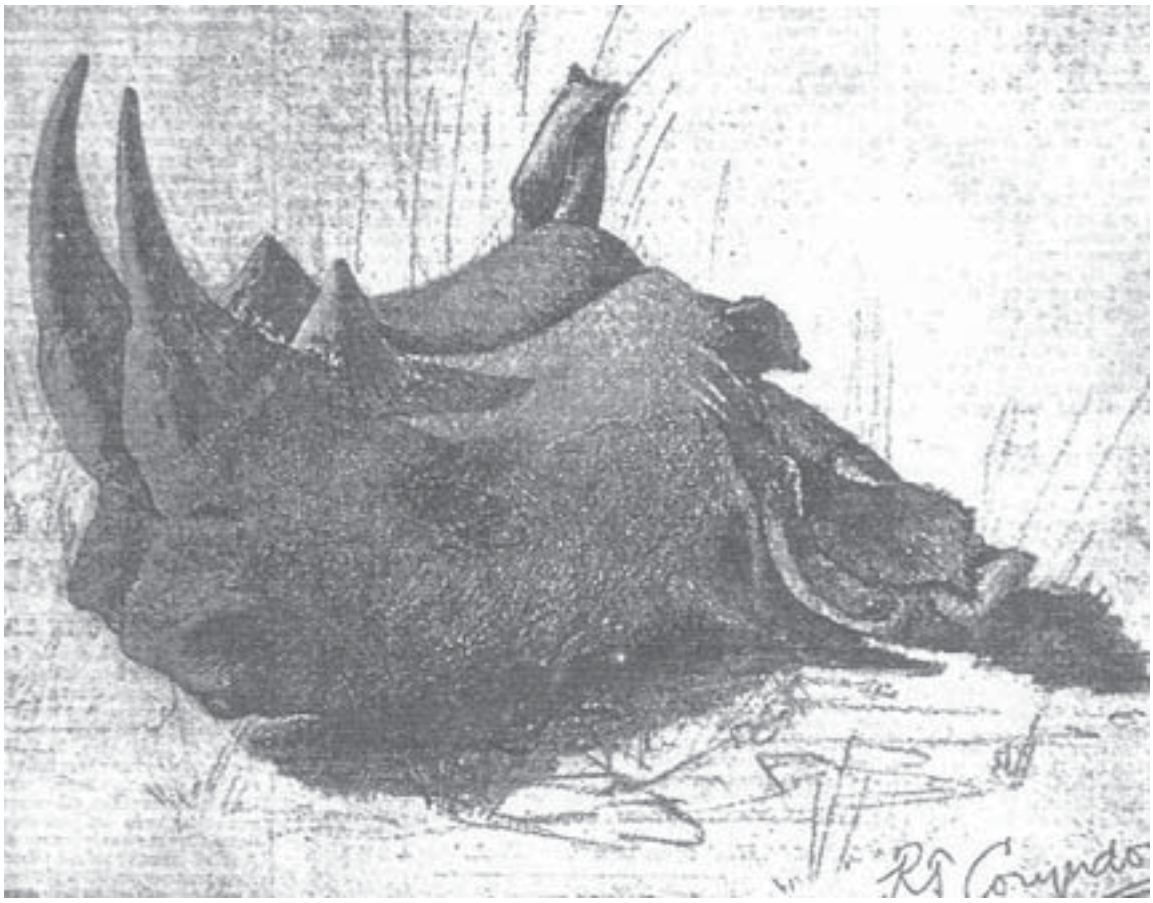

Figure 2. Heads of the white rhinoceroses shot in July 1893 sketched by Robert T. Coryndon, published in *The Field*, 14 April 1894.

Arrival of the white rhinoceroses in England

Meanwhile, Walter Rothschild had been happy to receive Coryndon's letter of 3 September 1893. When he wrote Alfred Newton (1829–1907), professor of zoology at the University of Cambridge, on 17 October, he announced in a postscript that 'a friend of mine has just killed & preserved for me two old bulls with their skeletons of the White Rhinoceros (*Rhinoceros simus*), the first entire specimens ever preserved' (UMZC 3: 139). It is unlikely that Rothschild was aware that Sidney Harmer had tried to obtain a white rhinoceros from Coryndon just a few months earlier. Newton immediately grasped the significance of this unexpected opportunity to add the rarest large mammal to the collection of the Museum of Zoology in Cambridge, and enquired by return of mail (19 October 1893) if Rothschild was amenable to parting with one of the specimens: 'What are you going to do with the second one, for you can't wish to keep two? Perhaps you will give it to us?' (UMZC 3: 139A). Rothschild good-heartedly replied on 20 October 1893:

> As to the 2nd *Rhinoceros simus*, I should be delighted to hand it over to you, but till my friend Mr Coryndon comes home, I cannot dispose either of the two skeletons or the stuffed specimens. I certainly shall only keep a stuffed specimen, but I paid half expenses (£250) & know that as Coryndon is a poor man, he will want to make up £250 (the other half) out of the 2nd *R. simus*. There are only 5 others left in the herd & that is the only remains of a gigantic mammal of which in 1875 one could still have killed 30 to 40 in a day. (UMZC 3: 140)

The price of £250 for a white rhinoceros was quite a sum of money at that time, when we compare it with the 6 pounds 18 shillings Rothschild paid for a 10-volume set of Buffon's *Planches Enluminées* with 1008 hand-coloured plates (still present in the library of the Zoological Museum at Tring). Newton, however, was willing to make every effort to secure one of the rhinoceroses if one would become available (UMZC 3: 141). On 8 December 1893, Rothschild informed Newton (UMZC 3: 143) that the boxes containing the hides and bones of the two white rhinoceroses had just arrived at Tring. He had heard that Coryndon had sold one complete animal, skin and skeleton, to the British Museum (Natural History). As Rothschild was interested only in keeping the hide to be mounted, he offered Newton the skeleton of that animal for £150, supposedly a bargain price, because three or four caudal vertebrae were missing and a boss on the thigh bone was smashed by a bullet. Newton never hesitated and on 12 December accepted 'the offer of the skeleton of *Rhinoceros simus* for £150 provided that it has no other defects than those you mentioned' (UMZC 3: 144). Unfortunately, Coryndon's friends in Salisbury had been careless in packing the specimens. Rothschild informed Newton about the confusion in a letter of 13 December 1893:

> F.C. Selous & Coryndon are the two scouts of the Company and as you know went to the front as soon as war was declared. The consequence was that a man named Maclaurin brought the 2 *Rh. simus* home & packed all the bones indiscriminately in one case & the two skulls in a 2nd. (UMZC 3: 145)

As mentioned earlier, Coryndon himself had indicated that a few bones might be missing or chewed by hyenas.

Coryndon addressed a meeting of the Zoological Society of London in their premises at Regent's Park on Tuesday 3 April 1894, with an account of his hunt of the white rhinoceros in Mashonaland and some details of the biology of these animals. The contents of his talk were printed in the Society's *Proceedings* with a coloured plate, which was available in August 1894 (Duncan 1937). However, the interested public could read all about it much sooner in the local press, in the *Pall Mall Gazette* of 12 April 1894 (Coryndon 1894b), the *Pall Mall Budget* of 19 April 1894 (Coryndon 1894c; see fig. 3 and *The Field* of 14 April (Tegetmeier 1894a). It is likely that Coryndon's talk in London also occasioned an anonymous note in the *Pall Mall Gazette* of 9 April 1894 on the arrival of two white rhinos in England (Anon. 1894a). Similar to the story related in his letter to Rothschild, Coryndon reported that he found tracks of the white rhinoceros in north-east Mashonaland in July 1893. After shooting two large adult males, the next 11 days were spent in the area to clean the bones and dry the skins. Both in his letter to Rothschild and in the printed versions of his talk in London, Coryndon was a little short on details and never disclosed where exactly he found the rhinoceroses, possibly to keep his options open for future commissions, because at least a few other white rhinoceroses were still alive in the area when he left. In his talk reported in the news magazines, Coryndon said that he found the animals in

Figure 3. Title of Robert Coryndon's report in the *Pall Mall Budget* of 19 April 1894.

north-east Mashonaland, while Caldecott had written to Harmer in Cambridge that Coryndon had set out into the direction of the junction of the Umniati and Zambezi Rivers. Although that might have been the plan, Coryndon did not actually travel that far from Salisbury. Among Coryndon's manuscripts in Rhodes House, Oxford (Rothschild Archives), is a hand-drawn map dated 'Chininga's, 6th July 1893' (fig. 4). The date coincides with the period in which Coryndon found the white rhinoceroses and it is more than likely that the animals were in fact shot in the immediate vicinity of the camp called Chininga. It was on the western bank of the Hanyani (or Manyame) River, 30 miles (50 km) north of Chinhoyi, which is roughly 100 km north-west of present-day Harare, about 17°15' S, 30°10' E.

The two specimens in England

Although Alfred Newton had gladly accepted to buy the skeleton for £150 (UMZC 3: 144), he still had to find the funds. It was decided to try to raise the necessary amount by public subscription, to which effect a pamphlet was printed and distributed. Dated December 1893 and signed by Newton and Harmer, it reads as follows:

> The skeleton of an adult African Rhinoceros of the largest species (*R. simus*) has been offered to the Museum at the price of £150. It is difficult to exaggerate the importance of the addition of this form to our collection. Mr Selous states, in his recently published work ('Travel and Adventure in South-East

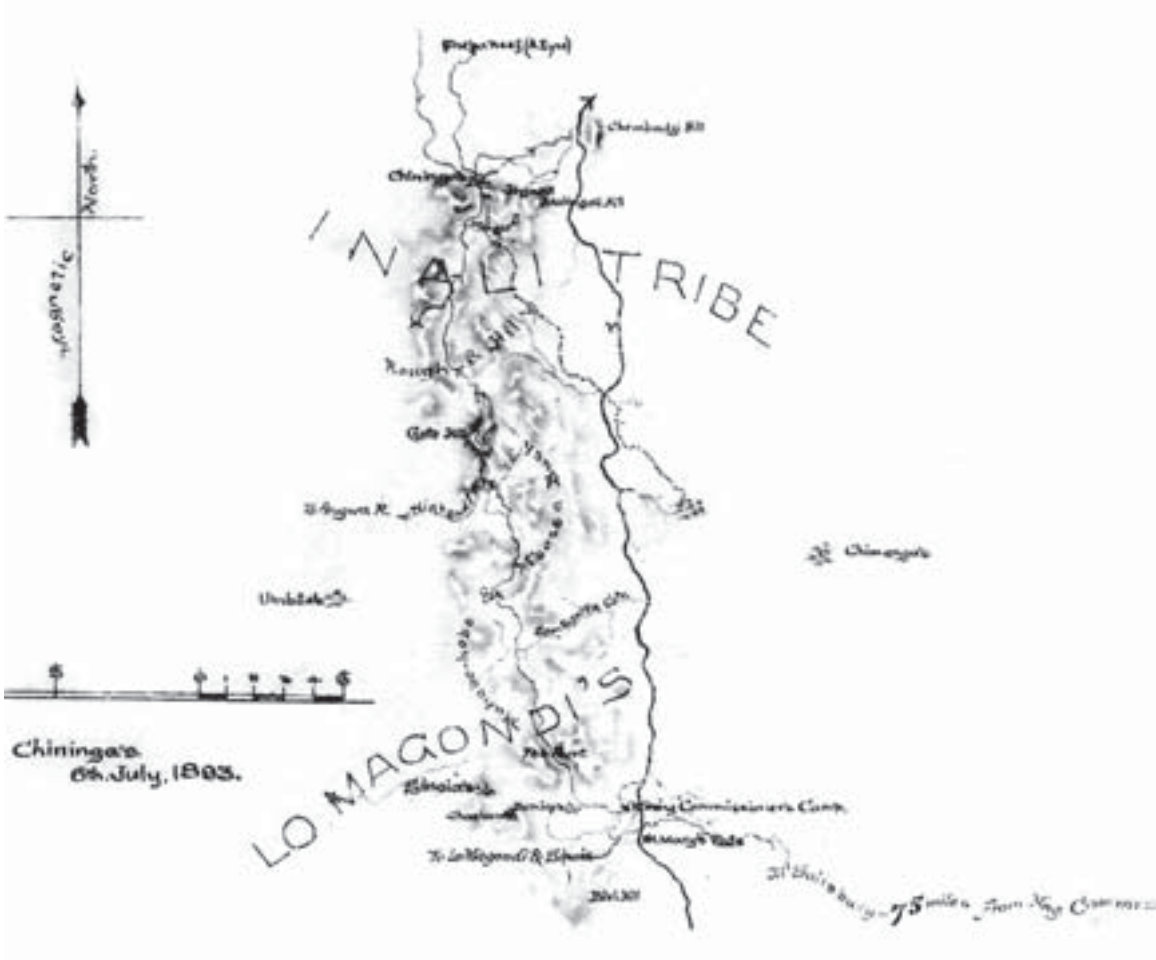

Figure 4. Map of Lomagundi's area drawn by Robert Coryndon at Chininga on 6 July 1893, preserved in the Bodleian Library of Commonwealth and African Studies at Rhodes House, Oxford, MSS. Afr. S 633, Box 12, f.16.

> Africa,' p. 158), that 'to the best of my belief, the great white or square-mouthed rhinoceros, the largest of terrestrial mammals after the elephant, will in the course of the next few years become absolutely extinct.' No living example has ever been received in Europe; and the only specimen of the skeleton to be seen in any Museum is believed to be that of Leyden. Within the last six months two adult males have been killed out of the few said to be still left in Mashonaland; and their hides and skeletons have arrived in England. The hide and skeleton of one have been secured for the British Museum. The skeleton of the other is now offered to us at a price which, considering the extreme rarity and impending extinction of the animal, is by no means excessive. An additional point of interest lies in the fact that this species of Rhinoceros seems to be more nearly allied than any other to the extinct species commonly known as R. tichorhinus [the woolly rhinoceros], of which remains are found in various parts of England. In the present state of the Maintenance Fund it is impossible that more than a very small portion of the price asked could be defrayed out of funds at the disposal of the Museum. We therefore hope that Members of the Senate and others interested in the study of Zoology at Cambridge will be as liberal now as in the past, and enable us to purchase this extremely desirable specimen by subscription. (Pamphlet in UMZC 3: 151)

Eventually the required funds were raised, which was announced in another printed circular (100 copies) dated 6 December 1894, in which Newton and Harmer stated:

> We have the pleasure of informing you that our appeal was so generously received that we were able to effect the purchase, and that the specimen has now been mounted and is exhibited in the Museum. (Circular in UMZC 3: 159; see fig. 5)

A total of £162-1-6 was raised, of which Newton donated £15 and Harmer £5. Other large donations of £10 each were received from Mr H. Evans, Prof. Sir G.M. Humphry and Mr S. Sandars, and of £5 each from The High Steward, The Master of Emmanuel, The Master of Trinity Hall, Mr W. Bateson, Mr H. Bury, Mrs Darwin, Prof. Foster, Mr F. DuCane Godman, Messrs Mortlock & Co., Mr M.R. Pryor, and Mr A.E. Shipley. Besides the purchase of the skeleton, expenditures were made for ironwork, for the stand, and for printing the circulars. The accession was proudly recorded in the museum's annual report for 1894 (Harmer 1895: 907). The skeleton may have been on exhibit for a short time only, to be returned to the taxidermist for further attention to some details.

When the boxes with the hides and bones of the white rhinoceros specimens arrived at Tring, all the bones were found packed in one box, and Rothschild indicated to Newton in Cambridge on 13 December 1893 that he 'could only pick out the correct number of bones to each skeleton & not fit them till macerated' (UMZC 3: 145). Newton was eager to supervise the maceration and mounting of the skeleton, but Rothschild informed him on 18 December 1893 that the bones had been taken to Alfred Brazenor, 39 Lewes Road, Brighton, for maceration (UMZC 3: 149). In June 1894 this process was still going on (UMZC 3: 154), but a few weeks later the bones of the skeleton bought by the museum in Cambridge were taken to the well-known taxidermist Edward Gerrard (1811–1910) in Camden Town on the outskirts of London. There was some confusion about the selection of bones for each specimen and Newton had the impression that the British Museum had been able to get first choice (UMZC 3: 161). Gerrard proceeded to mount the skeleton as best as he could, adding the missing bones in plaster, and completed the work in July 1895. It was duly registered in the Accession Register of the Museum of Zoology in Cambridge (Old Catalogue number 627A, now number H.6441). The register states that Gerrard added moulds of the missing bones, being the vestigial right metacarpal V, the internal and external cuneiform of right hindfoot, the middle left cuneiform, and several caudal vertebrae. More significant, perhaps, was the absence of the horns, which of course had to be placed on the hide of the same specimen in Tring. However, Rothschild supplied another pair of horns taken from a male shot 'some twenty years ago' (around 1875) in the Cape Colony (UMZC 3: 167). The skeleton is still on permanent exhibit in the gallery of the Museum of Zoology, University of Cambridge (fig. 6). It cannot be determined with certainty if the horns received by Rothschild from the 'Cape Colony' belong to a black or a white rhinoceros. If the location had been used in a strict sense rather than colloquial usage, one would expect them to be those of *Diceros bicornis*.

Reg. Sept. 20, 1894

UNIVERSITY MUSEUM OF ZOOLOGY, CAMBRIDGE,
December 6, 1894.

159

Some months since we asked your help towards securing a skeleton of *Rhinoceros simus* which had been offered to the Museum, but at a price beyond the means of the Maintenance Fund. We have the pleasure of informing you that our appeal was so generously received that we were able to effect the purchase, and that the specimen has now been mounted and is exhibited in the Museum.

In making this announcement we take the opportunity of most heartily thanking you for your liberality, and beg leave to append a list of the subscriptions received as well as a statement of their expenditure.

ALFRED NEWTON.
S. F. HARMER.

SUBSCRIPTIONS.

	£	s.	d.
The High Steward	5	0	0
The Vice-Chancellor	2	0	0
The Master of Clare	2	2	0
The Master of Downing	1	1	0
The Master of Emmanuel	5	0	0
The Master of St John's	1	1	0
The Master of Trinity Hall	5	0	0
Professor Allbutt	2	2	0
Professor Babington	1	1	0
Professor Sir R. S. Ball	1	1	0
Mr W. Bateson	5	0	0
Mr H. Bury	5	0	0
Col. R. T. Caldwell	1	0	0
Mrs Darwin	5	0	0
Mr H. Darwin	2	0	0
Mr M. S. Dimsdale	0	10	6
Mr E. H. Douty	1	1	0
Mr A. H. Evans	1	1	0
Mr H. Evans	10	0	0
Mr L. Ewbank	1	1	0
Mr W. Fawcett	1	1	0
Professor Foster	5	0	0
Mr J. E. Foster	1	1	0
Mr T. M. Francis	1	1	0
Mr W. H. Francis	0	10	6
Mr J. G. Frazer	2	2	0
Mr F. DuCane Godman	5	0	0
Mr J. Griffiths	1	1	0
Dr Guillemard	1	0	0
Mr F. W. Harmer	1	1	0
Mr S. F. Harmer	5	0	0
Mr J. A. Harvie-Brown	2	2	0
Mr C. T. Heycock	1	1	0
Carried forward	£84	2	0

	£	s.	d.
Brought forward	84	2	0
Baron A. von Hügel	1	1	0
Professor Hughes	1	1	0
Professor Sir G. M. Humphry	10	0	0
Mr A. Hutchinson	1	0	0
Dr James	1	0	0
Mr F. J. H. Jenkinson	2	0	0
Dr Lloyd Jones	0	10	6
Mr J. N. Langley	1	1	0
Dr Lea	1	0	0
Mr S. M. Leather	1	1	0
Professor Lewis	1	0	0
Mr J. J. Lister	1	1	0
Professor Macalister	3	0	0
Mr W. H. Macaulay	1	0	0
Mr J. E. M'Taggart	1	1	0
Messrs Mortlock & Co.	5	0	0
Mr R. A. Neil	0	10	6
Professor Newton	15	0	0
Mr E. H. Parker	3	3	0
Rev. C. H. Prior	0	10	6
Mr M. R. Pryor	5	0	0
Mr O. Salvin	1	0	0
Mr S. Sandars	10	0	0
Mr W. N. Shaw	1	1	0
Mr A. E. Shipley	5	0	0
Mr R. Taylor	1	0	0
Mr C. Warburton	1	1	0
Dr Ward	1	1	0
Mr J. C. Watt	0	10	6
Rev. C. Wolley-Dod	1	1	0
	161	17	0
Transferred from the Museum Account	0	4	6
	£162	1	6

EXPENDITURE.

	£	s.	d.
Skeleton of *Rhinoceros simus*	150	0	0
Messrs Macintosh, for iron-work	9	2	6
Mr Sindall, for stand	2	5	0
The University Press, for printing circulars	0	14	0
	£162	1	6

Examined and found correct,

ARTHUR E. SHIPLEY.

December 4, 1894.

Figure 5. Circular by A. Newton and S.F. Harmer acknowledging the assistance to purchase the skeleton for the University of Cambridge.

Figure 6. The skeleton of the white rhinoceros shot by Coryndon in 1894 in the Museum of Zoology, University of Cambridge.

