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Wildlife and People: Conflict and Conservation in Masai Mara, Kenya

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Wildlife and People: Conflict and Conservation in Masai Mara, Kenya

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Kenya.

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FOREWORD

"Wildlife and People: Conflict and Conservation in Masai Mara, Kenya" was a three year research and training programme based in and around the Masai Mara National Reserve, Kenya. It was a collaborative programme between the University of Kent, UK and six Kenyan partner institutions; Narok County Council, TransMara County Council, Moi University, the World Wide Fund for Nature, the Kenya Wildlife Service and the Department of Resource Surveys and Remote Sensing. Core funding for the programme was provided by the British Government, via the Darwin Initiative for the Survival of Species. Additional support was received from collaborating partners.

The purpose of the programme was:

to train Kenyans at all levels to undertake monitoring and research into various forms of human-wildlife conflict in the Mara ecosystem, and to use the results of such research to develop recommendations for the management and mitigation of human-wildlife conflict for the benefit of both people and wildlife.

The programme has directly supported the research of two Kenyan PhD students and one British postdoctoral researcher. Furthermore, it has contributed to the training of two Kenyan MSc students. In addition, eleven community members in TransMara District were trained in human-elephant conflict monitoring, ten tour drivers were trained in the use of GPS satellite navigation units to map the routes of their game drives, and the Narok County Council rhino surveillance unit received training, support and equipment.

A critical element of the programme was to disseminate, discuss and utilise the findings locally. To that end, a series of workshops took place in Kenya in August 2001. Research results were presented at a two-day workshop attended by all stakeholders and held at Dream Camp, Masai Mara National Reserve. This was followed by two additional one-day workshops held with communities in the TransMara District where the human-elephant conflict study had taken place. These additional workshops were held to return the findings of that particular study to the communities and authorities most affected by human-elephant conflict, who had contributed so much to the project, and who were unable to travel to the wider workshop held in the Reserve itself.

This document comprises the product of this dissemination process. The working groups at each of these workshops yielded recommendations, by debate and consensus, which are reproduced here in their entirety. It is hoped that these will form the basis of future management of human-wildlife conflict in the Mara ecosystem.

ACKNOWLEDGEMENTS

A programme of this nature could not take place without the input and support of countless individuals and organisations. It would not be possible to mention them all here, and so we would like to devote a general expression of thanks and gratitude to all those connected with the programme who, in any way, have contributed to its unqualified success. We would particularly like to thank Holly Dublin, Jethro Odanga, Bob Smith, John Watkin and Charles Matankory for their technical and logistical support throughout.

We are grateful to the UK Government's Department of the Environment, Food and Rural Affairs for funding the program under the auspices of the Darwin Initiative for the Survival of Species (Project no. 162/6/131). Equally, we would like to thank the Office of the President of Kenya and both Narok and TransMara Country Councils for permission to conduct research and training in and around Masai Mara National Reserve. The six project partner organisations in Kenya all contributed greatly to the success of the programme, and their individual contributions are noted elsewhere in this report. Additional funding and support was provided by The Wellcome Trust, National Geographic, The Wingate Trust, The Mammal Conservation Trust, The British Airways Assisting Conservation Scheme and The German Organisation for Technical Cooperation (GTZ). The Kenya Agricultural Research Institute (KARI) hosted project staff in TransMara for the duration of the fieldwork. In addition, Dream Camp, Masai Mara, provided an excellent venue and vital logistical support during the workshop itself. Izabella Koziell and Dilys Roe at IIED provided editorial support in the preparation of this report.

Finally, we would like to thank all of our colleagues, both staff and students, at the Durrell Institute of Conservation and Ecology (DICE) and the Department of Anthropology at the University of Kent for their support and encouragement throughout the programme.

Authors

Matt Walpole is a Research Associate at DICE, and project officer for the Darwin Initiative programme in the Mara ecosystem.
Geoffrey Karanja was a PhD student on the Darwin Initiative programme, and is currently a lecturer in the Department of Wildlife Management, Moi University, Kenya.
Noah Sitati was a PhD student on the Darwin Initiative programme, and is currently undertaking further research into human-elephant conflict mitigation in the Mara ecosystem for DICE and WWF.
Nigel Leader-Williams is the Director of DICE, and project leader of the Darwin Initiative programme.

For further details of the programme and its outputs, visit the programme web site (http://www.mosaic-conservation.org). See also the official Darwin Initiative web site (http://www.darwin.gov.uk).

ACRONYMS AND ABBREVIATIONS

AfESG	African Elephant Specialist Group (of IUCN/SSC)
AHP	Animal and Habitat Protection
DC	District Commissioner
DEM	Digital Elevation Model
DEO	District Executive Officer
DICE	Durrell Institute of Conservation and Ecology
FoC	Friends of Conservation
GIS	Geographical Information System
GPS	Global Positioning System
GTZ	German Organisation for Technical Cooperation
HEC	Human-Elephant Conflict
HECT	Human-Elephant Conflict Taskforce
IIED	International Institute for Environment and Development
IUCN	World Conservation Union
KARI	Kenya Agricultural Research Institute
KPSGA	Kenya Professional Safari Guides Association
KSh	Kenya Shillings
KWS	Kenya Wildlife Service
MMEMP	Masai Mara Ecological Monitoring Programme
MMNR	Masai Mara National Reserve
MZEP	Mid-Zambezi Elephant Project
NCC	Narok County Council
NDVI	Normalised Difference Vegetation Index
NGO	Non-Governmental Organisation
RRA	Rapid Rural Appraisal
SSC	Species Survival Commission
TM	TransMara District
TMCC	TransMara County Council
WPU	Wildlife Planning Unit
WWF	World Wide Fund for Nature

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INTRODUCTION

Biodiversity is facing widespread competition with humanity for space and resources (Pimm *et al*., 1995; Balmford *et al*., 2001). As a result, many species are increasingly coming into conflict with people, and this is particularly true of large mammals. Some, such as rhinoceroses and large carnivores, bear most of the cost of this conflict and are either critically endangered or declining rapidly (Woodroffe & Ginsberg, 1998; Emslie & Brooks, 1999). Others, such as the African elephant, also inflict considerable impacts on people and are in the unusual position of being simultaneously an endangered species (IUCN, 2000) and, in places, a pest species.

Protected areas, the cornerstone of modern biodiversity conservation, go some way to protecting species (Bruner *et al*., 2001). However, they do not completely resolve human-wildlife conflicts since they do not always exclude destructive human impacts (Liu *et al*., 2001). Equally, protected areas often only protect a part of an ecosystem or species range, and wildlife dispersal from such areas may increase conflict with man (Woodroffe & Ginsberg, 1998). Even as alternative forms of land use, such as wildlife tourism, are implemented in an attempt to derive sustainable benefits from wildlife, conflict may remain (Roe *et al*., 1997; Goodwin *et al*., 1998).

The challenge facing conservationists is to identify strategies to mitigate conflict between wildlife and people, be they resident communities or visiting tourists, so that mutually sustainable benefits can be derived for both sides (IUCN/UNEP/WWF, 1980; Boo, 1990). This is an extremely difficult task, requiring a detailed understanding of the issues in each particular case, and careful monitoring and adaptive management on the basis of informed decision-making and consensus among stakeholders.

The Serengeti-Mara ecosystem in East Africa embodies many of the current issues in biodiversity conservation (Sinclair & Arcese, 1995). Despite being a vast area incorporating two major protected areas, its considerable large mammal fauna requires access to large, unprotected dispersal ranges inhabited, and increasingly transformed, by agro-pastoral human communities (Homewood & Rogers, 1991; Homewood *et al*., 2001). Equally, its scenery and wildlife have attracted huge interest from the tourism industry (Gakahu, 1992). As a result, a variety of human-wildlife conflicts are evident both within and around the protected areas of the ecosystem. These conflicts are a significant threat to ecosystem viability in general, and large mammal populations in particular (Ottichilo *et al*., 2000).

Against this backdrop, the Durrell Institute of Conservation and Ecology, along with a variety of Kenyan partner organisations, obtained a grant from the Darwin Initiative for the Survival of Species (a British Government funding mechanism administered by the Department of Environment, Food and Rural Affairs) in 1997. This was to initiate a programme of research, monitoring and local capacity-building in human-wildlife conflict and its mitigation in and around Masai Mara National Reserve (MMNR), on the Kenyan side of the Serengeti-Mara ecosystem. The programme focused on three areas of human-wildlife conflict. First, on tourism impacts on wildlife within MMNR. Second, on tourist and local community impacts on the endangered black rhinoceros population within MMNR. And finally, on human-elephant conflict outside the Reserve.

THE SERENGETI-MARA ECOSYSTEM

The Serengeti-Mara ecosystem is an area of some 25,000 km^2 spanning the border between Tanzania and Kenya in East Africa (34-36° E, 1-3°30′ S). It is commonly defined by the movements of an annual migration of wildebeest from the southern plains of the Serengeti National Park to the northern grasslands of Masai Mara National Reserve and back (Sinclair & Norton-Griffiths, 1977).

The Kenyan part of the ecosystem lies in the south-west of the country in the Rift Valley Province, forming part of two Districts: Narok and TransMara. It comprises approximately 6000 km^2, of which c.25% represents Masai Mara National Reserve and 75% is unprotected land inhabited by Maasai and other agro-pastoral communities.

Lying at an altitude of c.1600 m, MMNR is an area of undulating East African woodland/savanna (Taiti, 1973) intersected by numerous drainage lines. It is bisected by the Mara River that forms the

border between Narok District to the east, and TransMara District to the west (Fig. 1). The extensive grasslands are dominated by *Themeda triandra*. Woody vegetation has shown a cyclical pattern over the past century (Dublin, 1991), and is currently in decline as a result of fire and the pressure of a sustained high-density elephant population (Dublin & Douglas-Hamilton, 1987; Dublin *et al*., 1990). It is principally limited to riverine forest along the Mara River, thickets dominated by *Croton dichogamus* on hill slopes and along drainage lines, and some remnant *Acacia* woodland (Dublin, 1984, 1991; Nabaala, 2000). Mean annual rainfall over the past decade was 950 mm, and normally lies within the range of 800 – 1200 mm, with a northwest to southeast declining gradient. Rainfall is bimodal, with a main dry period from mid-June to mid-October and a shorter dry season during January and February (Stelfox *et al*., 1986; MMEMP, unpublished data). Maximum daily temperatures lie between 26 and 30°C (Burney, 1980).

MMNR is unfenced and contiguous with unprotected land to the north, east and west, and the Serengeti National Park to the south. The characteristic grassland plains extend to the north and east. To the east and south the area becomes drier, more hilly and bushed, and is bounded by the Loita hills. To the north and west, MMNR is bounded by the Siria escarpment, beyond which the land rises to well over 2200 m, covered by a mosaic of Afro-montane, semi-deciduous and dry-deciduous forests and *Acacia* savanna woodlands (Kiyiapi *et al*., 1996).

MMNR is home to a wide range of mammal, bird, and reptile species. It is especially famous for its concentration of migratory herbivores, including approximately 100,000 zebra (*Equus burchelli*) and over 1 million wildebeest (*Connochaetes taurinus*), during the dry season from July to October (Maddock, 1979; Sinclair *et al*., 1985). Thomson's gazelles (*Gazella thomsoni*) also migrate, but only as far as the edge of the woodlands. This movement of wildebeest and zebra from the Serengeti in the south has occurred on a significant scale only since 1972, when wildebeest numbers increased as a result of the successful control of rinderpest (Stelfox *et al.*, 1986; Dublin *et al.*, 1990). The sight of hundreds of thousands of these animals moving together through the grasslands has been described by many popular accounts as one of the greatest wildlife spectacles on earth.

MMNR is also famous for its other large mammals. Among these are the so-called "Big Five" which include the cape buffalo (*Syncerus caffer*), elephant (*Loxodonta africana*), leopard (*Panthera pardus*), lion (*Panthera leo*) and black rhinoceros (*Diceros bicornis*), as well as a variety of plains game and large carnivores (Broten & Said, 1995). The endangered wild dog (*Lycaon pictus*) remains on the periphery of the ecosystem (FoC, unpublished data).

MMNR was first established as a Wildlife Sanctuary in 1948 (Koikai, 1992). It comprised a smaller area than the present reserve and included the Mara Triangle, a 520 km_ area between the Siria Escarpment, the Tanzanian border and the Mara River. Hunting was regulated in this area. In 1961 the borders were extended east of the river to encompass an area of 1,831 km_, converted to a Game Reserve and brought under the direct control of Narok County Council (NCC). Some 1,672 km_ of this area was given the status of National Reserve in 1974, under Legal Notice 271 (WPU, 1983). An area of 159 km_ that was not gazetted as a national reserve was returned to the local communities. There were discussions in 1976 between the Kenyan Government and NCC to further reduce the area by 162 km_. Following these discussions, sections in the northeast, southeast and the mid-north were excised through formal notice in 1984. These excisions reduced the area of MMNR to its present size of 1,510 km_. In 1995, the control of MMNR was divided between NCC and TransMara County Council (TMCC) when the latter was formed out of the western part of the former. In May 2001, the Mara Triangle was put under the management of Mara Conservancy, a not-for-profit organisation (Walpole & Leader-Williams, 2001).

The surrounding unprotected areas of the ecosystem are a mixture of private and communally owned land (Homewood *et al*., 2001). Historically, the area was inhabited by semi-nomadic pastoralist Maasai communities (Homewood & Rogers, 1991). Land was held in trust for communities by the government, and some areas in the east of the ecosystem retain this arrangement. From the 1970s, these trust lands were converted into group ranches under local administration. More recently, subdivision of group ranches into parcels of privately owned land has been widely promoted (Thompson & Homewood, 2002).

The sale of private land, and inward migration by neighbouring agricultural groups, has resulted in significant land transformation. This is particularly prevalent on the northern and western borders of

the ecosystem, where mechanised wheat production and intensive small-scale agriculture, respectively, are spreading (Homewood *et al*., 2001; Serneels *et al*., 2001; Sitati, 1997; 2003). These changes may be responsible for an observed twenty-year decline in resident herbivores on the Kenyan side of the ecosystem (Ottichilo *et al*., 2000, 2001; Homewood *et al*., 2001, Serneels & Lambin, 2001).

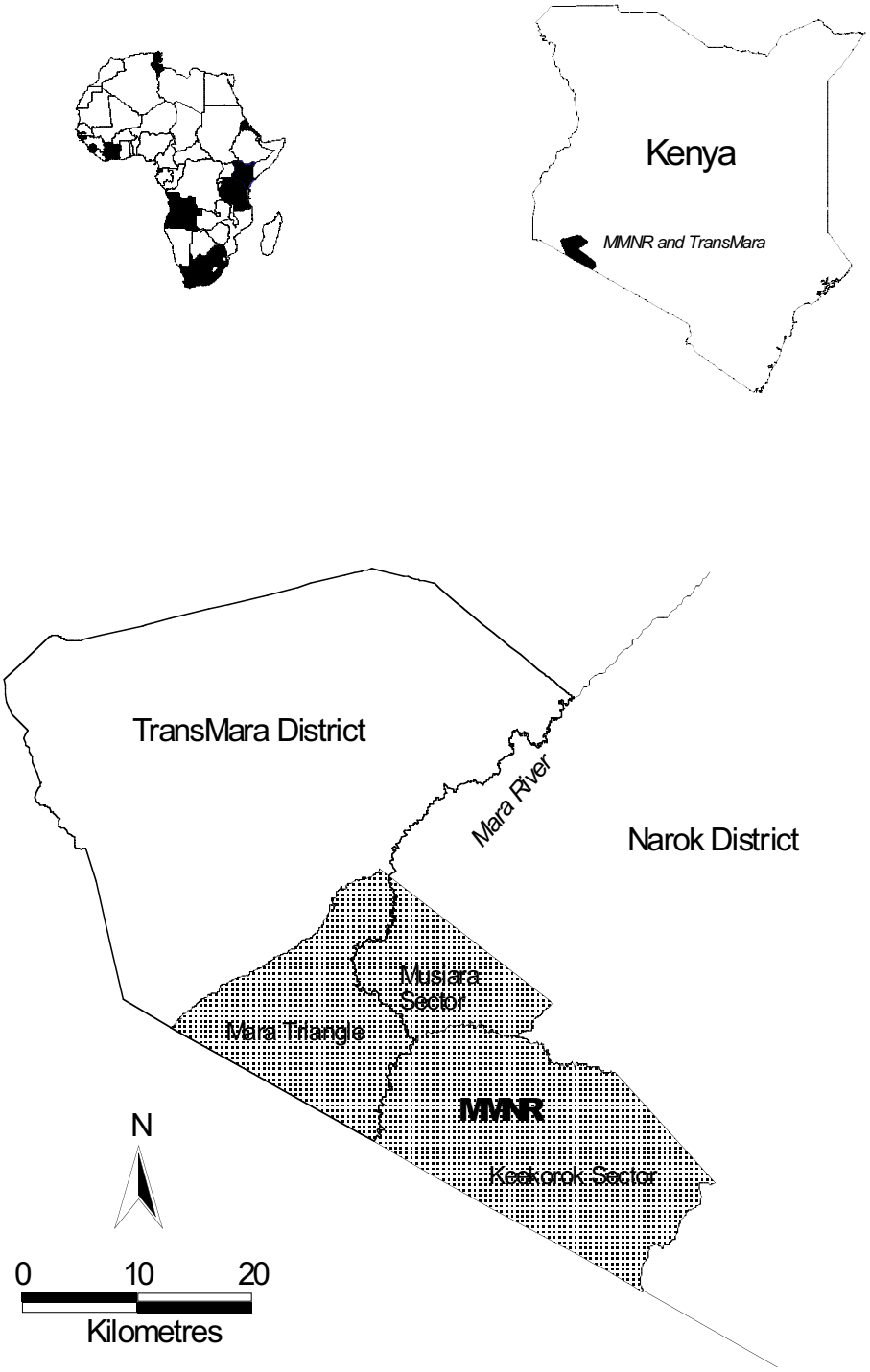

Figure 1. Map of the study area.

OPENING ADDRESS

DAVID OLE SEUR
Senior Warden (Trans Mara),
Masai Mara National Reserve

Mr Chairman, distinguished delegates,

First and foremost I would like to take this opportunity to thank the organisers for having invited me to open this important workshop on the work of the Darwin Initiative programme regarding human-wildlife conflict in and around Masai Mara. I am addressing you today on behalf of both myself, and James Sindiyo, Senior Warden of the Narok side of Masai Mara National Reserve. Together we are jointly responsible for overseeing the management of the Reserve, and it gives us both great pleasure to see this programme coming to fruition and to see the results disseminated to so wide an audience of stakeholders and partners.

The Masai Mara National Reserve is a unique resource for the Maasai people, the country of Kenya, and the World in general. Its 1500 square kilometres of grassland savannah are home to an outstanding variety of wildlife of every description, from the large mammals, to the huge variety of bird life, to the multitude of insect species that pollinate the plants and provide food for those higher in the food chain. This diversity is in turn a result of the huge variety of habitats found in the Mara, from the endless rolling grassland plains, to the upland thickets and acacia woodlands, to the swamps of Musiara and the tall canopy forest of the Mara river itself.

The Masai Mara is quite rightly the jewel in the crown of Kenya's tourism industry. Where else can one see such a huge number of animals in such variety, so easily? Where else can a visitor have the opportunity of seeing the big five – elephant, rhino, buffalo, lion and leopard – in the space of a few days? Watching a cheetah stalk its prey, or experiencing the dawn sunrise from a hot air balloon, are the highlights of any visit to Africa and are memories that visitors will cherish forever. Moreover, the money that visitors spend coming to Masai Mara provides vital resources for the Reserve to help us continue our conservation efforts, and provides jobs for our people and taxes to support national development. For these reasons, it is vital that we conserve the Mara and all of its biodiversity.

One of our most important resources, for both conservation and tourism, is the black rhino population in Masai Mara. Unlike other areas of the country, we have never lost our rhinos despite dramatic declines brought on by poaching. With the assistance of Friends of Conservation, which started out as Friends of Masai Mara, we began a major security and monitoring exercise in the mid 1980s to protect the remaining rhinos in the Reserve. Through the dedication and hard work of the rhino surveillance unit, led for many years now by Sergeant Philip Bett, we have seen a gradual recovery of the rhino population from the dark days of poaching. However, as we shall see today, we are still a long way from the good old days of the 1960s and 70s when rhinos numbered over 100 in the Reserve. Conflict between people and rhinos, manifested as poaching, caused their great decline in the past. To what extent is continued conflict, even after the end of poaching, affecting their recovery? We will hear more about this today.

The rhinos and other wildlife in the Mara are the attractions that bring tourists and their dollars to this place. However, tourism may not be completely benign. As with any industry, it is not totally harmless to the environment, despite our best efforts to ensure that it is as sustainable as possible. With over 100,000 visitors a year to the Mara, each staying for two or three days and each covering many miles in their vehicles in search of wildlife, it is not surprising that negative environmental impacts occur. As managers and custodians of this amazing resource, it is our job to ensure that visitor impacts are minimised, whilst visitor enjoyment is maximised. This will depend on our ability to adequately educate visitors about how they should behave, whilst enforcing the regulations from time to time. But the responsibility also lies with visitors and tour drivers to do their best to respect the rules that we have put in place. We will hear today something of the current impacts of tourism, and to what extent they are controlled by regulations and law enforcement.

Masai Mara is rightly regarded as a special and unique place. However, we should not forget that it is only a very small part of a much larger ecosystem. The Serengeti-Mara ecosystem spans over ten times the area of Masai Mara itself, crossing the international border with our neighbours in Tanzania. Whilst much of the Tanzanian side of the ecosystem falls within the protected area of the Serengeti National Park, the majority of the Kenyan side is Maasai community land rather than government protected area. Seventy-five percent of the Serengeti-Mara ecosystem on the Kenyan side of the border falls within group ranches such as Koyiaki-Lemek and Siana. Equally, wildlife within the ecosystem extends beyond the escarpment in the west into Maasai land in TransMara district.

The survival of Masai Mara, and of the ecosystem as a whole, is vitally dependent upon the coexistence of local people with wildlife in these dispersal areas. For example, the annual wildebeest migration, which is globally unique and one of the key reasons for the international recognition that this ecosystem receives, would not survive within the boundaries of Masai Mara alone. The wildebeest need the dispersal areas if they are to survive in such numbers. Equally, other wildlife populations would crash without seasonal access to resources outside the Reserve.

Historically, Maasai communities have coexisted with wildlife in this ecosystem fairly harmoniously. It is no coincidence that the richest wildlife areas in the country are within Maasai, and related Samburu, areas. However, as communities become more sedentary and change their lifestyles and as populations increase, there is an inevitable increase in conflict with wildlife over access to resources. Wherever wildlife and people coexist there will be some form of competition and conflict, and the challenge is to manage that, to reduce it. It is unlikely that conflict can ever be totally eradicated, but it needs to be controlled at a level that local people can tolerate, and at the same time people need to see a benefit from wildlife to offset those costs of conflict.

Besides predators that take cattle and kill people, one of the major conflict species is the elephant. Because of their size they can be very destructive, and pose a threat to people and their crops. All over Kenya, where elephant ranges are being constrained, we are seeing an upsurge in conflict with people. This mirrors the situation in other parts of Africa, and is becoming a major concern of the international conservation community. In TransMara, where cultivation is increasing dramatically, human-elephant conflict has also increased. We will hear today of studies into this problem, and of efforts to mitigate it.

Human-wildlife conflict, in whatever form, be it tourism impacts or conflict with local communities, threatens the very existence of wildlife in the Serengeti-Mara ecosystem. If we lose this resource then we lose a vital means of revenue generation in an otherwise marginal environment. And we lose a world heritage of unending value to us, our children, and to future generations. Those of us charged with managing and conserving this vital resource need basic information on patterns, trends and explanatory factors if we are to do the best we can. For many decades now we have welcomed researchers to Masai Mara National Reserve, and into the surrounding communities, to help us to collect the information we need to assist us in our tasks.

This workshop brings together the findings of the latest group of researchers to join us here in Mara. It gives me particular pleasure to welcome them back to tell us of their findings, because all too often research results get lost in technical reports that sit on shelves and never get read. By bringing all of us together to discuss the findings and how we can proceed in light of them, this workshop is adding considerably to the value of the research undertaken. I would like to urge all researchers and other partners to do their utmost to ensure that the valuable work that they do reaches the ears of those who need it most. In the past we have had an annual research forum supported by Friends of Conservation, and occasional workshops to discuss various conservation and development issues, such as those organised by the African Conservation Centre in Koyiaki-Lemek. I believe that this sort of function should be much more widely promoted, so that we can all learn from each other and understand each other better. In this way greater cooperation, understanding and achievement can be nurtured.