Rothschild had originally commissioned Coryndon to shoot a white rhinoceros because he wanted to exhibit a mounted hide in his museum at Tring. It was natural that he approached Rowland Ward (1853–1912) in London to mount the specimen, because the firm at that time was the largest and most famous of its kind in the world. Rowland Ward was especially well known for mounting big game animals and their heads as trophies. From 1879, the shop was located at 166 Piccadilly, and many different kinds of animals could generally be seen on these premises (Frost 1981: 19–22). It was announced in the *Daily Graphic* of 13 April 1894, in *Land and Water* of 14 April, and in *Nature* of 19 April that 'Mr Rowland Ward has now on view in Piccadilly a superbly mounted example of *Rhinoceros simus*, being one of two shot by Mr R.T. Coryndon last July in the north-west of Mashonaland' (Anon. 1894b, c,d). Coryndon, still in London, had been assisting the taxidermists. An illustration of the mounted rhinoceros in Ward's premises was published in *The Field* of 21 April 1894 (Tegetmeier 1894b) and in two of the other local magazines (fig. 7). The correspondent of *Land and Water* added:

> The specimen now on view at the 'Jungle' is the larger of the two bulls. With the aid of Mr Coryndon and Mr Ward's assistants, we took a few measurements which will give our readers an idea of the size of this animal. Before giving these, we should say that Mr Coryndon expressed to us his surprise and delight at the manner in which the rhinoceros has been set up. 'It is the animal himself,' he said, and drew attention to the skill wherewith the outlines of the beast have been preserved, and the manner in which the forelegs

Figure 7. The white rhinoceros at Rowland Ward inspected by Richard Lydekker, from *The Daily Graphic* of 13 April 1894.

> convey a sense of the weight they have to support. The animal stands 6 ft. $1^1/_2$ in. [186.7 cm] at the withers; length, between uprights, 12 ft. 1 in. [368.3 cm]; length from lip, along bases of horns, up between ears, and following curves of back, 13 ft. [396 cm] to root of tail; 15 ft $8^1/_2$ in. [478.8 cm] to tip of tail; girth behind shoulders, l0 ft. $3^1/_2$ in. [313.7 cm]; girth round forearm 3 ft. $4^1/_2$ in. [102.9 cm]. The development of the muscle of the forearm, by the way, attracts attention at once. The width of the lip between greatest depth of nostrils is just under twelve inches [30 cm]. The specimen is not remarkable for the length of the horns. The anterior horn measured 2 ft. 3 in. [68.6 cm] round the base, and 1 ft. $10^1/_2$ in. [57.2 cm] from base to tip. (Anon. 1894c)

The mounted specimen is still in the Natural History Museum in Tring, registered with number ZD.19.39.4807. Besides the illustrations in contemporary newspapers, its likeness was engraved by Joseph Smit (1836–1929) on a coloured plate accompanying Coryndon's paper in the *Proceedings of the Zoological Society of London* (Coryndon 1894a, pl. XVIII; see fig. 8), while Renshaw (1904, facing p. 126) published a photograph.

When the British Museum (Natural History) in London negotiated with Rothschild and Coryndon about the purchase of a hide and skeleton of one of the white rhinoceroses, they stipulated that their own taxidermists should be responsible for mounting the skeleton, which gave them more control over the selection of the bones. The hide was mounted by Rowland Ward in London, and in May this specimen and the one destined for Tring were exhibited together in Piccadilly for a few days (Tegetmeier 1894c). The specimen was officially registered in their register on 21 September 1894 and placed on exhibit. The *Guide to the Galleries* dated 1894 states that the white rhinoceros 'is now almost exterminated, and it is only quite recently that the Museum has been able to obtain the fine specimen exhibited' (Anon. 1894e: 37). According to Renshaw (1904: 142), it was a young adult male with the following measurements: height at shoulder, 6 ft. 6 in. (198 cm); base of horn to tip of tail, 14 ft. 6 in. (442 cm); anterior horn, 1 ft. 7 in. (48.3 cm) and posterior horn, 7 in. (17.8 cm).

At the end of the 19th century, it was often reported in newspapers as well as in the scientific literature that the white rhinoceros was extinct, or quickly nearing extinction. Coryndon kept his silence about the numbers of white rhinoceroses that he may have encountered in M ashonaland. These animals were valuable, and it probably was wise to keep quiet about their whereabouts and their numbers. It is unlikely that he in fact shot the last ones, or even the last one to be preserved for science. Even though there are no known reports of the white rhinoceros in northern Zimbabwe after 1895, it is prudent to agree with Roth (1967: 218) that 'a few stragglers might have sur

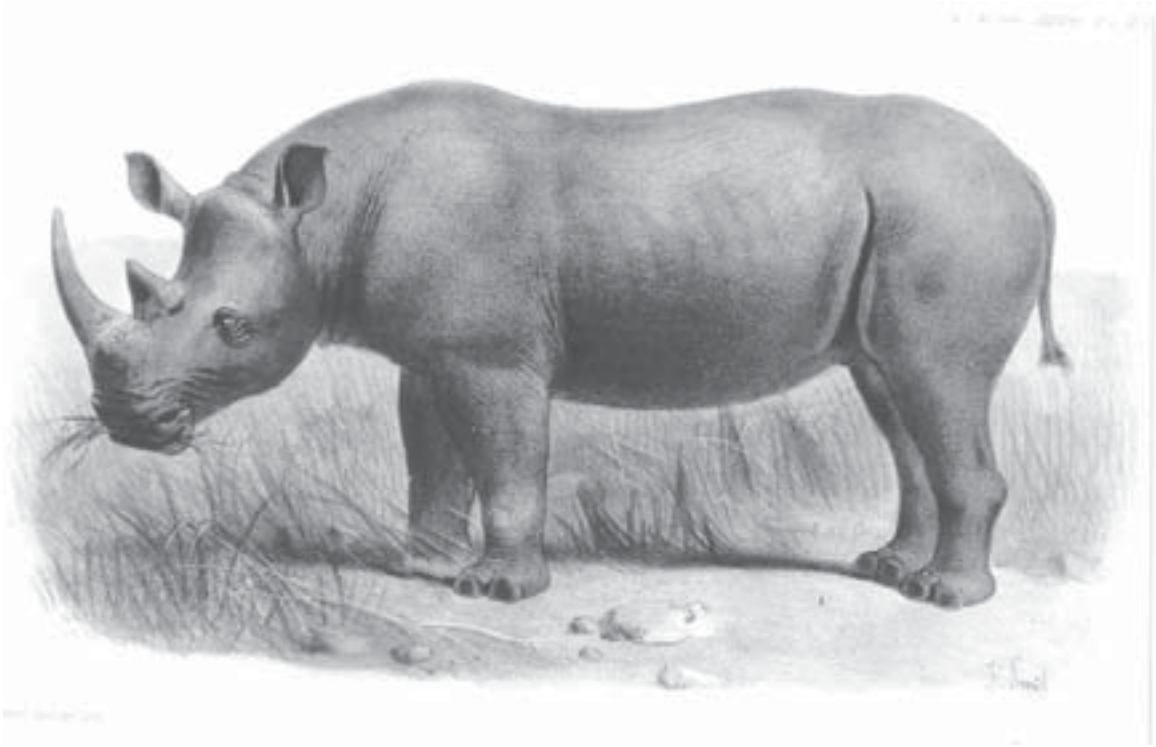

Figure 8. The white rhinoceros shot by Robert Coryndon in northern Zimbabwe in July 1893, mounted by Rowland Ward in London, later exhibited in Walter Rothschild's Museum at Tring, drawn by Joseph Smit; from the *Proceedings of the Zoological Society of London*, 1894, pl. 18 (copyright, Zoological Society of London, published with permission).

vived much longer in this and other peripheral areas'.

Renshaw (1904: 138, 144) stated that another fine bull white rhinoceros was shot in Mashonaland by Arthur Eyre in 1895 and presented to the South African Museum in Cape Town by Cecil Rhodes. This is not quite true in every detail. Although Arthur Eyre appears regularly in the accounts about the rhinoceros, I have been unable to find more about his life, except that he was part of Rhodes's pioneer column in 1892. He may have started to farm on the Umvukwe Mountains in the Lo Maghonda District with his brother Herbert, who was killed in the Mashonaland Rebellion on 21 June 1896 (Hole 1898). Arthur Eyre had been with Coryndon when they first sighted the white rhinoceroses in 1892. He went back to rhino country in 1894 and shot an adult bull animal, according to a remark in a letter written by Selous on 19 January 1906 (printed in Lyell 1935: 8). When Selous was in Salisbury in July 1895, he saw the skin and skull of this specimen 'with a very good horn'. Brown (1899: 228–230), unfortunately without dating the event, reproduced the text of a letter that Arthur Eyre wrote to friends at home, in which he relates how he shot a male white rhinoceros on Mount Domo. Eyre was at the same pool where he shot his first white rhinoceros (in 1892?), saw fresh spoor and after tracking it, he wounded a rhinoceros. It took another day to find the animal again and finally kill it. It was a large male, with a height of 6 ft. 4 in. (193 cm) and a length from the end of the nose to the tip of the tail of 13 ft. 8 in. (416 cm). Eyre added that the skin and skeleton were bought by Cecil Rhodes for £250 to be presented to the museum in Cape Town. Selous (in Lyell 1935: 8) was 'quite sure that the white rhinoceros in the Cape Town Museum was shot and preserved by Mr Arthur Eyre, but he may have sold it to Mr Harvey Brown, who sold it to Rhodes, who gave it to the Cape Town Museum'. When H.A. Bryden and G.E. Yale visited the South African Museum, they took a photograph of the specimen, published by Bryden (1893: 492, 1894).

In September 1895, Rowland Ward was sending out invitations to inspect another mounted example

of the white rhinoceros, this one from Zululand in South Africa, where its existence up to then was unsuspected by the public (Anon. 1895). The number of rhinoceroses in this new population was unknown, but generally considered to be very low. Although figures as low as 20 animals have often been published, I have suggested that this may not have been correct, because no attempt to count the white rhinoceros in Zululand was made until much later in the 20th century (Rookmaaker 2000, 2002). The white rhinoceroses procured by Robert Coryndon in the northern part of Zimbabwe in 1893 were among the last from that region, and certainly among the best publicized trophies to be exhibited.

Acknowledgements

The history of the rhinoceroses in Mashonaland has been pieced together from material in three collections of letters and newspaper cuttings. I am grateful to Dr Michael Akam, Mr Ray Symonds and Ms Ann Charlton of the University of Cambridge, Museum of Zoology for access to the historical documents about the collection, and to Mr Russell Stebbing in assistance to take the photograph of the skeleton in the public gallery. The material in the Bodleian Library of Commonwealth and African Studies at Rhodes House, Oxford, was made available by the archivist, Ms Lucy McCann. Initial enquiries at the Zoological Museum in Tring were answered by Mrs A. Harding, who directed me to the holdings in the Natural History Museum in London. I was allowed access to the correspondence of Rothschild in that institution by the archivist, Dr Susan Snell. Dr Richard Sabin, Curator, Mammal Group, Natural History Museum, London, gave information about rhinoceros specimens in the collection, which includes material in the Zoological Museum in Tring. The work on this paper is part of the ongoing research of the Rhino Resource Center, sponsored by SOS Rhino and the International Rhino Foundation (IRF).

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OPINION

The proposed sale of ivory from Botswana, Namibia and South Africa: conditions and verification

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Abstract

In November 2002 in Santiago, CITES parties agreed to a one-off sale of up to 60 tonnes of ivory from Botswana, Namibia and South Africa, but not before May 2004 and subject to conditions. Approval was achieved by a small margin and many countries supporting the proposal did so only on the understanding that the conditions would be defined and applied rigorously to minimize the possibility that the sale would result in an increase in the illegal killing of elephants and ivory trading. These conditions for the sale are now being defined by the CITES Standing Committee. Compliance by trading countries will then need to be verified before final approval of the sale. This paper assesses the conditions and definitions, identifies loopholes, and makes recommendations for improving verification and compliance. It concludes that the conditions are flawed since they do not allow for verification of trade controls in exporting countries or implementation of recommendations to improve law enforcement coordination. Ivory trade controls in prospective trading countries, particularly Japan, are assessed and found to be inadequate. Detailed guidelines on standardized controls are needed, on the basis of which it is proposed that an independent review team verifies compliance. An assessment of MIKE (Monitoring Illegal Killing of Elephants) concludes that time is needed free of any approved ivory sales to resolve issues of methodology, enable linked analysis with ETIS (the Elephant Trade Information System) and collect baseline data on elephant populations, poaching and illegal trade. To determine detrimental impacts of renewed ivory trade on elephant populations, adequate trend data will be needed, as well as a robust multivariate analysis capable of assessing the significance of different factors on any observed changes in trends. Estimated timelines to achieve a baseline preclude any ivory trade before 2005 at the earliest, and acquiring the data set to allow determination of detrimental impacts is likely to push this horizon significantly further into the future.

Résumé

En novembre 2002, à Santiago, les Parties à la CITES ont accepté la vente unique de 60 tonnes d'ivoire venu du Botswana, de Namibie et d'Afrique du Sud, mais pas avant mai 2004, et à certaines conditions. L'accord

fut obtenu à une courte majorité, et de nombreux pays n'ont soutenu la proposition que parce qu'ils étaient convaincus que les conditions seraient bien définies et appliquées rigoureusement, pour réduire le plus possible les risques que cette vente aboutisse à une augmentation du massacre illégal d'éléphants et du commerce d'ivoire. Le Comité Permanent de la CITES est occupé à définir des conditions et il faudra encore vérifier leur respect par les pays vendeurs avant l'approbation définitive de la vente. Cet article évalue les conditions et les définitions, identifie les lacunes et fait des recommandations pour améliorer la vérification et le respect des conditions. Il conclut que les conditions imposées sont imparfaites dans la mesure où elles ne permettent pas de vérifier les contrôles qui sont faits dans les pays exportateurs, ni la réalisation des recommandations destinées à améliorer la coordination de l'application des lois. Les contrôles du commerce de l'ivoire dans les futurs pays acheteurs, et spécialement au Japon, sont aussi évalués et jugés inadéquats. Il faut donner des directives détaillées pour des contrôles standardisés, sur base desquelles on propose qu'une équipe de révision indépendante vérifie le respect des conditions. Une évaluation de MIKE conclut qu'avant de vendre le moindre ivoire, on a besoin de temps pour résoudre les problèmes de méthodologie, pour permettre l'analyse jointe avec ETIS et récolter les données de base sur les populations d'éléphants, le braconnage et le commerce illégal. Il faudra disposer des données adéquates sur la tendance des populations d'éléphants, pour déterminer l'impact négatif du nouveau commerce d'ivoire, ainsi que d'une solide analyse multivariée capable d'évaluer la signification de différents facteurs dans tout changement de tendance constaté. On estime que le temps nécessaire pour réaliser cette base empêcherait toute vente d'ivoire avant 2005, au plus tôt, et que l'acquisition du set de données qui permettrait de déterminer les impacts négatifs pourrait repousser cet horizon plus loin encore dans le futur.

Introduction

In Santiago in November 2002, the 12th meeting of the Conference of the Parties (CoP12) to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) decided to allow a one-off sale of up to 60 tonnes of ivory from Botswana, Namibia and South Africa, but not before May 2004 and subject to certain conditions. The convention's executive body, the Standing Committee, is tasked with defining and assessing compliance with the conditions, which it started at its 49th meeting in Geneva in March 2003 (SC49) and will continue at its 50th meeting in March 2004 (SC50).

This is the second one-off sale approved since the ban on ivory trade was agreed in 1989. The first involved 50 tonnes of ivory from Botswana, Namibia and Zimbabwe, exported to Japan in July 1999. Beforehand, eight African range states had expressed concerns to the Standing Committee that a poorly drafted set of conditions imposed on the sale had not been met (Burkina Faso et al. 1999). They cited problems with proposed international monitoring systems, MIKE (Monitoring Illegal Killing of Elephants) and ETIS (Elephant Trade Information System), and considered that trading states had failed to commit themselves to international cooperation on law enforcement. Nevertheless, the Standing Committee, in what was considered a politically motivated decision, approved the sale (Reeve 2002).

On its Web site the CITES Secretariat states: 'It is crucial that the decisions taken by CITES on elephant issues are based, and seen to be based, on the best possible information'. The main sources of this information are MIKE and ETIS. MIKE in particular is central to deciding whether the latest proposed sale should go ahead. Many early criticisms have been addressed but the programme remains controversial. With a view to ensuring that future decisions on ivory trade are indeed based on 'the best possible' verified information and not political expediency, this paper assesses the Santiago conditions imposed on the sale, the status of MIKE and the ability of potential trading states to control ivory trade, and it makes recommendations accordingly.

The Santiago conditions

Conditions for the proposed ivory sale require that

- Baseline information (such as elephant population numbers, incidence of illegal killing) is reported by the MIKE programme to the Secretariat.
- The Secretariat must verify, in consultation with the Standing Committee, that prospective importing countries have sufficient national legislation and domestic trade controls to ensure that the imported

Japan Wildlife Conservation Society/IFAW

Sign in front of a hanko shop in Japan. The sign says 'Ivory Ban Lifting Commemoration Sales, Elephant Ivory–50% Off'.

ivory will not be re-exported and will be managed in accordance with all CITES requirements.

- Only registered government-owned stocks of raw ivory originating in the exporting countries can be traded, despatched in a single shipment under Secretariat supervision. Seized ivory and ivory of unknown origin are excluded. The maximum allowed is 60 tonnes—20 from Botswana, 10 from Namibia and 30 from South Africa.
- Proceeds of the trade are to be used exclusively for elephant conservation and for community conservation and development programmes within or adjacent to elephant range.

The above conditions are to be agreed by the Standing Committee. A safety mechanism provides that 'on a proposal from the Secretariat, the Standing Committee can decide to cause this trade to cease partially or completely in the event of non-compliance by exporting or importing countries, or in the case of proven detrimental impacts of the trade on other elephant populations'. The Standing Committee was also tasked with

- defining the geographical scope and the nature of the data that constitute the baseline information from MIKE
- determining how it would conclude that a detrimental impact on other elephant populations had occurred as a result of approved trade in ivory
- recommending measures for improving coordination of law enforcement between ivory-producing and ivory-importing states

MIKE

Origin, objectives and methodology

MIKE, which originated from the 1997 decision to downlist elephant populations in Botswana, Namibia and Zimbabwe and allow a one-off ivory sale, is a programme to monitor elephant populations, inci

dence of killing and threats at selected sites across Africa and Asia. Its objective, shared by ETIS, which monitors illegal trade in elephant products, is to establish an information base to support decision-making on elephant-related management, protection and enforcement. Initially another objective was to assess whether trends in illegal killing were the 'result' of CITES decisions on elephants or the resumption of ivory trade. But criticism that the systems could not demonstrate a causal link led to a change in the objective to assessing whether and to what extent trends are 'related' to CITES decisions concerning elephants or resumption of ivory trade or both. A further objective to build capacity to manage and conserve elephants in range states was given increased emphasis following criticism that MIKE was imposing a top-down approach.

MIKE is ambitious, young and controversial. It was formally implemented in Africa in October 2001 (although some southern African countries started in 2000). Of the 35 African range states, 31 are involved, 2 have expressed interest and 29 have identified between 1 and 5 sites each, giving a total of 55 sites across Africa, divided among four subregions (Anon 2002a). The sites cover habitat ranging from savannah to forest. Some are relatively secure while others, such as in the Democratic Republic of Congo (DRC), are affected by war. The extent to which MIKE has been implemented varies greatly between sites and subregions. In Asia, where 28 sites have been identified (15 in South Asia and 13 in South-East Asia) MIKE was expected to begin in August 2003 (Nigel Hunter, MIKE director, pers. comm.).

At site level there are essentially three types of data collection—population surveys, law enforcement monitoring (LEM) and information on elephant carcasses (Anon 2002b). The aim is to conduct population surveys every two to three years, while LEM and the collection of data on elephant deaths and possible causes is a continuous process. LEM is considered important since the more effort put into enforcement the less illegal killing is expected. It can also be used to inform site managers where to deploy rangers for maximum effect. LEM is being conducted through a standardized ground patrol form for recording patrol effort (when and where personnel went) and observations. In addition, all elephant carcasses found on patrol or in other circumstances, within or outside sites, and the possible cause of death are to be reported, using standard carcass-reporting forms. The use of GPS (global positioning system) is encouraged to assist with mapping and locating carcasses. Two main population survey techniques are being used—aerial surveys in savannah ecosystems and ground surveys using dung count methods in forested areas.

Data from LEM forms are compiled into monthly and annual reports and entered into a computerized database at site level along with population survey results and other relevant geographic or socio-economic data. This information is transferred to the national office (usually the wildlife authority headquarters) where further information, such as national law enforcement capacity and other influencing factors, is entered and analysed. MIKE has identified over 20 variables that could affect population numbers and trends, for example, human access, conflict, and land use adjacent to sites (Anon 2002b). Information on national trends in elephant population and patterns of illegal killing, law enforcement effort and other influencing factors is sent to a central database at the MIKE Central Coordinating Unit (CCU) in Nairobi for subregional and continental analysis. Advice on methodology is provided by a technical advisory group (TAG) composed of subregional representatives and persons with expertise in elephant conservation. TAG's full potential has not been realized; it has held only three meetings since it became operational in December 2000, but more frequent meetings are planned (Nigel Hunter, pers. comm.).

The Asian MIKE programme is far behind Africa's. As fewer data exist on Asia's forest elephants than on the African savannah populations, it will take relatively longer to gather baseline information. And with the different circumstances that exist in Asian range states it is expected that some of the methodology may need to be adapted (Nigel Hunter, pers. comm.). The TAG is currently deliberating population survey methods to suit Asian circumstances.

Some of the MIKE methodology has been questioned, notably dung counts and LEM methods. It was claimed following work by the MIKE Central Africa Pilot Project and in Ghana that results of dung counts are now comparable with aerial surveys (Anon 2002b). But despite its rapid evolution dung count methodology is less developed; it measures secondary indicators (not the elephants themselves); and results differ depending on the analytical software (Patrick Omondi, Kenya Wildlife Service Elephant Programme Coordinator, pers. comm.). Many dung count surveys are not of good quality and the meth-

odology is difficult to apply in tropical forests (Nishihara 2003). They have the potential to produce results comparable with aerial surveys, but they need to be well conducted according to minimum guidelines (Julian Blanc, IUCN African Elephant Specialist Group, pers. comm.). Even then they are comparable only with sample surveys, not total counts (Iain Douglas-Hamilton, elephant biologist, pers. comm.). Genetic analysis of dung, of which MIKE has contracted a study, offers the potential for improving the value of dung counts. The methodology involves extracting genetic material from dung to enable identification of the number of unique individuals within an area surveyed (Julian Blanc, pers. comm.).

Some experts have questioned MIKE's LEM methodology. LEM was originally developed as a management tool, a standardized recording of law enforcement effort that can be used to control illegal activities and improve management strategies. In the context of MIKE, the purpose of LEM is to measure effort and link it to carcass numbers and illegal activities concerned with killing of elephants. But effort is hard to measure and standardize to produce comparable data. The MIKE forms were initially considered by some to be too complex (although they were subsequently simplified) and the requirements at site level too sophisticated. One TAG member considered that a cruder proxy value for effort is needed (Iain Douglas-Hamilton, pers. comm.). Meanwhile another expert thought that MIKE is aiming at too much precision too soon and that there is a need to work gradually towards sophistication (Kes Hillman Smith, LEM coordinator for UNESCO/UNF/DRC, pers. comm.). Rather than imposing a highly sophisticated system from the top down, Hillman Smith, who wants MIKE to work as a practical tool, considers a standardized system should be developed from the bottom up. It should take into account site-specific needs—particularly the fact that the main task of the guards is to protect their ecosystems, not to collect data—and, where available, existing monitoring systems. For example in Garamba National Park in DRC, LEM has been successfully conducted for many years with the purpose of protecting the site through optimizing anti-poaching (Hillman Smith et al. 2002). Rangers can accommodate a higher level of sophistication than at other sites in the DRC where LEM has not been conducted before (Kes Hillman Smith, pers. com.). The CCU has attempted to address this by harmonizing existing systems (MIKE CCU 2003).

Singapore Agri-food and Veterinary Services

Some 6.5 tonnes of raw ivory, plus 40,810 hanko seal blanks were seized in Singapore on 28 June 2002 while being transshipped.

In forested sites where carcasses are difficult to find and other sites where large areas are unprotected LEM through patrolling alone is insufficient to measure effort. In a recent study of Samburu and Laikipia in Kenya, most of which is unprotected, 80% of the carcasses discovered were found through intelligence (community information) while only 4% were found through patrolling. Similarly, in sites where there is intense research effort this needs to be taken into account (the more research activity the less poaching) (Iain Douglas-Hamilton, pers. comm.). The MIKE process is encouraging use of local information networks as a LEM approach, but since it is more complex than deriving information from patrols advice is being sought from TAG (MIKE CCU 2003).

Another controversial issue is the restricted area that some of the sites cover. Kenya has taken an ecosystem approach to site selection, covering different types of areas and different threats. But several sites, particularly in southern Africa, fail to cover unprotected parts of the elephants' range, Chobe National Park being one example. Meanwhile in other countries, selected sites experience less poaching than others (for example, Zambia's choice of Luangwa but not Kafue, where poaching has been more prevalent). The CCU argues that sites with different characteristics are needed to minimize bias but recognizes and is addressing the bias towards protected area coverage in some areas (MIKE CCU 2003).

A number of field problems are evident. One is lack of GPSs, which are restricted to three per site. The aim is to increase them to five (Nigel Hunter, pers. comm.), but even this will be inadequate for large sites with more than five daily patrols. Tsavo in Kenya, for example, has 26 patrols going out every day (Patrick Omondi, pers. comm.). Other issues that will take time to resolve are the logistics involved in establishing solar-powered computer facilities on site and training field personnel lacking a scientific background in data analysis.

Comparison and links with ETIS

Developed in parallel, MIKE and ETIS share the same objectives. But while MIKE is active, ETIS, which depends largely on voluntary reporting of seizures by CITES parties, has been criticized for being too passive (Paula Kahumbu, former Kenya Wildlife Service assistant director, Protected Areas and CITES coordinator, pers. comm.). Initially reporting to ETIS was poor, most parties failing to report as required within 90 days of a seizure (Milliken and Sangalakula

Singapore Agri-food and Veterinary Services

More of the Singapore seizure.

2000). However, TRAFFIC, which manages the ETIS database, now contacts key countries to solicit data, yielding a better response than reliance on passive information (Milliken et al. 2002).

A further concern is that ETIS does not directly measure effort by enforcement officers to implement national legislation and intercept illegal shipments (Kes Hillman Smith, pers. comm.). Proxy measures are used to monitor law enforcement. The CITES national legislation project, which ranks parties' legislation according to whether it meets all, some or none of the requirements for implementing CITES, is used to assess law enforcement effort; the Corruption Perceptions Index of Transparency International is used to assess law enforcement efficiency; and annual reporting of trade data by parties is used to assess rates of reporting concerning the seizure data, a proxy that TRAFFIC considers might also serve to assess law enforcement efficiency (Milliken et al. 2002). However, problems can be identified with two of these approaches. Parties may have model legislation (category 1) but no means to enforce it, a case in point being the DRC (Reeve 2002). Meanwhile, national agencies other than the CITES Management Authority, which compiles annual reports, may be responsible for wildlife law enforcement or customs controls. Thus annual reporting may be efficient but this is not necessarily reflected in law enforcement. Advice from the TAG may be needed with a view to ETIS becoming more proactive and, if possible, developing a direct measure of effort.

Finally, the lack of a clear link between MIKE and ETIS has been cited as a potential stumbling block to achieving their shared objectives (Paula Kahumbu and Kes Hillman Smith, pers. comm.). According to the CCU, achieving as much linkage as possible has always been an objective; use of the two systems to monitor each other and linking the analyses is currently being addressed (MIKE CCU 2003). Once linked the two programmes should provide a more sensitive means to detect change following ivory trade decisions. But linkage is not a condition of the ivory sale, and when it will be achieved is unclear.

Geographical scope and nature of baseline information

At SC49 CCU/IUCN recommendations on the geographical scope and nature of the baseline information to be provided by MIKE were agreed with no amendments. It was unfortunate that TAG, scheduled to meet only after the Standing Committee, had no input to the definitions, although MIKE Director Nigel Hunter confirmed that it will be involved in reviewing MIKE data. Nevertheless there could still be a need for external peer review since there will be situations when the TAG would be reviewing its own inputs and could not be considered independent.

The geographical scope will constitute 45 sites in Africa (82% of the total) and around 15 in Asia (MIKE CCU and IUCN 2003). Kenya questioned why all 55 African sites could not be included but the Standing Committee failed to address the question. Instead the MIKE director clarified that the geographical scope chosen was the one already agreed at the 41st Standing Committee meeting. Concerning the nature of baseline information, the following will be required from each site:

- at least one population survey
- levels of illegal killing derived from a minimum of 12 months of data from African sites and 6 months data from Asian sites
- a descriptive report of the patterns of influencing factors
- an assessment of effort made in providing the illegal killing information
- a preliminary baseline analysis of the above information

Kenya thought that trends were needed, but Hunter responded they had been asked for a baseline, not a trend analysis. Israel was concerned that six months was inadequate to collect data on illegal killing in Asia due to seasonal influences. Hunter explained that this affected southern India rather than elsewhere in Asia, the basis for the timeframe being the low levels of illegal killing in most Asian range states, the majority from human conflict. He also stated that a longer period was not precluded where such data existed. NGOs who prepared briefings for SC49, the International Fund for Animal Welfare (IFAW) and Species Survival Network considered two population surveys should be required, particularly where baseline information does not exist such as in central and West Africa and Asia (IFAW 2003; SSN 2003). To iron out methodology, address field problems and test analysis, IFAW proposed a minimum of three years of carcass and effort data (IFAW 2003). The Standing Committee ignored the suggestions.

The David Shepherd Wildlife Foundation took up the issue of influencing factors, expressing concern that a 'descriptive report' was vague, questioning

Japan Wildlife Conservation Society/IFAW

A shamisen (part for a musical instrument), jewellery, pipes, ornaments and other accessories made of elephant ivory in a retail shop window in Japan.

whether factors had been identified for each baseline site, and commenting that ideally changes should be recorded over time. Holly Dublin, chair of the IUCN African Elephant Specialist Group, stated that while influencing factors will be looked at on a site-specific basis, the analytical system (GIS spatial analysis) will not be up and running for the baseline data, a factor that the Standing Committee also chose to ignore.

Hunter considers that baseline information cannot easily be provided before early 2005. Given the considerable obstacles still to be overcome, this is optimistic. MIKE needs to be established properly to avoid defeating its objective. This demands resources, time and patience. MIKE is open to evolution, demonstrated by its change from a top-down process to one more inclusive of range states. But time is needed to resolve controversial areas of methodology through more active involvement of TAG and collaboration with experts whose constructive criticism is aimed at making MIKE work; to overcome field problems and provide adequate training; to implement the Asia programme; and to enable reliable peer-reviewed data analysis.

Determining detrimental impacts of CITES decisions

At SC49 Germany suggested a working group should deal with how a detrimental impact on other elephant populations can be determined in order to stop trade, but the suggestion failed to gain support. Instead the secretariat will address the issue for SC50. It stated that defining a protocol earlier rather than later would allow detrimental impacts to be determined before trade has occurred and if necessary prevent the trade. However, the wording agreed in Santiago for this 'safety mechanism' implies that trade has to have

occurred before detrimental impacts may be detected, which makes no sense for a one-off sale and contradicts the Secretariat's intention. This is probably because the wording was drafted in the context of an initial proposal for annual export quotas (which was rejected by CoP12).

The safety mechanism also fails to account for limitations of MIKE and ETIS. It states that the detrimental impacts need to be 'proven' to cease trade. Proof and a causal link are required, but the information systems cannot satisfy this, leading to a catch-22 situation.

This is not the first time the Conference of the Parties has agreed wording for a safety mechanism that would be problematic in its implementation. As a precondition to the first ivory sale following the downlisting of three elephant populations to Appendix II, it was decided at CoP10 that the Standing Committee should agree to a mechanism 'to halt trade and immediately re-transfer to Appendix I populations that have been transferred to Appendix II' in the event, *inter alia*, of an escalation of illegal hunting of elephants and/or trade in elephant products due to the sale (CITES Decision 10.1). Since the Standing Committee cannot transfer populations back to Appendix I without contravening the Convention, it had to clarify that this should be by a postal vote of CITES parties on a proposal by Switzerland (the depositary government).

The Standing Committee should provide a clear interpretation of the Santiago wording on detrimental impacts. To be a true safety mechanism, it needs to be able to prevent the sale from taking place in the event the *decision* to trade leads to detrimental impacts. Furthermore, given the difficulty of proving those impacts, correlations between trends observed by MIKE and ETIS and the decision to trade should be adequate 'proof' that detrimental impacts have resulted from the approved trade in ivory.

The issues are complex, and arriving at answers will be more so, which is why Germany's proposal for a working group merits further consideration at SC50. In any event the Standing Committee should seek advice from TAG before drawing conclusions.

A simplified way to look at the issue is to see MIKE sites as potential warning lights across two continents. There is a need to decide:

- How many of these warning lights must flash red in order to show a correlation with the sale, taking into account the inability of some sites, for example, those affected by conflict, to detect a change?
- What data are needed to indicate a red light?
- How will the analysis be linked with data from ETIS?
- Who will peer review the analysed data?

Answering these questions is akin to defining the 'geographical scope' and 'nature' of the baseline information, except that the purpose is to provide an indicator of detrimental impacts of CITES decisions based on jointly analysed data from MIKE *and* ETIS. To determine detrimental impacts, *trends* in elephant populations, illegal killing and trade, and patterns of influencing factors at sites in non-exporting countries will be needed. Moreover we need to know the number of years of data required for the MIKE and ETIS results to conclude, with reasonable levels of confidence, whether and to what extent trends are 'related' to CITES decisions concerning elephants. Given the number of variables that could affect population numbers and trends and the complexity of the multivariate analysis, it has been suggested that TAG may need to seek guidance on this from other independent statistical experts (IFAW 2003).

Establishing a genuine baseline and determining trends are contingent on collecting data in a period free of trade or anticipated trade; otherwise detrimental impacts of resumed trade cannot be determined. The 1999 ivory sale and the CoP12 decision may have contaminated the baseline information in ways we cannot determine.

Legislation and trade controls

Importing countries

The Santiago conditions do not specify an importing country. Japan, however, has declared its interest in importing the ivory, and with its emerging market China may come under domestic pressure to import the stocks. However, according to TRAFFIC there are 'serious deficiencies in the current regulation of sales of elephant products in China' (O'Connell-Rodwell and Parry-Jones 2002). This alone deems it an unlikely candidate. China's legislation is also inadequate to implement CITES, having been assessed under the national legislation project as category 2 (legislation believed generally *not* to meet all the requirements for CITES implementation) (CITES Secretariat 2002; Reeve 2002). Meanwhile, according to ETIS results, China (along with Thailand) has one of 'largest unregulated ivory markets in the world' and

demonstrates 'very poor law enforcement effort and efficiency' (Anon 2002c). The findings on Thailand, excluding it too as a serious contender, are supported by another study, which reports a large domestic market (mainly for sale to tourists) and a significant illegal trade (Martin and Stiles 2002).

China, Thailand and Japan are among 10 countries ETIS has identified as having active domestic ivory markets. As a result of ETIS findings all are due to have their internal legislative, regulatory and enforcement measures with regard to internal ivory trade controls assessed by the Secretariat. Countries failing to comply with CITES requirements will be required to produce an action plan to adopt controls and could face wildlife trade restrictions if they fail. While this verification exercise ought to be completed before any ivory sale, it has not been made a precondition.

JAPAN

The Santiago conditions require legislation and domestic controls sufficient to ensure imported ivory will not be re-exported and internal legislative, regulatory and enforcement measures to

- register or license all importers, manufacturers, wholesalers and retailers dealing in raw, semi-worked or worked ivory products
- establish a nationwide procedure, particularly in retail outlets, informing tourists and non-nationals not to purchase ivory if it is illegal to import it into their home countries
- introduce recording and inspection procedures to enable monitoring of internal ivory flow, particularly through
  - compulsory trade controls over raw ivory
  - a comprehensive and demonstrably effective reporting and enforcement system for worked ivory

Japan's ability to fulfil the Santiago requirements will be assessed point by point, based on the findings of two studies, one by the Japan Wildlife Conservation Society (Sakamoto 2002) and the other by TRAFFIC East Asia (Kiyono 2002).

Preventing re-export. Although ivory is mostly smuggled into Japan rather than out it is still necessary to assess Japan's ability and will to prevent re-export of imported ivory. An indicator is its record in preventing illegal trade. Illegal imports to Japan continue (there were 208 seizures from 1994 to 2001)

Japan Wildlife Conservation Society

A netsuke – a Japanese ornament carved from ivory.

(Sakamoto 2002). One case where ivory was smuggled from Singapore in April 2000 involved a board member of the Tokyo Ivory Arts and Crafts Association, but he was fined just 300,000 yen (about USD 2500) and not suspended from operating as a registered ivory dealer (Kiyono 2002; Sakamoto 2002). On 28 June 2002, 6.5 tonnes of African ivory bound for Japan was seized in Singapore. The seizure was one of several shipments by an ivory-smuggling syndicate operating since 1994 (Hastie et al. 2002). Japan was criticized for its reluctance to investigate the consignee, a Japanese customs clearance company, only announcing preliminary results of an investigation in a closed session at SC49, nine months after the seizure.

Currently there is nothing to prevent re-export of imported ivory as tourist souvenirs, and Japan's inadequate penalties and lacklustre record on enforcement inspire little confidence that it has the will to prevent smuggling.

Registration of businesses. Under Japanese law all ivory manufacturers and wholesalers and retailers of ivory *hanko*s (name-seal stamps accounting for over 80% of ivory used) are required to register their businesses. But no such requirement is demanded of wholesalers and retailers trading in ivory products other than hankos. Given the many kinds of ivory products on sale such as carved ornaments, accessories for dresses, parts for the *shamisen* (a traditional musical instrument), chopsticks and pipes, this is a loophole (Sakamoto 2002). Japan denies this on the basis that the volume of these products is negligible (Japan 2003), missing the point that *all* businesses involved in manufacture and trade must be registered to comply with the Santiago requirements.

To compound things, a significant proportion of ivory hanko retailers are not registered. Out of 1072 listed in the Tokyo phonebook in September 2002, 39% were unregistered. In a random selection of 218 of these unregistered dealers, 87% were confirmed by phone interview to be selling ivory hankos (Sakamoto 2002). Also noting this problem, TRAFFIC concludes that the failure to register is 'abetted by current regulations which make it illegal for non-registered dealers to purchase cut pieces, but not illegal for registered dealers to sell or transfer cut pieces to non-registered dealers' (Kiyono 2002).

When IFAW drew to the attention of SC49 deficiencies in the registration system (IFAW 2003) Japan objected, claiming that they are strengthening their effort to investigate non-registered ivory hanko retailers (Japan 2003).

Nationwide information procedure for tourists at retail outlets. This requirement has not been fully implemented in Japan.

Trade controls for raw and worked ivory. Both Sakamoto and Kiyono identified weaknesses in Japan's domestic ivory trade control system additional to those noted above. Compulsory registration applies only to whole tusks. Even then tusks need be registered only if the holder wishes to sell or transfer them, and there is no time limit for registration (Kiyono 2002). Since no registration is required to possess whole tusks, the total number of registered tusks does not represent the total stock of tusks in Japan, which is unknown (Sakamoto 2002).

According to Sakamoto there is no marking system for registered ivory, just a requirement to describe it and submit a picture (Sakamoto 2002). Japan informed SC49 that this is untrue but failed to elaborate further (Japan 2003). The transfer of whole tusks is tracked with a registration card system and each transaction is entered into a database. But the use of management cards is not compulsory for cut tusks (Kiyono 2002). A separate scheme manages cut pieces, under which registered owners are obliged to report the volume of stocks at the time of registration then record in a ledger the volume after each transaction. But there is no requirement for recording on the transaction ledgers cut pieces that originated from whole tusks in the owner's possession (which themselves are not required to be registered) (Sakamoto 2002). Because 'stocks of whole tusks and stocks of cut pieces continue to be managed under different schemes' it is 'impossible to get a clear picture of the total stock of ivory in the market place' (Kiyono 2002). Registered dealers are required to keep separate transaction ledgers for cut pieces and hankos, but the ledgers are not linked to ensure that the number of hankos produced matches the weight of cut pieces used (Sakamoto 2002).

The certification seal system is voluntary and not used by all manufacturers. Out of 50 shops that TRAFFIC surveyed, 14 displayed seals for all hankos on view, 21 displayed only sample certification seals, and 15 did not display seals (Kiyono 2002). There is no clear link between the certification seal database and the ledger system. If a manufacturer chooses not to apply for seals then the stock data are not updated, and it is impossible to trace products back to the origi

Japan Wildlife Conservation Society

Ivory hankos on sale in Japan.

nal tusk or cut piece. The Secretariat recommended in December 1999 that manufacturers and wholesalers record certification seal numbers in their ledgers so that database records could be traced through the ledgers to individual traders. As of September 2002 this recommendation had not been implemented (Kiyono 2002).

Registered dealers are required to submit annual returns from ledgers, but there is no specific reporting schedule (Kiyono 2002). In 2001, a quarter of manufacturers failed to submit ledgers for cut pieces and 18% failed to submit them for hankos; 34% of wholesalers and 29% of retailers failed to submit ledgers for hankos. None have been penalized as required by law (Sakamoto 2002).

It is hard to conclude anything other than that Japan's ivory trade controls fail to comply with CITES requirements, although the Secretariat has twice visited Japan to verify them, and twice approved them. Separating the schemes for cut pieces and tusks and failing to require registration of tusks in possession are obvious flaws. The missing links between the schemes, the existence of unknown quantities of unregistered stocks of raw and worked ivory, and the ease with which ivory can be transferred to unregistered dealers or laundered into the system mean that the flow of ivory within Japan cannot be monitored. The reporting and enforcement system for worked ivory is neither comprehensive (it applies only to hankos) nor demonstrably effective given the failure rate for reporting.

Exporting countries

The Santiago conditions only allow sale of registered government-owned stocks of raw ivory originating in the exporting countries. These countries therefore need an effective registration, marking and record-keeping system that separates stocks permitted for export from seized ivory and ivory of unknown ori-

gin, and secures the storeroom to ensure no mixing of the ivory. The last time this was verified was by the Secretariat in November 1998. Namibia was approved, but Botswana had to improve its system and be reverified before the 1999 sale could go ahead. Since South Africa was not involved in that sale, its system has not been verified by the Secretariat (other than through the Panel of Experts that assessed its downlisting proposal in 2000).