As a last word I would like to thank the sponsors of this workshop, the Darwin Initiative for the Survival of Species, which is part of the British Government's Department of Environment, Food and Rural Affairs, and also the organisers of the workshop: the Durrell Institute of Conservation and Ecology from the University of Kent, UK.

Mr Chairman, distinguished delegates, I wish us every success in our deliberations, and I now formally declare this workshop open.

CHAIRMAN'S INTRODUCTION

NIGEL LEADER-WILLIAMS
Durrell Institute of Conservation and Ecology,
University of Kent

Ladies and gentlemen,

I would like to thank the distinguished speaker for opening this workshop. As chairman and facilitator, it is my role to ensure that the proceedings run smoothly and to time. I will do my best to ensure that we get the most that we can out of the time we are all devoting to this exercise.

First, however, I want to say a few words about the Darwin Initiative programme and about this workshop and what we hope to achieve. Four years ago, the Durrell Institute of Conservation and Ecology at the University of Kent received funding from the British Government, under their biodiversity funding body the Darwin Initiative for the Survival of Species, to undertake research and training in human-wildlife conflict in and around Masai Mara National Reserve. This project came about through extensive discussions with KWS, WWF and Moi University, and meetings with representatives from both County Councils. The Darwin Initiative gives funds to UK institutions such as the Durrell Institute to assist local partners with training and research into conservation problems. With that in mind, and after discussions with partners, a proposal was written with the following aim:

to train Kenyans at all levels to undertake monitoring and research into various forms of human-wildlife conflict in the Mara ecosystem, and to use the results of such research to develop recommendations for the management and mitigation of human-wildlife conflict for the benefit of both people and wildlife.

The formal aims of the programme are listed in your introductory material, but in essence they were to conduct research into three aspects of human-wildlife conflict: tourism impacts, black rhino recovery, and conflict between elephants and people outside the reserve. This research was to be conducted by two Kenyan PhD students overseen by a British project coordinator, and was to involve training and involvement of community members and other stakeholders wherever possible.

From the outset this Darwin Initiative programme has been a collaborative exercise, involving many local partners. The rhino project has involved a close working partnership with the Narok County Council Rhino Surveillance Unit, who have both assisted and learnt from the research. The tourism research benefited from good relations with Reserve staff, lodge managers and especially the assistance of several tour drivers who recorded the routes that they drove through the Reserve. The human-elephant conflict study developed very close ties with communities in TransMara, who gave their time and knowledge but who also received training in conflict monitoring. Close working links were also developed with local KWS staff on this study, who assisted in many ways with the collection of data.

Moreover, all of our official partners in the programme provided vital resources to ensure its success. Both county councils were generous with their hospitality in Masai Mara, allowing us to come and go freely and assisting us at every opportunity, particularly when project vehicles broke down or were stuck in the bush – many hours were spent searching for us on more than one occasion! The Department of Resource Surveys and Remote Sensing provided much needed technical support and resources throughout the programme. At the outset they provided maps, satellite images, aerial photos, and wildlife survey data. Subsequently, their staff gave vital technical support to all of the programme staff to assist with data analysis and interpretation. Kenya Wildlife Service generously supported Noah Sitati in his PhD research into human-elephant conflict with funding from the Elephant Research Trust Fund, and also provided housing at the Mara Research Station during the first year of the programme. Moi University continued to support Geoffrey Karanja, a staff member at the Department of Wildlife Management, during his PhD research into tourism impacts in Masai Mara. Equally, WWF provided funding and vehicles to support all three studies, as well as office space and administrative support in Nairobi. We would like to express our heartfelt thanks to all of these partners, without which this Darwin Initiative programme would not have taken place. Additionally, we would like to thank the

representatives of each of these organisations who gave their time to sit on the steering committee of the programme and advise the field staff.

The research and training components of the project took place over two years between July 1998 and August 2000. From September 2000, the two PhD students travelled to UK to analyse their findings and write their dissertations. These sections of the project are now complete. What remains is to disseminate the findings to all the relevant stakeholders, discuss their implications, and develop management recommendations. This is the purpose of this workshop. At this point I would also like to thank the owners and management of Dream Camp, who have become a *de facto* partner in this project, for providing such a congenial setting in which to hold this workshop.

Over the course of the coming day and a half we will hear presentations from the three principal researchers on the programme regarding their particular areas of research and their interpretations of their findings. This morning, presentations will be made by Geoffrey Karanja on tourism impacts and Dr Matt Walpole on black rhino conservation and management. Tomorrow morning we will hear from Noah Sitati about human-elephant conflict in TransMara.

In the sessions following the formal presentations of research findings, this afternoon and later tomorrow morning, workshop delegates will be assigned to smaller Working Groups. The task of these Working Groups will be to discuss particular aspects of the findings from the presentations and to develop recommendations for decision-making, monitoring and management. We have invited a wide range of delegates from all the different stakeholder groups, with their own particular experiences and perspectives. Besides representatives from the councils and reserve staff, we have representatives from the national wildlife body, Kenya Wildlife Service, and the national wildlife and natural resource monitoring body, the Department of Resource Surveys and Remote Sensing. We have community representatives from the group ranches, and numerous representatives from the tourism industry. Finally we have researchers and university staff, and representatives from non-government organisations. Between us we have a wealth of relevant experience, and I feel sure that we can approach a consensus as to the meaning of the findings we are presented with, and of the way forward in management from them.

It is my great pleasure to welcome you all here today, and to express my hope that our deliberations are fruitful.

Thank you.

TOURISM IMPACTS IN MASAI MARA NATIONAL RESERVE

GEOFFREY KARANJA
Durrell Institute of Conservation and Ecology,
University of Kent

ABSTRACT

Tourism is the world's largest industry, and nature-based tourism is an increasingly significant proportion of global tourism. It provides an economic rationale for protected areas and has the potential to generate significant benefits for conservation, local communities and national governments. However, tourism is not cost-free, and uncontrolled and ill-managed tourism can have significant negative impacts on wildlife and the environment in protected areas. This study examined tourism impacts in Masai Mara National Reserve (MMNR), in particular the nature, causes and consequences of impacts on habitat and wildlife, the role of law enforcement, and knowledge and adherence to reserve regulations. The major impact is uncontrolled off-road driving that occurs in accessible areas where vehicle pressure is greatest. This has damaged or destroyed several square kilometres of grassland, although its aesthetic significance may be greater than its ecological effects. Impacts on wildlife appeared limited to short term disturbance by vehicles passing, which was increased with increasing vehicle speed. Wildlife was not displaced permanently by tourism, and habituation in heavily visited areas served to limit the amount of disturbance. Drivers and visitors were generally aware of the MMNR regulations, but regulations were broken in over 90% of lion and cheetah viewing events. The presence of the MMNR animal and habitat protection patrol vehicle limited some infringements but not others.

INTRODUCTION

Tourism and conservation have long been intertwined (Boo, 1990; Ceballos-Lascurain, 1996). Many protected areas were originally set aside for recreational purposes rather than explicitly for conservation (Runte, 1987; Leader-Williams *et al*., 1990). Moreover, tourism provides direct economic benefits from wildlife and biodiversity, seemingly without the environmental impacts of more consumptive industries like mining and forestry (Goodwin, 1996). It thereby serves to give biodiversity an economic rationale (McNeely, 1988; Goodwin *et al*., 1998).

Much of the tourism industry in Kenya relies on the National Parks and National Reserves that occupy approximately 8 % of the total land area. These areas are responsible for generating millions of dollars annually for the treasury, and literally thousands of Kenyans are employed in the wildlife-based tourism industry throughout the country (Sindiga, 1999). However, there are costs as well as benefits to tourism. Tourism has been shown to affect habitats, animals and local communities. Uncontrolled and unregulated tourist use in some wildlife areas is a source of concern for a variety of perceived or actual ecological and social impacts, including wildlife disturbance and displacement, habitat damage and pollution. Much of this impact is due to ignorance or a lack of effective management and control (Roe *et al*., 1997).

The vast majority of parks are not equipped to minimise the negative impacts of tourism. National Parks and National Reserves lack trained guides, interpretative information, visitor centres and infrastructures to manage visitors. For example, the 'Big Five' did much to promote Kenya's tourist economy in the 1960s through safari hunting. Today, the 'Big Five' mentality is doing more harm than good. Traffic jams are forming around prides of lions in the vastness of Kenya's wildlife areas (Muthee, 1992).

The jewel in Kenya's wildlife crown is undoubtedly Masai Mara National Reserve (MMNR). However, it is becoming just as notorious for its uncontrolled tourism as it is well known for its wealth

of wildlife. Despite the preparation of tourism management plans for the Reserve in the 1980s (Thorsell, 1980; WPU, 1983), and the existence of visitor regulations, environmental impacts remain largely unchecked (Onyeanusi, 1986; Gakahu, 1992; Bhandari 1998). This study aimed to examine a range of tourism impacts, and the attempts to manage and mitigate them.

AIMS AND OBJECTIVES

The main objective of this study was to quantify a number of tourism impacts and identify ways of resolving wildlife-tourism conflicts in Masai Mara National Reserve. To achieve this objective, several aspects of the relationship between tourism and the environment were examined. These included patterns of tourist and wildlife distribution, habitat degradation, visitor behaviour, tourism management and law enforcement. The following research topics were investigated:

- Spatial and temporal patterns of development of tourist facilities in MMNR.
- Spatial patterns of habitat degradation in relation to infrastructure development, vehicle pressure and management intervention.
- The relationship between tourist and wildlife distributions.
- Wildlife responses to tourist behaviour and activity.
- Awareness of, and compliance with, Reserve regulations by visitors and tour drivers.

PATTERNS OF TOURISM DEVELOPMENT AND GROWTH

Chronological patterns in the development and capacity of tourist accommodation facilities in MMNR were investigated by interviewing lodge managers. Information on long-term changes in the numbers of tourists visiting MMNR was obtained from MMNR headquarters and supplemented by other published information (Kiokai, 1992, Bhandari, 1998). The characteristics of tourists visiting MMNR were obtained from questionnaires completed by 234 respondents, whilst seasonal patterns of tourist visitation were determined from data on bed occupancy from lodges and tented camps in and around MMNR.

Tourist accommodation facilities started developing after MMNR was gazetted in 1963. In 1965, Keekorok Lodge was established from former self-catering chalets (Fig. 2). Further facilities were established inside MMNR between 1972 and 1986. Facilities outside MMNR started developing in 1977 and have continued to the present day, despite the existence of a moratorium on further establishment of facilities. These facilities blossomed after hunting was banned in Kenya, and professional hunters were encouraged to establish permanent tented camps in the former hunting blocks in group ranches neighbouring MMNR. There are now a total of 24 permanent camps and lodges in and around MMNR, providing a total of approximately 2,200 beds.

Visitor numbers to MMNR peaked at over 200,000 in the early and mid-1990s. However, a combination of insecurity and competition from southern Africa had reduced the visitation rate to fewer than 100,000 visitors per year by the end of the 1990s, although this may have recovered slightly since. Visitor arrivals followed a bimodal pattern with two peaks and two troughs during the year, when examined in terms of monthly bed occupancy. Bed occupancy was highest in July and August during the long dry season and wildebeest migration from the Serengeti that also coincides with the European and American summer holiday period. There was a smaller peak in February, during the shorter dry period between the two rainy seasons. Occupancy was lowest in May, during the long rains, although there was also a trough during the short rains in November and December (Fig. 3).

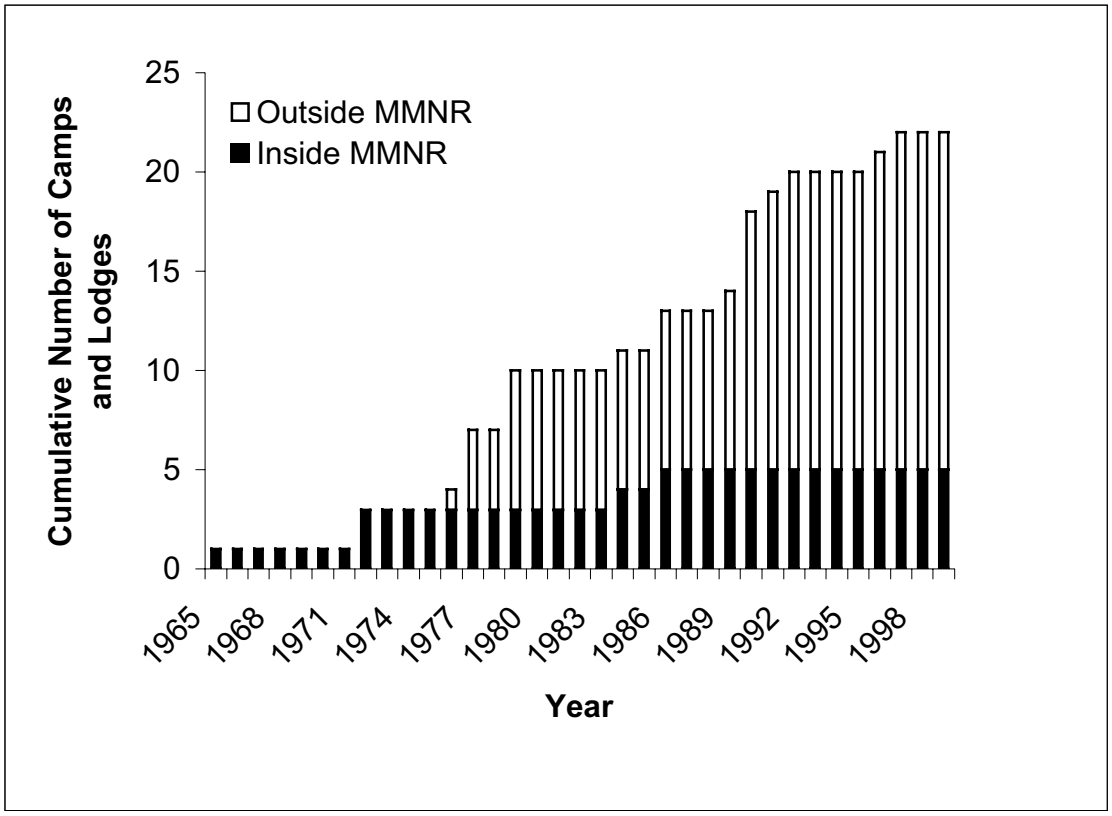

Figure 2. Cumulative number of permanent accommodation facilities established in and around MMNR.

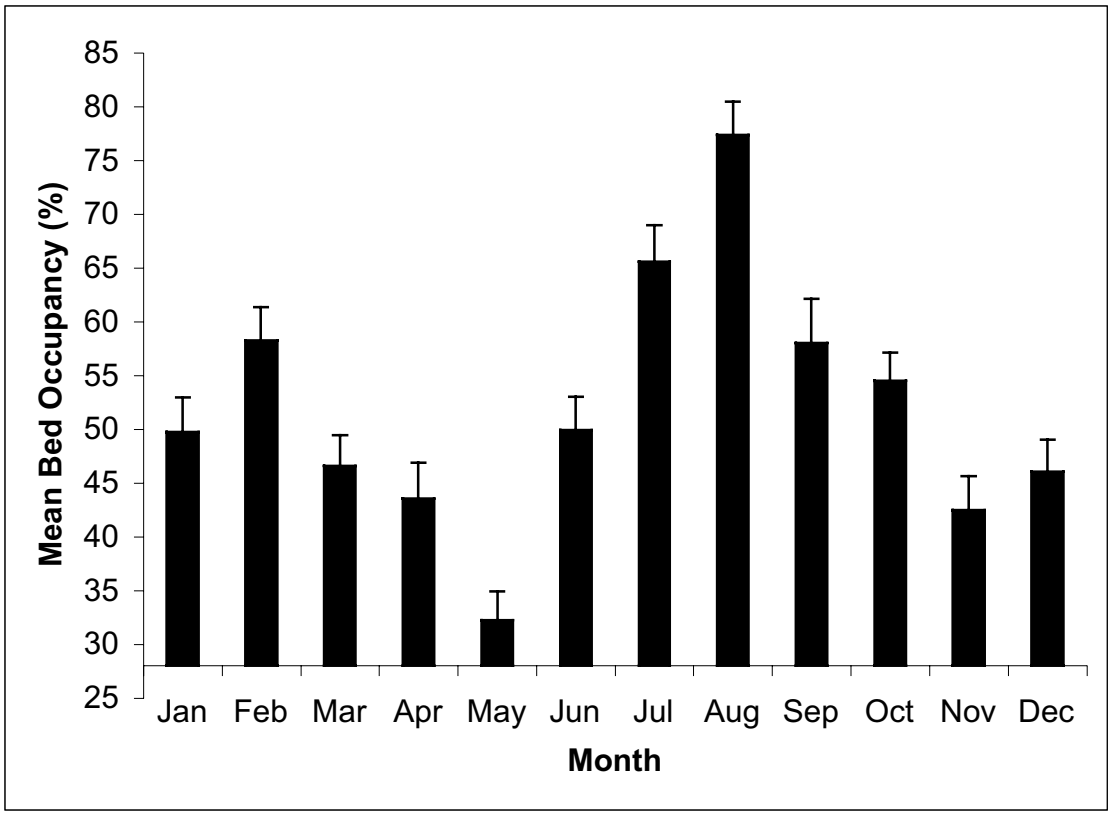

Figure 3. Mean monthly bed occupancy from a sample of tented camps and lodges in MMNR, 1997-2000.

HABITAT DEGRADATION CAUSED BY OFF-ROAD DRIVING

All roads and tracks present in 1999 in MMNR were mapped in the field using a hand-held GPS unit. Measurements of track and road widths were taken at one-kilometre intervals. For comparison, roads and tracks that were present in 1991 were digitised from aerial photographs. These methods are comparable since the resolution of the aerial photograph was sufficient to detect even the slightest vehicle track, whilst the intensity of the field survey provided a full coverage of tracks.

An indication of vehicle pressure in different parts of MMNR was derived by training a sample of lodge tour drivers from six lodges east of the Mara River to use GPS units to map their game drives. These data, and remotely sensed landscape data, were incorporated into the ArcView GIS system and converted into a $1km^2$ grid for analysis of spatial relationships.

Results suggest that the length of roads and tracks within MMNR has increased by around 30% between 1991 and 1999, the majority being unofficial off-road tracks (Table 1). The area of MMNR covered by discernible roads and tracks in 1999 was 8.77 km^2 (0.6% of the total area), of which 4.68 km^2 was completely bare ground, denuded of grass. These figures are lower than previous estimates (Muthee, 1992). However, they do not take into account the 'hidden' effect of a shifting mosaic of tracks. Even where old tracks are no longer discernible to drivers, their effect on grassland community composition can be sustained for many years (J.Watkin and H.Dublin, unpublished data).

Category	Length in 1991 (km)	Length in 1999 (km)	Increase (km)	% Increase
Roads	188.6	222.5	33.9	18.0
Tracks	1656.3	2166.7	510.4	30.8
Total	1844.9	2389.2	544.3	29.5

Table 1. Comparison of the lengths of roads and tracks in MMNR between 1991 and 1999.

Tracks were not evenly distributed throughout MMNR, but were concentrated in areas of higher degradation in both 1991 and 1999 (Figs 4 and 5). Spearman's correlation indicated that there were significant relationships between the density of tracks in $1km^2$ grid cells and vehicle pressure, distance from main roads and distance from lodges/tented camps ($p<0.01$). Tracks proliferated closer to main roads ($r_s=-0.51$), and where vehicle pressure was greatest ($r_s=0.56$). This tended to be at an intermediate distance from lodges ($r_s=0.26$).

The change in distribution of tracks between 1991 and 1999 can be explained by two key changes. First, the development of a murram road between Talek and the Sekenani-Keekorok road in 1994 and the subsequent nearby development of a new lodge on the Talek River. These developments caused an increased build-up of tracks between Talek and Sekenani in an area known as the short-grass plains. Second, the closure of areas of grassland in the vicinity of Keekorok Lodge has caused some areas of severe degradation to begin to recover (Figs 4 and 5).

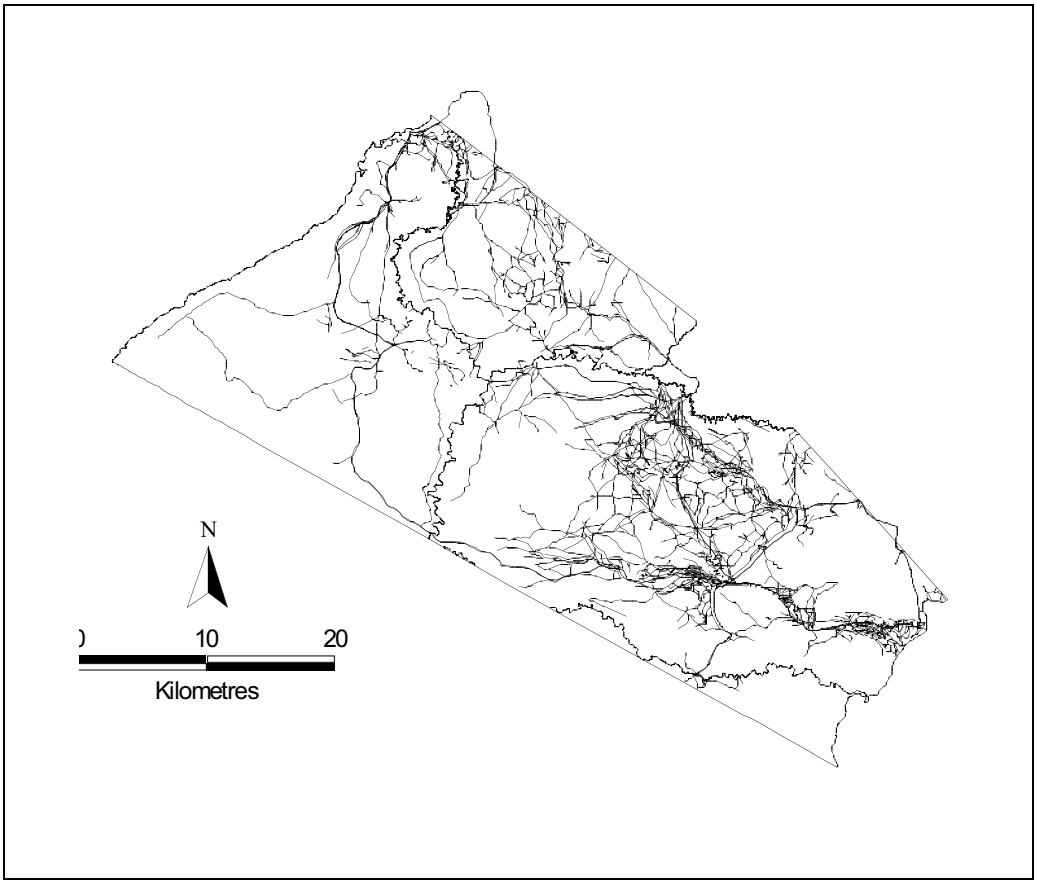

Figure 4. Tracks inside MMNR in 1991 from aerial photography.