A loophole in the Santiago conditions is their failure to explicitly require adequate CITES legislation and trade controls in exporting countries and to provide for their verification as a prerequisite to trade. This is despite the fact that Botswana, Namibia and South Africa have all been assessed under the national legislation project as having category 2 legislation. The project required South Africa to adopt legislation by 31 January 2003, and if it had not done so by 31 March 2003 the Secretariat was supposed to notify parties of a recommended suspension of trade in CITES-listed species with South Africa. But on the basis of good legislative progress they were given a reprieve and are due for review again at SC50 (CITES Secretariat 2003). In fact, all South Africa has done is to publicly gazette draft legislation, which is still far from being enacted. Botswana and Namibia were required to submit a legislation plan by 31 May 2002 and adopt legislation by 31 December 2003. Namibia submitted its plan but not Botswana, which was due to receive a formal warning. If both countries fail to adopt adequate legislation by the deadline the Standing Committee is to recommend trade restrictions at SC50.

It could be argued that only national legislation related to elephants and ivory trade is relevant, but the approval of ivory sales is a high-profile issue important to CITES. Countries considered in non-compliance with the Convention on such a fundamental issue as national legislation and under threat of trade restrictions should not be given the go-ahead to trade in ivory. South Africa in particular has drawn fire for its legislative failure and chaotic system of permit issue and record-keeping, largely due to reluctance of the provinces to hand over competence (IFAW 2002; see Bürgener et al. 2001 for an overview of legislation and the permit system). There has also been a generalized failure of cooperation and communication between national and provincial wildlife law enforcement agencies and customs, and recently South Africa disbanded the Endangered Species Protection Unit, a specialized wildlife crime unit operational since 1989. This backward step cannot fail to affect South Africa's ability to control ivory trade.

Another question that merits consideration is the ability of exporting countries to control smuggling through their territories. The Southern African Customs Union, in existence since 1969 between Botswana, Lesotho, Namibia, South Africa and Swaziland, has facilitated the smuggling of wildlife products, including ivory, by reducing border controls to expedite cross-border movement of goods (Austin et al. 1992). The implementation of a free trade area between 11 members of the Southern African Development Community (SADC) in 2000 has the potential to exacerbate the problem. The ivory seized in Singapore last year was sealed in a container in Malawi and passed unobstructed through several border posts before leaving South Africa through Durban (Hastie et al. 2002).

Verification

The Secretariat has been tasked with verifying trade controls in importing countries in consultation with the Standing Committee. But given its anomalous approval of Japan's system and widespread problems of illegal trade and uncontrolled markets, there is a need for clear detailed guidelines on ivory trade controls and their enforcement in exporting and prospective importing countries against which an independent expert review team can verify compliance (IFAW 2003). Precedents for this approach exist in the CITES tiger technical missions and in-depth review teams that carry out on-site visits under the Climate Change Convention (Reeve 2002). The review team should be appointed by the Standing Committee from a roster of independent experts approved by the Conference of the Parties.

To ensure compliance with recommendations of the proposed review team, it is important that any approval of ivory trade be dependent on trading countries revising their systems in accordance with the guidelines.

Recommendations for minimum guidelines on ivory trade controls

- Participation in a standardized, transparent international computerized system for registration, marking and record-keeping to enable tusk-to-product tracing and prevent laundering of illegal ivory

- Annual inspection of all businesses registered as dealing in ivory and of all their stocks, and the provision of publicly available reports to CITES
- An obligation to investigate nationals suspected of involvement in illegal trade, and temporary suspension of registration while under investigation
- Deterrent penalties for illegal trade (minimums to be specified) and permanent suspension of registration of convicted traders
- Enforced border controls adequate to prevent in-transit illegal trade as well as illegal imports and exports
- Cooperation and coordination among national CITES authorities and wildlife law enforcement agencies, including customs, through national CITES committees
- Participation in an effective system of law enforcement coordination between exporting and importing states through formal agreements or memoranda of understanding

Law enforcement coordination

The Santiago conditions encourage the Standing Committee to recommend measures for improving law enforcement coordination between ivory-producing and ivory-importing states but there is no requirement for the recommendations to be implemented before trade is approved. This is another loophole. Unfortunately all that was recommended at SC49 was that ivory-producing and ivory-importing countries be encouraged to increase flows of information; open channels of communication and improve use of existing channels; and improve communication between relevant agencies. Germany made several concrete recommendations that the Standing Committee failed to take up, including the need for clear reporting lines for all illegal activities on elephants, encouraging parties to participate in regional law enforcement agreements, and providing contact points for information exchange.

R. Reeve

Ivory trade in Kinshasa market two weeks after the ivory sale was approved. The vendor stated, 'in 18 months the ivory trade is completely open. I read it in the newspaper.'

Lack of political support for improved coordination of wildlife law enforcement is a persistent problem (Reeve 2002). It was the reason for establishing the Lusaka Agreement Task Force (LATF), yet none of the three export countries is a member. South Africa signed the Lusaka Agreement but failed to ratify it. No equivalent mechanism for regional enforcement cooperation exists in Asia. Clearly the best way to improve coordination of law enforcement would be for all African elephant range states to ratify the Lusaka Agreement while Asian countries establish a counterpart, with both regional task forces mandated to cooperate. As a prerequisite to trade, states should be obliged to join the relevant agreement and to exchange information and coordinate their law enforcement operations and training through the two regional forces.

A less preferable alternative to an Asian regional task force would be memoranda of understanding (MoUs) between LATF and wildlife law enforcement agencies in ivory-importing states. The MoUs would need to include exchange of intelligence on illegal trade and offenders, lines of communication, training, and provision for cooperative enforcement operations between the agencies (for example, controlled deliveries).

Proceeds of the sale: conservation trust funds

The condition that revenues from ivory trade were to be invested in elephant conservation was included in the last approved one-off sale. To date there has been no credible, detailed reporting to indicate how any of the funds generated were in fact used. An audited financial mechanism, separate from the government's general budget, with independent oversight and transparent reporting on projects will need to be established or designated to ensure that proceeds of the most recently proposed sale will be used, as stipulated, exclusively for elephant conservation and community conservation and development programmes within or adjacent to the elephant range. To avoid conservation in range states becoming dependent on ivory trade funds, a potentially risky scenario, qualifying projects should be additional to existing core conservation programmes. An option to be considered is a conservation trust fund with an independent board of trustees including a cross-section of NGO, government and community representatives (Resor 1998). At the outset, the governing instrument will need to clarify the types and size of activities that can be funded, and who will implement them. To ensure transparency, independent auditing is essential, as is reporting on the projects to CITES and publishing of the reports on the CITES Web site.

Compliance mechanism

The Standing Committee has been delegated the task of deciding compliance with the Santiago conditions, and of stopping trade partially or completely if exporting or importing countries are not complying. Considering the controversy surrounding decisions on the ivory trade and their importance to CITES, the final arbiter of whether the conditions had been fulfilled should have been the Conference of the Parties. But since this is not the case, the mechanism whereby the Standing Committee assesses compliance and responds to non-compliance *in advance of the sales*, as well as during and after the sales, needs to be clearly defined.

The information on which to assess compliance should be provided by the independent review team recommended above. It should be tasked with drawing up recommendations on action to be taken following on-site visits to the trading countries. The Standing Committee should then set a deadline for implementing the action, after which the review team will assess compliance and report to the Standing Committee. In the event of non-compliance with any of the conditions or guidelines on the part of any of the trading countries, the Standing Committee should recommend that trade *not* take place. The review team should also be tasked with assessing compliance with the condition concerning the proceeds of the sale. To ensure transparency all its reports should be publicly available.

Implementing this mechanism will require considerable funds. But given the importance of the ivory issue and the extensive funds already devoted to MIKE—over USD 3 million for 2001–2003 (Anon 2002b)—trade controls and their enforcement must be stringent and verification unbiased and transparent. To avoid political bias or undue influence, donors to these activities, indeed to any elephant-related CITES activities such as range state dialogue meetings, should exclude parties or organizations that have any commercial interest in the ivory sale.

Conclusions

Given the evidence that poaching and illegal ivory trafficking continue (Hastie et al. 2002; Martin and Stiles 2002; Milliken et al. 2002), neither the Standing Com

mittee nor the Conference of the Parties should authorize any ivory trade before both monitoring programmes are fully operational and providing jointly analysed data. MIKE is still in the development stage and not expected to produce baseline information until 2005 at the very earliest. Time is needed to iron out field problems and provide training, and for the TAG to resolve controversial areas of methodology and enable reliable peer-reviewed data analysis. ETIS needs to be more proactive and clearly linked with MIKE. To determine detrimental effects of ivory trade, decisions on other elephant populations will require trends based on data from both programmes. Obtaining this information is going to take far longer than establishing a baseline. The process cannot be rushed by three range states pressing to sell ivory as soon as the May 2004 deadline is passed. In any case, given the estimated timeline for producing baseline information, no sale will be possible before CoP13 in October 2004.

Ideally the protocol for the safety mechanism should have been settled and baseline information provided before any sales were considered. The Santiago decision was premature. The least to be done now is for the Conference of the Parties to suspend decision-making on further sales until the data requirements to enable the monitoring systems to achieve their objectives have been established and the safety mechanism is in place.

Ivory trade controls in exporting and prospective importing countries leave a lot to be desired, including in Japan, which is supposed to have one of the most rigorous systems in the world. Seizures indicate Japan as a destination for contraband ivory, which in turn indicates that some of the ivory on sale there could be from illegal sources. The missing links between management schemes, the inadequate reporting and enforcement system for worked ivory, and the inability to monitor flow of ivory within Japan or to know how much ivory is in the market at any given time all indicate the need to reassess Japan's system. Its previous approval by the Secretariat flies in the face of the evidence and calls for a more independent and transparent system of verification on the basis of more detailed and stringent guidelines than currently exist by a review team of independent experts. Providing for their appointment by the Standing Committee from a roster approved by the Conference of the Parties should help to ensure independence.

The Santiago conditions were integral to the CoP12 decision provisionally approving the sale of ivory stockpiles, which achieved the necessary votes by only a narrow margin. Many parties agreed only on the understanding that the conditions would be stringently applied. But these conditions are flawed, as is the existing system to assess compliance and trade controls in exporting and importing countries, which places too much reliance on the Secretariat. The Standing Committee's lacklustre approach at SC49 to definitions for baseline information and recommendations on improved coordination of law enforcement inspires little confidence. If it fails to take a rigorous approach at SC50 there will be a strong case for revisiting the conditions and definitions at CoP13. In any case the Conference of the Parties will need to close loopholes such as failure to provide for verification of ivory trade controls in exporting countries and lack of a requirement to implement recommendations on improved coordination of law enforcement.

Only stringent conditions, standardized and enforced trade controls, an independent and transparent verification system, and coordinated law enforcement will ensure that the proposed sale does not result in increases in illegal ivory trade with consequent detrimental effects on wild elephant populations. Moreover, sufficient data from MIKE and ETIS need to have been collected in a period free of impending trade long enough to be able to relate trends to decisions on elephants and ivory trade and to determine detrimental consequences. If these steps cannot be taken on such a high-profile issue as ivory before any sale takes place, it will call into question not only the intent to base all elephant decisions on the 'best possible information' but the effectiveness of CITES itself.

Acknowledgements

Thanks are due to IFAW and the David Shepherd Wildlife Foundation for funding and supporting this work. We are indebted to persons who provided information or assistance, notably Julian Blanc, Bill Clark, Iain Douglas-Hamilton, Kes Hillman Smith, Nigel Hunter, Paula Kahumbu, Esmond Martin, Leo Niskanen, Patrick Omondi and Masayuki Sakamoto.

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FIELD NOTES

Reconnaissance survey of human–elephant conflict in the Dadieso area, western Ghana

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Abstract

A reconnaissance study was carried out to determine historical elephant occupation as well as the nature and extent of human–elephant conflict in the Dadieso area of western Ghana. Because no crop raiding occurred during the period of study, there are no quantitative data; therefore, the study used social science methods to achieve its objectives. A questionnaire developed and administered in 14 villages around the two forest reserves during the survey indicated that elephants dwelt in the area before 1957. Since then they have gradually disappeared, starting from north of the Dadieso Forest Reserve, until recently they can be seen only south of the Disue River Forest Reserve. Since 2000, no village has seen signs of elephants in their area.

Villagers mentioned that elephants had raided crops since colonial times. Plantain, cassava, cocoa, oil palm, cocoyam and yam were the foods that they most often ate or destroyed. The last crop-raiding incident in any village in the area was in the year 2000. Generally, it appeared that crop raiding has not been as serious as around Kakum National Park or the Red Volta Valley in Ghana.

Résumé

On a réalisé une étude de reconnaissance pour connaître l'historique de l'occupation des éléphants ainsi que la nature et l'étendue des conflits hommes-éléphants dans la région de Dadieso a l'oest de Ghana. Comme il n'y a eu aucun dommage aux récoltes pendant la durée de l'étude, il n'y a pas de données quantitatives. C'est pourquoi l'étude a utilisé les méthodes des sciences sociales pour arriver à ses fins. Par un questionnaire mis au point et distribué dans 14 villages situés autour des réserves forestières, l'étude a appris que les éléphants étaient bien installés dans la région avant 1957. Depuis lors, ils ont peu à peu disparu, en commençant par le nord de la Réserve Forestière de Dadieso, et aujourd'hui, on ne les observe plus qu'au sud de la Réserve Forestière de la rivière Disue. Depuis 2000, aucun villageois n'a observé de traces d'éléphants dans la région.

Des villageois ont mentionné le fait que des éléphants avaient encore ravagé des récoltes après l'époque coloniale. Les plantations les plus souvent mangées et détruites étaient les bananes-plantain, le manioc, le cacao, les palmiers à huile, les taros et les ignames. Le dernier incident connu avait eu lieu en 2000. Il semblait qu'en général les dommages causés aux récoltes n'étaient pas aussi graves qu'autour du Parc National de Kakum ou de la Vallée de la Volta Rouge, au Ghana.

Introduction

Conflict between elephants and humans has been a serious issue in many parts of Africa, leading to loss of life and damage to property (Sam 1998). Conservation and political circles increasingly agree on the need to mitigate the negative effects of this conflict between humans and elephants (Hoare 2001).

In Ghana, crop raiding by elephants has been the major human–elephant conflict issue that has been recorded in most elephant ranges. The nature and extent in the Dadieso area (Dadieso and Disue River Forest Reserves) has not been documented. The primary objective of this study was, therefore, to collect data on human–elephant conflict in the area. However, since there were no elephants in the field during the study, we undertook a social survey to determine what history there was of crop raiding in the villages bordering the two forest reserves. As this technique is emerging, it is worth noting the value of the qualitative methods we used in assessing areas where no data had previously been collected.

The specific objectives were to determine 1) the history of elephants occupying the Dadieso area and 2) the nature and extent of human–elephant conflict in the area in the recent past.

Study area

The study site is located in the south-western portion of Ghana (fig. 1) in the moist evergreen vegetation zone, between latitudes 5°51' and 6°05' N and longitudes 3°05' and 2°54' W. It comprises areas around two contiguous forest reserves, the Dadieso Forest Reserve and the Disue River Forest Reserve, both managed by the Enchi Forest District of the Forest Services Division.

The Disue River Forest Reserve covers an area of 24 km^2. It was last logged in 1978 and the canopy in the logged areas is now open. The hilly portion of the reserve is designated as Hill Sanctuary and most of the canopy is closed. The Dadieso Forest Reserve covers 171.2 km^2 of which 4.5 km^2 is admitted farms. More than one-third of the reserve boundary lies on the Ghana–Côte d'Ivoire frontier.

The reserve is an important ecological site with a moderately high genetic heat index due to its flora diversity of up to 170 plant species per hectare and has since 1998 been designated a globally significant biodiversity area (Hawthorne and Abu-Juam 1995). With the exception of nine compartments logged to construct the Enchi-Dadieso road, the reserve has never been logged. It therefore largely remains an undisturbed forest (FSD 2000).

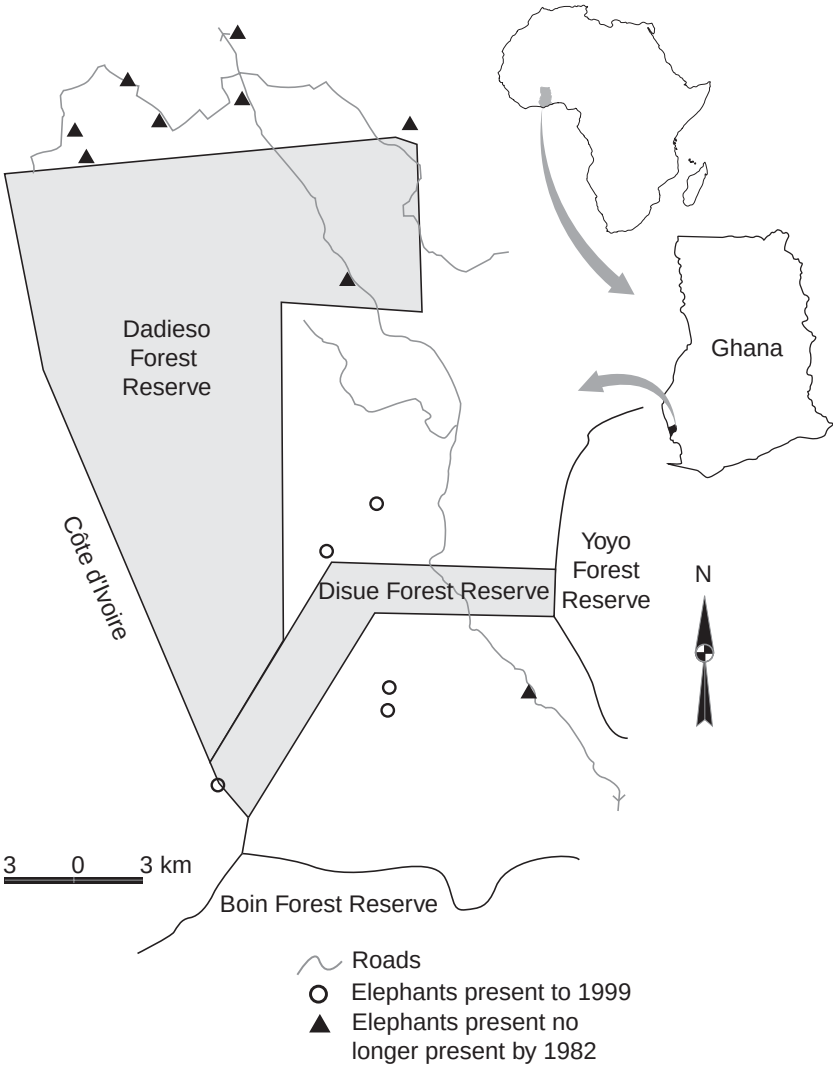
Methods

We drew up a list of villages lying within about 5 km on the Ghanaian side of the Dadieso and Disue River Forest Reserves and compiled a list of questions. As the amount of time available was limited, we randomly selected 14 villages, which was two-thirds of the total, and conducted interviews using the questions. Depending on the answers, other questions could be asked beyond the predetermined ones. At each village we contacted the chief or headman, who then organized a meeting. There was usually an attempt to rally the village elders and if possible, the hunters. At some villages, younger men and women were also present.

The interviews were conducted as an informal conversation in a local dialect (Twi) with one member of our team asking the questions and other team members joining in where appropriate (Sam et al. 1997. Usually the elders were the ones who replied to the questions. We tried to ensure through counter-questions that they did not control the information given because of a hidden agenda. As in all such surveys, the validity of the data collected depends upon the honesty of the respondents and their willingness to be interrogated by a team of students.

The questions were designed to uncover the history of elephant occupation of the areas around the villages, and the time of the year they appeared. Regimes of governance were used to differentiate three distinct periods—the period before Ghana's independence (1957), the period up to the overthrow of the Third Republic (1981), and the year before the new millennium (1999). This year of 1999, when voter registration reopened in Ghana, was used as the upper limit of the third period.

We also tried to find out what kind of conflict existed between elephants and people. If farms were damaged, we asked what crops the elephants ate on the farms. We enquired about trends in game populations. Occasionally people volunteered information on how many elephants had been shot for raiding crops and other similar information.



Map of survey area indicating the 14 villages where respondance were interviewed.

Results

During the interviews, 134 peaple, including 32 women, were present (see table 1). Elephants have occurred around Dadieso and Disue River Forest Reserve since colonial times until 2000. Since that time villagers reported no sign of elephant presence on their farms. Figure 1 shows in which villages within the study area elephants were seen up to the year 1982 and in which they were still present by 1999.

Ten of the 14 villages said elephants had come into the area since the colonial period. All 10 said they came either from Côte d'Ivoire or the nearby forest reserves.

All 10 communities cited crop raiding as the major conflict that existed between humans and elephants. Six villages said that the elephants actually stopped to feed while four said they simply trampled crops as they passed through the farms. Villagers in the six villages said that a herd of about six elephants could destroy almost half of a 3-acre farm in one raiding event. Some farms suffered repeated raids that resulted in especially heavy losses. Eight villages named cassava and plantain as the crops most often destroyed. Other crops mentioned by at least half of the villages were cocoa (pods and beans), oil palm, yam, cocoyam and maize. Two villages mentioned banana, rice and pineapple as being delicacies for the elephants.

Elephant movement appeared to be year round although much occurred during the major harvesting period. Groups of up to six elephants were mentioned as involved in crop raiding. Three villages also mentioned seeing one or two bulls around their area. Half of the villages where crop raiding occurred mentioned seeing calves or their signs among herds that visited their farms.

All villages, even those in areas where no elephants visited, mentioned using elephant dung as medicine. Measles and skin rashes were the ailments most often mentioned that the dung is believed to cure. Only Tawiakrom village added that elephant meat also served as food for the villagers when available.

Villagers usually used traditional methods such as making noise and setting fires to ward elephants off their farms, trying to prevent crop raiding (Sam et

Table 1. Information from villages interviewed

Village	Inter-viewed (no.)	Elephant presence around fields			Calves	Crop raiding	Elephants last observed	Stop/ Pass
		to 1957	1958–1981	1982–1999				
Adonkrom	9 (0)	yes	yes	yes	no	yes	2000	S
Afrimkrom	5 (2)	yes	yes	yes	–	yes	2000	P
Asuo Pokua	10 (0)	yes	yes	no	yes	yes	1995	S
Bediaben	7 (3)	no	no	no	–	no	–	–
Fawokabra	5 (0)	yes	yes	yes	yes	yes	2000	S
Ganyo	15 (6)	no	no	no	–	no	–	–
James Adom	10 (2)	no	no	no	–	no	–	–
Kaalo	38 (2)	yes	yes	no	yes	yes	1983	S
Kooboy Nokwanta	10 (7)	no	no	no	–	no	–	–
Maame Yaa Nsia	6 (2)	yes	no	no	yes	yes	1978	S
Nsiakrom	4 (0)	yes	yes	yes	no	yes	2000	P
Obengkrom	9 (6)	yes	yes	no	yes	yes	1994	P
Susan	5 (1)	yes	yes	no	no	yes	1992	P
Tawiakrom	2 (1)	yes	yes	yes	no	no	2000	S

Numbers of other animal species were all decreasing
Numbers in parentheses are the number of women present
S – stop to feed
P – disturbance through passage only

al. 1997). On a few occasions, the Wildlife Control Unit at Goaso was called upon while in other cases experienced hunters were hired to shoot crop-raiding elephants. The people mentioned that the last time elephants were shot in Nsiakrom was in 1999, and in Tawiakrom it was 2000.

All 14 villages mentioned that the numbers of other animals in general in their lands have declined. They attributed this mainly to excessive hunting by both Ghanaian and Ivorian hunters.

Discussion

Historical perspective of elephant occupation and crop raiding

Elephants have occurred around the Dadieso area since colonial times but they had been wiped out from the northern part of the area by 2000, when they were seen only around the Disue River Forest Reserve in the south of the area. The impression gathered from the survey is that the elephants in this area were part of a large ranging population, which had been severely attacked by hunters and hence left the area. Excessive hunting had been reported in the area (ECONS 2003), believed to have occurred especially over the last two decades. The hunting has been linked to the opening of the Elubo–Enchi–Dadieso–Juabeso road, which links south-western to midwestern Ghana, and also the apparent absence of the Wildlife Division, the agency responsible for enforcing wildlife laws in Ghana.

Elephant movement within the area was year round. However, a lot of movement coincided with the major harvesting period in the rainy season, when crop raiding peaked. Elephant movement was significant in the dry season (November–April) when water was limiting in many places. A large portion of the movement in the dry season is also probably to feed in cocoa farms, as this time is one of the cocoa-harvesting seasons.

Calves participating in crop raiding in half of the afflicted communities probably indicates that elephants did not find crop raiding a risky venture (Sam et al. 1997). This is buttressed by the repeated raiding attempts at particular farms.

Whatever variable drew the other animals such as duikers and bushbucks out of the reserves probably affected elephants as well (ECONS 2003) and

contributed to elephants lurking around the boundaries and getting into nearby farms to feed on more nutritious and succulent plants such as cassava and plantain than foliage of a matured forest vegetation as found especially in the Dadieso Forest Reserve.

It did not appear that crop raiding was as great as it is elsewhere in Ghana, such as in the Kakum Conservation Area (Dickinson 1998), where several farmers and hectares of farmland are affected every harvesting season. Besides, the survey results gave an impression that although an appreciable number of farmers were affected, farmers in the area did not see crop raiding as burden. This could probably be attributed to little regard for wildlife and forestry laws and inadequate enforcement of them, as the farmers could arrange among themselves to eliminate any elephants they considered a nuisance on their farms.

We recommend that the Forestry Commission collaborate with the district administration to plan and execute a comprehensive awareness programme emphasizing wildlife and forestry laws to avert the indiscriminate and unsustainable exploitation of the forest and wildlife resources in the area.

Conclusion

No crop raiding took place during the survey. However, interviews indicated that crop raiding had been a serious issue in the area, occurring not just when most food crops were harvestable but also during the dry season. It did not appear burdensome, because farmers themselves killed the elephants when problems arose.

This paper has demonstrated how a social science survey can be used as a method to evaluate conflict in areas where no data have previously been collected.

Acknowledgements

We would like to thank the European Commission, who funded the IUCN/SSC African Elephant Specialist Group Small Grants Programme, which sponsored this project. Mr Leo Niskanen, the AfESG programme officer, and his office were kind and patient with us, for which we are very grateful. This study was part of a capacity project undertaken under the auspices of the Eden Conservation Society of Ghana, to which we are grateful.

We are highly indebted to the managers of the Ankasa Conservation Area and Enchi Forest District, their lieutenants and all their field staff who were involved in gathering data.

We acknowledge the technical support of Dr Richard F.W. Barnes during the data analysis and preparation of this manuscript. Messrs Seth Ken Appiah-Kubi, Sammy Boye-Doe, Joseph Amponsah, Mike Abedi-Lartey, Jerry Antwi, James Pouridemi and Papa Ekow Quansah helped with various aspects of the project.

To all the students who participated in the training programme, our able driver, Mr Samuel Taye, and all whose assistance and dedication made the study a reality, we say thank you and *ayekoo*.

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Training as a critical component of elephant research and management in Ghana

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Introduction

Institutional weakness prevents elephant manage-ment programmes in West Africa from becoming established and functioning efficiently. Most government wildlife departments lack the personnel needed to carry out their mandate, as existing personnel frequently do not have the necessary technical and professional training (AfESG 1999). Consequently, parks and reserves are not effectively protected from poachers and farm encroachment. Surveys cannot be conducted and there are no moni-toring programmes.

Most research on elephants in Ghana, over the years, has been undertaken by staff of the Wildlife Division in collaboration with visiting researchers and students, both local and international. However, the increasing problem of human–elephant conflict stemming from shrinking habitats and other factors, with limited capacity and financial resources of the Wildlife Division (2000), has shown that the division cannot single-handedly shoulder the responsibility of elephant conservation and management.

The Eden Conservation Society through the IUCN/SSC AfESG Small Grants Programme initiated a training programme to build a work force for undertaking various elephant biology and management activities. Eden is a young, environmental, non-governmental organization in Ghana that is membership-based. It intends to be a strong partner of the Wildlife Division in implementing Ghana's Elephant Conservation Strategy.

The specific objectives of the project were to

- train 12 wildlife and forestry students of Kwame Nkrumah University of Science and Technology, Kumasi, in various aspects of elephant biology and management techniques
- determine the population size and distribution of elephants in the Dadieso area
- determine factors affecting elephant conservation in the area
- determine the nature and extent of human–elephant conflicts in the area.

The objective of this field note is not solely to bring this information to the knowledge of readers. We hope countries, institutions and other organizations that similarly lack funds, staff and know-how will be encouraged to undertake similar capacity-building programmes. We also hope that the content of the course will serve as a template for training in other countries.

Methods

An initial two-week theoretical training course was held in Ankasa Conservation Area, where elephants occur. This course was reinforced with an additional two weeks of actual fieldwork in and around Dadieso and Disue River Forest Reserves in Dadieso area.

The course was designed to provide a continental overview of the status of elephants, problems of elephant management and human–elephant conflict, the biology of elephant populations and individuals, and census methods. Classroom work consisted of lectures, discussions, paper exercises, group syndicate work, case studies and plenary sessions. A typical day comprised four main classroom and field sessions of $1^1/_2$ to 2 hours, in addition to 1 to 2 hours of individual or group assignments in the evenings.

Various census methods were taught. The pattern was usually to introduce the topic in the classroom and then conduct a series of exercises of increasing complexity. Field trials with compass, tape measures, GPS (global positioning system) and camera were undertaken to equip the students to handle the field work later at Dadieso.

Literature in the form of books, journals and reprints, the core being AfESG products, were assembled for the students to use.

During the second phase of the project, the standard line-transect method (Buckland et al. 1993) was used to survey elephants and other animals on 45 1-km transects, while questionnaires were administered in 14 randomly selected villages within 7 km around the two reserves. [Ed. note: See also proceeding note]

The topics treated in the theoretical section are given in table 1.

Results

The preliminary elephant survey showed that few elephants were using the area at the time of the study. The questionnaire survey also indicated that elephants had gradually disappeared, starting from the northern part of the study area, and their signs are now found only in the south. The full results of these studies have been documented elsewhere (Eden Conservation Society 2003).

Discussion

The capability of a workforce of 12 young scientists working with elephants was improved through the training. The first-ever baseline information on elephants for the Dadieso area and historic information on elephant crop-raiding issues have been documented.

Although the actual contribution of the training to elephant conservation in particular and wildlife man

Table 1. Topics covered in the training course for wildlife managers

Topic and no. of sessions used	Skills	Emphasis
Behaviour (6 sessions)	Morphology and behaviour to aid identification, differentiation and education activities	Age and sex categories, social behaviour, musth and mating, feeding and foraging, differences between forest and savannah elephants
Population dynamics (6 sessions)	Determining age: using tusk growth, tooth wear and eruption, sex ratio, age distribution, tusk measurement	Population trends and influencing factors: conception rate, birth and death rates, conservation and management of elephants
Counting elephants (12 sessions)	Conducting reconnaissance surveys, sampling, variation; calculating estimates, standard errors, confidence limits	Direct and indirect counting methods, total and sample counts, aerial and ground counts, strip and line transects; registering individuals in a population
Crop-raiding (14 sessions)	Defining the problem, collecting data, judging incidents, considering management options, disseminating information; using diplomacy, patience, and communication skills in dealing with complaints	Causes of crop raiding; locating and mapping incidents; evaluating frequency and severity, identifying problem elephants, deterrent methods
Elephants in Ghana (3 sessions)	Assessing current status of elephants as enumerated in the elephant strategy for Ghana	Strategy for the conservation of elephants: current status, opportunities for research, monitoring, census plan for both savannah and forest zones
Grant proposal writing (3 sessions)	Equipping students to be able to prepare their own projects: planning and implementing projects	Conceptualization and development of projects, logical framework and budgeting
Field trials and practice (6 sessions)	Reading maps, using compass, tape measures, hip chain, GPS, camera	Learning to use field instruments

agement in general will become more evident after evaluation in a few years to come, five months after the training, the following benefits can be attributed to the training:

- The project has provided insight into the current status of elephants, the history of elephant occupation and the status of human–elephant conflict as well as factors militating against biodiversity conservation in general.
- Participants' knowledge of the species has been improved, which will particularly boost research and public education about the species.
- Analytical skills of the participants have been improved considerably.
- Participants' ability to plan and implement a project has been developed and improved.
- Participants obtained training in writing project proposals.
- Two participants have been motivated by the training to work on elephants for their final-year thesis.
- Some participants have led two groups of Ghanaian students to write two project proposals on elephants for student BP Conservation project awards for the year 2003. Both projects passed through the first phase of assessment with one of them finally winning a bronze award.

Acknowledgements

The European Commission provided funds for this project under the IUCN/SSC African Elephant Specialist Group Small Grants programme. We are grateful to Mr Leo Niskanen, the AfESG programme officer, and his office. The project was undertaken under the auspices of the Eden Conservation Society of Ghana.

Many thanks to the Wildlife Division (Forestry Commission) for permission to use the facilities at Ankasa Conservation Area and to Mr John Naada and his staff for both technical and administrative support. Messrs Moses Kofi Sam and J. Naada were the resource persons.

Dr Richard F.W. Barnes and Mr M.K. Sam provided comments on the manuscript. We are grateful to Mr Seth Ken Appiah-Kubi, Mr Samuel Boye-Doe, participants of the course, Mr Samuel Taye (our driver) and all others who helped with various aspects of the project.

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Immobilizations and evaluation of clinical parameters from free-ranging elephants in southern Tanzania

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Introduction

To study the seasonal movements of bush African elephants and collect data about their home range in the Selous–Niassa wildlife corridor (SNWC), a capture and radio-collaring programme was implemented within the framework of the SNWC project. The SNWC project is a joint programme between the Institute for Zoo and Wildlife Research (Berlin, Germany), the Selous Conservation Programme, German Technical Cooperation (SCP/GTZ), the Wildlife Division of the Tanzania Ministry of Natural Resources and Tourism, Sokoine University of Agriculture (SUA, Morogoro, Tanzania) and the Tanzania Wildlife Research Institute, with funding from the Tropical Ecology Support Programme of GTZ. Its objective is to collect baseline data to assist in implementing a planned development cooperation project to protect and manage the corridor by setting up a string of village wildlife management areas. The goal of the project is to protect the entire wildlife corridor by encouraging local communities to participate, to benefit from sustainable use of natural resources and to combat transboundary poaching.

Capture methods

To accomplish the above objectives, 12 elephants were immobilized and 10 were radio-collared during two periods. The first took place from late August to early September 2000, the second in November 2001. Throughout the capture operation, a knock-down dose of the immobilizing drug was administered according to the main age group, as suggested by as suggested by Kock MD et al. (1993), Kock RA et al. (1993) and Hoare (1999) to induce rapid recumbency and limit the animal's post-darting movements. Either a capture gun (Parker Hale) or a dart gun (Dan-Inject) was used to administer the immobilizing drug mixture remotely. Etorphine hydrochloride (M99, C-Vet Ltd.) was the principal immobilizing drug. During the first phase, a dosage of 10 to 12 mg of M99 was used for females and 12 to 15 mg for bulls (table 1). M99 was combined with 40 mg of azaperone (Stresnil®, Janseen-Cilag, Neuss, Germany) irrespective of the elephant's size. In addition, 3 to 4 drops of thermo-stable, tissue-accelerant compound (an experimental substance supplied by Prof. Henning Wiesner, Munich, Germany) was added to the dart to increase the rate of drug absorption and hence the speed at which immobilization and anaesthesia would take effect. Stresnil was included during the first period to prevent pink-foam syndrome as a certain degree of excitement and stress was expected during approaches on foot.

Haematology and blood chemistry

Blood for haematology and clinical chemistry was collected from the ear vein within 10 minutes of lateral recumbency, in vacutainer tubes (plain, EDTA, heparin and NaF tubes). These were kept at 4°C in a portable cool box. Plasma and serum separations, haemoglobin (Hb) and haematocrit (PCV) measurements were performed at the camp not later than six hours after the samples were collected from the field. Blood stabilized in EDTA was used to assess PCV and Hb concentration and to determine the number

Table 1. Date, time, location, sex, type of drug, dose and posture of elephants immobilized in different areas of the Selous-Niassa wildlife corridor in southern Tanzania

Date	Time	Location	Herd size	Sex	Type of drug[a]	Initial dose	Add'l dose dose & route	Total dosage	Recumbency position	Reversing agent	Other observations
27 Aug 00	2.15 pm	Likuyu	1	M	M99 Stresnil	M 15 mg, S 40 mg	M, 1 mg IV	M 16 mg, S 40 mg	—	M5050 (diprenorphine) 5 ml	Immobilized near Likuyu, fields of the old refugee area
28 Aug 00	3.07 pm	Mtilandambo	5	F	M99 Stresnil	M 12 mg, S 40 mg	none	M 12 mg, S 40 mg	semi-sternal	naltrexone 50 mg	Herd a matriarch, one subadult bull and two calves, found browsing on aquatic plants
03 Sep 00	9.14 am	Mkundi	12	M	M99 Stresnil	M 12 mg, S 40 mg	M, 1 mg IV	M 13 mg, S, 40 mg	left lateral	naltrexone 6 ml	After being darted the animal went into recumbency at the foot of dry river bank
04 Sep 00	3.03 pm	Mbarangandu	16	F	M99 Stresnil	M 12 mg, S 40 mg	3 mg	M 15 mg, S 40 mg	right lateral	M5050 3 ml naltrexone 1 ml	Single-tusk female; 69 adult elephants and 4 calves were seen in the vicinity
04 Nov 01	3.23 pm	Ndalala elephant route	5	M	M99	15 mg	none	M 13 mg	right lateral	naltrexone 5 ml	Ultrasound examination showed empty ampullae, which signify recent breeding
09 Nov 01	3.45 pm	Mkasha	1	M	M99	15 mg	M 1 mg IV	M 14 mg	right lateral	M5050 1 ml naltrexone 5 ml	A small suppurating wound on the lateral medial aspect on the right side of the neck was treated with oxytetracycline spray
10 Nov 01	11.10 am	Msanjesi	2	M	M99	15 mg	M 1.8mg IV	M 16.8 mg	left lateral	M5050 5 ml	Trunk traumatized by snare; wound was cleaned and treated with oxytetracycline spray
10 Nov 01	2.05 pm	Sasawala Forest	1	M	M99	15 mg	none	M 15 mg	left lateral	M5050 5 ml	Animal was aggressive immediately after reversal but was scared by our shooting in the air
11 Nov 01	11.00 am	Sasawala River	2	M	M99	15 mg	none	M15 mg	left lateral	M5050 5 ml	Animal died, trunk partially obstructed by tree; PCV and Hb low
12 Nov 01	11.00 am	Nampungu	1	M	M99	15 mg	2.8 mg IV	M17.8 mg	—	M5050 5 ml	—
12 Nov 01	1.22 pm	Sasawala Forest	1	M	M99	15 mg	2.7 mg IV	M 17.7 mg	right lateral	M5050 4 ml	—

M – M99; S – Stresnil

[a]The route for all initial doses was intramuscular

of red and white blood cells using standard methods as described by Coles (1986). PCV was measured by the micro-haematocrit method using a portable battery-operated micro-haematocrit centrifuge (Microspin®, Bayer, Germany) in which the PCV was read without removing the micro-capillary tubes. The acid haematin method was used to measure Hb concentration (Coles 1986). This method depends upon converting haemoglobin to acid haematin by using dilute hydrochloric acid. The resulting brownish yellow mixture is matched with a standard in a comparator. To determine the total white blood cell count, 50 µl of EDTA blood was mixed with 950 µl of Tuerk solution, while blood for the total red blood cell count was prepared by mixing 4 ml of sterile isotonic (0.85 N) solution with 20 µl of EDTA blood as described by Benjamin (1986). Both preparations were stored at 4°C until final analysis was done within 14 days at the SUA Faculty of Veterinary Medicine, Tanzania. Blood stabilized in heparin and NaF and in plain tubes was used to extract plasma and serum. After extraction, serum and plasma were deep frozen in liquid nitrogen for transportation to Germany. Blood samples stabilized in NaF were used to extract plasma in which glucose concentration was determined. Serum and plasma from blood collected in plain and heparin tubes were used to measure various clinical chemical parameters. With the exception of PCV and Hb (measured in the field) and red blood count and white blood count values (measured at SUA), all clinico-chemical parameters were determined using an automated analyser—Hitachi 747-400 or Hitachi 917-Japan (Roche, Germany). An accredited laboratory, the Labor für Medizinische Chemie und Serologie GmbH (Berlin, Germany), analysed the clinico-chemical parameters.

Results

In general, darting free-ranging elephants from the ground proved difficult and dangerous. The Selous ecosystem is thick miombo woodland, and the area has a history of ivory poaching and of licensed hunting, with up to 30 elephants sport-hunted every year. The first capture period illustrated that elephants tended to retreat into remote and extremely dense vegetation during the day and were very wary of people. The dense woodland and riverine vegetation made tracking elephants by car impossible and by foot difficult and time- consuming in areas with steep terrain. Due to these obstacles, a helicopter was used for the second capture period, and the anaesthesia protocol was modified accordingly. M99 was therefore used without Stresnil to decrease the recovery time (table 1). With a helicopter, it was possible for the pilot to manipulate the entire herd during immobilization by directing the movement of both darted and undarted animals into an open area within a short time, hence minimizing the amount of stress for the darted individual. With a helicopter, the recovery process could be closely monitored from the air, thus minimizing the danger to people that were present during ground darting. The helicopter could also be used to guide revived animals in a safe direction.

Four elephants were thus immobilized with a combination of M99 and Stresnil, and eight were successfully immobilized using M99 only (table 1). All 12 immobilizations were uneventful. Immobilization of one lactating female darted from the helicopter was soon reversed, because she was lying on her sternum and her calf that was 7 or 8 years old persistently refused to move away, regardless of the noise of the helicopter. One adult bull darted from the helicopter using M99 died before the capture team reached it. The remaining 10 elephants were successfully radio-collared.

The following definitions were adopted when referring to time events at different stages of immobilization and neuroleptoanalgesia. The time to first effect was the interval between administering an immobilizing agent and first observing immobilization effects such as slowing of pace, tail flaccidity, and separation from the herd. It is a common phenomenon for the darted animal to stand still soon after it has lost control of its trunk (Raath 2003). Induction time was the interval between administering an immobilizing agent to the point at which the depth of immobilization was sufficient to cause recumbency. Recovery time was the interval from administering the antidote until the animal stood again. Total down time was measured from the moment when the animal went into lateral recumbency until the time it stood up.