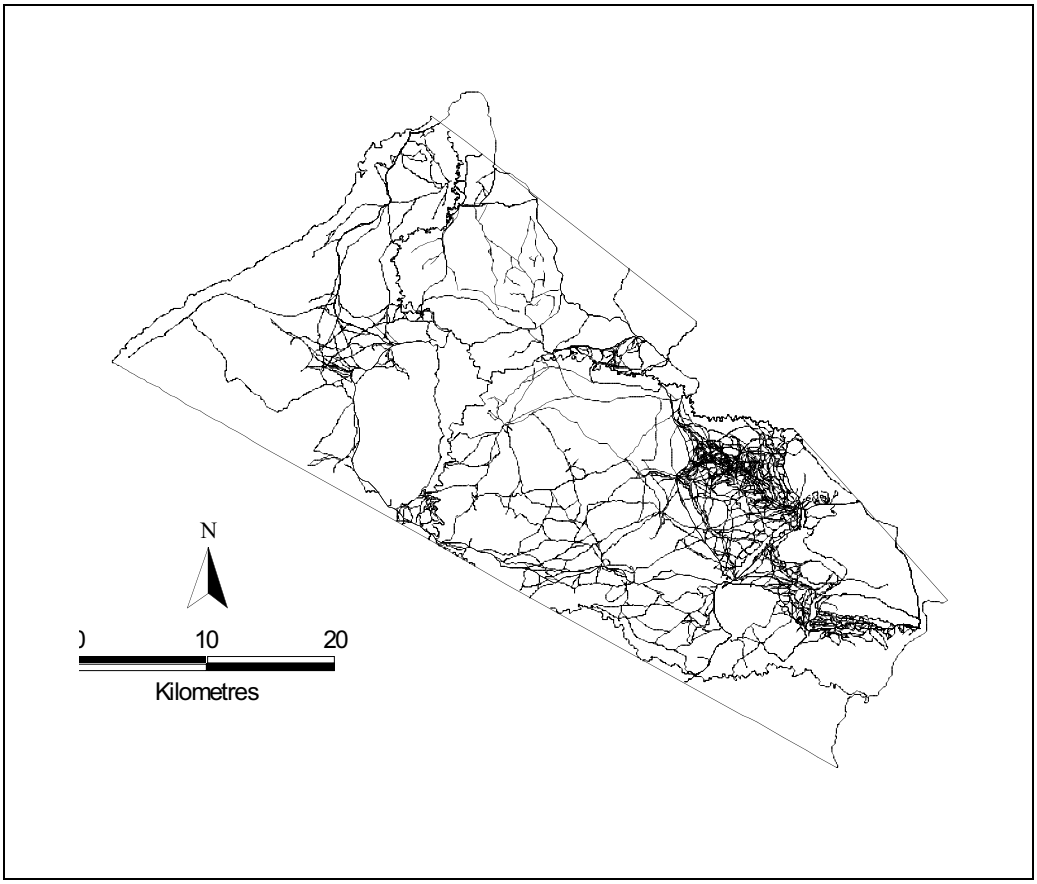

Figure 5. Tracks inside MMNR in 1999 from ground survey.

HERBIVORE DISTRIBUTION IN RELATION TO TOURISM

The sensitivity of large carnivores (especially cheetah and lion) to tourist attention in MMNR has been widely publicised (Muthee, 1992). Little attention, however, has been paid to the effect of tourism on the more common herbivore species that receive less direct attention. This study attempted to establish the effect of passing vehicle traffic on both the distribution and behaviour of a range of common herbivores.

Animal census data at a resolution of 25 km_ obtained from the Department of Resource Surveys and Remote Sensing were used to determine the distribution of animals. Eight animal species were selected for analysis. These were impala, kongoni, ostrich, giraffe, topi, waterbuck, warthog and zebra. The distribution of these animals was examined in relation to altitude, vegetation, visitor pressure, distance from drainage system, and distance from roads.

Altitude was determined from a digital elevation model (DEM) while vegetation cover was determined from satellite imagery using a normalised difference vegetation index (NDVI). For NDVI both the mean and range of values within a grid cell (variety) were used. Visitor pressure was determined from the density of roads and tracks obtained from mapping as described earlier. Distance from roads and rivers was calculated using ArcView.

Stepwise linear regression analysis of species richness in each grid cell entered only mean distance from all rivers and streams in the model. This indicated that among all the explanatory variables that were tested it was only the mean distance from all rivers that had a significant relationship with species richness ($F_{1,83} = 42.667$; $p < 0.0001$). The relationship was negative, suggesting that grid cells nearer to the rivers and streams tended to have more species.

With the distribution of individual animal species, stepwise logistic regression revealed a variety of explanatory variables (Table 2). Proximity to rivers and streams correlated with the presence of waterbuck, kongoni, impala, zebra and topi. Vegetation heterogeneity correlated with the presence of waterbuck and warthog. Elevation correlated with the distribution of giraffe. For ostrich, no explanatory variable was entered into the model.

Species	Explanatory Variable	df	P- value	R
Waterbuck	NDVI variety	1	0.0083	0.2838
Waterbuck	Mean distance from major rivers	1	0.024	-0.2241
Kongoni	Mean distance from all rivers	1	0.0052	-0.2422
Impala	Mean distance from all rivers	1	0.005	-0.2986
Giraffe	Mean DEM value	1	0.0201	0.1892
Zebra	Mean Distance from all rivers	1	0.004	-0.2287
Warthog	NDVI variety	1	0.001	0.2769
Topi	Mean distance from all rivers	1	0.0002	-0.3201

Table 2. Results of logistic regression of herbivore presence in 25 km^2 grid cells in MMNR.

None of the explanatory variables associated with tourism pressure were entered in any species' model. This suggested that tourism pressure was not affecting the distribution of these herbivore species within MMNR.

DISTURBANCE OF HERBIVORES BY TOURIST VEHICLES

The response by five herbivore species (impala, topi, warthog, wildebeest and zebra) to various vehicle speeds was investigated. These animals were approached at speeds of 10, 20, 30 and 40 km/hr and the distance at which they changed their activity in response to the approach of the vehicle was measured using a handheld laser range finder. The approaches were conducted in areas with high and low visitation pressure for comparison.

Initial analysis indicated that there were significant differences in response distance among the different species studied ($F_{4,324} = 35.458$; $p < 0.0001$). Topi were the least timid to vehicle approach while warthogs were the most timid (Fig. 6). Consequent analyses were therefore based on various species individually.

In general there was a positive relationship between the approach speed and the distance at which the animals responded (Fig. 7). Animals tended to respond at shorter distances when the vehicle was at lower speed than at higher speed, suggesting that higher vehicle speeds cause more wildlife disturbance. Equally, animals appeared to respond at shorter distances in areas with high visitation level than in areas with low visitation level (Fig. 8). These differences were significant for topi, warthog, wildebeest and zebra, and suggest that most animals have become habituated to vehicles in highly visited areas.

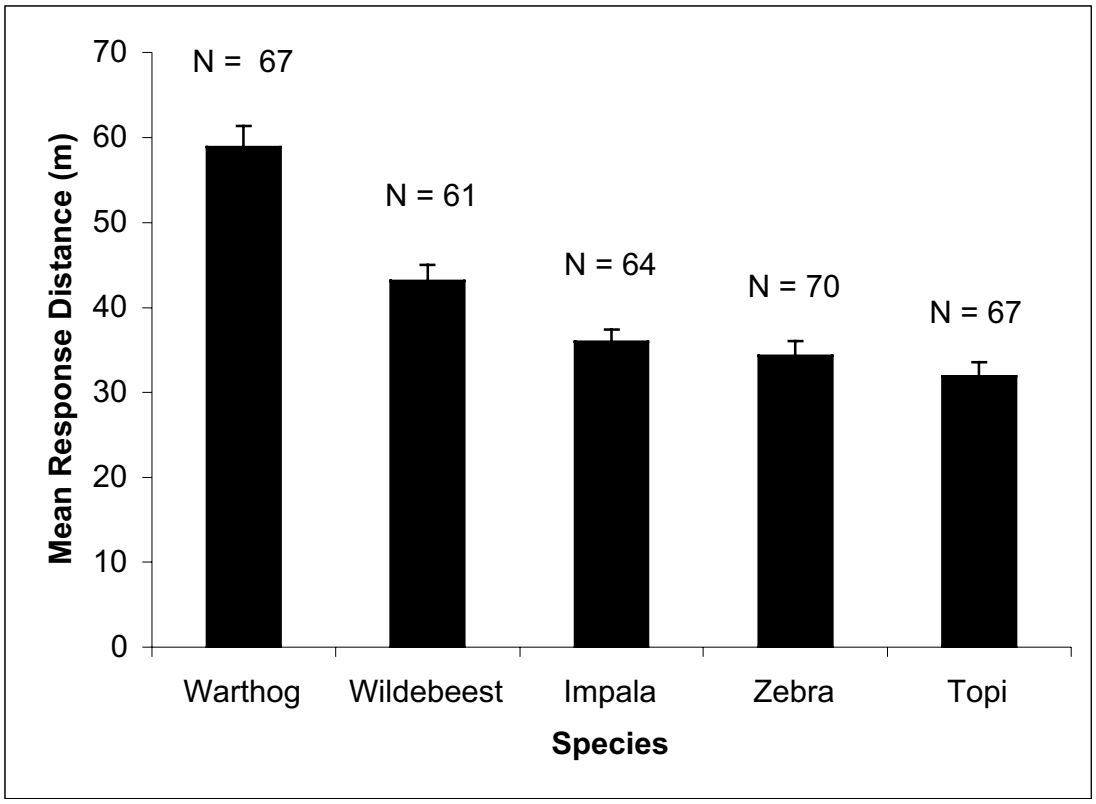

Figure 6. Mean response distance of five herbivore species to vehicle approaches.

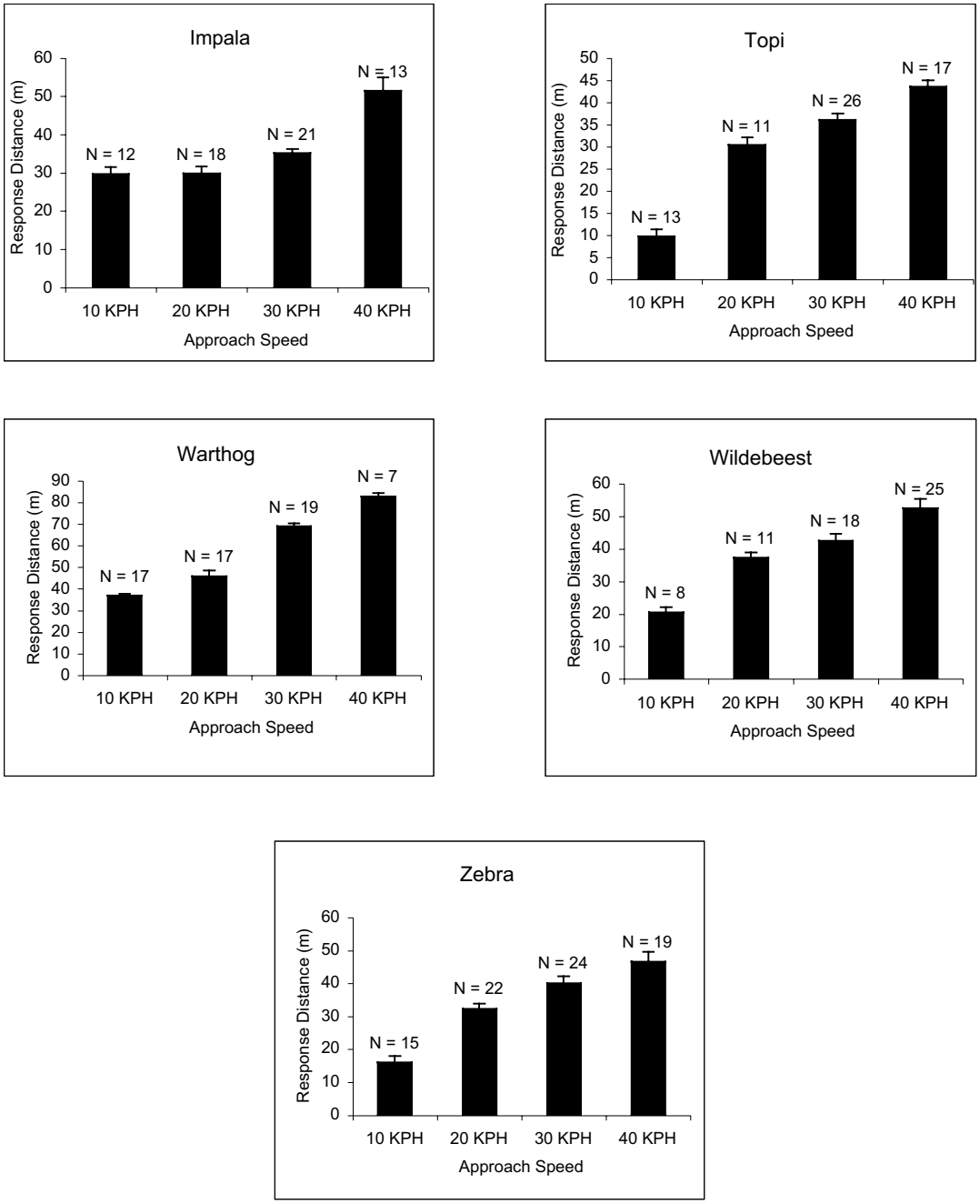

Figure 7. Mean response distance of five herbivore species to vehicle approaches at different speeds.

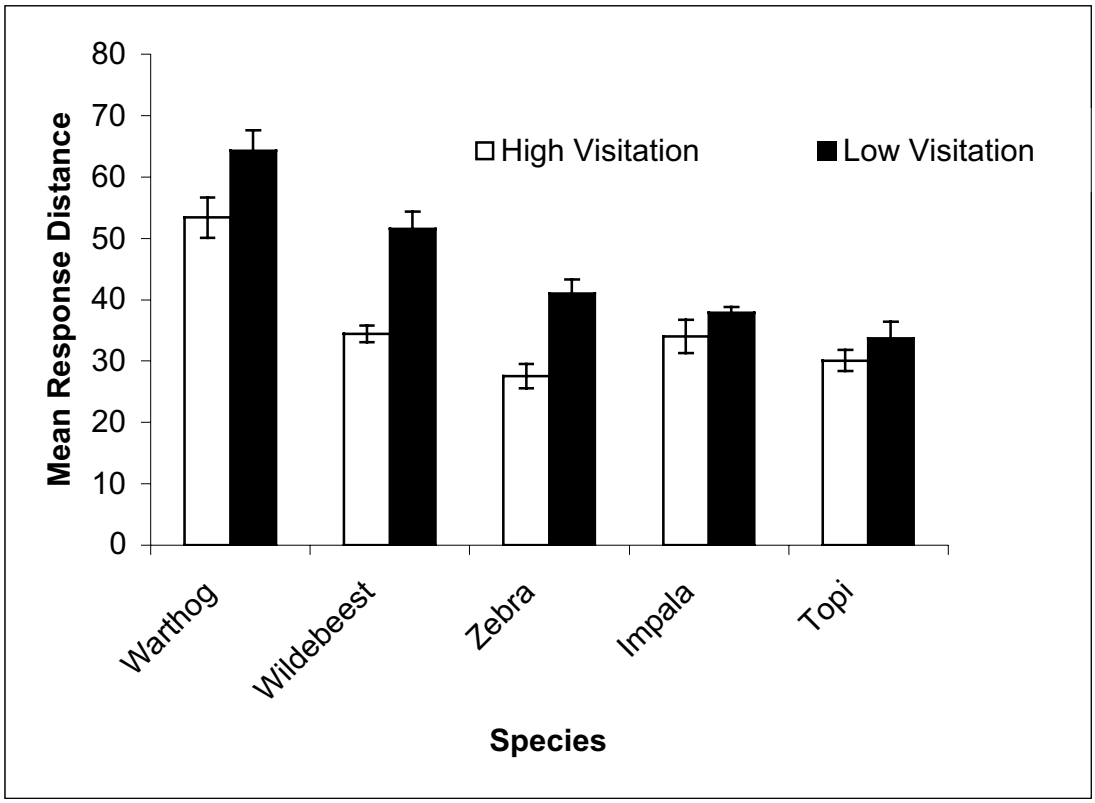

Figure 8. Mean response distance of five herbivore species to vehicle approaches in areas of high and low visitation.

VISITOR BEHAVIOUR WHEN VIEWING LARGE CARNIVORES

The sensitivity of cheetahs and lions to tourism pressure has been documented previously (Muthee, 1992), and a set of Reserve regulations exist to minimise disturbance. Moreover, an official animal and habitat protection unit, operating out of Sekenani headquarters, is maintained to enforce these regulations, in particular when visitors are viewing cheetahs and lions. However, the efficacy of Reserve regulations and their enforcement have not previously been investigated. This study investigated the behaviour of tourists when watching these large predators, and infringements of the MMNR regulations were recorded. This was done in the presence and absence of the official animal and habitat protection unit.

The regulations set out in the printed leaflet distributed to visitors and guides are as follows:

- No off-road driving.
- No following of animals.
- Minimum approach distance of 20m to an animal.
- Limit of five vehicles at any one viewing.
- Limit of 10 minutes viewing when other vehicles are waiting to view.
- Maximum speed limit of 50km/hr.
- No deliberate use of noise to distract wildlife.
- No leaning out of vehicles (except roof hatches) and no getting out of vehicles.
- No dropping litter.
- No pets.
- No starting fires.

Infringement of these regulations carries a KSh 2000 (US$ 25) fine, although this is rarely applied.

Results from watching visitors during game drives indicated that regulations were observed to varying degrees. Out of the 251 records made, in only 17 cases (6.8 %) did tourists observe all regulations,

suggesting that regulations are broken in over 90% of cases. Among the eleven regulations studied, results indicated tourists broke between one and three of them in between 25% and 80% of cases inclusively. The maximum number of regulations broken on a single case was six, which occurred only once.

Too many vehicles around animals and driving too close to the animals were the most frequently broken regulations. These were broken during 76% and 75% of lion viewing events, and 57% and 47% of cheetah viewing events, respectively (Fig. 9). The other most frequently broken regulations were visitors remaining too long viewing animals and driving off road. These infringements occurred in 40% and 36% of lion viewing events, and 36% and 52 % of cheetah viewing events, respectively. There were no records of driving fast, dropping litter or having pets while visitors were watching predators.

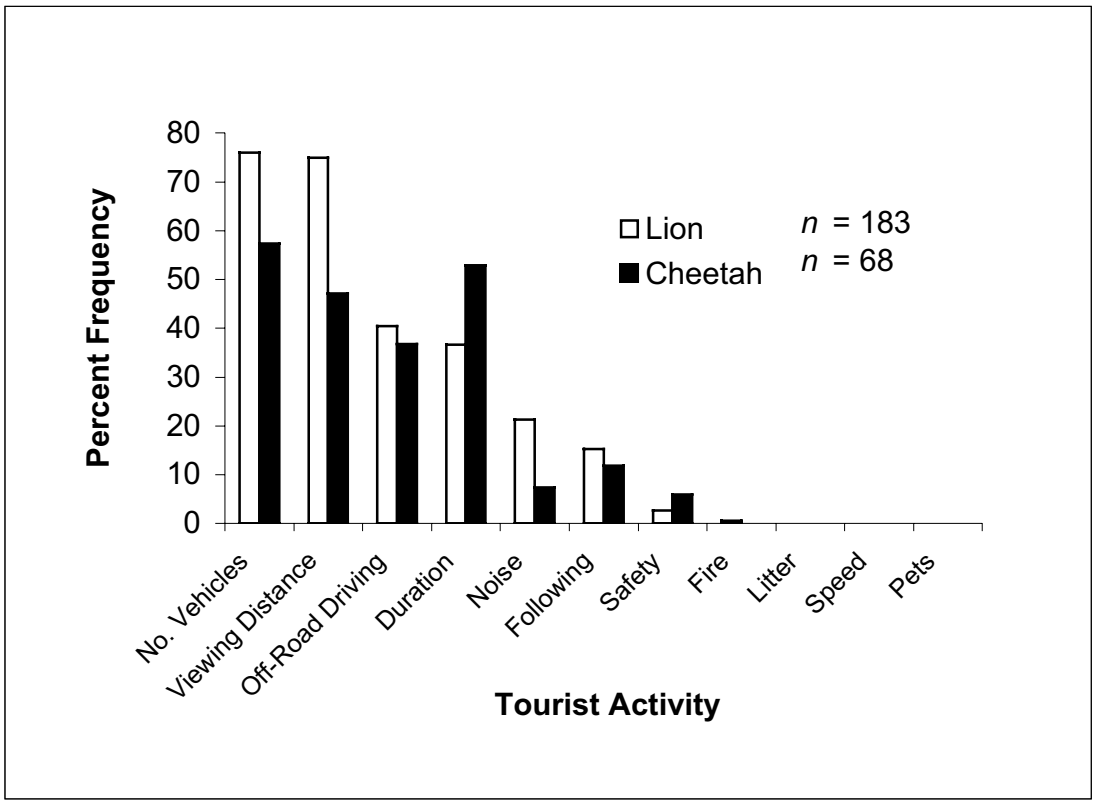

Figure 9. Frequency of predator viewing events where MMNR regulations were broken.

Results on the effect of Animal and Habitat Protection (AHP) vehicle on tourist behaviour (Fig. 10) suggested that there were instances where the presence of the unit influenced the behaviour of tourists. In cases where the unit was present, there were no records of off-road driving, noise, and tourists leaning out of vehicles. These rules were often broken in the absence of the AHP unit. In the presence of the AHP unit, incidences of too many vehicles, driving too close and following animals only decreased in frequency but still occurred. The AHP unit did not seem to have any effect on the length of time that animals were viewed (Fig. 10). In general, then, the AHP unit appeared to improve adherence to MMNR regulations by visitors and drivers. However, its success is limited by its capacity to patrol such a large area.

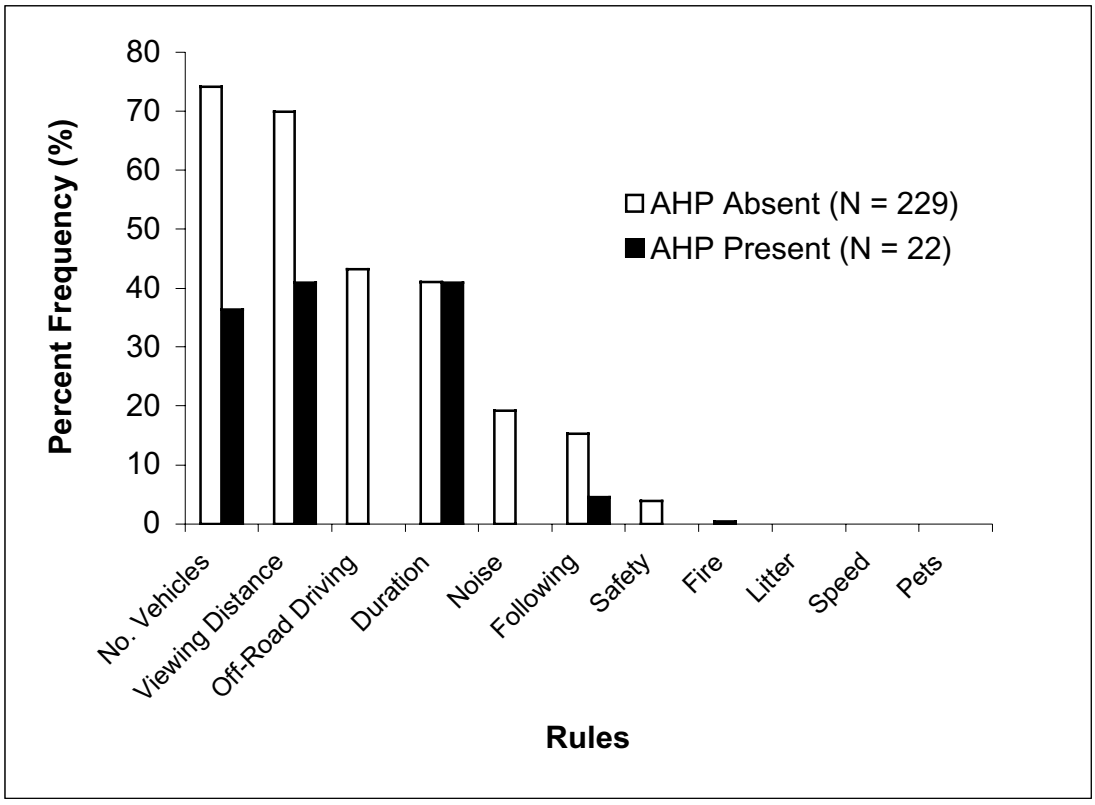

Figure 10. Frequency of predator viewing events where MMNR regulations were broken, in the presence and absence of the AHP unit.

TOURIST AND DRIVER KNOWLEDGE OF REGULATIONS

Questionnaires were distributed to tourists and driver guides, requiring them to indicate where they learnt about MMNR regulations. Five questions were used to test tourists' understanding of the regulations.

68% of visitors were aware of the existence of the MMNR regulations, as opposed to 100% of tour drivers questioned (n = 230 and 45, respectively). When visitors were asked where they learnt about the MMNR regulations, ten different sources were identified. Among the most frequent were pamphlets (20.4%), notice boards (19.6%) and driver guides (18.7 %) (Fig. 11). The British appeared to have higher frequencies for all printed material, whilst Americans relied more heavily on oral sources (Fig. 12).