Physiology

Immobilization and physiological data are presented in table 2. The blood chemistry values for cholesterol, triglycerides, creatine, sodium, iron and total protein

Table 2. Immobilization, haematology and blood chemistry values in elephants from different areas of the Selous–Niassa wildlife corridor in southern Tanzania

Immobilization parameters	M99 and Stresnil (*n* = 3)	M99 (*n* = 6)	Literature values
Time to first effect (min)	not detectable, done from the bushy ground	8 (3–20)	
Induction time (min)	10.3 (7–15)	11.2 (5–22)	31 ± 9.1[a]
Recovery time (min)	6.3 (4–9)	4.2 (1–10)	2–5[b]
Total down time (min)	77 (61–106)	72 (50–109)	
Mean heart rate (per min)	64 (50–78)	58.2 (53–65)	72–98[b]
Mean respiration rate (per min)	(4–8)	6.25 (6–7)	4–6[b]

Haematology and blood chemistry	Values from M99 anaesthesia (*n* = 6)	Values from dead elephant	Literature values		Remarks
			Brown and White (1980)[c]	ISIS (1999)[d]	
PCV (%)	45.7 (41–50)	25 ↓	44 (38.2–49)	38.1 (25.7–52.2)	
Hb (g/dl)	11.7 (9.4–14.4)	8 ↓	14.3 (10.2–17.2)	13 (9.6–17.8)	
Total RBC (cells/l) x 10^{12}	2.4 (1.6–3.04)	haemo-lysed	3.6 (2.96–5.02)	3.11 (2.05–4.8)	haemolysed in transit from field
Total WBC (cells/l) x 10^{9}	11.4 (10.1–12.6)	14.4 ↑	10.2 (9–11)	11.03 (5.6–19.3)	
Glucose (mmol/l)	4.22 (3.74–5.5)	4.79	–	4.72 (2.28–8.44)	
Alkaline phosphatase (IU/l)	163.2 (103–213)	272	48	186 (64–411)	age & sex variations[c]
Gamma glutamyl transferase (IU/l)	6.8 (4–9)	8	–	13 (3–29)	
Glutamyl oxalo-transferase (AST) (IU/l)	9 (8–14)	10	–	22 (10–80)	
Glutamyl phosphotransferase (ALT) (IU/l)	3.2 (2–5)	3	3	8 (0–26)	
Lipase (IU/l)	4.5 (4–6)	5	–	0.83 (0.28–1.67)	
Alpha amylase (IU/l)	1473 (1272–1895)	1704	2650	307.1 (68.64–1380)	seasonal variations[c]
Bilirubin (μmol/l)	1.25 (0.51–2.22)	1.03	5	3 (0–9)	seasonal variations[c]
Cholesterol (mmol/l)	1.61(1.24–1.81)	1.45	1.58–2.99	1.99 (0.0–6.06)	
Triglyceride (mmol/l)	0.77 (0.50–0.85)	0.3	0.34–0.59	0.49 (0.19–1.08)	
Creatine (μmol/l)	167.96 (130.83–190.95)	169.73	131	159 (71–513)	seasonal & age variations[c]
Total protein (g/l)	82 (64–97)	79	87	77 (62–96)	
Uric acid (mg/dl)	0.13 (0.1–0.2)	0.1	0.05	0.02 (0.0–0.06)	
Urea (mmol/l)	7.86 (6.43–10)	5.72	3.4–9.5		seasonal & regional variations[c]
Sodium (mmol/l)	129 (94–134)	133	125–137	127 (107–145)	seasonal variations[c]
Pottassium (mmol/l	5.6 (3.7–8.9)	7.6	5.3–6.4	4.9 (3.3–7.9)	seasonal & age variations[c]
Calcium (mmol/l)	2.6 (2.2–2.9)	2.96	2.19–2.91	2.75 (2.38–4.45)	
Iron (μmol/l)	12.66 (8.06–16.66)	14.51		13 (6.265–23.27)	

[a] Douglas (1994), [b] Kock et al. (1993b), [c] Brown and White (1980) references for free-ranging African elephants; [d] ISIS (1999) reference for captive African elephants.
IU/l = international units per litre

were within clinically normal ranges. Slight increases were noted for alkaline phosphatase (AP), lipase, urea, potassium and calcium whereas a slight decrease was noted for α-amylase, bilirubin and aspartate amino transferases (AST). Sex, age and seasonal variations have been reported to induce minor variations in elephant blood parameters (Brown and White 1980). Leucocytosis and substantially lower values for PCV (25%) and Hb (8 g/dl) were observed in the elephant that died (table 2). Its total RBC count could not be determined because the sample haemolysed. Trauma and some disease conditions have been reported to lower PCV and Hb values in a variety of domestic animals (Doxey 1983; Benjamin 1986). Persistently low PCV coupled with normal plasma protein is usually suggestive of deficient erythropoiesis as a result of inflammation (Jones 2003). In humans, chronic bleeding and trauma are characterized by leucocytosis and a decrease in both PCV and Hb (Claudia Kühn, pers. comm. 2003). Other conditions associated with change in PCV and Hb include time of sampling in relation to the period of anaesthesia or death (Richard Kock, pers. comm. 2002). In the present case, the changes in PCV and Hb values were unlikely to be caused by neuroleptoanalgesia or death as sampling was done at approximately the same time as for other individuals. The type of anaemia was not established due to the lack of total RBC count values. Other than leucocytosis and low PCV and Hb values, parameters were within clinically normal limits (table 2).

Discussion

Use of M99 for elephant immobilization is a standard procedure and mortalities are rare. However, there are certain risks, which range from mild physical trauma to death. Physical reasons such as trunk obstruction and positional problems are the leading causes of hypoxia and death (Kock MD et al. 1993; Coetsee 1996; Elkan et al. 1998). Other reported causes of death during elephant capture and immobilization include acidosis associated with the consumption of lush vegetation (Njumbi et al. 1996) and viral infections weakening the heart, as has occurred with elephants in Kruger National Park, South Africa (Richard Kock, pers. comm. 2002). From our experience, bullet traumas to vital organs may also pose a risk. Under such circumstances, the wounded animal appears not to withstand the stress caused by neuroleptoanalgesics. Unfortunately, it is difficult to identify in advance by visual observation such a compromised individual. It is therefore important to investigate properly all mortalities including a thorough post-mortem examination, haematology and biochemistry.

Several important requisites have been suggested for successfully immobilizing elephants. Osofsky and Hirsch (2000) summarized some of these factors as 1) behaviour, social structure and the social status of the subject; 2) environment, such as ambient temperature, humidity, wind, terrain, amount of daylight; 3) animal welfare issues, including the type of drug to be used and dose selected, the species-specific response to different capture drugs, the availability of antagonists for the selected restraint drug, the proper assessment of the health status of individual animals, and measures to reduce stress associated with capturing and immobilization.

The combination of these factors thus determines the scouting method, dosage protocol and type of follow-up to be undertaken. Therefore, the capture protocol for elephants in open savannah or semi-wooded habitats differs from that used in the dense miombo woodland and riverine vegetation of Selous. The latter is characterized by low visibility, high variability of terrain and difficulty of locating individuals at a safe distance. These situations create unique and challenging situations, which require much flexibility during the capture operation.

Acknowledgements

This study would not have been possible without the assistance of many people, including Dr W. Rietschel (Wilhelma Zoo, Stuttgart, Germany), Mr Mzamilu Kaita and Mr M.O. Mwangalimi (SUA, Morogoro, Tanzania), Mr David Kaggi from SCP/GTZ (Dar es Salaam), and Mr Nalimi Madatta and Mr Dickson Koishwa, district game officers for Songea and Tunduru, respectively. The services of the game assistants, village game scouts and traditional hunters from several villages in the corridor are greatly appreciated. We also extend our gratitude to our pilots, Ms Sybille Quandt, Mr Martin Bower, Mr Peter Otto and Mr Friedrich Alpers, for their expertise, and to the independent observers from the Tanzania People's Defence Force, Maj. Nandala and Maj. Athanas and Dr Richard A. Kock (Inter-African Bureau for Animal Resources) for helpful comments on an earlier draft. This project was financed by the Tropical Ecology

Support Programme of GTZ, Germany, through the Institute for Zoo and Wildlife Research and run in collaboration with SCP/GTZ and the Division of Wildlife, Ministry of Natural Resource and Tourism, Tanzania. We thank the Messerli Foundation, Switzerland, for their material support.

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NOTES FROM THE AFRICAN RHINO SPECIALIST GROUP

Poaching upsurge in Garamba National Park, Democratic Republic of Congo

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In the second half of 2003 there has been a major upsurge in elephant poaching in Garamba National Park in the north-east corner of the Democratic Republic of Congo (DRC) (fig. 1), with a switch from meat to ivory as the driving force. The carcasses of two poached rhinos have been found with horns and meat removed, and a horn was offered for sale in Ariwara in June, which was earlier than the estimated date of death of the carcasses and therefore probably came from yet another carcass.

The park, which covers 4900 km^2 of rolling tall-grass savannah, bush and woodland and its surrounding 7527 km^2 of wooded reserves, has been recently supporting over 6900 elephants (*Loxodonta africana)* of a unique species intergrade, some 14,480 buffalo *(Synceros caffer brachyceros)*, the last 30 northern white rhinos (*Ceratotherium simum cottoni)*, and it is the only location in DRC where the rare Congo giraffe (*Girafa camelopardalis congoensis)* can be seen. By virtue of its conservation importance, the park was declared a UNESCO World Heritage Site in 1980, and like all the World Heritage Sites in DRC it is currently on the Danger list.

The protected areas in DRC are staffed by the Institut Congolais pour la Conservation de la Nature (ICCN). Since 1984 the conservation of the park has been supported technically and financially by the Garamba National Park Project, working in partnership with ICCN.

The work has been funded by a number of donors and the project is currently coordinated by the International Rhino Foundation. The Frankfurt Zoological Society provides an aircraft for logistical support and several other organizations, such as the United Nations Foundation/UNESCO, the US Fish and Wildlife Service, Save the Rhino International, the Wildlife Conservation Fund (WCF) and the Zoological Society of London, are substantial supporters. Until August a reconnaissance aircraft belonging to WCF and the Garamba Project personnel did all the rhino and anti-poaching survey work and back up. In the current poaching crisis it has just been lost, fortunately with no loss of life.

In the six years before the start of the project, elephant numbers had dropped from 22,000 to a low of 4500 and rhinos from about 490 to 15. In the first eight years of the project, both elephant and rhino numbers doubled, proving the suitability of the ecosystem if protection can be adequate.

Since 1991 the threat to large mammals, generated largely by the side effects of the war in adjacent Sudan, has been gradually increasing and has moved down through the park towards the southern sector where the elephants and rhinos are found (fig. 2). This threat has recently escalated to crisis proportions that threaten the rhinos with extinction if we cannot urgently tackle it successfully. Three phases have led to the current situation.

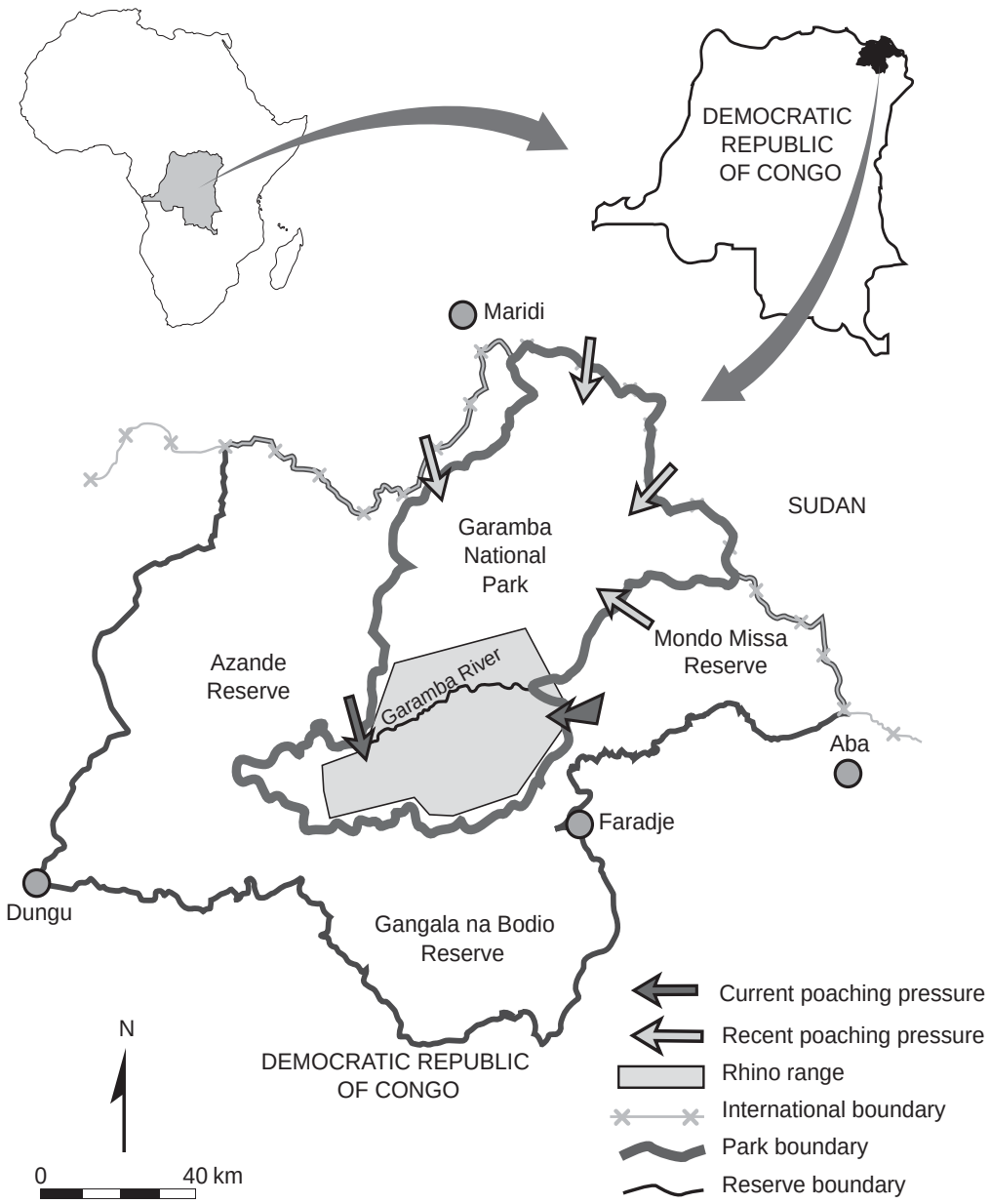

Figure 1. Map showing the location of Garamba National Park and the rhino range.

Phase 1: 1991–1997

In 1991 the Sudanese People's Liberation Army (SPLA) took the town of Maridi in southern Sudan, 30 km from the northern boundary of the park. This resulted in over 80,000 refugees fleeing Sudan and settling around the park and in military camps near its northern border. The Sudanese brought with them arms and ammunition and have been involved in supplying meat for the commercial bushmeat trade. Poachers took mainly buffalo in the north and centre of the park, but despite strong resistance from the guards, they gradually moved south, with significant impact on the distribution and number of buffalo

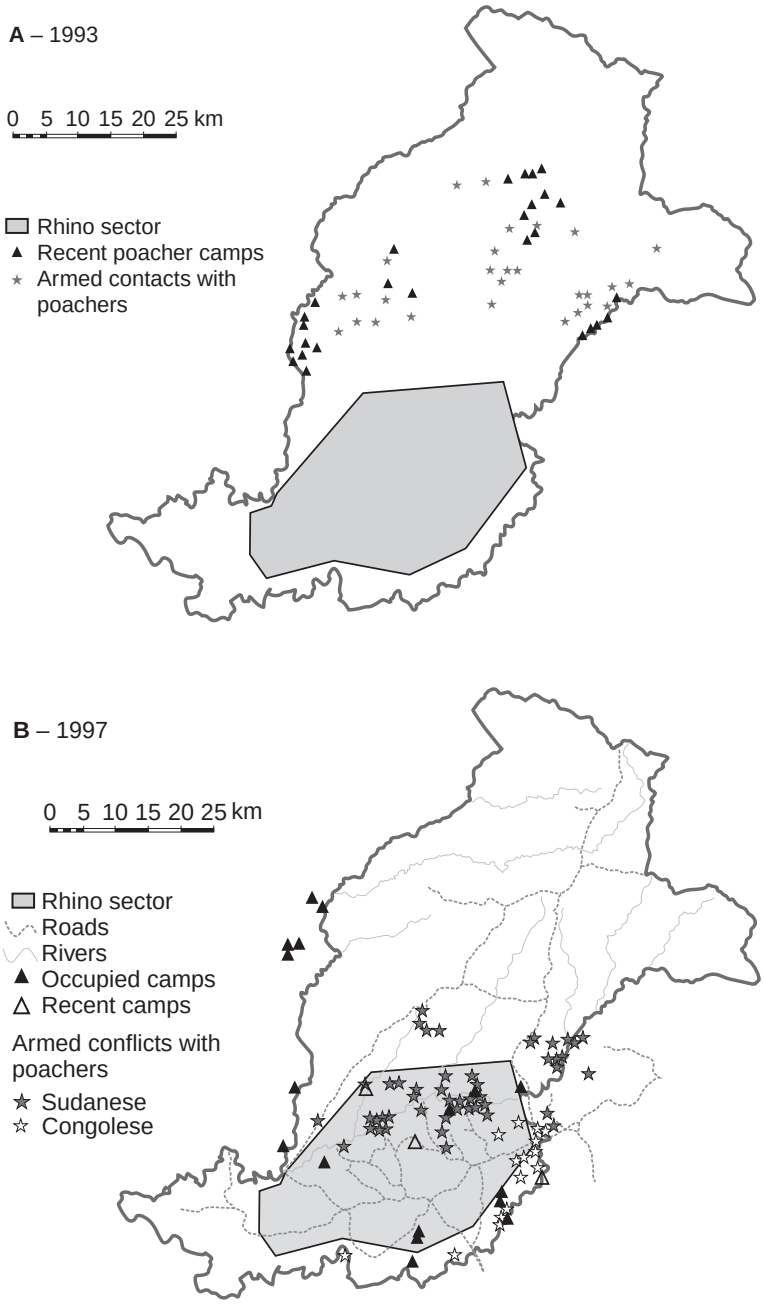

Figure 2. A) In 1993 most of the poaching was in the north and centre of the park, as law enforcement monitoring results show. The driving force was for meat, with camps for smoking it being relatively detectable. B) Despite active antipoaching activity, the front line of poaching moved south. During the main conflict of the liberation war in 1997 in DRC, poaching moved right into the southern sector, which supported the rhinos and in 1995 had the highest density of elephants in Africa. Over 70% of the armed contacts for the last 12 years were with Sudanese and the minority with Congolese.

Phase 2: 1997–2003

The civil conflict in DRC, which has continued since 1997, precipitated an upsurge in poaching, because the guards were disarmed and anti-poaching was curtailed for several months. Poaching in 1997 reduced elephant numbers by half from 11,175 (±3670) to 5874 (±1339). This devastation proved the importance of active presence of field staff, and as soon as possible conservation activities in the park recommenced. When the second war broke in 1998, the committed partner projects and the ICCN staff of the five World Heritage Sites developed a project with the UN Foundation and UNESCO, which provided the money to keep paying the ICCN park guards, provided diplomatic support to facilitate working in a country at war and developed supportive collaboration between sites. The Garamba Project remained committed throughout to supporting the conservation of the park. The number of rhinos remained stable during this period with 12 births as well as losses. The commitment of the ICCN guards in eastern Congo during these difficult years led to the Society for Conservation Biology awarding them Distinguished Service Awards in 2001 in recognition of their continued work in the face of danger and difficulty. Much of the equipment, vehicles, radio communications and patrol observation posts were looted or destroyed.

Major rehabilitation is getting under way and the project is trying to raise more support for redevelopment. However, through this war period virtually all wildlife was eliminated from the north and centre of the park and the buffering effect of the meat poaching of buffalos has been lost. All pressure is on the southern sector, the Intensive Protection

Zone of the rhinos and elephants. In 1999 a group of Sudan People's Liberation Army regulars was sent across the border at the request of the local civilian authorities, because local people were being harassed. Initially their weapons recovery had a positive effect on reducing poaching and two mixed operations were held jointly with park staff, local authorities and the SPLA. But at the end they refused to return, and they and the military camps on the border have been the main force behind the poaching now moving well into the southern sector from east and west.

Phase 3: Late June 2003 to date

Since late June 2003 poaching in Garamba National Park has changed focus from meat to ivory. The level of poaching of elephants has exploded, with poachers taking only the tusks and leaving the meat. Reports indicate that ivory is traded in exchange for equipment as well as for arms and ammunition to resupply rebel factions in Sudan. A survey in August showed 34 fresh elephant carcasses and 2 rhino carcasses gunned down by the automatic fire of AK 47s. There are almost certainly more live rhinos than the 22 seen as one never sees them all at one time and the survey was not fully comprehensive but focused on key areas. The area of high density of elephant carcasses, however, was an area (Nambira/Matakpe) of rhino concentration throughout the war periods. Some of the individuals from there were seen elsewhere, others were not and it is believed that at least 3 rhinos have been killed. However, a new calf was also found in August, and another in November. Infant of 5dF, Jengatu, the August calf was named Keba, which means 'Beware!' in Bangala. The latest calf is to 3eF, Etumba.

A survey and anti-poaching reconnaissance back-up in November found that fresh elephant carcasses are now as far west as the Nangume River and right at the edge of the second rhino area (fig. 3).