The majority of information obtained by visitors was from hotels and tour operators (58%), with only 13% from MMNR management. Conversely, 88.6% of tour drivers indicated that their principal source of information was the pamphlet issued at the gates.

Evaluation of tourists' knowledge of reserve regulations indicated that most of them had good knowledge of the regulations. Some 33% of the respondents scored full marks compared to only 3.5% who did not score any mark. Moreover, 82% of the respondents were proficient (scored three marks and above out of five) while only 18% scored less than three of the five questions. Therefore ignorance is not an adequate explanation for the lack of adherence to MMNR regulations. A more likely explanation is a lack of appreciation by visitors of the significance of their actions.

Equally, all driver guides knew what they were supposed to do in terms of MMNR regulations but their responses indicated that they did not understand why the regulations were in place, nor appreciated their significance.

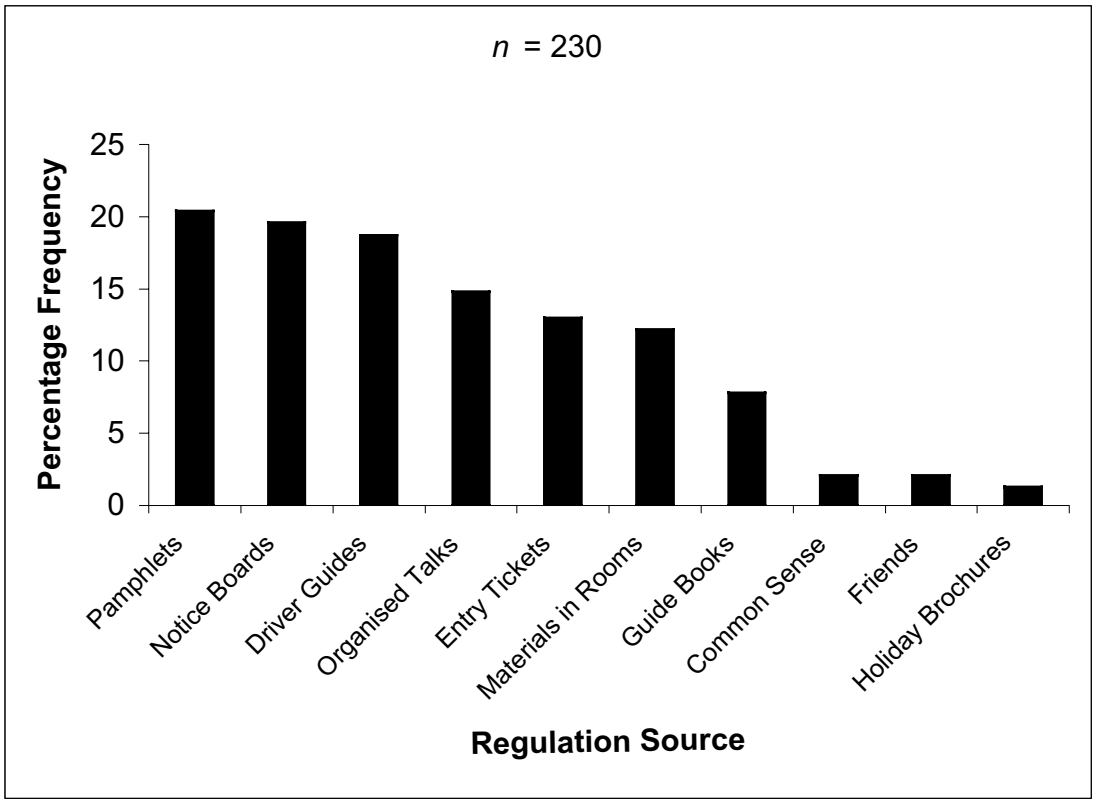

Figure 11. Sources of visitor information regarding MMNR regulations.

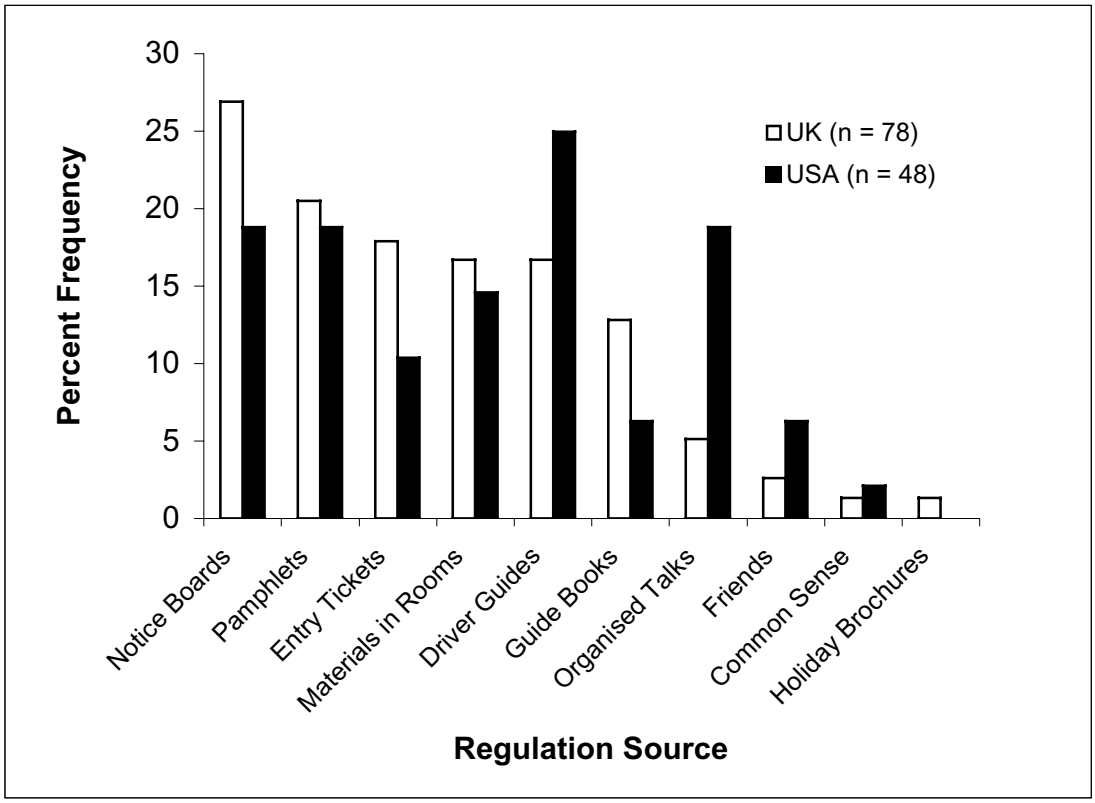

Figure 12. Sources of information regarding MMNR regulations for British and American visitors.

FACTORS AFFECTING THE RECOVERY OF THE MASAI MARA BLACK RHINO POPULATION

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ABSTRACT

The black rhino population in Masai Mara National Reserve (MMNR) in Kenya is recovering after a major decline due to poaching. However, ecological changes in MMNR may affect the capacity for recovery. This study aimed to assess resource utilisation and the effects of woodland decline, cattle encroachment and tourism on habitat suitability in MMNR for black rhinos. Multivariate analysis and GIS technology were used to predict the growth and expansion of the population. Findings suggest that a long-term woodland decline has reduced the quality of food resources for black rhinos in MMNR, and that rhinos are dispersing to potentially more favourable, but unprotected, areas outside of MMNR. Equally, the presence of cattle inside MMNR has constrained rhino distribution and carrying capacity. Strategies for maximising the recovery of the population were identified. These include; (1) collaborating with Tanzanian authorities on cross-border rhino monitoring so as to secure areas in northern Tanzania to which rhinos may be dispersing; (2) undertake foot patrols within MMNR to increase sighting rates; (3) collaborating with monitoring groups outside MMNR on the Kenyan side of the border, in areas where rhinos are known to reside, and may be dispersing from MMNR, and; (4) preventing cattle and other livestock from entering the Reserve.

INTRODUCTION

The black rhinoceros (*Diceros bicornis* L.) in Africa declined throughout the 20th century, but most dramatically between the 1960s and 1980s as a result of illegal killing to supply the international demand for rhino horn (Leader-Williams, 1992). During this time it is estimated that over 95% of the population that existed in the 1960s was eliminated. Recently the situation has improved as a result of the concentration of the majority of wild rhinos into well protected areas administered by both government and private owners, and by intensifying anti-poaching efforts. Many populations have stabilised or recovered, and the continental population now numbers c.2,600 rhinos (Emslie & Brooks, 1999).

Kenya contains approximately 400 black rhinos, or 15% of the continental population (Emslie & Brooks, 1999). Within Kenya, MMNR is a key refuge for the endangered black rhinoceros. It currently holds around 23 rhinos, around 6% of the Kenyan population and 1% of the continental population (Walpole *et al*., 2001). The MMNR black rhino population is unique in Kenya, as it contains only rhinos that are indigenous to the Serengeti-Mara ecosystem with no inwards translocation from other areas (Brett, 1993).

In the 1960s, MMNR contained a large population of around 150 black rhinos (Brett, 1993). In the 1970s and early 1980s, the population was decimated by poaching to supply the illegal trade in rhino horn, and declined to less than 15 individuals (Morgan-Davies, 1996). However, from the mid-1980s the population slowly begun to recover, due to increased security and surveillance by NCC rangers supported by Friends of Conservation, which at that time was known as Friends of Masai Mara. This study aimed to examine the recovery of the population since the poaching of the 1970s and 1980s, and identify ecological and human factors affecting it. In this presentation, three issues are considered:

- the dynamics of the black rhino population recovery.
- ecological change and its implications for black rhino habitat suitability.
- human disturbance of black rhinos in MMNR.

POPULATION DYNAMICS

Since the mid-1980s, twice-daily vehicle-based monitoring of the population has been carried out within MMNR by a team of NCC rangers, led by Sergeant Phillip Bett. Individual rhinos were recognised by a number of features (age, sex, horn size and shape, ear notches, body shape and nose wrinkle patterns), as have been widely used elsewhere. For each sighting, the individual(s) encountered and general area of sighting were recorded. For each patrol, regardless of whether a sighting was made, the date, start and end times, personnel involved and areas traversed were recorded. Periodically, between 1992 and 1999, GPS technology was used on patrols to record accurate locations of individual rhinos encountered (Walpole *et al*., 2001; Walpole, 2002). Most patrols took place in Keekorok Sector (Fig. 1) where all but one of the Mara rhinos resides.

In 1988, 20 rhinos were observed in MMNR. Considering only known births (*n*=25), deaths (*n*=7) and immigrations (*n*=5), the population grew to 43 individuals by 1999. However, by 'discounting' rhinos that had not been seen for two years or more (Leader-Williams, 1988), the population only reached a peak of 35 in 1993/94 before declining to 23 in 1998/99 (Fig. 13) (Walpole & Bett, 1999a; Walpole *et al*., 2001). It has since remained static at this level (P.Demmers, *pers comm*.).

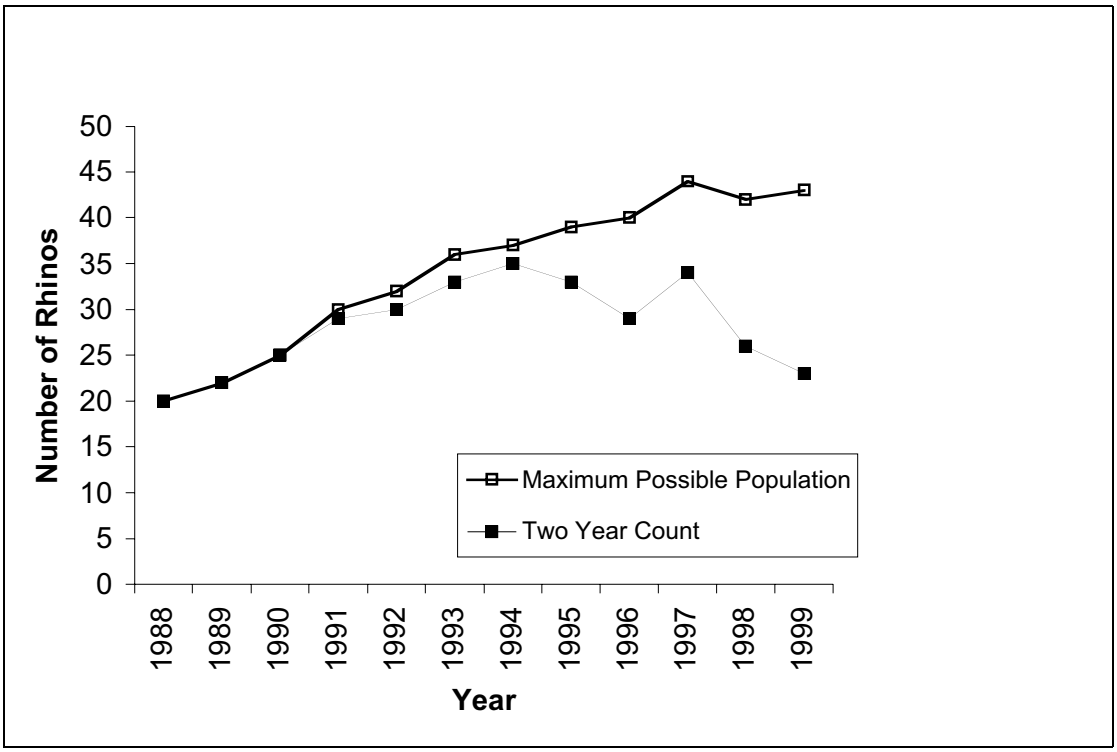

Figure 13. Population dynamics of the Mara rhinos, 1988 – 1999 (after Walpole *et al*., 2001).

During the 1990s, the black rhino population recovered to only approximately half the distribution and density at which it had existed in the 1970's (Table 3, Figs 14-15). Therefore, at no time in its recovery has the population reached the size, density or distribution of the population prior to poaching.

Time Period	Area (km^2)	Number of rhinos	Density (rhinos/km^2)
1971/72 (Total)	749	108	0.144
1971/72 (Keekorok Sector)	395	72	0.182
1994/95 (Keekorok Sector)	345	31	0.090
1997/98 (Keekorok Sector)	370	27	0.073
1999/00 (Keekorok Sector)	254	22	0.087

Table 3. Black rhino distribution and density in MMNR (after Walpole *et al*., 2001, incorporating data from Mukinya, 1973).

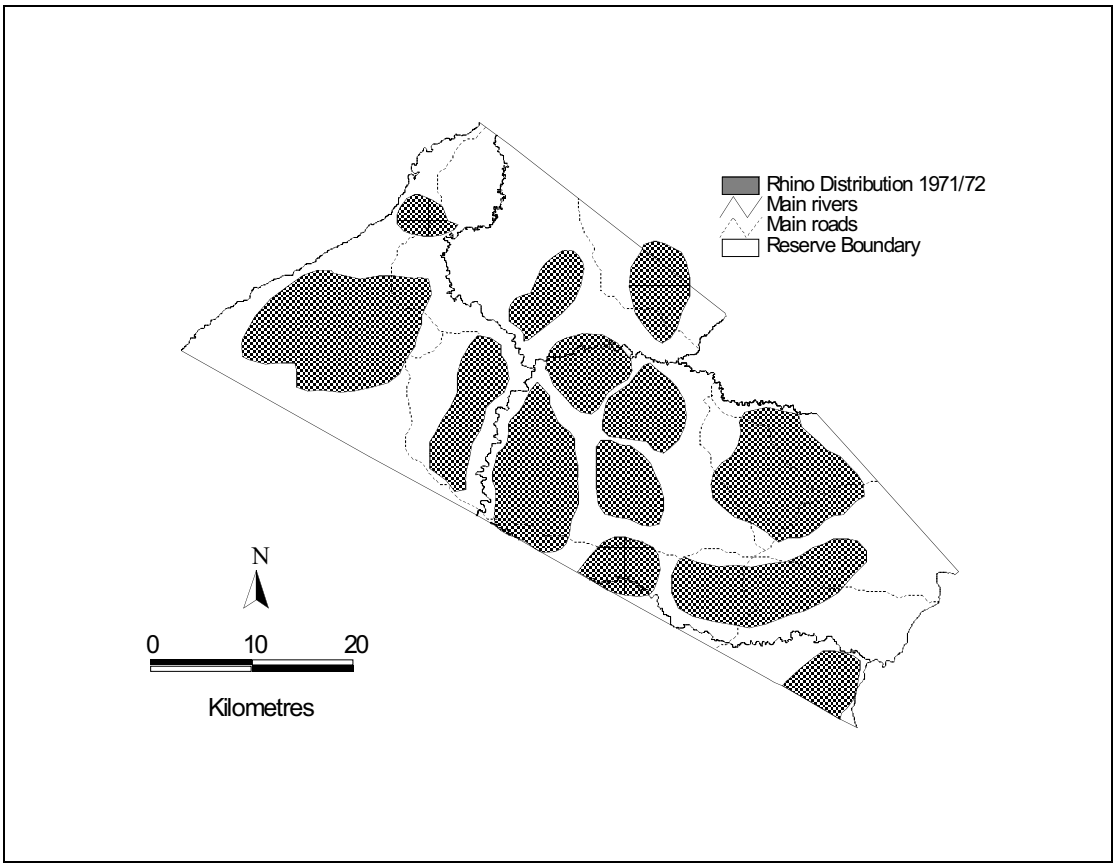

Figure 14. Rhino distribution in MMNR in 1971/72 (adapted from Mukinya, 1973).

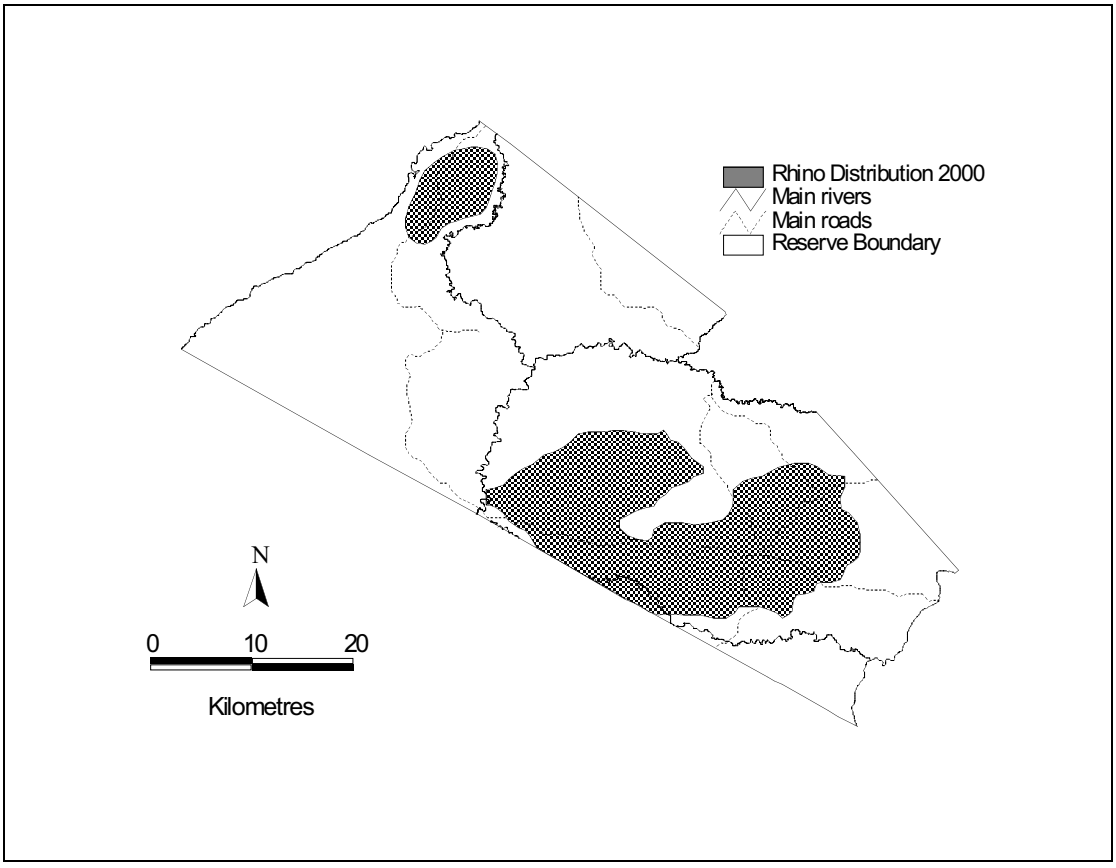

Figure 15. Rhino distribution in MMNR in 2000.

The apparent decline is not due to a failure of the population to breed. Over two thirds of the female population are accompanied by calves at any one time. Moreover, the mean intercalving interval was 35 months (Fig. 16), which is only slightly longer than average for black rhinos in the wild, and suggests that females are breeding well.

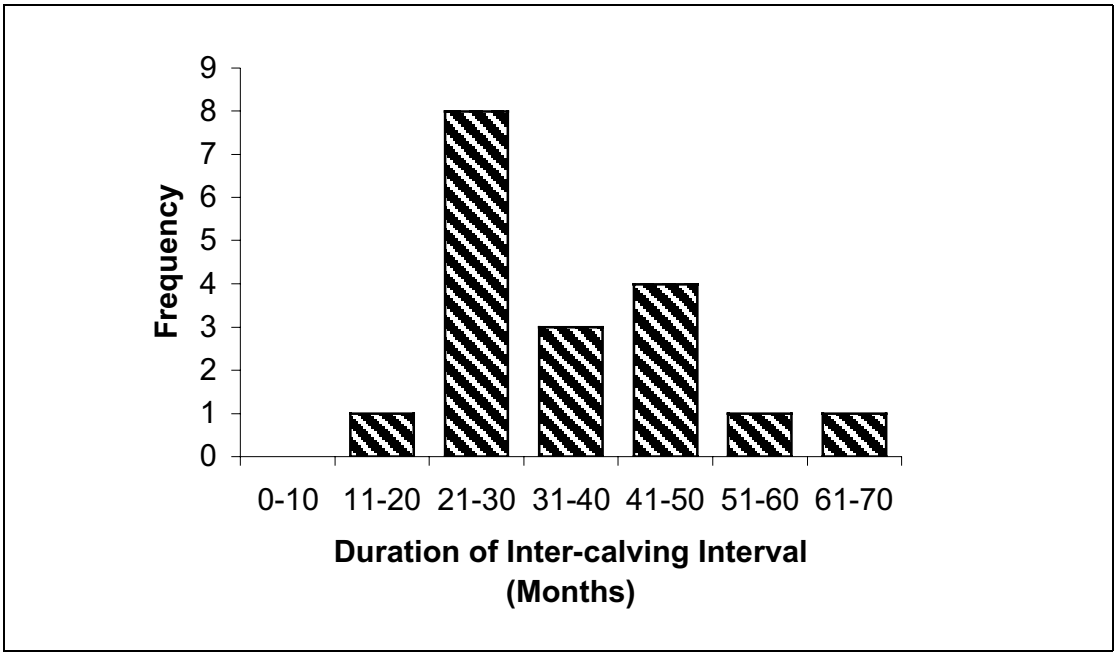

Figure 16. Inter-calving intervals of female rhinos in MMNR (n=18, after Walpole *et al*., 2001).

The most likely explanation for the decline is dispersal out of MMNR, and principally into northern Serengeti. Several of the rhinos living on the border have been seen south of Sand River within the Serengeti, so it is known that they can travel there. Moreover, a comparison of the age and sex structure of the current population with those animals known to have disappeared during the 1990s suggests that more sub-adults than expected have disappeared from the population, and that these are generally males (Walpole *et al*., 2001). Animals of this age that are about to leave their mother are actively in search of an area of their own, and can be expected to disperse from their natal area. This evidence supports, but does not confirm, the hypothesis that rhinos are dispersing out of MMNR, and that this is limiting the population recovery inside the Reserve.

Two possible explanations for this dispersal were considered in this study. Firstly, a decline in resource quality for rhinos within MMNR, and secondly increased human disturbance of rhinos within MMNR.

HABITAT CHANGE AND RESOURCE COMPETITION

The effects of woodland decline on woody resources were measured using data from relatively large permanent plots established by Dr Holly Dublin, which had been surveyed at approximately 2-year intervals since 1989 by the Masai Mara Ecological Monitoring Program (MMEMP). In addition, in 1999/2000, rhino feeding data were collected indirectly throughout MMNR. Browse utilisation and availability on a species/size class basis was recorded for every woody plant in small (10x30m) plots. Rhino feeding preferences were compared with those of a similar study conducted 30 years previously when the population was considerably larger and the vegetation of MMNR was somewhat different.

Results of long term research into habitat change reveals a decline in woody resources that rhinos rely on. Aerial photograph analysis revealed large declines in both *Croton* thicket and *Acacia* woodland density between the 1950s and 1980s (Dublin, 1991). Further research in the 1980s and 1990s showed a continued decline in both of these habitats to 1998 (Fig. 17; Obara 1999). Equally, analysis of the recent Acacia woodland plots revealed lower species diversity at lower densities (Fig. 18), suggesting that the remaining areas of woody habitat have lower plant diversity over small spatial scales.

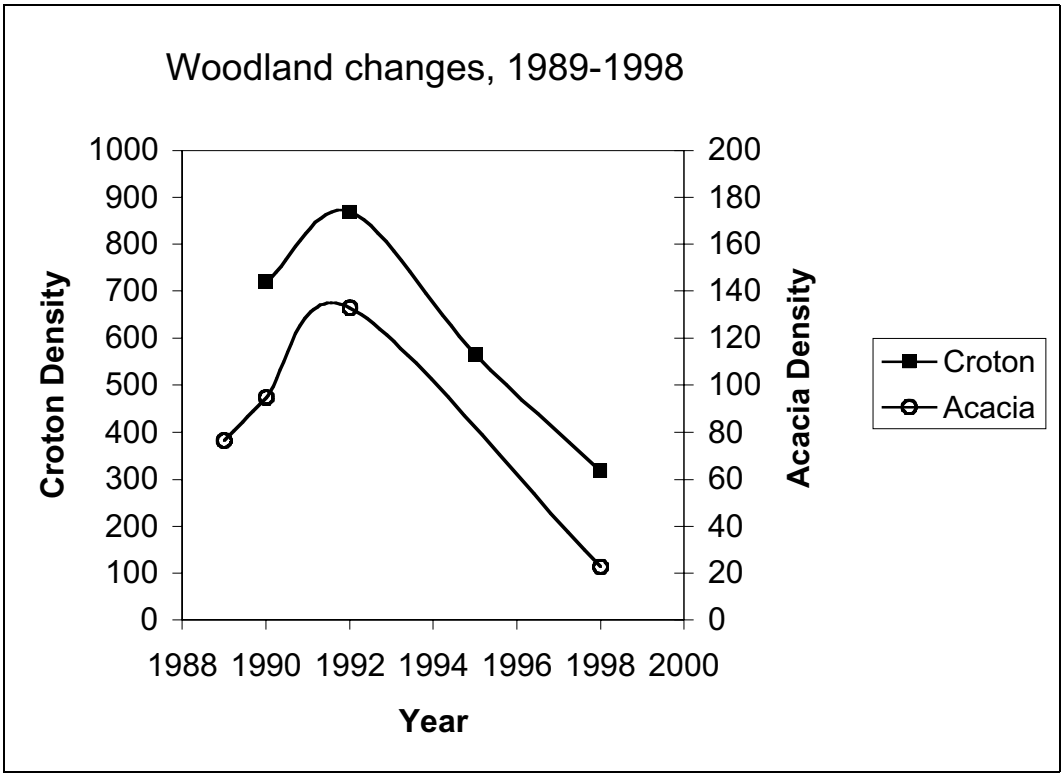

Figure 17. *Croton* and *Acacia* decline, 1989 – 1998 (data from MMEMP).

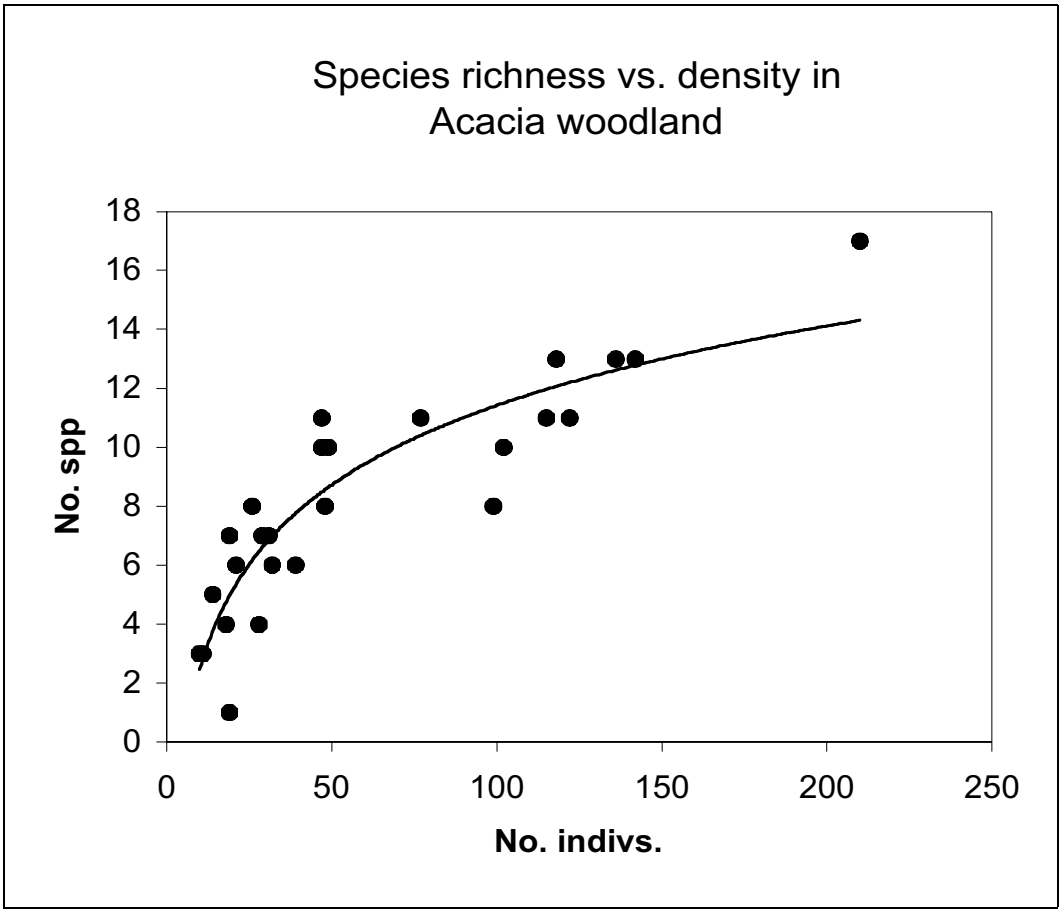

Figure 18. The relationship between density and species richness in *Acacia* woodland.

Dublin's work suggests this decline is a result of fire and elephant pressure (Dublin *et al*., 1990; Dublin 1995). Aerial surveys indicate that the elephant population in MMNR is increasing, thereby increasing the pressure on woody resources. At the same time, other wildlife is decreasing in the system, and browsers such as eland and giraffe appear to be decreasing faster than other species (Fig. 19). This evidence all supports the hypothesis that MMNR is becoming less valuable for browsers such as rhinos, partly due to elephant-induced habitat change.

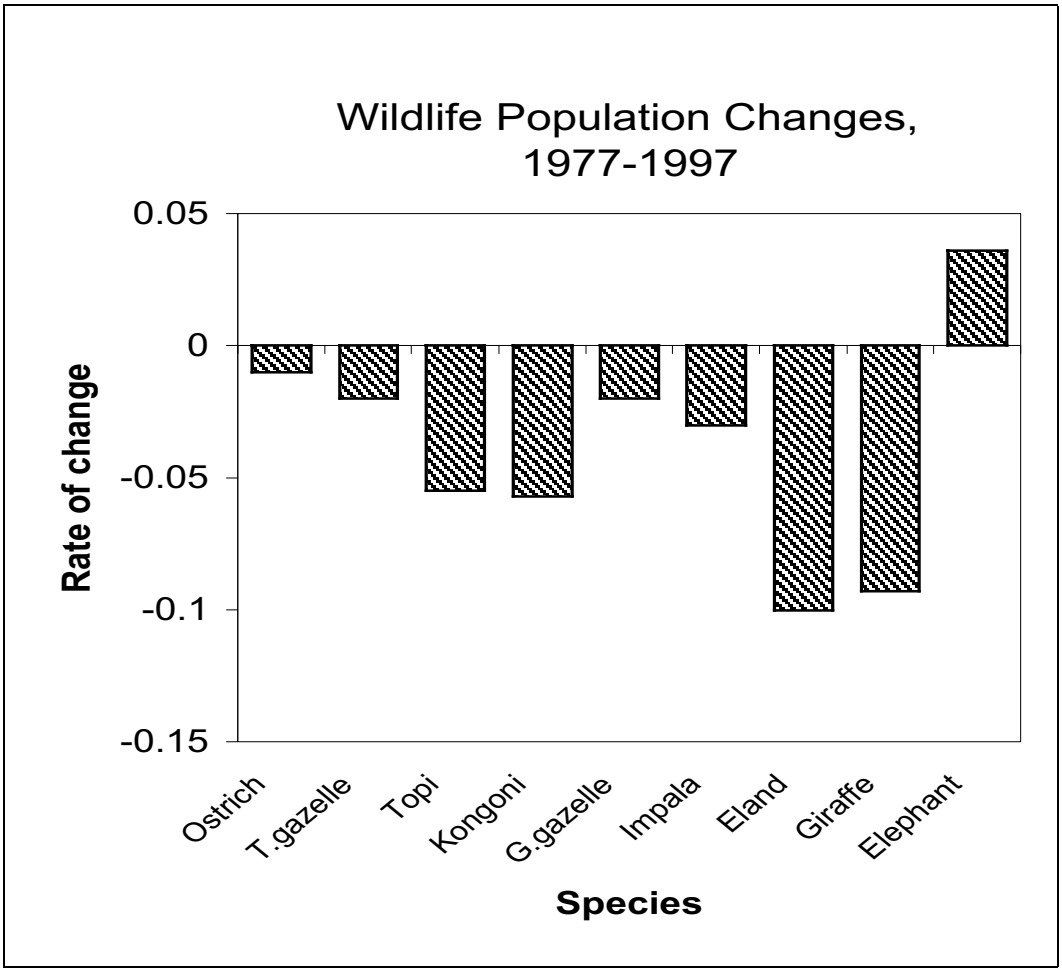

Figure 19. Wildlife population trends, 1977 – 1997 (data from Ottichilo *et al*., 2000).

Further evidence of a decline in resource quality can be gained from an analysis of rhino food preferences. A total of 48 species from at least 25 families were found to be utilised by black rhinos in Keekorok sector of MMNR. The species with the most rhino browsing offtake were *Grewia similis*, *Phyllanthus ovalifolius*, *Euclea divinorum*, *Croton dichogamus*, *Grewia bicolor* and *Flueggia virosa*. Together, these six species accounted for over 67% of all observed browse offtake. Only 15 species comprised over 86% of all observed browse offtake, suggesting that, whilst rhinos utilise a wide range of plant species, they rely on relatively few species for the bulk of their diet.

Evidence of rhino feeding was found on plants in *Croton* thicket, *Euclea* thicket, bushy luggas, and open and bushy grassland. Of these habitat types, most browsing evidence was found along bushy luggas, where *Phylanthus* and *Flueggia* species were favoured, and also in open or bushy grassland with high densities of *Grewia* species. *Croton* and *Euclea* thickets displayed some browse evidence.

Comparison with an earlier study by Mukinya (1977) revealed striking changes in black rhino diet in MMNR. Between 1972 and 2000, the favoured *Acacia/Dichrostachys* species declined in the diet considerably, whilst the less palatable *Croton* and *Euclea* species increased (Table 4). These changes would indicate a decline in the quality of available browse, although further analysis is needed to examine preferences in more detail.

Woody diet, 1972		**Woody diet, 2000**	
Species	**% of diet**	**Species**	**% of diet**
Acacia hockii	19.9	*Grewia similis*	18.3
Dichrostachys cinerea	19.1	*Phylanthus sepialis*	12.4
Grewia similis	10.1	*Euclea divinorum*	12.1
Croton dichogamus	9.1	*Croton dichogamus*	11.3
Acacia brevispica	7.2	*Grewia bicolor*	7.1

Table 4. Rhino feeding preferences, 1972 vs. 2000 (data from this study and Mukinya, 1977).

Taken together, the evidence presented here suggests that one reason for the suspected rhino dispersal out of MMNR could be a decline in the availability and quality of woody resources within MMNR. This is matched by an increase in woody resources in northern Serengeti (Sinclair, 1995). Elephants are thought to be beginning to expand out of MMNR into northern Serengeti, and it seems likely that rhinos are doing the same. Although unstudied, this area would appear to provide good resources for black rhinos but is lacking in law enforcement and is therefore insecure.

RHINO DISTRIBUTION AND CATTLE ENCROACHMENT

The distribution of black rhinos in MMNR was investigated using ArcView GIS and multivariate statistical analysis. Rhino location data collected with GPS units was overlaid with field data on the distribution of tourist lodges, vehicle tracks, tourism pressure and the distribution of cattle. Additional environmental data were obtained from satellite imagery.

A logistic model of rhino presence and absence in $1km^2$ grid cells covering the whole of MMNR was constructed. This revealed that, after taking account of spatial autocorrelation (the likelihood that rhinos will occupy adjacent cells), rhino presence could be predicted on the basis of the presence of cattle (negative relationship) and the distance from drainage lines (negative relationship). Essentially, rhinos are more likely to be found close to drainage lines (a proxy for vegetation suitability), and where there are no cattle. Neither tourism pressure, expressed either as road density, vehicle density, or distance from lodges, nor elevation had any effect on rhino distribution.

This result can be illustrated by examining rhino and cattle distribution maps from 1972 and 2000 (Figs. 20-21). In both cases there is almost no overlap between where rhinos reside and where cattle encroach, suggesting that cattle disturbance affects where rhinos are to be found, and consequently diminishes the carrying capacity of MMNR. Anecdotal evidence from inside and outside MMNR support this conclusion.

The two distribution maps suggest that cattle encroachment is more severe now than in previous years. This may in part be due to the degazettement of parts of the northern and eastern borders of the Reserve two decades ago, and resultant human settlement of these areas. Human population growth in these areas has been high throughout the 1990s (Boydston *et al.*, *in press*), and this has fuelled the increase in cattle incursions into the Reserve.

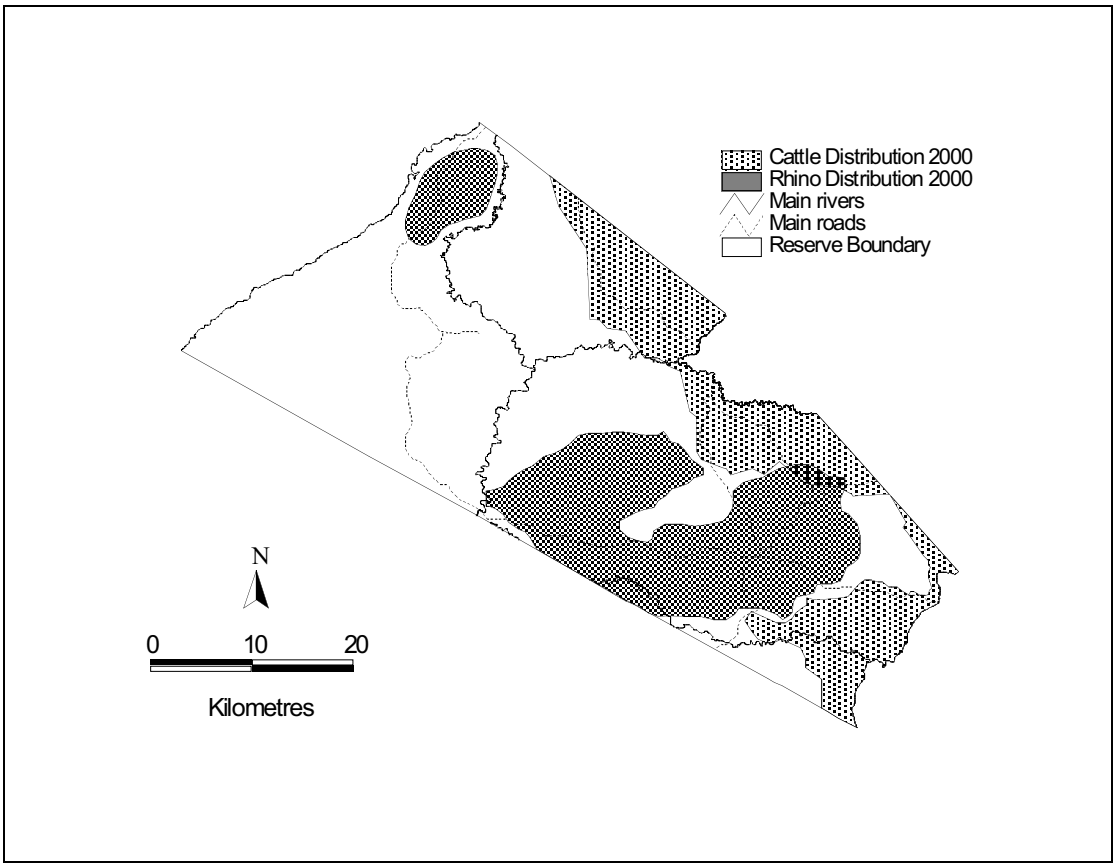

Figure 20. Rhino and cattle distribution in MMNR in 2000.

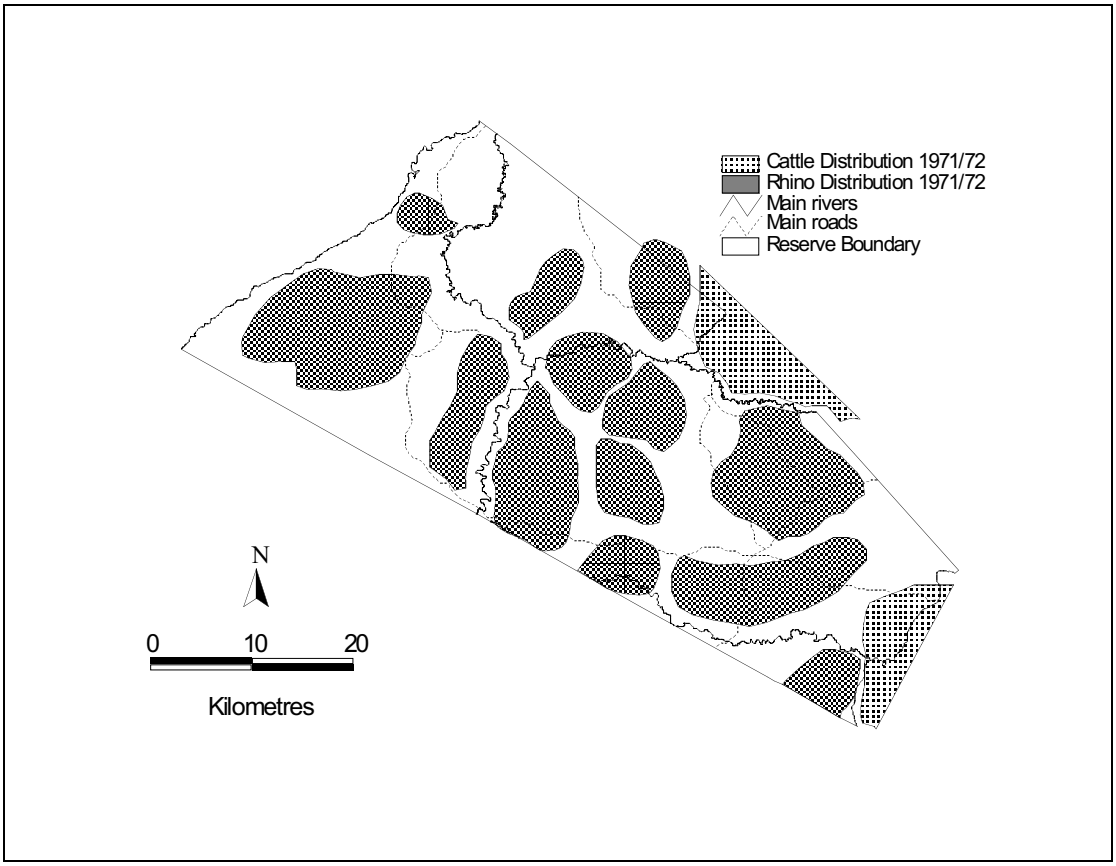

Figure 21. Rhino and cattle distribution in MMNR in 1971/72 (adapted from Mukinya, 1973).

CONCLUSIONS AND RECOMMENDATIONS

Woody vegetation decline in MMNR has occurred as a result of elephants and fire, and possibly with additional effects of tourism and livestock encroachment. As a result, it would appear that the Mara black rhinos have become constrained in their recovery. Their diet appears to have shifted towards more unpalatable species. Moreover, they appear to be dispersing from MMNR rather than recolonising it after the major poaching-induced population decline.

These observations would suggest a decline in carrying capacity for black rhinos that may affect the ability of the population to recover from poaching. Furthermore, this capacity is currently constrained by the continued presence of cattle inside MMNR borders. Whilst cattle do not compete directly with black rhinos for resources, they appear to disturb rhinos so that they do not make use of areas where cattle reside. This disturbance is probably a result of cattle bells, and the presence of herders and dogs with the cattle, the noise from which prevents rhinos from resting in thickets in areas where cattle occur.

The model of rhino distribution suggests that, with or without cattle, there is scope for further expansion of the black rhino population, which currently numbers 23. However, it would appear that rhinos are dispersing out of MMNR rather than into areas currently unoccupied within MMNR. It is likely that there are unoccupied areas contiguous to MMNR, especially in northern Serengeti, which are more favourable to black rhinos, which is why rhinos prefer to disperse out of MMNR. However, such areas are not patrolled by security forces, and represent a significant risk for rhinos. It is not yet known how many rhinos survive in northern Serengeti, but it is clear that this area must be secured for rhinos, and the population must grow there, before expansion of the population is witnessed within MMNR.

A presentation of some of the findings reported here was made at a National Rhino Planning Workshop held in Naivasha, Kenya by KWS in September 2000. At this meeting, the findings were discussed and a number of recommendations were made for the management and conservation of this population of black rhinos:

1. Develop collaboration with the Tanzanian authorities to establish cross-border monitoring of rhinos between the Serengeti and Masai Mara. This would help to secure the area for rhinos, and would establish the size and range of any rhinos currently residing there (Walpole & Bett, 1999b; Walpole *et al*., 2001).

2. Undertake foot patrols in hills and areas of thicker vegetation to check for undetected live rhinos and carcasses. The current method of vehicle-based patrols, although practical in a large area like MMNR, risks missing evidence of rhino presence. A planned combination of foot and vehicle-based patrols would increase rhino sightings and improve security (Walpole, 2002).

3. Increase the links between rhino monitoring programmes inside and outside MMNR on the Kenyan side of the international border, particularly with regard to foot patrol methods and the potential movement of rhinos between MMNR and adjacent areas. There are areas to the east of MMNR along the border where rhinos exist, which are unlikely to be isolated from the population within MMNR. Patterns of movement between these sub-populations need to be elucidated to help explain why rhinos seem to prefer unprotected areas beyond MMNR borders.

4. Increase efforts to keep cattle out of MMNR. It is clear from the model presented here, and from earlier reports, that high densities of cattle limit the distribution of black rhinos. A valuable test of this hypothesis would be to remove all cattle from MMNR over an extended period of time and see whether areas historically occupied by black rhinos are recolonised.

HUMAN-ELEPHANT CONFLICT IN TRANSMARA DISTRICT, KENYA

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ABSTRACT

Human-elephant conflict is an increasing problem in TransMara District adjacent to Masai Mara National Reserve (MMNR) in Kenya. This stems from increasing human population, both through reproduction and immigration, coupled with increasing land conversion and forest loss to farming. Concurrently, elephant populations in the ecosystem are growing, while outside protected areas elephants are becoming constrained to smaller areas of forest fragment. As a result, elephant conflict is a significant form of wildlife conflict. Moreover, due to the danger that elephants pose to people and the catastrophic damage that they can inflict on crops, human-elephant conflict is more frequently reported and less easily tolerated than conflict with other wildlife species. This study examined the history and characteristics of human-elephant conflict and its mitigation in TransMara district. Human and elephant deaths and injuries increased in the 1990s. Elephants raided a variety of crops seasonally in two harvesting periods. The spatial distribution of crop raiding was determined mainly by the density and distribution of farming and human settlement. Communities used a variety of methods to combat crop raiding, of which fire, noise and guarding appeared to be most successful for scaring away elephants. However, KWS contribution and response to incidents was low. A hidden cost for communities of living with elephants was a negative impact on children's education, due to disturbance of children travelling to school.