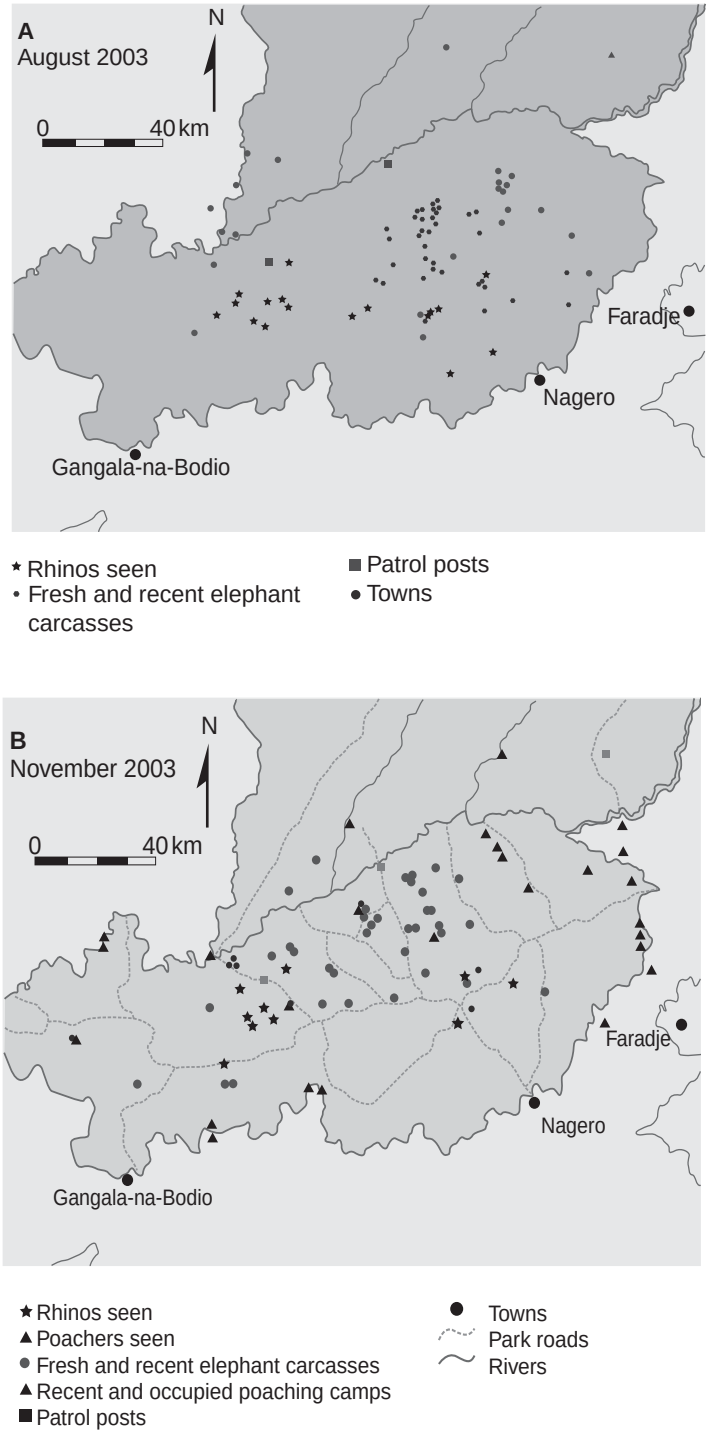

Figure 3. Since June 2003, the nature of poaching has exploded from commercial meat to commercial ivory poaching. Rhinos seen and fresh elephant carcasses found on aerial reconnaissance A) in August 2003 and B) in November 2003.

In November, 47 fresh and recent (stages 1 and 2) elephant carcasses were found, plus a further 7 stage 3. Five groups of poachers were found in and around the park and 15 recently occupied camps. Several air and ground operations were carried out, including one where a group of poachers was found cutting tusks from a freshly dead elephant and a carrying a further 8 tusks. One of the mobile patrols was dispatched using the vehicle recently donated through the project by the International Elephant Foundation and was guided from the air. We then found they had killed a further three adults including two tuskless females, wounding one of their juveniles and orphaning another. Successful armed contacts continue, but with grass the 2 metres tall at present, these are difficult and not enough to eliminate all the poacher penetrations.

Now that the poachers have entered the heart of the park, the threat to the last few northern white rhinos is greater than it has been in the last 20 years. Despite their tough antipoaching stance and motivation, the guards are finding it difficult to repel the well-armed and determined poachers, who are largely southern Sudanese military and military deserters. The current situation in Garamba is being actively and urgently addressed by an emergency strategy developed jointly at the park and approved by the administrateur directeur general of ICCN. The aim is to stop the poaching in the southern sector, prevent any more deaths of key species and allow numbers to rebuild before it is too late, then gradually to regain control of the whole park by

- developing and implementing a full-scale effective training and retraining operation from a training base that has been built in the park, using an expert professional trainer and assistant working with ICCN trainers and project personnel
- revising and implementing an effective anti-poaching strategy to protect the southern sector in the immediate term and to regain control of the whole park in the long term
- providing technical, logistical, maintenance, equipment and ration support necessary, increasing aerial support, raising awareness, and raising further support on the basis of successful actions
- carrying out a major diplomatic and pressure initiative to inform the Sudanese hierarchy and UN peace-keeping forces of the true situation and request their action and support
- increasing communications and collaboration with the surrounding communities and encouraging local diplomatic initiatives

Several diplomatic actions have taken place including an excellent meeting with the SPLA commander, who promised to recall the troops in DRC who are doing the poaching. However, another meeting at local level ended in an agreement between the SPLA and local authorities that their withdrawal should be delayed by 2 months and be dependent on payment of USD 10,000 by DRC government authorities. The recent aerial survey and anti-poaching recce indicated that the Sudanese are making the most of this period to take as much ivory as possible, and this situation is being taken up again at high level.

Twenty-two more young guards have been recruited and trained by ICCN trainers who have followed the African Field Ranger Training Services course. More intensive and active field training and leadership starts in January. The radio relay looted twice during the wars has been reinstalled and there is now full radio communications. Small tents and uniforms have been flown in to resupply foot patrols and enable greater coverage by smaller groups, with six groups of 10 men each out all the time. More equipment and vehicles and a suitable replacement aircraft are being actively sought.

Now is the time, with peace coming to both DRC and Sudan and more chances of support, to focus all resources on addressing this threat and rebuild the effective conservation of the park.

Black rhinos *(Diceros bicornis minor)* now back in North Luangwa National Park, Zambia

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After an absence of more than 15 years, black rhinos are back in North Luangwa National Park, Zambia. The first 5 animals of a planned founder population of 20 were introduced into a central fenced sanctuary in the park in May 2003 as planned (Kampamba 2003). The reintroduction was a combined effort by the Zambia Wildlife Authority supported by the Frankfurt Zoological Society, and South Africa National Parks, with support from the SADC Regional Programme for Rhino Conservation (RPRC) and other sponsors.

Two male and three female black rhinos from Kruger National Park and Marakele National Park in South Africa spent the first few weeks after arrival in bomas where they were fitted with radio transmitters, introduced to local browse, and inoculated against trypanosomiasis. They were then released into the 55-km^2 sanctuary. Initial post-release monitoring, conducted from the first day after their release, was predominantly in the form of aerial radiotracking. Data are being entered into the WildB database.

All the animals are doing well, and none have attempted to break out of the sanctuary. The sanctuary is surrounded by a simple, low-cost 4-strand electric fence, which allows relatively free movement of other animals to take place and has proved effective in containing the black rhinos to this central area.

The Zambia Wildlife Authority has provided an additional 30 wildlife police officers to bolster the existing law enforcement force in North Luangwa. Officers who have been attached to a special rhino protection team have received specialized training and are deployed around the sanctuary at all times. The ranger in charge of this team attended the AfRSG training-of-trainers course in rhino monitoring held at Pilanesberg National Park, South Africa, in July 2003 and jointly funded by the US Fish and Wildlife Service's Rhinoceros and Tiger Conservation Fund and SADC RPRC.

Now that the first phase of the reintroduction has been successful, the next challenge facing this project is to find the additional 15 animals needed to bring the founding population number up to the planned 20 in the near future.

Reference

Kampamba, G.H. 2003. Black rhinos reintroduced to North Luangwa National Park, Zambia. *Pachyderm* 34:94–95.

The Black Rhino Range Expansion Project begins

Pam Sherriffs

Project Communications Manager; email: psherriffs@wwfsa.org.za

The WWF/Ezemvelo-KZN Wildlife Black Rhino Range Expansion Project, which aims to increase numbers of Critically Endangered animals by increasing the land available for their conservation, began in July this year in KwaZulu-Natal, South Africa. If successful, the project will help reduce pressure on existing reserves in the province and provide new territory in which the endangered animals can breed and multiply quickly.

First, expressions of interest from potential partners were called for. Potential partners don't need to have been traditionally involved with conservation,

and they can include communities and private and corporate landowners. They must hold suitable habitat within the historic range of the black rhino. The site chosen will ideally be at least 20,000 hectares with a carrying capacity of 50 to 100 black rhinos. To meet the size requirement, fences might have to be dropped between neighbouring landholders.

The project is looking initially for partners within KwaZulu-Natal, although the potential exists to look further afield at a later date. Over 20 individual property owners and one traditional authority within KwaZulu-Natal have responded, and expressions of interest have also come from outside the province. All the properties will be visited and assessed by WWF project leader Dr Jacques Flamand, who was a wildlife veterinarian with the then Natal Parks Board (now Ezemvelo-KZN Wildlife) for many years and has extensive experience with rhinos around the world.

As well as size of the area, other criteria to be taken into consideration include current poaching levels, which must be low, adequate fencing, links to existing black rhino areas and the potential to offer economic benefit to local communities.

'It has been really encouraging to see the level of interest from landholders', says Dr Flamand. 'Establishing partnerships between landholders with a strong tradition of independence will be a challenge, yet I'm hopeful that the opportunity to be part of a significant conservation story, with such a magnificent animal, will help overcome the obstacles. As well as helping black rhinos, the project is an opportunity to get land under more rational conservation, as smaller pieces of land can be merged into larger, more ecologically sensible units.'

Once Dr Flamand has assessed all the sites and identified which appear to be the most suitable for the initial phase of the project, specialist ecologists will conduct further ecological assessment. The final decision will rest with the board of Ezemvelo-KZN Wildlife. Then the serious work of thrashing out a business and partnership model will be tackled. It is hoped that this model will be useful enough to be replicated for future partnerships.

When the partnerships have been formalized, founder populations of about 20 black rhinos will be released simultaneously, as experience has shown that releasing relatively large groups at the same time is optimal for rapid population growth. Larger founder groups of individuals not closely related also mean that less manipulative management of the population is necessary later on.

The project's proposed model is that Ezemvelo-KZN Wildlife will make black rhino and management guidelines available in exchange for suitable land and the provision of security. Landowners will be custodians of the initial founder population, which will remain the property of Ezemvelo-KZN Wildlife. However, half of the progeny will be owned by the landowners and half by Ezemvelo-KZN Wildlife.

'It should be a win-win scenario for everyone,' said Dr Flamand. 'In their tradition of conservation excellence, Ezemvelo-KZN Wildlife has made a decision that is in the best interests of black rhino.'

The Black Rhino Range Expansion Project is being funded and run by WWF in conjunction with the Conservation Partnerships and Projects branch of Ezemvelo-KZN Wildlife. 'The focus of our branch is the power of partnerships,' says branch head Derek Potter. 'This project is a partnership between an NGO, a formal conservation organization and private enterprise with the objective of being beneficial to all.'

The investor's golden principle of compound growth lies behind the project's intention to increase the growth rate of the black rhino population, explains Dr Richard Emslie of the African Rhino Specialist Group.

As is the case with money and investments, seemingly small differences in growth rate of the black rhino metapopulation have a significant impact over time. 'If we start with 1000 black rhinos, then the time to reach a goal of 2000 will be 70 years at 1% growth, 15 years at 5% and only 9 years at 9%.'

Security of existing and new black rhino populations will always be a top priority, and a major component of the project is the continuation of WWF funding in this area. But focusing exclusively on keeping existing animals safe at the expense of growth 'is like keeping your money under the bed in case you get robbed on the way to the bank,' says Dr Emslie. 'What on the surface might seem a safe, low-risk strategy could be anything but. As with money or your share portfolio, it is far more prudent to invest in real growth. Ten years down the line the key question should be: "How many rhinos are there?" not "How many rhinos have been poached?"'

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Enhancing rhino horn stockpile management: database now available for range states

Simon Milledge

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Following several years of documenting rhino horn accumulation dynamics and best stockpile management practices, TRAFFIC East/Southern Africa has recently developed the Wildlife Stockpile Register Database (WSRD). WSRD version 1.0 is designed for rhino horns. This work was funded by the SADC Regional Programme for Rhino Conservation. This tool, which is also adaptable for elephant ivory stockpiles, is specifically designed to help range states optimize the management of rhino horn stockpiles while helping to answer key field management questions including results-based patrol monitoring.

Why is effective rhino horn stockpile management so important?

The illegal trade in rhino horn continues to be rhinos' greatest danger globally. While the focus of preventing illegal trade has traditionally been on ensuring adequate field protection and infiltrating illegal trade syndicates, it is increasingly clear that the potential for illegal trade involving horn stockpiles—including both horns held within strong rooms and horns moving en route from field recoveries—could undermine ongoing conservation efforts.

Through the action of field and law enforcement personnel in range states, consumer markets and elsewhere, stocks of rhino horn are now found throughout the world. Among other causes, horns accumulate from natural mortalities, dehorning exercises, trophy hunting, pre-CITES specimens and seizures. Existing horn stockpiles are not only substantial but are accumulating rapidly where wild populations increase. For example, rhino horn stocks in eastern and southern Africa are accumulating at the fastest rate in the world with over 12 tonnes now officially registered in private and government sectors.

To minimize the risk of horn reaching the illegal market, it is essential to ensure first that existing stockpiles are adequately registered, marked and secured, and second, that the collection and centralization of all horns from the field is optimized. It is vital that such measures are improved before horn volumes get too large to handle. Indeed, the need to mark, register, store and secure rhino horn stockpiles has been recognized by parties to CITES in the context of Resolution Conf. 9.14 (Rev.), 'Conservation of and trade in African and Asian rhinoceros'. Further, adequate stockpile management must be a vital precondition for any country wishing to pursue limited legal options for horn trade.

How the Wildlife Stockpile Register Database can strengthen stockpile management and conservation efforts

What are the trends in accumulating horn and does the stockpile register meet audit requirements? Are rhino mortalities being detected fast enough and collected horns stockpiled in a timely manner? These are just some of the many questions commonly asked by conservation managers but whose answers normally lie beneath piles of paperwork in different localities. WSRD puts an end to this challenge by maximizing the use of information already routinely collected, while moving beyond existing data storage spreadsheets to an interactive management-level database. WSRD runs on Microsoft Access with a simple user interface that does not require any specialized computer knowledge or training. At the touch of a button, WSRD produces sorted lists and information summaries that facilitate audits; it responds to specific queries and searches, securely and permanently stores all records; and produces numerous automated reports to provide answers to key management questions.

Summary information:

- Where are horns coming from and what are the general trends in accumulation?

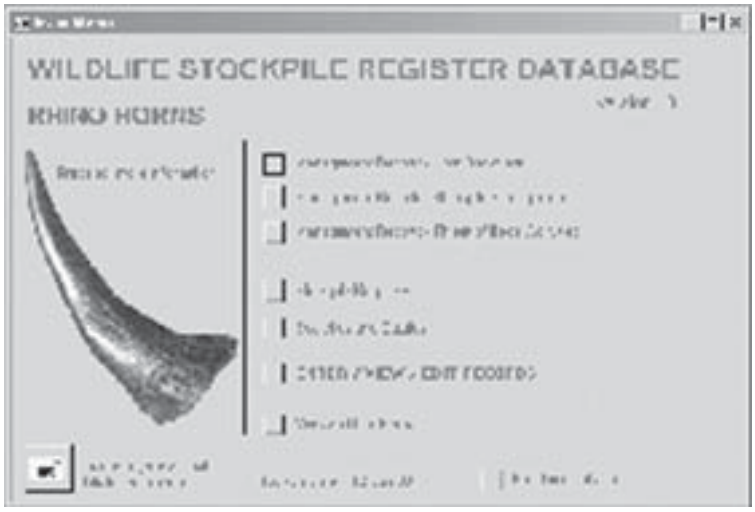
- Which species are the horns coming from and what are horn measurements?

Stockpile administration, checks and balances:

- Are all the horns from discovered natural mortalities actually being stockpiled?
- Are all the horns seized by law enforcement agencies being stockpiled?
- Are both horns being collected when possible?
- Are all the horns being marked and identified adequately and where are they stored?
- Is there an effective registration process and does it meet audit requirements?
- Is there a record of horns removed from the stockpile?

Results-based field monitoring:

- Are mortalities being detected fast enough?
- What level of understanding do we have of rhino mortality causal factors?
- Are field patrols collecting acceptable levels of horn?
- Are all the horns collected being stockpiled in a timely manner?
- What is the law enforcement success rate through recovery of illegally sourced horns?



The Wildlife Stockpile Register Database main menu.

TRAFFIC is the world's largest wildlife trade monitoring programme, a joint programme of WWF, the World Wide Fund for Nature, and IUCN, the World Conservation Union, working in close cooperation with the secretariat of CITES, the Convention on International Trade in Endangered Species of Wild Fauna and Flora. TRAFFIC has over 25 years of experience working on rhino horn and elephant ivory trade issues including over 10 years of focusing on stockpile management. Interested range states should contact TRAFFIC East/Southern Africa at traffictz@raha.com regarding the software and to obtain assistance to strengthen stockpile management practices.

AfRSG's training course in rhino monitoring revised and training courses for instructors held

Richard H. Emslie

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The AfRSG's revised Sandwith training course for field rangers in rhino monitoring techniques has recently been revised by Keryn Adcock and Richard Emslie with primary funding from the US Fish and Wildlife Service's Rhinoceros and Tiger Conservation Fund (USF&W RTCF), and some additional funding from the Italian-funded SADC Regional Programme for Rhino Conservation (SADC RPRC).

The trainer's manual has also been extensively revised and desktop published and is now produced in .pdf format, greatly cutting down file sizes. The structure of the modules has been modified, so that with little modification the course can be made a South African Qualifications Authority (SAQA) accredited course. At the start of each module a number of text boxes outline 1) the rationale behind the module,

Trainee rhino monitoring instructor prepare training modules for presentation, Nakuru, Kenya.

2) its purpose, 3) the learning assumptions (what you need to know or be able to do before doing the module), 4) the specific outcomes (what a person assessed as competent in the module must be able to know or do after training), 5) the assessment criteria (how trainees can be tested to determine if they have mastered each of the listed specific outcomes) and 6) the performance criteria (what it means to have passed or failed the assessment tests for this module—some modules being compulsory for one to become accredited). Rather than binding the whole trainer's manual as one document as before, the modules are now filed as standalone documents separated by dividers in a lever-arch file. This and the .pdf file format make it easy for new modules to be emailed, printed out and inserted to replace old modules.

Another feature of the revised course is that for the first time accreditation tests have been developed for instructors. In the two training-of-trainers courses held to date with the revised course (in Pilanesberg, South Africa, and Nakuru, Kenya), the pass mark for each module has been set at 80%. This may seem high, but this was because 1) those being tested were trainers and therefore the standard set should be higher than that for field rangers, and 2) because, like the Scene of the Crime course, trainees get a second chance to pass a test if they fail it the first time round. In practice those who easily passed most modules clearly were the 'right stuff' to be good instructors, those that were borderline appeared to be borderline instructors, and the few who were a little off the pace clearly needed to improve before they could become instructors. However, those who did not manage to become accredited as instructors first time round still greatly improve their ability to monitor rhino. Thus the pass mark to become accredited as instructors seems to have been set at the right level. Apart from ensuring thattrainees work on the course, one main advantage of the accreditation tests is that it enables course instructors to determine who has not yet mastered what. Follow-up instruction can then, on a one-to-one basis, focus specifically on where a particular trainee needs assistance. The process of accrediting instructors not only helps maintain monitoring standards, but it also provides a mechanism to assist field officers decide which field rangers' data are likely to be accurate and reliable and therefore can be used in subse

Reviewing the finer points of assessing black rhino condition, Nakuru, Kenya.

quent data analyses that inform biological management decision-making. Importantly, this process also provides a way to more formally recognize the skills of field rangers that might otherwise go unnoticed, and in this way it helps boost morale.

The A3-size poster sets for the course have been revised, and many more example photographs have been included for trainees to practise on. The AfRSG is particularly grateful to Derek Brown and Kirsten Bond for kindly providing many of their digital rhino photographs for use in the course. Additional new posters on ageing and condition assessment have been added, as well as a poster showing the importance of rhino monitoring and the role of monitoring in biological management. This poster shows why data quality in monitoring is critical by showing the link between the results of monitoring and making decisions on the management actions required to keep populations healthy and productive. The 60 posters have now been printed back to back and can be more conveniently stored in correct order in an A3 lever-arch file.

Another new feature of the revised course is that an A5-size trainees' booklet has been produced. This summarizes key lessons from the course and includes key posters such as the ageing series and condition assessment charts. The booklet, to be given to all field rangers who are being trained using the course, will provide them with a summary of key components that they can consult later. It has been designed to be relatively cheap to produce. The initial version was produced in English. More recently a revised Swahili version has been produced as part of the new UK Darwin Initiative black rhino project in Kenya. At the June 2003 SADC Rhino Management Group (RMG) meeting in Namibia requests were received for the new trainees' booklet to be produced in other local languages including Afrikaans, Damara-Nama, Matabele, Otjiherero, Ovambo, Portuguese, Shona, Swazi and Tswana. Some RMG members have offered to assist with translations.