INTRODUCTION

Human-elephant conflict (HEC) has always appeared whenever humans and elephants co-exist (Hoare, 2000). However, changes in the sizes of human and elephant populations, and in land use patterns, have increased competition between humans and elephants for space and resources (Hoare & du Toit, 1999). Conflict with humans is now a major conservation issue threatening the future of elephants, especially outside protected areas (Dublin *et al*., 1997). Different types of conflict have evolved as different spatial and temporal patterns of human behaviour emerge, while people and elephants have evolved strategies to cope with increasing tensions.

TransMara District (TM) is a classic example of increasing HEC on communal lands adjacent to MMNR. TM incorporates the western portion of MMNR, known as the Mara Triangle, and human settled areas to the north and west of MMNR above the Siria escarpment that forms the northwestern border of the reserve. Elephants reside within human settled areas and make incursions from MMNR and group ranches below the escarpment in Narok District, with resultant HEC that includes human and elephant deaths and injuries, crop raiding, and disturbance of children's education.

This project studied HEC in TM from both human and elephant perspectives. Topics included:

- local perceptions and understanding of HEC and elephants.
- trends in human population, land use change and elephant density and distribution.
- patterns of HEC, including human deaths and injuries, crop raiding and education disturbance.
- the efficacy of local strategies for coping with HEC.

COMMUNITY ATTITUDES AND PERCEPTIONS

A participatory approach using Rapid Rural Appraisal (RRA) and socio-economic questionnaires underscored the role of indigenous knowledge in understanding HEC and designing a HEC study. The local community mapped important elephant resources such as salt licks, swamps, rivers and corridors. They also identified the various types of conflict, and ranked human deaths and injuries as the most serious form of conflict.

The attitudes of the local community towards elephants was generally negative because of a lack of related benefits. The resident elephant population is found in areas where people do not derive any benefits from tourism. The future of elephants in TM is bleak unless local tolerance to elephants can be improved. This can only be achieved through improved HEC mitigation and increased elephant-related benefits (Walpole & Leader-Williams, 2001).

HUMAN POPULATION AND LAND USE PATTERNS

There are four major tribal groups that have settled in TM: Maasai, Kipsigis, Kisii and Kuria. The Maasai have three major clans: Uasin Gishu, Moitanik and Siria. The density and spatial distribution of these tribes and clans have changed over time. The human population density in TM has increased tremendously over the years as a result of rapid reproduction and of immigration by other tribes (Fig. 22). This has resulted in increased demand for land and a clamour for change in land tenure patterns from communal (group ranch) systems to individual holdings. This change has also resulted in increased land related conflicts and changes in land use patterns, which are incompatible with conservation. The spatial distribution of human population density reveals that the low-density areas generally correspond with the present elephant range, while densely populated areas have been converted into farming and are generally settled by non-Maasais.

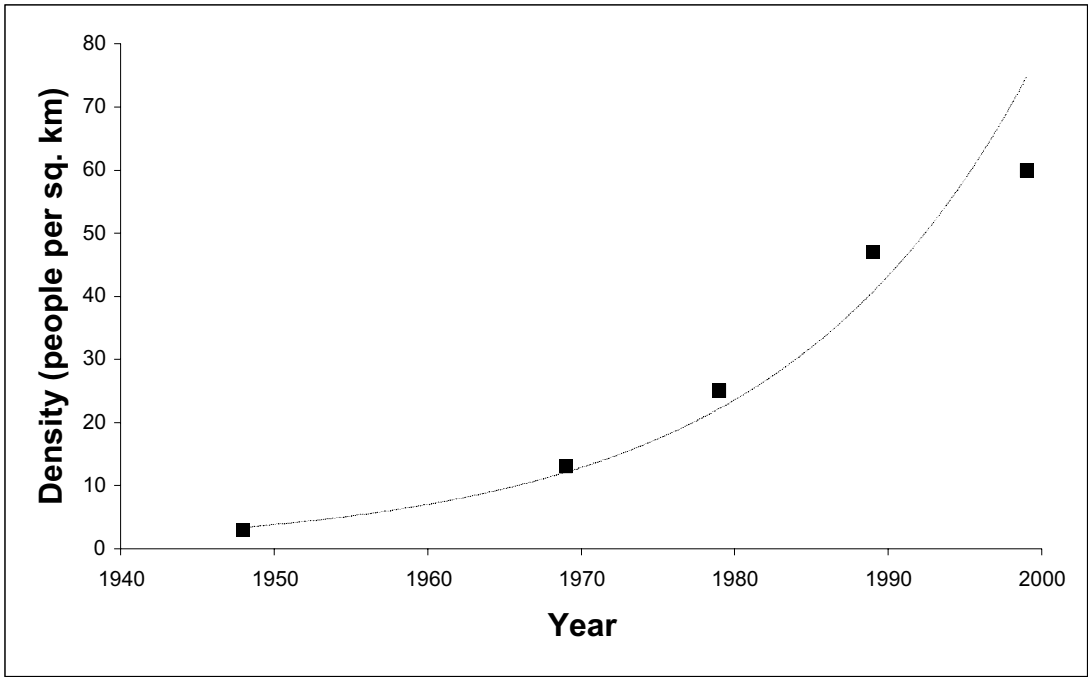

Figure 22. The trend of human population density in TransMara District, 1948-1999.

Six land use types related to vegetation were derived and delineated comprising: farming, forest, *Acacia* woodland, wire grass, wooded grassland and MMNR (regardless of habitat types). A comparison of the key land use types of forest areas and farm areas from 1975 to 2000 showed a large decrease in the area of the forest, and a large increase in the area of farms (Fig. 23). Excluding MMNR, 38% of TM is currently under farming while the forest occupies only 10%.

The frequency of deforestation decreased with increasing distance from the road, suggesting that forest areas without a road network have been less exploited. There was a lower occurrence of deforestation near the forest edge, due to an attempt to conceal the reality of the deforestation process from outside.

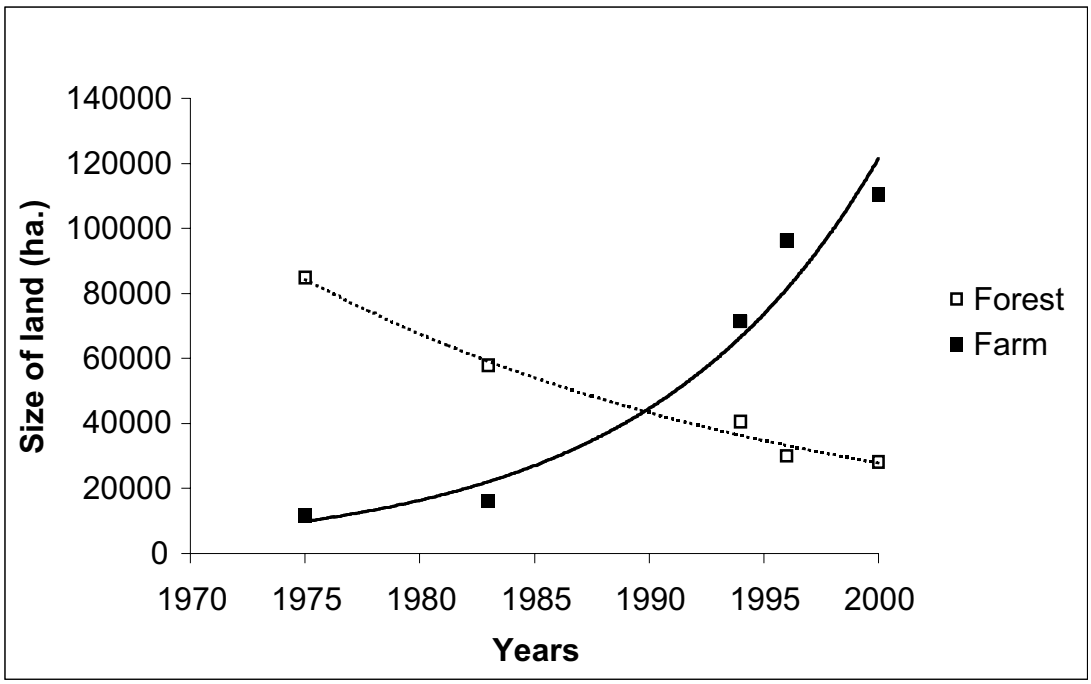

Figure 23. Changes in areas of land under forest and farming in TransMara District, 1975 - 2000.

ELEPHANT NUMBERS AND DISTRIBUTION

The elephant population resident in the Mara ecosystem increased from the 1960s, but has stabilised since 1989. This increasing trend in elephant numbers is an indicator of increasing HEC. However, little is known of the population resident in TM outside MMNR because thick forest prevents aerial surveys. A dung count transect method was used to obtain some indication of the patterns of elephant occupancy and density in different forest blocks (Fig. 24).

Elephants once ranged across most parts of TM and beyond, and covered an area of over 2,340 km^2. The present elephant range is of scattered, fragmented populations confined to central parts of the District and covers 1,158 km^2, which represents a 51% reduction in range. Elephants now regularly use areas within Laila, Esoit and Mogor Riverine forests and a section of Nyakweri forest. Human population density shows an inverse relationship with dung density, suggesting that a human constraint is acting on elephant distribution. Elephants currently occupy areas with lower rainfall, low soil fertility and lower river density, where forest fragments remain.

The mean dung density in all transects was 2,752/km^2 ± 665.2 for the month of May and 2,413/km^2 ± 450.1 for the month of August, with no significant difference in dung density between the two months (Fig. 25). This suggests little or no seasonal influx of elephants into the main forest blocks in TM, suggesting that there is a year round resident elephant population that is responsible for HEC in these areas.

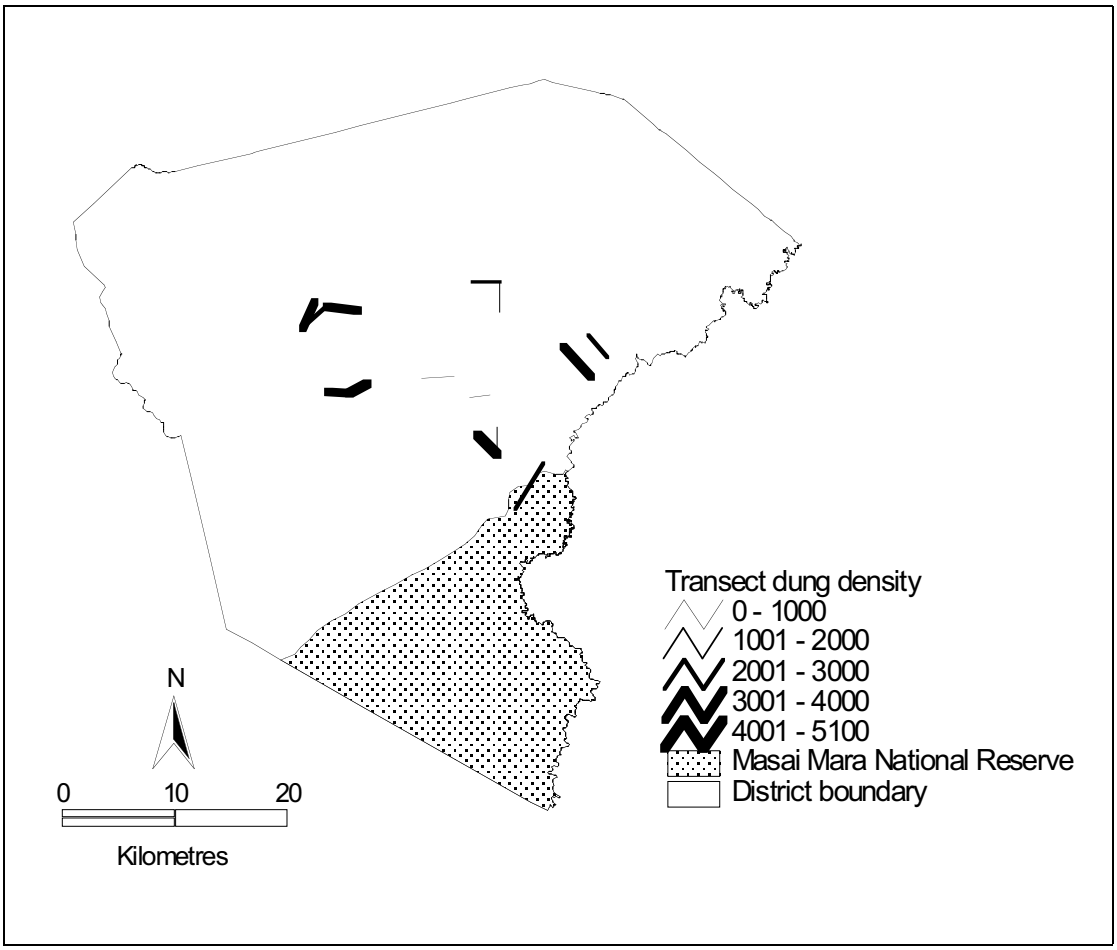

Figure 24. Location of transects and differences in mean dung densities during May and August 2000 in TransMara District.

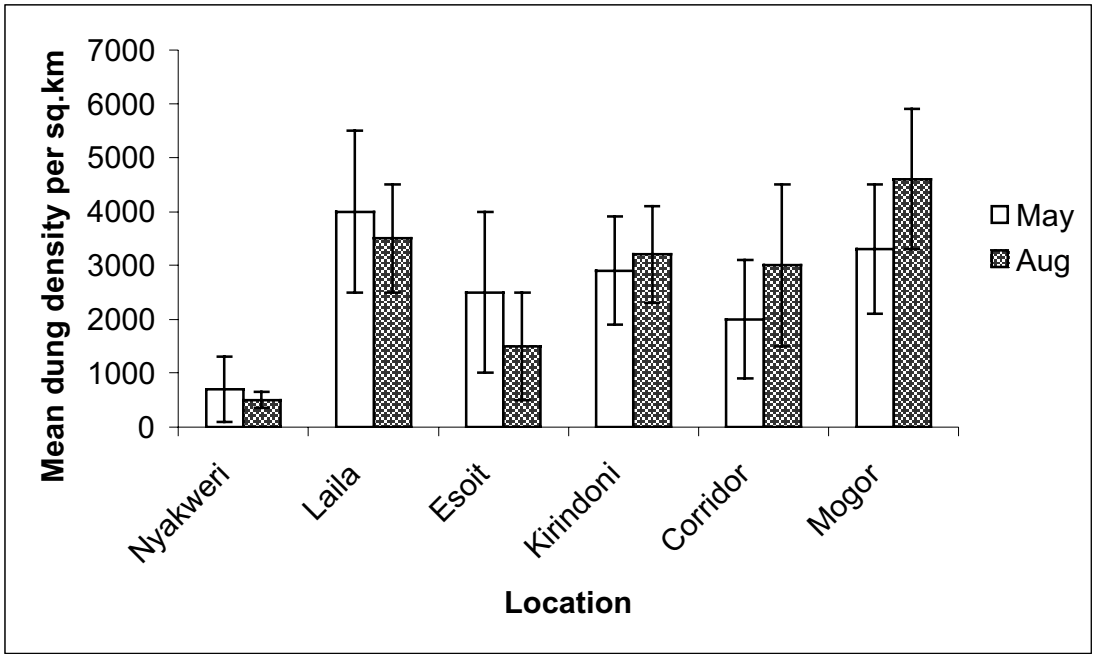

Figure 25. Seasonal differences in the mean dung density on transects between May and August 2000.

Besides the resident elephant population, there were some seasonal influxes of elephants from MMNR and Narok group ranches to the edge of TM, mainly in the form of movements up and down corridors in the Siria escarpment. There are 10 such wildlife corridors along the escarpment, of which three were used most frequently: Oloololo, Kichwa Tembo and Mpata. Elephants generally moved up the escarpment in the early evening and down again in the early morning. Resource availability is likely to be the determining factor in elephant dispersal, although other factors such, as the seasonal increase in tourism, disturbance may also influence elephant movement.

More elephants used the Oloololo corridor than Kichwa Tembo and Mpata, which is partly due to human settlement and disturbance in the Kichwa corridor and partly due to increased elephant density below the Oloololo corridor. Human disturbance also determines other aspects of elephant movements. More bulls, which are bolder than females, use the Kichwa corridor. Similarly, elephants generally spend time above the escarpment (which is more risky than below within MMNR) at night when there is less chance of disturbance from people. That said, their movements up and down the corridors coincide with morning and evening movements of people going to work and school.

TYPES AND PATTERNS OF HUMAN-ELEPHANT CONFLICT

Past data on human deaths and injuries caused by elephants and other species of wildlife were obtained from the RRA survey, KWS occurrence book records, and the District Compensation Committee documents between 1960-2000. Specific locations of elephant attack were mapped. Any dead or injured elephants were recorded, and their exact locations mapped. Secondary data on crop damage were collected from observation books in KWS stations and primary data were collected through field surveys and monitoring using a protocol derived from that developed by the Human-elephant Conflict Taskforce (HECT) of the IUCN/SSC African Elephant Specialist Group (Hoare, 1999). Schools and student performance in and out of elephant ranges were compared using standard mean scores and students' lateness and absenteeism as a result of elephants was monitored and compared with other variables.

HUMAN AND ELEPHANT DEATHS AND INJURIES

Between 1986-2000, elephants caused 35 cases of attacks on humans, and 47 attacks on humans were caused by ten other wildlife species (Table 5). These comprised: lion (*Panthera leo*); leopard (*Panthera pardus*); hippopotamus (*Hippopotomus amphibius*); crocodile (*Crocodylus nilotica*); buffalo (*Syncerus caffer*); warthog (*Phacochoerus aethiopicus*); bushbuck (*Tragelaphus scriptus*); baboon (*Papio cynocephalus*); hyena (*Crocuta crocuta*) and snakes.

	Elephant		**Herbivores**		**Predators**		**Total**
Period	Deaths	Injuries	Deaths	Injuries	Deaths	Injuries	
1986-1990	1	2	1	2	0	2	8
1991-1995	9	5	0	9	0	5	28
1996-2000	11	7	1	5	2	20	46
Total	21	14	2	16	2	27	82

Table 5. Numbers of people attacked by wildlife in TransMara District between 1986 and 2000.

A total of 56 cases of elephant attack on humans were recorded between 1961 and 2000 of which 46 were verified. The Maasai suffered more deaths (83%) and injuries (94%) than non-Maasais. More males were attacked than females and the 6 females attacked were all Maasais. Out of 53 such cases, 17 people were reported "drunk", and 36 were "sober".

The trend in human deaths and injuries generally showed a decline from the 1960s to the 1980s, followed by increasing numbers of deaths and injuries (Fig. 26). This is probably due to a retreat of elephants into MMNR in the 1970s and 1980s during heavy poaching, and a subsequent dispersal out again in the 1990s once poaching had declined. The spatial distribution of human deaths and injuries shows that the Kirindoni corridor and the area around Laila forest have high conflict (Fig. 27).

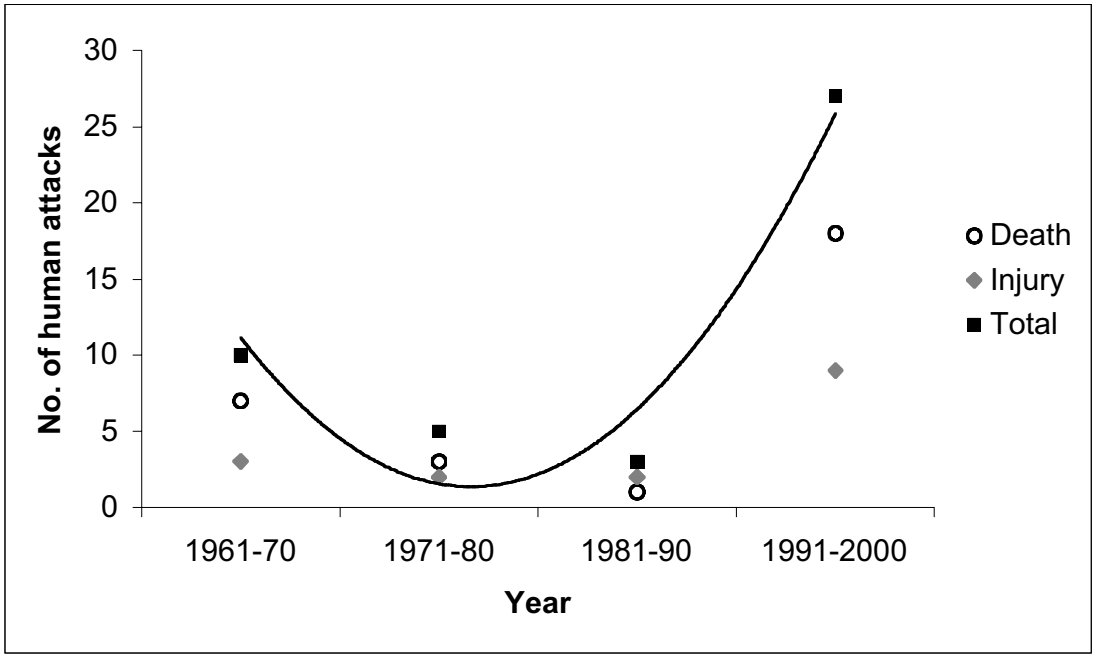

Figure 26. The trend in elephant related human deaths and injuries in TransMara District by decade, 1960 – 2000.

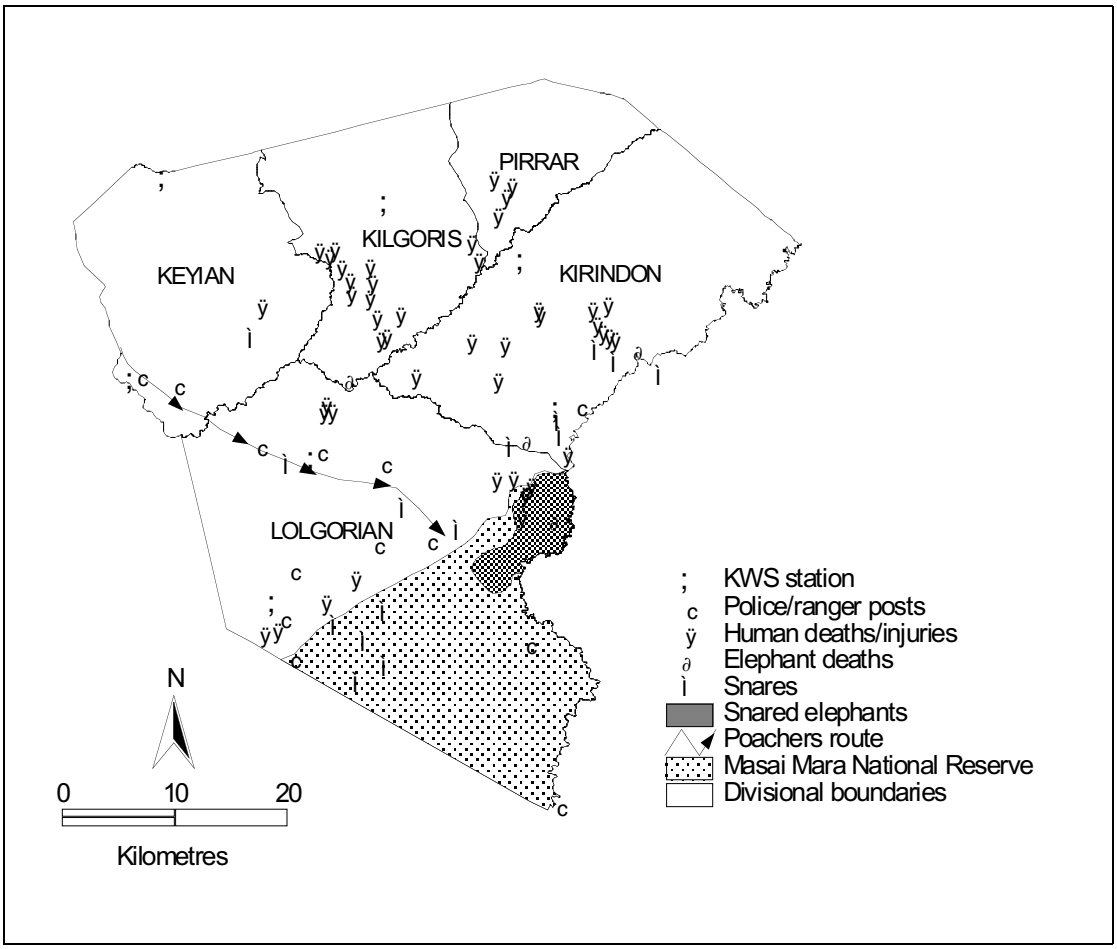

Figure 27. The spatial distribution of human and elephant deaths and injuries in TransMara District, 1960-2000.