For the first time sets of small laminated pocket cards have been produced as a field aid to assist rangers correctly age and assess the condition of a black rhino. These cards have been designed to be handed out to all field rangers taking the course. The new pocket cards have been well received. They are weatherproof and easily fit into a shirt pocket. The four double-sided making up a set are bunched together using a small key ring. One card shows the AfRSG-recommended A–F ageing series and how to more accurately age animals less than one year old, based on horn growth patterns. The other cards show the key body areas to look at when assessing black rhino body condition, with pictures illustrating each of the 5 standardized AfRSG condition scores from 1 to 5 and using the standardized scoring system AfRSG recommends for assessing condition. Apart from assisting rangers in the field, these cards should further contribute to standardizing ageing and condition assessments. Rusty Hustler of the North-West Parks and Tourism Board plans to produce a similar set of cards for the white rhino in the near future.

As part of the revised course, small booklets of field recording forms, each booklet containing 10 rhino ID forms, have been mass produced for distri-

Presenting a training module to a volunteer audience, Nakuru, Kenya.

bution with the course. Separate booklets have been produced for black rhinos and for white rhinos.

The first instructor's course using the revised course was held at Pilanesberg National Park in South Africa's North-West Province in early July 2003 with funding from USF&W RTCF and SADC RPRC. Course compilers Keryn Adcock and Richard Emslie together with North-West's Rusty Hustler and Gus van Dyk co-presented the course, in which 19 participants were accredited as trainers. Those attending came from Bostwana, Malawi, Namibia, South Africa (Ezemvelo-KZN Wildlife, SANParks, North-West Parks and Tourism Board, and Tswalu, a private rhino reserve), Tanzania (Wildlife Division) and Zambia. Encouragingly a number of those trained on the course have already started training field rangers back on site.

The second training-of-trainers course was held in Nakuru, Kenya, as part of a newly started, UK-funded Darwin Initiative Project, called 'Building capacity for the conservation of a Critically Endangered species', being undertaken in collaboration with the rhino programme of Kenya Wildlife Service (KWS). Course participants came from each of the KWS rhino reserves, the Masai Mara reserve, a community-run group ranch, and a number of the main private custodianship populations. The course was presented by Darwin Fellows, AfRSG's Richard Emslie and Keryn Adcock, and the Zoological Society of London's Dr Raj Amin. The Kenyan rhino coordinator, Martin Mulama, also helped organize the course and assisted with the examinations, and 18 of those who attended this course were accredited.

A great number of course sets are being produced compared with previous editions. Once minor changes have been made to the course modules in the light of lessons learned from the two courses given to date, more ID sets will shortly be distributed throughout the continent to those who need course sets. If you wish to receive training as a trainer or if you would like to receive a course set, please write to me, providing details of your reserve and your motivation to take the course. Also, if you have sets but require more ID field recording form booklets, trainees' booklets or pocket card sets, please contact me. If you want trainees' booklets produced in a local language, you will be asked to provide translations of the English text.

Finally the compilers of the revised course would like to thank experienced trainers Rob Blok, Craig Reid, Rusty Hustler and Raj Amin for their very valuable comments and suggestions on improving the course.

Rhino and Elephant Security Group update

Richard H. Emslie

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Since the last report in *Pachyderm* 33, the Southern African Rhino and Elephant Security Group (RESG) has continued being active, holding further meetings at the Garden House Hotel in Lusaka, Zambia (July 2003), and at the Phillip Sanders Resort of the Free State's Department of Tourism, Economic and Environmental Affairs, near Bloemfontein, South Africa (October 2003). As usual the RESG meetings were held back to back with subregional meetings of Interpol's Environmental Crime Task Group.

In both RESG meetings delegates presented country and agency reports. The RESG terms of reference were reviewed at the Lusaka meeting and, subject to a few minor modifications, were adopted. A number of invited presentations were given at the Bloemfontein meeting.

On behalf of programmer Rose Hamilton, Richard Emslie gave a presentation to illustrate the features of the Law/Information Database. This database has recently been completed with additional joint funding from Ezemvelo-KZN Wildlife and the Italian-funded SADC Regional Programme for Rhino Conservation (SADC RPRC). The software is currently undergoing final field testing and debugging before being released. With SADC RPRC funding and the kind permission of Ezemvelo-KZN Wildlife, the database is to be installed in a number of conservation agencies throughout the region. From January 2004, RESG secretary Samantha Watts will train staff in its use. Agencies who wanted training completed letters of intent at the RESG meeting. Some outstanding questionnaires detailing their hardware and soft

ware were provided by conservation agencies at the meeting.

Simon Milledge of TRAFFIC East/Southern Africa gave an excellent presentation on best practices for managing rhino horn stockpiles in the SADC region, as well as giving an overview of the wildlife stockpile register database, which he had developed with funding from SADC RPRC. He demonstrated how this database is not just a vehicle for storing data but can automatically generate a number of graphs and reports to provide answers to a set of standard queries. The software is currently being tested by Ezemvelo-KZN Wildlife. As many agencies attending the RESG meeting expressed a desire to get this database, TRAFFIC has proposed holding a workshop where training in its use will be given. Simon Milledge also gave an informative presentation on CITES developments with respect to rhinos and elephants, and he outlined the basics of ETIS, the Elephant Trade Information System, highlighting the key results to emerge to date from analyses of ETIS data.

Richard Emslie summarized the results to date of the AfRSG horn fingerprinting project before informing members formally of the current phase 6 of the horn fingerprinting project. This penultimate phase of this project has been designed to determine the level of spatial resolution possible and the number of samples required per park. Based on the results of phase 6, a decision will be made as to whether or not to proceed to full implementation.

Scene of the Crime trainer Rod Potter demonstrates how to use plaster of paris to lift a shoeprint from a mock crime scene during the Kenyan training course.

On behalf of the Scene of the Crime course developer and coordinator, Rod Potter, the meeting was informed about the successful Scene of the Crime training courses that have been held to date in Namibia, Zimbabwe (both funded by SADC RPRC) and Kenya (funded by WWF). The response to this course has been very positive in the three countries where it has been held; and RESG chair and Zimbabwe's chief warden, Mr Lovemore Mungwashu, strongly recommended the course to members. With SADC RPRC funding, further Scene of the Crime courses are scheduled for Swaziland and Botswana over the next six months. More courses are likely to be held in future in South Africa, Tanzania and Zambia.

On behalf of Ezemvelo-KZN Wildlife's Rod Potter, the meeting was also informed that four different versions of the Microtrak rhino horn microchip (transponder) database have been largely completed with additional funding from US Fish and Wildlife Rhinoceros and Tiger Conservation Fund. A number of conservation agencies from three countries requested copies of the software. The possibility of incorporating the Permits version of Microtrak into TRAFFIC's horn stockpile management database will be considered. The RESG meeting also discussed how best to set up a continental transponder number database to facilitate finding out the source agency should any recovered horns be found with transponders.

RESG is grateful to SADC RPRC for the limited funding it has received, which enables the RESG administrator and secretary to assist the chair organize meetings and to produce and distribute minutes of the meetings. This will help RESG install the Law Database throughout the region and train staff in its use.

Bostwana will host the next RESG meeting in April 2004.

Scene of the Crime training

Rod Potter

Ezemvelo-KZN Wildlife, PO Box 243, Merrivale 3291, South Africa

The year 2003 has been a busy one for Rod Potter and Wayne Evans, presenters of the Scene of the Crime training course, which has been developed and presented with the help of funding from the Italian-funded SADC Regional Programme for Rhino Conservation.

This intensive course has so far been presented in three rhino range states, with another four courses envisaged over the next year. The first course was held in Etosha National Park, Namibia, with the 19 participants attending being drawn from both the Ministry of Environment and Tourism (MET) and the Protected Resources Unit of the Namibian Police. Follow-up training courses have been held by Namibian MET staff who attended the initial course. In Kenya, WWF sponsored 19 participants from the investigations and intelligence branches of the Kenya Wildlife Service (KWS) together with staff from the KWS rhino programme. Tremendous camaraderie was achieved among members of that group during the 10-day course. The Zimbabwe Parks and Wildlife Department sent 19 people on a course, which was held in Hwange National Park. Despite severe fuel shortages, participants came from all over Zimbabwe, using whatever transport means available, to be part of an interesting hands-on course.

The course is designed to take participants through a process of preferred actions before, during and after visiting a rhino-related crime scene. The courses are adapted to take the legislation applicable to the host country into account. Although geared towards rhinos, the principles of the course can be easily applied to crime scenes relating to elephants or any other wildlife.

A participant in the Zimbabwe Scene of the Crime training course recovers a rifle cartridge case as part of a practical exercise.

The course has received accolades from all the departments that have supported the training of their staff. Course participants have commented on the functional value of the course content and have found the training valuable in their work. Together we all win—except the poachers!

AfRSG Tanzanian representative killed

Martin Mulama

With utmost shock we have just learned of the death of Mr Matthew Maige, the Tanzanian representative to AfRSG. On 1 December, he was shot by armed bandits at his home in Dar es Salaam. Thugs burst into his home at 7:30 p.m. and demanded his gun. During the following commotion, they shot him twice in the head. He was rushed to Muhimbili Hospital but died at around 1:00 a.m.

AfRSG is investigating the possibility of setting up a Matthew Maige fund for purposes such as helping sponsor an up-and-coming young African rhino conservationist to attend AfRSG meetings.

May Matthew's soul rest in eternal peace.

BOOK REVIEWS

The ivory markets of East Asia

Esmond Martin and Daniel Stiles, with drawings by Andrew Kamiti

Save the Elephants, PO Box 54667, Nairobi, Kenya, and
7 New Square, Lincoln's Inn, London WC2A 3RA, England
published 2003; 112 p. ISBN 9966 9683 3 4
available from Save the Elephants

review by Kees Rookmaaker

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Cambridge CB3 ODL, United Kingdom

This book gives details about a survey of the ivory trade in five East Asian territories: China, Hong Kong, Japan, South Korea and Taiwan. It is handsomely produced and although in a soft cover, the printing is pleasant, the text without typing errors, the drawings artistic and the colour photographs on separate pages clear and useful. This monograph is a sequel to the reports of two previous surveys, *The Ivory Markets of Africa* (2000, reviewed in *Pachyderm* 29, p. 61) and *The South and South East Asian Ivory Markets* (2002, reviewed in *Pachyderm* 32, p. 78). As its precursors, this is a technical report, filled with facts and figures, data and trends, aimed at national government officers, non-governmental organizations involved in wildlife conservation and CITES officials. Let us hope that those people, together with informed conservationists, take time to read and digest the information gathered during the survey, either in this format (Martin and Stiles 2000, 2002) or in the easier popular summaries (Stiles and Martin 2000 to 2003).

While the two previous reports dealt with trade in range states where elephants are still found in the wild, this time Esmond Martin and Daniel Stiles ventured into a region where the elephant has on the whole not been seen in living memory. Only China may have a small population left in the southern part of Yunnan Province, bordering the wilderness areas of Myanmar and Laos, although elephants are said to have ranged earlier as far north as the Yellow River Basin. The authors do not explain why they decided to survey these East Asian countries, and they probably did not need to, because we are all aware that certainly China and Japan have ranked among the major manufacturers of worked ivory items throughout recent history. In fact, many of the reports produced by TRAFFIC and other organizations about the ivory trade have looked at the markets in these countries.

The results of the survey are set out carefully in five chapters, each about one of the territories, occupying just under three-quarters of the book. Each chapter starts with a page of details about the legal position of the ivory trade, followed by a history of the ivory markets, the sources and prices of raw ivory from the early 1980s to the present, followed by data obtained during the survey regarding ivory workshops, retail outlets, the use of substitutes where applicable, and finally the vendor's view on the future of the market. The section on the legal situation I found particularly well written and enlightening, and it explains the standards by which each government and wildlife authority should be measured. As a general rule, the East Asian governments comply with CITES regulations and prohibit import and export of ivory. Internal sales and manufacturing are still le-

Esmond Martin

Ivory-carving association members in Japan sometimes group together to carve ivory at the end of the day to share information and sometimes help apprentices.

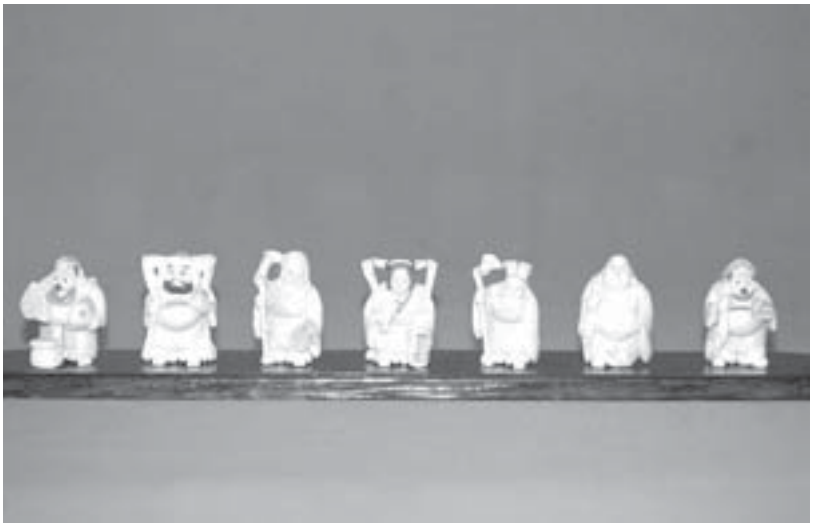
gal, but regulated by a variable set of controls. Vendors' views are interesting by their subjectivity, showing that most people who depend on their livelihood on ivory are pessimistic about the future, with stockpiles diminishing, and wildlife laws tightening.

The bulk of the data gathered by Martin and Stiles necessarily document the workshops where ivory is worked and the retail outlets where the various items are sold. As in the two previous reports, the amount of detail in the figures and the tables is quite staggering. For instance, in Tokyo the investigator found ivory items for retail sale in 51 antique stalls, 17 department stores, 9 gift shops, 1 grocery shop, 7 ivory specialty shops, 9 name-seal shops, 1 netsuke shop and 1 stationery shop—96 outlets, selling 5358 items altogether. The same attention to detail is found in all the other data sets found in the book, which is a tribute to the method of surveying and the perseverance of the investigators. They know where to search for ivory, which questions can be asked, and what kind of data can be expected. They have tried everywhere to record what they saw, instead of what they wanted to see or were told to look at, and while I would imagine that they must have missed a retail outlet or two, and may not have counted every ivory item for sale in each country, their data are quite sufficient for their primary aim—to provide essential baseline indicators of the trade in ivory products.

When the investigator went to Japan, he would have been curious to find first-hand information on the impact of the one-off sale of 50 tonnes (49,735 kg to be exact) of ivory, which was allowed after the 10th Conference of the Parties to CITES in 1997 decided to downlist to Appendix II the elephant populations in Botswana, Namibia and Zimbabwe. Against expectations, ivory dealers in other countries paid very little attention to this and nobody expected this to lead to a relaxation of the trade ban on ivory in general. The Japanese traders also have kept their promise to keep this ivory for the local market only and not for export to other places. Although it worked once, would it be possible to have more regular auctions of surplus ivory from countries where elephant populations are increasing, without damaging the dwindling populations, especially in Asian countries? This is a serious question to which there are no easy answers. To be truly transparent, I would believe that countries intending to sell ivory must have an accounting system in place that ensures that not a single gram of ivory in their stocks originates from outside their country or from an illegally killed specimen. Elephant owners must be willing to allow scrutiny of their holdings and their management procedures to ensure that a poacher or an unscrupulous owner can never benefit from any one-off or direct government auction. As CITES has allowed another sale of 60 tonnes after May 2004, the market will have another chance to be tested under international supervision.

During this survey in five East Asian territories, Martin and Stiles, travelling independently, counted about 54,000 ivory items in 413 retail outlets in 11 cities. They found 66% of these in Hong Kong, 17% in China, 14% in Japan. There is no longer any evidence of an active ivory trade in either Taiwan or

Esmond Martin



These carvings of the laughing Buddha in Japanese mythology are called 'the seven gods of luck' or *hodei.*

South Korea. These figures are most surprising for the rather small numbers, probably much lower than would have been expected. Figures of ivory stocks, imports and exports for all countries were gathered seriously until 1990 when the CITES ban on ivory trade came into force in most countries but have become much more patchy after that time. When local traders in Africa and South East Asia were asked about the destination of ivory, most of them imagined that the greatest part of their stocks were headed for markets in Japan and China. While the manufacture and sale of ivory products is definitely ongoing in both these countries, as well as sales in Hong Kong and Singapore, one rather worrying fact is emerging. Wherever Martin and Stiles went in the course of their three surveys, be they in Africa, Thailand or China, everywhere they were told that ivory was bought primarily by diplomats, expatriate staff and tourists. It is true that the *nouveau-riche* of China and the citizens of Japan like to purchase items made out of ivory, but as stressed in a recent issue of *BBC Wildlife*, 'the unpalatable truth is that much of the ivory heads for places such as Portobello Road' (Stiles and Martin 2003). Elephants are poached by local Africans and Asians, their ivory turned into little works of art in East Asia, but I cannot shake the impression that the most important market is to be found among Americans and Europeans.

I don't know if Martin and Stiles will look at those continents next, or if they will want to revisit the countries where they found the greatest concentrations of ivory items for sale. It would seem to me that their survey needs to be repeated at regular intervals to discover and understand changing trends and markets. It will not be enough to go around a town with a questionnaire on which boxes can be ticked. These surveys need the personal input of an expert, who can understand and explain the larger picture. Let us hope that Save the Elephants will continue to sponsor this type of work. Certainly, the three reports produced by Martin and Stiles during the last three years are a tribute to all those involved in this study. The reports should be read by government officials and conservationists, and they would be a great asset to the shelves of libraries in zoos, museums and universities, as well as interested conservationists, for future reference. Let us hope, most of all, that the surveys executed so effectively and carefully by Martin and Stiles, over a period of many years and often not without personal danger, will help in shaping policies that aim to increase the population of elephants and to stop the horrors of poaching and illegal trade.

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Policing international trade in endangered species: the CITES treaty and compliance

by Rosalind Reeve

The Royal Institute of International Affairs, EarthScan Publications
2002; 346 p. ISBN 1 85383 880 2; £19.95 paperback

review by Kes Hillman Smith

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'It is not legislation alone, but rather the implementation process that determines whether a commitment has any practical influence.' Quoted in the preface of Rosalind Reeve's book, this not only sums up the basis of her thesis but pinpoints the crux of the matter in natural resource conservation that so many of us are involved in and care about.

Dr Reeve has worked on wildlife trade issues for over 16 years. Based on her master's thesis in environmental law and her wide range of experience, this book is an extremely comprehensive but very readable examination of how effectively the Convention on International Trade in Endangered Species (CITES) has been implemented worldwide. Dating from 1973, CITES has been a flagship agreement and one of the most innovative of the multilateral environmental agreements. But it has also been one of the most difficult to apply comprehensively, in the face of financially associated challenges and emotive issues. Its implementation has much to teach us and Rosalind Reeve has done an excellent job of analysing and presenting this information.

She covers the structure and mechanism of the convention, the compliance system and non-compliance response, problem issues and mechanisms for dealing with them. Through structured detail and a range of interesting case studies, she examines the enforcement mechanism and how it has been developed and improved, lessons learned and relationships with other treaties—and then she looks to the future.

Her book is a comprehensive reference work for a widely ranging audience, an analysis of 30 years of rules in practice and a fascinating insight into the realities of implementation. Starting from a legal basis for global decision-making on such an important issue as the trade in endangered species, it seems that much of the present institutional framework was not part of the original treaty text, but has developed subsequently with a wide range of input including non-governmental participation. From chameleons and golden frogs in Madagascar, through ivory and chimpanzees from the Democratic Republic of Congo, the caviar and sturgeon issue, tigers, parrots and a host of threatened plant species, she takes us to the importing countries, both end users and those who profit along the way. At every stage she has real facts and figures and interesting examples.

As she says, 'enforcement is the Achilles heel of CITES'. A treaty is nothing more than a piece of paper if it is not implemented. This book is a must for all who want to learn from these experiences or who are in any way involved with or affected by CITES—a treaty crucial to natural resource conservation and sustainable use. I thoroughly recommend it.

GUIDELINES TO CONTRIBUTORS

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Pachyderm publishes papers and notes concerning all aspects of the African elephant, the African rhino and the Asian rhino with a focus on the conservation and management of these species in the wild. At the same time, the journal is a platform for dissemination of information concerning the activities of the African Elephant, the African Rhino, and the Asian Rhino Specialist Groups of the IUCN Species Survival Commission (SSC).

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

Use an 's' for the plural form for animals: rhinos, elephants.

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Use British spelling, following the latest (10th) edition of the *Concise Oxford Dictionary*, using 'z' instead of 's' in words like 'recognize', 'organization', 'immobilized'; but 'analyse', 'paralyse'.

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Spell out numbers under 10 if not a unit of measurement unless the number is part of a series containing numbers 10 or over, for example: 14 adult males, 23 adult females and 3 juveniles.

In the text, write four-digit numbers without a comma; use a comma as the separator for figures five digits or more: 1750, 11,750. The separator will be a full stop in French papers.

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Woodford, M.H. 2001. [Title]. [*Journal* or publisher]. Forthcoming. [if publication date is known]

Woodford, M.H. [Title]. [*Journal* or publisher]. Forthcoming. [if publication date is not known]

Government reports, reports to wildlife departments, MSc theses, PhD theses, etc. are to be noted as unpublished.

Not accepted as references are papers in preparation or submitted but not yet accepted.

'Pers. comm.' accompanied by the date and name of the person are cited in the text but not given in the reference list.