Most attacks on humans occurred early in the morning (0600 - 0900hrs) and late in the evening (1900 - 2000hrs). Other reported cases of wildlife related problems in TM included: crop damage; livestock attack; competition for water; insecurity; destruction of property among others. There were more reports of human wildlife conflict for elephants (45.7%) than for other herbivores (20.6%), predators (22.6%) or primates (10.9%).

CROP RAIDING

Elephants in TM destroyed a variety of crops including: maize (*Zea mays*); millet (*Eleusine coracana*); sorghum (*Sorghum vulgare*); cassava (*Manihot esculenta*); banana (*Musa domestica*); sugarcane (*Saccherum officinarum*); tomato (*Lycoposicon esculentum*); kales (*Brasica* spp); pumpkin (*Curcabita maxima*); potatoes (*Ipomea patatas*); tobacco (*Nicotina tobacum*); beans (*Phaseolus vulgaris*), and Napier grass. Most of the reported cases were not responded to KWS.

There were two crop raiding seasons, coinciding with the two harvesting periods. Crop raiding occurred mainly during the months of May, June, July and August and then during the short growing season of December and January (Fig. 28).

The mean number of elephants involved in crop raiding was less than 15. The proportion of mixed herds (68.1%) was higher than bulls. Crop raiding started as early as 1900hrs depending on the distance of the farms from the elephant zone and the weather, with most incidents of conflict occurring from 2100 - 2200hrs. The spatial distribution of crop raiding shows a series of highly clumped conflict zones (Fig. 29).

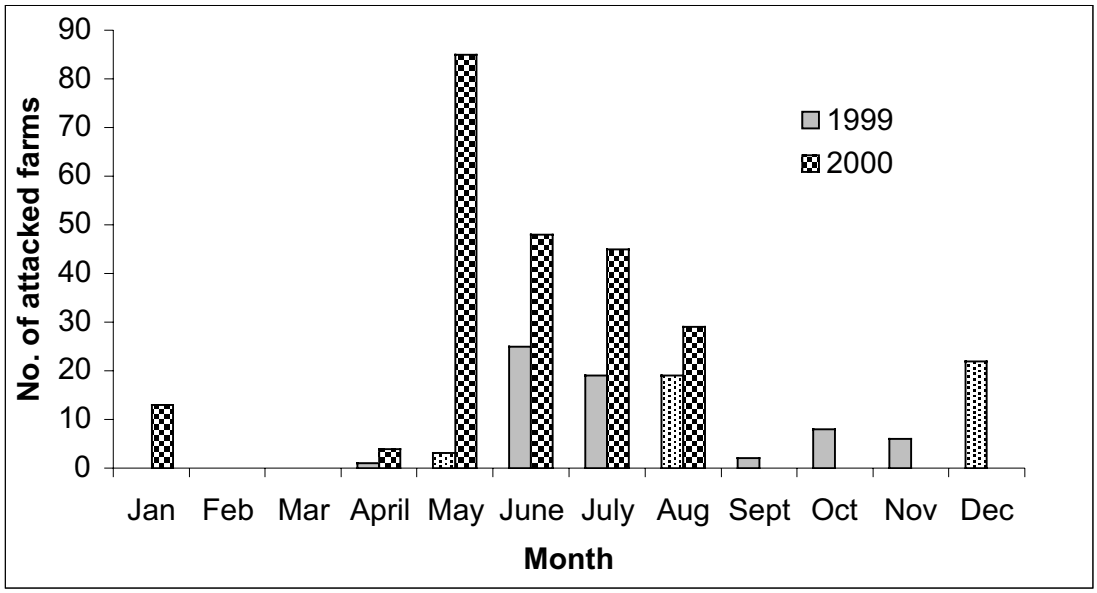

Figure 28. Seasonal pattern of crop raiding in TransMara District, 1999-2000.

A grid-based GIS method was used to identify spatial correlates of crop raiding. Significant relationships were observed between the location of crop raiding incidents, the size of the cultivated area, and distance from market centres. There was a positive relationship between crop raiding and size of the cultivated area, suggesting that large areas under farming were more likely to be raided than small areas. There was a negative relationship between crop raiding and distance from the market centres, such that crop raiding was more likely near market centres than further away. This was particularly so for male elephants that appear to take more risks than females.

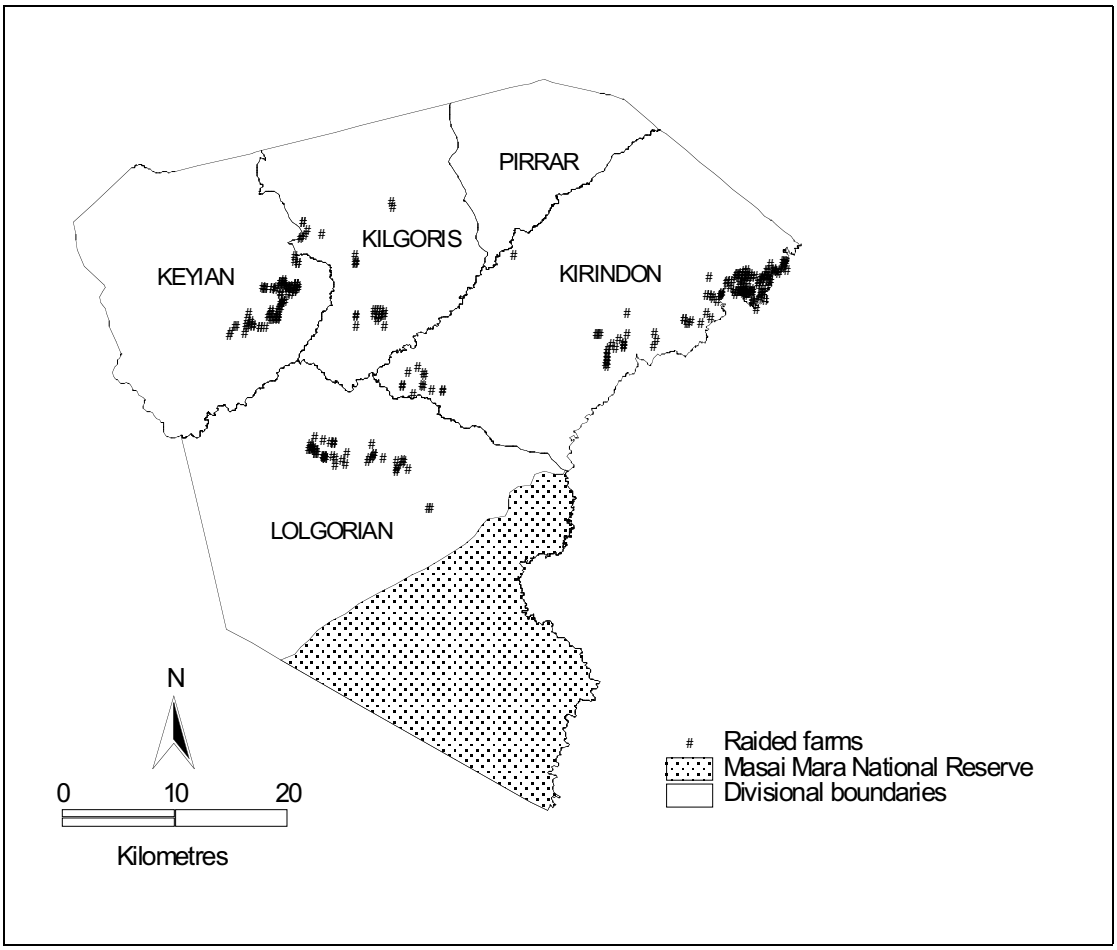

Figure 29. Maps of the locations of raided farms in TransMara District during 1999-2000.

CROP PROTECTION MEASURES

The community employed many different methods to keep the elephants away from their fields. These included fencing, noise from tins and pipes, shouting, bee hives, tobacco, fire, burning elephant dung, communal farming and guarding, premature harvesting of maize, and use of used oil. Other methods used included blowing a whistle, throwing embers, use of a sling, effigies and driving a tractor into the field. The KWS personnel mainly employed shooting and scaring of elephants using thunder flashes and firing blanks. Despite this wide variety of methods, crop raiding was prevalent and many farms were abandoned as a result.

A comparative survey of raided and non-raided farms was conducted, using logistic regression, to identify successful mitigation strategies. The use of fire, tin drums and more intensive guarding appeared to reduce the chance of successful crop raiding. In contrast, farms near houses (settlements) had more chance of being raided than farms far away. This was because in these cases there was a temptation for guards to remain within their houses rather than actively patrol the fields. There were more chances of larger farms being raided than smaller farms. Torches appeared ineffective, possibly because they were not bright enough. Also, farms with fences, especially pole fences, were more likely to be raided than farms without, suggesting that a reliance on fencing was a poor mitigation strategy. Farms that were planted early (January) stood a greater risk of being attacked than farms planted later in the season, due to earlier maturation.

The size of the area of maize farms destroyed was positively correlated with elephant group size and farm size, but in general mitigation methods were ineffective at limiting the amount of damage once elephants were within a field. This highlights the need for adequate early warning systems (Osborn & Samson, 2002).

Most farmers did not report the incidences of crop raiding to KWS. This may be due to the long distance between the farms and KWS stations, the lack of transport and the small size of many farms making it not worth the effort. Alternatively, farmers might be discouraged because of many cases of previous reports not being tended to by KWS. Some farmers therefore resorted to abandoning their farms, which were mainly located next to forest areas with high elephant density as the last option after persistent crop raiding.

HEC AND CHILDREN'S EDUCATION

There are 132 primary schools in TM District, of which 96 (73%) sat the national examination during 1999. Out of these 96 schools, 77 (80%) are outside the elephant range while 19 (20%) are within the elephant range. An elephant killed one pupil while going to school in 1994. Most students in elephant ranges therefore wait until elephants have receded back into the forest before going to school. Many students arrive late and/or are always absent, and this obviously affects their education. Therefore, an analysis was undertaken of the performances of both schools and individual pupils.

There were differences in school scores between divisions with different teacher-pupil ratios, and between schools located within and outside the elephant range. However, scores for boarding schools did not differ from those of day schools (Fig. 30).

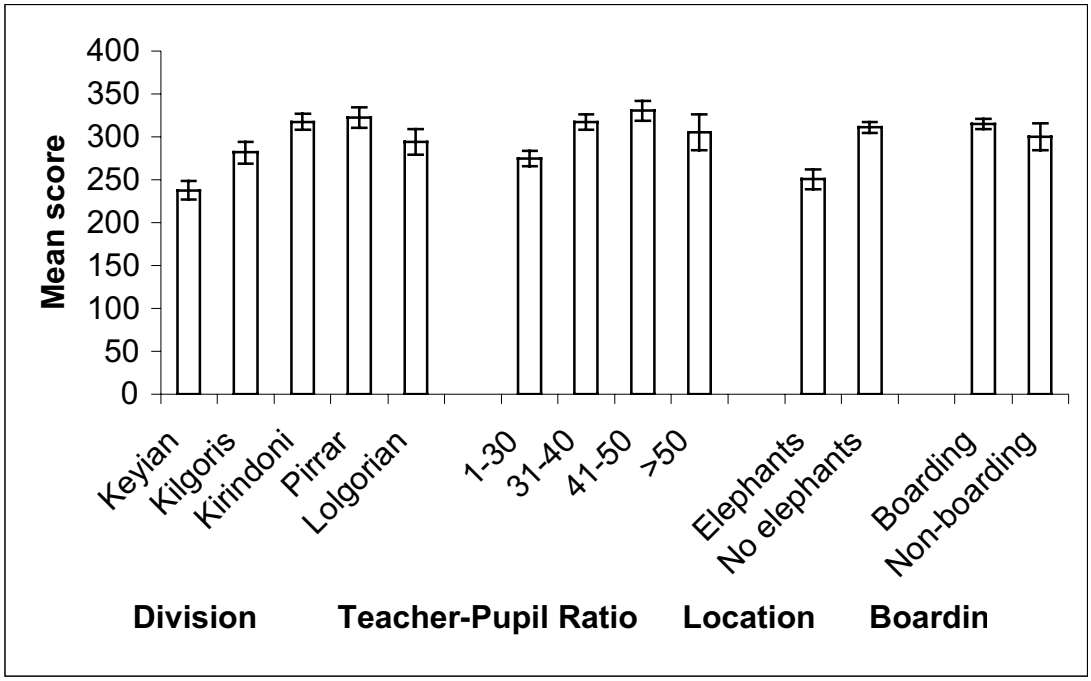

Figure 30. Relationship between school performance relative to division, teacher-pupil ratio and elephant range in TransMara District, 1995-1999.

Surprisingly, the mean score was lowest in schools with the lowest teacher-pupil ratio. However, many of these schools occurred within the elephant range and experienced very low enrolment. The key factors that affected school performances were division, elephant presence, tribe and number of candidates.

Individual pupil performance was also affected by elephants, along with tribe, distance to school and absenteeism (Fig. 31). The mean score of the Maasai pupils from outside the elephant range was higher than of those within the elephant range (Fig. 32). In contrast, the mean score of non-Maasai pupils from both the elephant range and outside the elephant range did not differ. Absenteeism also varied with distance travelled (Fig. 33).

In a multivariate analysis, distance travelled emerged as the strongest predictor of pupil performance, followed by tribe, absenteeism and location within elephant range respectively. Thus the score of pupils decreased with increasing distance from schools, among Maasai pupils, with increased absenteeism, and for pupils from within elephant ranges.

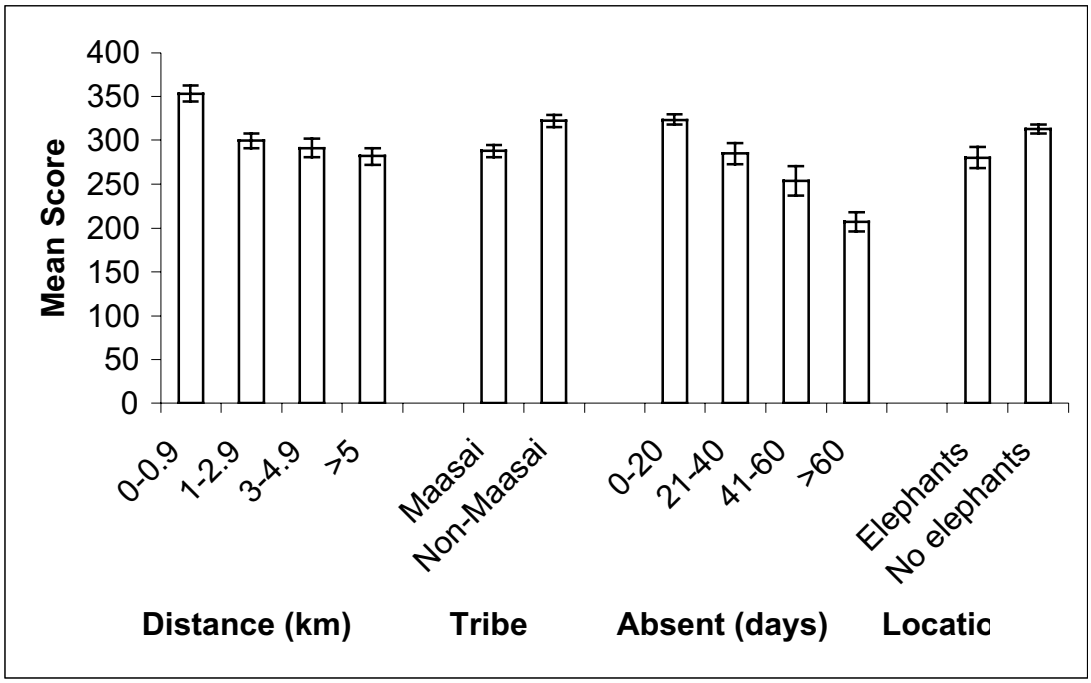

Figure 31. Relationship between pupils mean scores and elephant range, tribe, days absent and distance from school in TransMara District.

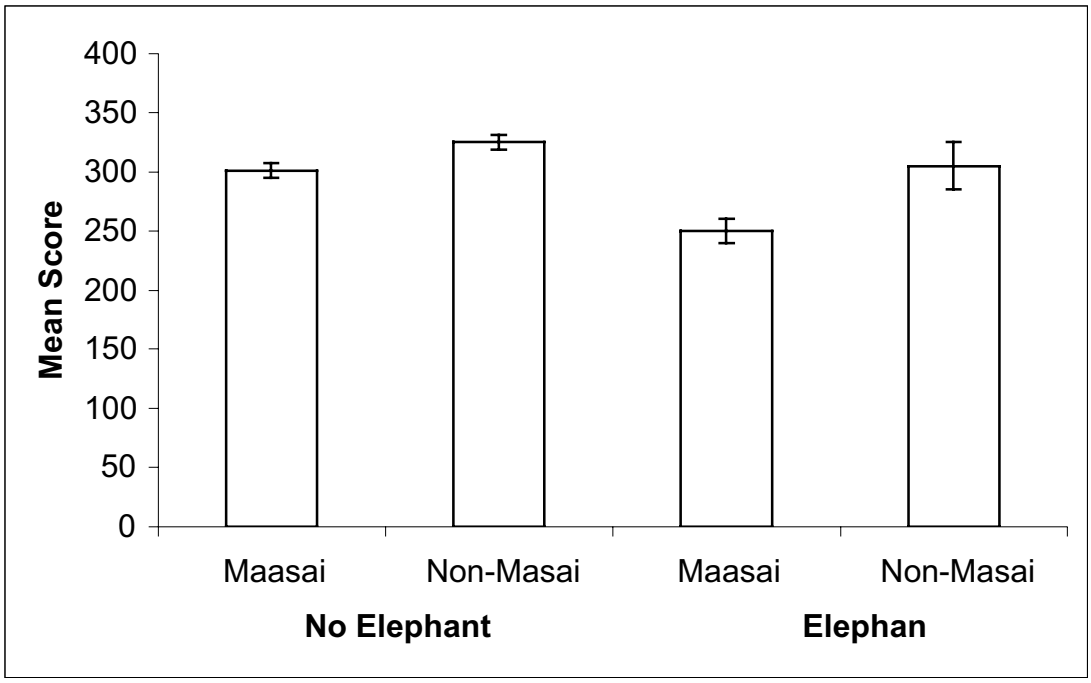

Figure 32. A comparison of mean scores of pupils from different tribes in relation to their location inside or outside the elephant range.

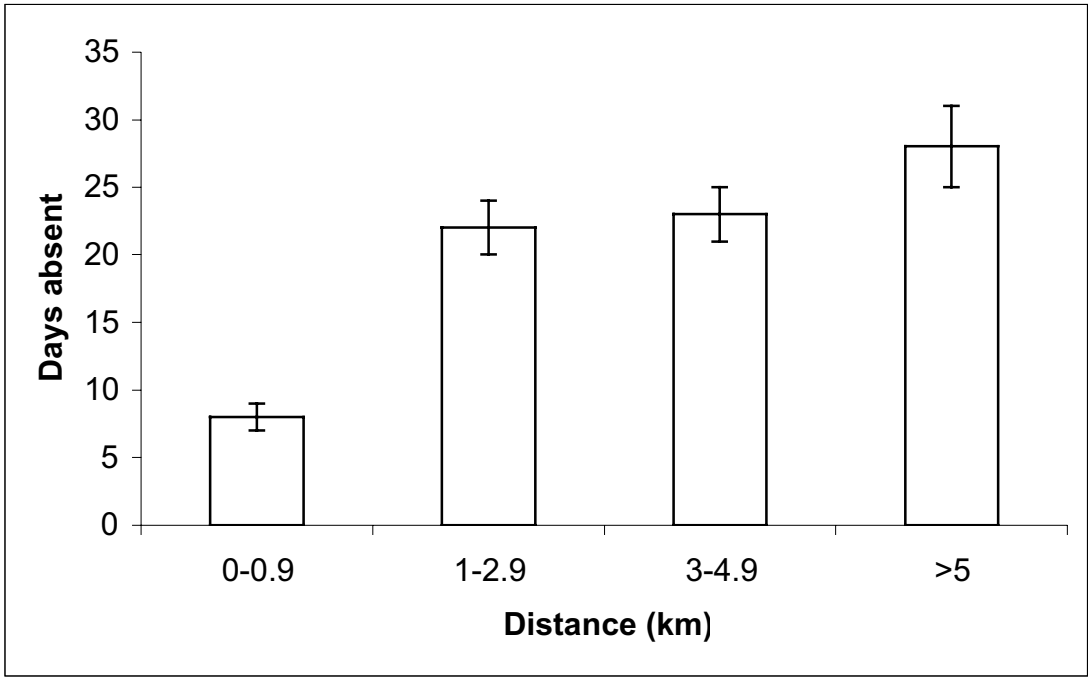

Figure 33. Relationship between distance covered by pupils and absenteeism.

WORKING GROUP RECOMMENDATIONS

WORKING GROUP 1:
Tourism Regulations and Law Enforcement

RATIONALE

Minimising tourism impacts requires a certain level of regulation and law enforcement. Equally important is visitor and driver awareness and education. Sometimes a simple explanation of the impacts that tourism has and the reason for particular regulations can help to limit those impacts. Moreover, finding ways to distribute information about regulations will help to ensure that they are abided by.

The task of this working group was to consider the findings of the presentation on tourism impacts and to decide how regulations, law enforcement and information dissemination can be improved. A second working group on tourism impacts considered management actions and monitoring. A list of key topics and questions for this working group to consider and decide upon is given below. This list formed the basis of their deliberations and recommendations.

TOPICS TO CONSIDER

1. Regulations governing tourist behaviour:
   Are current regulations necessary and sufficient?
   Do the regulations need to be amended or added to?
2. Publicising regulations:
   How do visitors currently find out about regulations?
   In what other ways (signs, talks, lodges, etc?) should regulations be publicised?
3. Codes of conduct for drivers and tour operators:
   Are there currently any codes of conduct?
   What should be included in driver codes of conduct?
4. Law enforcement:
   How can the current anti-harassment programme be improved?
   What fines and sanctions should be placed on visitors, drivers and companies?
5. Role of NGOs, lodges and tour companies:
   How can these organisations contribute to a better understanding of regulations and more responsible attitudes towards tourism?

CONCLUSIONS

The group felt that current regulations were necessary and sufficient. However, respect for regulations was lacking and they were regularly broken. At a policy level it was decided that softer management, focusing on information dissemination and the provision of infrastructure to guide behaviour, was a better approach than hard management relying purely on law enforcement, although the latter should still be applied as part of the mix. Moreover, it was felt that collective responsibility falls upon tourism and NGO stakeholders to contribute to better understanding and behaviour regarding impacts and regulations.

RECOMMENDATIONS

1. Regulations Governing Tourist Behaviour

- The importance of regulations, and the reasons for their existence, should be made clearer to guides and visitors.

- Drivers/visitors should be made to read the regulations upon entry to the Reserve and should sign to indicate that they have understood them.

- The regulations should be rephrased in a more positive and encouraging style.

2. Publicising Regulations

- A manned information point should be established at all points of entry to the Reserve.

- A Reserve web site should be created for visitors to access information and Reserve regulations prior to their visit.

- Greater use should be made of sign boards on main roads within the Reserve.

- Greater use should be made of lodges and camps for information dissemination.

3. Codes of Conduct for Drivers and Tour Operators

- The Kenya Association of Tour Operators or equivalent body should develop a code of conduct for driver guides.

- Tour companies themselves should develop or improve their in-house training and education of drivers.

- All driver guides should be licensed to indicate their knowledge and acceptance of regulations within protected areas.

4. Law Enforcement

- The official road and track network within the Reserve should be improved, expanded and maintained, with signposts.

- Proper viewing circuits should be established in less used areas of the Reserve, within a defined system of zoning.

- Records of offenders should be kept.

- Stiffer on-the-spot penalties should be implemented for offenders.

5. Role of NGOs, Lodges and Tour Companies

- NGOs and researchers should maximise the exposure of lodges, tour companies and Reserve management to their findings and knowledge regarding tourism impacts and management.

- NGOs should sponsor information dissemination through publications.

- Driver guides should make clients aware of Reserve regulations and of their efforts to observe them during game drives.

- Lodges should adhere to the principles of ecotourism and should increase the awareness of their clients regarding regulations and sustainable practice.

Notes

Language of regulations should be expressed less dictatorially. For example, phrases such as “please avoid ……. because…..” would be more encouraging to visitors and drivers than “do not ….” or “it is prohibited to …..”, whilst providing more of the rationale for regulations.

A proper network of well-maintained roads and tracks should help to alleviate the problem of off-road driving. By expanding the network into less used areas, congestion and animal harassment should be reduced. Whilst it is recognised that some areas are best kept under-utilised as sanctuary zones, and some fragile or sensitive areas may not support increased infrastructure development and visitation, there is a perception that the current distribution of visitors is over-concentrated and contributes greatly to animal harassment. For this reason a wider network of official tracks is recommended.

Recording offenders will serve both to identify repeat offenders who could then be excluded, and to enable pressure to be applied to tour companies through negative publicity.

Penalties do not appear to have worked well to date within the Reserve, but this was partly because they were too low. Whilst penalties are considered a last resort for managing impacts, it was felt that they should continue to be used, but at a level that acts as more of a deterrent to regulation infringement.

WORKING GROUP 2:
Tourism Impacts, Management and Monitoring

RATIONALE

Minimising tourism impacts requires a certain level of field management – practical activities that help to limit impacts. To decide on what and how to manage, it is imperative that impacts are monitored. The presentation on tourism impacts illustrated some of the ways that monitoring can inform management, but what monitoring should be continued? Equally, the effects of management need to be monitored so that the success of management can be evaluated and demonstrated.

The task of this working group was to consider the findings of the presentation on tourism impacts and to decide what kinds of management and monitoring should be implemented in the field. A second working group on tourism impacts considered regulations and law enforcement. A list of key topics and questions for this working group to consider and decide upon is given below. This list formed the basis of their deliberations and recommendations.

TOPICS TO CONSIDER

1. Visitor impacts:
    How significant are impacts on habitat and wildlife?
    What are the key factors (seasonality, volume and overcrowding, behaviour, etc.) affecting visitor impacts?
    Which impacts should be actively managed and limited, and to what extent?
2. Managing off-road driving:
    What strategies (education, signs, zoning, closures, better permanent roads, sanctions, etc.) can be implemented to reduce off-road driving?
3. Managing wildlife disturbance:
    What strategies or regulations can be implemented to reduce overcrowding and disturbance of sensitive species such as carnivores?
    How can driver speeds be limited?
    What should be done about unrestricted driver radio communication?
4. Monitoring tourism impacts:
    What types of monitoring can and should be implemented?
    Who should be responsible for the funding and implementation of monitoring?
    How can partners and stakeholders contribute?
5. Monitoring law enforcement effectiveness:
    How can the effectiveness of tourism regulation enforcement be evaluated?

CONCLUSIONS

The group felt that plant species are particularly vulnerable to off-road driving and vegetation communities can take many years to recover. Visual impact of off-road driving for visitors is also a consideration. Wildlife is becoming partially habituated, so displacement appears minimal although disturbance is still an issue. It is unlikely that impacts can be eradicated but all must be done to minimise them. Furthermore, monitoring must be implemented to ensure that impacts (such as changes in animal behaviour) are minimised.

RECOMMENDATIONS

1. Managing tourism impacts

- KWS, tour companies and the Kenya Professional Safari Guides Association (KPSGA) should ensure that all driver guides be given some professional training.

- Signs should be located in Reserve, and better interpretation provided so that regulations are better understood and adhered to.

- Well-established game viewing circuits should be provided to minimise impacts.

- Tour companies should be rewarded for good environmental performance in the Reserve.

- An awards ceremony with incentives and certificates should be held every year. This should be widely publicised to provide maximum marketing gain for the best companies, as an incentive to perform well.

- Ranger viewing points should be established for surveillance of drivers' behaviour and to provide early warning of congestion and harassment.

- Animal and habitat protection patrols should be intensified.

- A universal radio system should be provided to the anti-harassment patrol team.

- All operators in Masai Mara should reinvest part of their profits into management programmes geared specifically towards reduction of tourism impacts. Other stakeholders should also contribute.

2. Monitoring tourism impacts and its management

- Reserve management should encourage regular surveys and continuous monitoring of tourism and its impacts by research and education institutions such as universities.

- Reserve management should keep records of those drivers disobeying regulations so that persistent offenders can be identified and, if necessary, excluded.

Notes

Tour drivers communicate the presence of sought-after wildlife such as large cats on various radio frequencies, and this serves to increase congestion and wildlife disturbance. If the anti-harassment team could tap into these communications they would have a better idea of where to patrol, thereby increasing their efficacy.

It is recognised that the management itself lacks the capacity to undertake research and monitoring and so specialist partners should be identified to perform this role.

WORKING GROUP 3:
Black Rhino Conservation and Management

RATIONALE

It is clear that the black rhino population in Masai Mara is not recovering as fast as it might. It is also clear that the Masai Mara rhino population is not isolated from surrounding areas, and may rely on these areas for its survival. The impacts of ecological change and of human activities also need to be taken into account.

The task of this working group was to consider the findings of the presentation on black rhino conservation and management and to decide how best to improve the situation for rhinos in and around Masai Mara. To what extent can monitoring, both inside and outside Masai Mara, be improved, and what practical management initiatives can be implemented to assist the recovery of the population? A list of key topics and questions for this working group to consider and decide upon is given below. This list formed the basis of their deliberations and recommendations.

TOPICS TO CONSIDER

1. Rhino monitoring inside Masai Mara:
   What are the problems or limitations, if any, of current rhino monitoring?
   How could rhino monitoring be improved inside Masai Mara?
2. Cross-border monitoring:
   How can cross-border movements best be monitored?
   What collaboration needs to be established with Tanzanian authorities?
3. Cattle in the reserve:
   What are the regulations governing cattle inside the Reserve?
   How can cattle disturbance of rhinos be limited and controlled?
4. Outlier rhinos and population expansion:
   What should be done about isolated rhinos?
   Why don't more rhinos use the Mara Triangle?
   Can and should they be encouraged to do so? If so, how?
5. Resources and partnerships:
   What additional resources are needed to implement effective rhino monitoring in and around Masai Mara? Where will they come from?
   What additional training is required, if any?
   What links need to be established with partners and communities?
   How can tour drivers, tourists and lodges contribute to rhino monitoring and security?

CONCLUSIONS

Whilst it was felt that the reasons for possible dispersal from the Reserve were well understood, it was not clear where rhinos were going and whether they were surviving. Limitations were recognised in monitoring both within and outside the Reserve, and a clear need was felt for both improved monitoring and improved partnerships and collaboration between monitoring teams across Reserve borders.

RECOMMENDATIONS

1. Rhino Monitoring Inside MMNR

- Tracks and crossings should be improved to allow better access for the rhino surveillance unit.
- Additional resources should be provided to the rhino surveillance unit, particularly a second vehicle and handheld radios.

- A specialised surveillance unit should be created, separate from the general ranger force, with appropriate incentives.

2. Cross-Border Monitoring and Rhinos Outside MMNR

- A working relationship should be developed with the Serengeti authorities.
- A cross-border security unit should be established, with freedom of access to both sides of the international border.
- A joint training programme utilising the expertise within MMNR should be undertaken to build capacity on the Tanzanian side of the border.
- Information should be shared between all rhino monitoring agencies inside and outside MMNR, including NCC, FoC/Eden Wildlife Trust and the Serengeti authorities.
- Monitoring capacity should be improved by putting horn transmitters or radio collars on as many rhinos as possible, especially those most likely to disperse from MMNR such as border residents and sub-adult individuals.

3. Cattle in the Reserve

- Patrols and law enforcement efforts should be increased to keep cattle out of the Reserve.
- Stiffer penalties should be implemented for offenders bringing cattle into the Reserve.

4. Outlier Rhinos and Population Expansion

- The population of black rhinos in the Mara Triangle should only be boosted after a clear demonstration of the capacity and ability of the Trans Mara authorities to undertake effective security and monitoring.

5. Resources and Partnerships

- Tour drivers and visitors should be encouraged to report rhino sightings, particularly locations, through the provision of report books at lodges and gates.
- Tourists should be encouraged to make donations to the rhino surveillance unit through illustrated talks and other publicity at lodges, and donations boxes.
- International donors with an interest in the Serengeti-Mara ecosystem should be approached to fund a joint security and monitoring programme.

Notes

The NCC rhino surveillance unit faces a problem of high staff turnover and a consequent loss of capacity due to rangers preferring to be posted to Reserve entrance gates than to the rhino unit. It was felt that better incentives alone would not encourage staff to remain in the rhino unit, and so it was suggested that a team should be hired with specific rhino responsibilities, and without the option to transfer to other duties. Such a team would warrant higher benefits than the standard ranger force due to their inferior conditions and workload.

The issue of collars or horn transmitters was raised previously and rejected by NCC. However, the current view is that some form of tagging to allow the dispersal of rhinos from MMNR to be tracked would be very welcome.

Almost all of the rhinos in MMNR reside on the Narok side. Currently only one female resides in the Mara Triangle. However, there are political difficulties in moving rhinos between the Narok and Trans Mara sides of the Reserve, which may necessitate moving a male into the Mara Triangle from elsewhere: a consideration that has genetic implications regarding the maintenance of the current purely indigenous population. Moreover, questions need to be asked as to why more rhinos do not use the Mara Triangle. There is some ecological capacity for more rhinos, but low levels of security mitigate against supplementation of the population there.

A suggestion to build a sanctuary within the Reserve raised a lot of objections. Ecological conditions, such as declining woody resources, indicate that a large sanctuary would be needed. However, the movements and requirements of other animals such as the migratory wildebeest preclude a sanctuary large enough to contain more that a few rhinos. A sanctuary would not address the root cause of the apparent dispersal and would only be a short-term solution since animals would have to be exported once the carrying capacity was reached. KWS are about to evaluate the past performance and future direction of the rhino programme and in particular how sanctuaries fit in to this. Until such time as national policy on sanctuaries is defined it is recommended that efforts be put into finding out where rhinos are going from the Reserve and whether they are secure there, rather than moving them into a sanctuary.

WORKING GROUP 4:
Mitigating Human-Elephant Conflict

RATIONALE

Human-elephant conflict is a fact of life wherever people and elephants coexist, and especially in the presence of agriculture. It is unlikely that conflict can be entirely eliminated but there are numerous methods that might be employed to reduce it. Both KWS and communities can be active in conflict mitigation, using a variety of complimentary tools.

The task of this working group was to consider the findings of the presentation on human-elephant conflict and to decide what short-term mitigation methods might best be employed to limit conflict. A second working group considered land use change and possible measures to generate benefit from the presence of elephants. A list of key topics and questions for this working group to consider and decide upon is given below. This list formed the basis of their deliberations and recommendations.

TOPICS TO CONSIDER

1. Traditional community-based methods:
   What existing methods should be continued?
   What new methods could be tried?
2. Official (KWS) intervention:
   What methods should KWS be implementing?
   How can reporting and follow-up procedures be improved?
3. Fencing:
   Where and how could fences be used to good effect?
   What types of fences would be used?
   Who would be responsible for construction and maintenance?
4. Education:
   What can be done to lessen the effects of elephants on children's education?

CONCLUSIONS

It was recognised that, whilst many traditional methods have been explored to reduce HEC, elephants often become habituated to individual methods so that over time they all failed. However, frontline defences by farmers themselves are critical to HEC mitigation and management. Therefore a communal strategy of multiple methods used simultaneously in the short term to minimise habituation was recommended. Moreover, KWS should revise their approach to HEC and increase their resources deployed locally to allow more effective collaboration with affected communities and improved response time to incidents.

RECOMMENDATIONS

1. Traditional Community-Based Methods

- A mixture of multiple traditional methods should be used by farmers during the conflict period. Methods should include light (fires, powerful torches), noise (banging tins and drums) and deterrents (oil and chillies either burnt or smeared on fencing, as developed in Zimbabwe by Osborn & Samson, 2002).

- Defences should be concentrated along a front line of farms closest to the point of origin of the elephants.

- Communal guarding in teams should be employed during the conflict period to ensure a rapid response to elephant presence.

2. Official (KWS) Intervention

- KWS should work with communities in a combined strategy for mitigating HEC.
- KWS should increase its deployment of field staff in the area.
- KWS stations should be moved to high conflict zones.
- A mobile HEC mitigation unit should be established, that could be deployed to front line areas in high conflict seasons for rapid response. The unit should be provided with a motorbike, radios and thunder flashes.
- KWS should train a local community rapid response unit, equipped with bicycles and watchtowers, to augment official units.
- A joint KWS/community HEC board should be established to plan and manage local mitigation activities.
- KWS should assist the community to establish a HEC insurance scheme in which all farmers would have a stake.
- If compensation can be shown to be effective and workable, it should be administered by and through KWS rather than government ministries less connected with wildlife.

3. Fencing

- Traditional live fences such as Mauritius thorn and Kayapo should be planted for medium term defence.
- An existing KWS mobile electric fence design used elsewhere in Kenya should be deployed seasonally in high conflict areas.

4. Education

- More boarding schools with bursaries funded by the council from wildlife benefits should be established.
- Transport or secure group travel should be provided for children in high-risk elephant areas.

WORKING GROUP 5:
Land Use Change to Reduce Human-Elephant Conflict

RATIONALE

Human-elephant conflict is a fact of life wherever people and elephants coexist, and especially in the presence of agriculture. It is unlikely that conflict can be entirely eliminated but there are numerous methods that might be employed to reduce it. Ultimately this may rely on altered land use practices and generation of tangible benefits from elephants for communities that have to live with them.

The task of this working group was to consider the findings of the presentation on Human-elephant conflict and to decide what longer-term mitigation methods, relying on land use change and benefit distribution, might best be employed to limit conflict. A second working group considered short-term practical measures such as deterrents and barriers. A list of key topics and questions for this working group to consider and decide upon is given below. This list formed the basis of their deliberations and recommendations.

TOPICS TO CONSIDER

1. Human immigration and land conversion:
   What can be done to halt immigration and land conversion?
   Whose responsibility is this?
2. Elephant range:
   Is the elephant range in TransMara being threatened or reduced?
   What can be done to secure places for elephants to move freely?
   How can incursions of elephants from the Narok side be reduced?
3. Farming practices:
   Do the ways that people farm affect HEC?
   What changes can be made to current farming practices to limit HEC?
4. Tourism and revenue generation:
   How can tourism be developed as a tool to offset the costs of elephants in TransMara?
   How could it be linked to tourism inside Masai Mara?

CONCLUSIONS

The principal conclusion was that farming is increasing because communities receive no other form of benefit from their land. Therefore, if wildlife could be made to pay, residents would be willing to set land aside for conservation and tolerate the presence of wildlife in the area. To ensure that, better local coordination and planning are also needed.

RECOMMENDATIONS

1. Human Immigration and Land Conversion

- Incentives should be provided for landowners not to convert land.
- Livestock and wildlife should be promoted as alternative land uses to cultivation.
- Government department policies on land use should be harmonised.
- Local education and awareness regarding forest conservation should be improved.

2. Elephant Range

- A community forest should be created and managed for conservation.

- Benefits from elephants, other wildlife and the forest should be generated (see below).
- Benefit distribution from wildlife related activities should be extended over the whole elephant range.
- Forest encroachment should be discouraged through effective and appropriate rural planning.
- Guards and barriers should be provided to prevent incursions of elephants from Narok District to farming areas.

3. Farming Practices

- Planting and harvesting seasons should be synchronised to limit individual risk of crop raiding.
- Farms should be consolidated in cultivation zones away from elephant corridors and critical ranges.
- Alternative crops that are rejected by elephants, such as tobacco or chillies, should be considered.

4. Tourism and Revenue Generation

- A community wildlife association should be established to plan and manage sustainable utilisation and benefit distribution.
- Alternative, community-based tourism activities should be developed in the forest and on the escarpment, such as bird watching and walking and horseback safaris.
- Special-interest groups that may also contribute to conservation and community development activities, such as 'Earthwatch', should be encouraged.
- Other wildlife-compatible revenue generating activities should be developed, such as bee keeping and butterfly farming.
- The County Council should provide an enabling environment for development of tourism and other alternative economic activities that are compatible with wildlife conservation.
- The flow of community benefits from such wildlife-related activities should be ensured, to provide services such as boarding schools and clinics.
- The 19% dividend from MMNR revenues that is distributed to communities should be increased.

RECENT UPDATES

The Serengeti-Mara is a dynamic ecosystem, and both human and ecological elements are in a constant state of flux. Since the Darwin Initiative workshops took place, a number of changes have occurred in and around MMNR that are of relevance to the topics described in this document. This section is intended to update the reader with regard to these changes, and to illustrate the implementation of some the recommendations arising from the workshops.

TOURISM IN MMNR

The Kenya Professional Safari Guides Association (KPSGA) has introduced a series of qualifications (bronze, silver and gold awards) for safari guides operating in the country. This is a major step forward in the development of professional standards within the industry at all levels. These qualifications are based principally on natural history and cultural knowledge, but issues regarding driver behaviour and reserve regulations are not being ignored.

These qualifications are gaining widespread support and endorsement within the tourism industry in Kenya, and it is hoped that this will help to reduce the ecological impacts of safari tourism throughout Kenya's natural areas. Many of the guides operating within and around MMNR are gaining these qualifications. In addition, FoC, in conjunction with the Ecotourism Society of Kenya, have redeveloped their visitor code of conduct (guidelines for visitor behaviour whilst on safari) which is widely publicised and distributed to tourists.

New research conducted in MMNR highlights the continued impact of tourism on the cheetah, a particularly sensitive species (Ronn, 2002). This research took place as part of a wider cheetah monitoring project being conducted by KWS, NCC and WWF in partnership. Equally, WWF are continuing to support the long term ecological monitoring within the Reserve. Such partnerships remain vital to assist the Reserve authorities by providing data on the state of the ecosystem.

A major development, in May 2001, was the initiation of a partnership between TMCC and the Mara Conservancy, a not-for-profit organisation charged with managing the TransMara portion of MMNR, known as the Mara Triangle. Since the initiation of this partnership, the infrastructure and security in the Mara Triangle has increased immeasurably, as have reported incomes from visitor entrance fees (Walpole & Leader-Williams, 2001). A well-defined network of murram tracks, with clear sign posts, has been developed for visitors. Strategies for tourism monitoring, management and diversification are being developed and implemented. Moreover, a significant part of the revenue from tourism is being reinvested in management activities. Whilst this partnership is still in its infancy, it is already yielding measurable success, and offers a model of public-private partnership for the rest of the ecosystem.

BLACK RHINO CONSERVATION

A recent review of the KWS black rhino programme found that the Mara population was one of the better known and understood, with a relatively high-quality monitoring programme (P. Demmers, *pers comm*.). The GPS monitoring conducted during this project has been maintained as part of an enhanced monitoring and database system implemented throughout the Kenyan rhino sanctuaries. Moreover, cross-border collaboration with Tanzania has been initiated through a partnership with the Frankfurt Zoological Society, which supports rhino conservation in the Serengeti and Ngorongoro. Currently this partnership had yielded financial and material support for the NCC rhino monitoring programme in MMNR. However, closer collaboration for cross-border monitoring is being explored.

The improved security in the Mara Triangle through the efforts of the Mara Conservancy bodes well for a recovery of the black rhino population in that area. The single female currently residing in the Mara Triangle recently crossed to the Narok side and was observed mating with a male on that side of the Reserve, before returning to her usual range within the Triangle (P. Kirui, *pers comm*.). This suggests that the two sides are not isolated, and may signify the beginning of a recolonisation of the western part of the Reserve.

HUMAN-ELEPHANT CONFLICT

After the workshops in TransMara, a new follow-up project was implemented in the area with funding from WWF. This aimed explicitly to test a number of simple, cost-effective mitigation methods that could be used by farmers themselves to defend their crops. These included traditional deterrent and barrier methods, and novel innovations such as the use of chilli. Farmers are organising themselves into associations and practising communal guarding of front lines. Preliminary results indicate a certain amount of success, and identify factors that affect the success of these methods (Walpole & Sitati, 2002).

As part of this project, a greater collaboration between KWS and communities has been initiated. KWS field staff are more involved in monitoring and mitigating HEC than previously, although their efficacy remains limited by a lack of transport and other resources. Efforts are underway to enhance KWS involvement in both TransMara and Narok Districts.

Over the longer term, communities recognise that alternative activities to farming that generate benefits from forest and wildlife are likely to be more sustainable. As a result, numerous communities have registered associations, with constitutions, to place conservation at the heart of their development aspirations. Two communities (Dupoto and Enkiorero) are already practising small-scale tourism, in terms of short walking trips and cultural tours, for visitors to MMNR. Another community (Lepolosi) has undertaken a pre-feasibility study for tourism development to alleviate human-wildlife conflict (Stewart-Cox, 2002). In conjunction with these efforts, communities to the east of MMNR in Narok District are also registering associations and considering how they might use tourism to alleviate conflict. These communities are mindful of the problems and constraints that other areas have encountered regarding tourism, in particular the monopolisation of benefits by local elites (Thompson & Homewood, 2002). Community-based tourism has been widely promoted as a conservation and development panacea with little critical assessment, but still offers opportunities for communities if it is properly planned and executed as part of a wider conflict mitigation strategy (Walpole & Thouless, *in press*).

COMMUNITY-DRIVEN TOURISM AND CONSERVATION

A second grant has been obtained from the Darwin Initiative, to implement some of the findings and recommendations reported here. The overall purpose of this new project is to conserve biodiversity and alleviate human-wildlife conflict in unprotected Maasai communal lands by generating tourism benefits from the environment, through employment and income, to offset the costs of conservation. It is assisting communities in Naikarra and Olderkessi locations, to the east of MMNR, to form registered trusts, to develop human-wildlife conflict monitoring and mitigation plans, and to develop small-scale nature-based tourism. A particular theme of the project is capacity building, both at MSc level for local community representatives and liaison officers, and in the field for local wildlife scouts and conflict enumerators.

This project has already achieved practical outcomes in training, research and monitoring (Walpole & Martyn, 2001), and the formation of community trusts with enhanced land tenure rights. It is now beginning to assist these communities to gain an understanding of tourism that will enable them to develop the appropriate partnerships for tourism development. If direct linkages to conservation can be made, and if a sustainable market niche can be exploited, then this may offer the most hopeful long-term approach to human-wildlife conflict mitigation in the Mara ecosystem.

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Wildlife and People: Conflict and Conservation in Masai Mara, Kenya

The Wildlife and Development Series is published by the International Institute for Environment and Development (IIED) to highlight key topics in the field of sustainable wildlife use. The series is aimed a policy-makers, researchers, planners and extension workers in government and non-governmental organisations world-wide. The series arises from two sources. First by invitation of IIED to others working in this field, and second from IIED's own work.

Biodiversity is facing widespread competition with humanity for space and resources. As a result, many species are coming into increasing conflict with people, and this is particularly true of large mammals. Some, such as rhinoceros and large carnivores, bear most of the cost of this conflict and are either critically endangered or declining rapidly. Others, such as the African elephant, also inflict considerable impacts on people and are in the unusual position of being simultaneously an endangered species and, in places, a pest species. Even within protected areas, tourism can generate considerable human-wildlife conflict. The challenge facing conservationists is to identify strategies to mitigate conflict between wildlife and people so that mutually sustainable benefits can be derived.

This report summarises the main findings of a three-year programme, funded by the Darwin Initiative for the Survival of Species, and carried out in and around the Masai Mara National Reserve in Kenya. The purpose of the programme was to train Kenyans at all levels to undertake monitoring and research into various forms of human-wildlife conflict in the Mara ecosystem, and to use the results of such research to develop recommendations for the management and mitigation of human-wildlife conflict for the benefit of both people and wildlife.

A critical element of the programme was to disseminate, discuss and utilise the findings locally. To that end, a series of dissemination workshops took place in Kenya in August 2001. This document comprises the product of this dissemination process. The working groups at each of these workshops yielded recommendations, by debate and consensus, which are reproduced here in their entirety. It is hoped that these will form the basis of future management of human-wildlife conflict in the Mara ecosystem.

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