SOUTHERN GROUND HORNBILL POPULATION AND HABITAT VIABILITY ASSESSMENT

Southern African Wildlife College
07 - 11 February 2005

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Endangered Wildlife Trust
Ground Hornbill Working Group

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CONSERVATION BREEDING SPECIALIST GROUP
SOUTHERN AFRICA

SOUTHERN GROUND HORNBILL POPULATION AND HABITAT VIABILITY ASSESSMENT

7 – 11 February 2005

Southern African Wildlife College

FINAL WORKSHOP REPORT

Hosted by:

ENDANGERED WILDLIFE TRUST
CONSERVATION BREEDING SPECIALIST GROUP (CBSG) SOUTHERN AFRICA

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Sasol
National Zoological Gardens of South Africa
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The Endangered Wildlife Trust's Ground Hornbill Working Group

In collaboration with

THE CONSERVATION BREEDING SPECIALIST GROUP
SOUTHERN AFRICA (CBSG – SSC / IUCN)

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The CBSG, SSC and IUCN encourage workshops and other fora for the consideration and analysis of issues related to conservation, and believe that reports of these meetings are most useful when broadly disseminated. The opinions and recommendations expressed in this report reflect the issues discussed and ideas expressed by the participants at the Southern Ground Hornbill PHVA Workshop and do not necessarily reflect the opinion or position of the CBSG, SSC, or IUCN

The photograph on the front cover of this report was supplied by Alan Kemp.

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EXECUTIVE SUMMARY AND CBSG WORKSHOP PROCESS

EXECUTIVE SUMMARY

It is believed that if a Southern Ground Hornbill (*Bucorvus leadbeateri*) (hereinafter referred to as the Ground Hornbill) appears in the village it means that rain is coming. As a sacred bird, traditional healers believe that killing a Ground Hornbill is a bad omen and seeing a live Ground Hornbill is a symbol of prosperity and good luck. Why then are Ground Hornbills under severe threat with the only stronghold for the species being within formal conservation areas?

The Ground Hornbill is distributed as far north in Africa as Rwanda, Burundi and Kenya, down the east coast as far south as the Eastern Cape in South Africa and west into Angola and north eastern Namibia (Kemp 1995). Just over 5% of the total Ground Hornbill range falls within South Africa and as a flagship species for the current status of South Africa's savanna biome, the status of this species is alarming. The savanna ecosystem has always been considered to be relatively stable – but if Ground Hornbills are indicators of the status of this habitat, then southern African savannas may require much closer attention than previously thought.

Ground Hornbills are charismatic birds and are easily identified on sight and sound. However, there are estimated to be less than 1500 Ground Hornbills left in South Africa and the species has experienced a 50% decline in range with more than a 10% decline in numbers over the past three decades. The species has thus been classified as Vulnerable in the *Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland* (Barnes 2000) due to its risk of extinction in the wild.

Due to their complicated social structure and the dramatic decline in habitat and population numbers, in February 2005 the Endangered Wildlife Trust's Ground Hornbill Working Group convened a Population and Habitat Viability Assessment Workshop (PHVA), facilitated by the IUCN's (World Conservation Union) Conservation Breeding Specialist Group (CBSG) Southern Africa. This workshop was held at the Southern African Wildlife College near Hoedspruit with the aim of identifying the major threats and conservation priorities for the species and its habitat throughout the sub-region.

The 35 participants at this multi-stakeholder workshop represented the local conservation NGO community, academic institutions, captive breeding facilities, the IUCN Reintroduction Specialist Group, forestry companies, SANParks, governmental departments, provincial parks boards, private game reserves and traditional healers. Together, the group developed a prioritised action plan for the future of Ground Hornbills in South Africa.

Ground Hornbill conservation will, in the future, focus on four themes, namely: research into the biology of the species; research into the species' ecological needs; quantification, qualification and mitigation of their threats; and stakeholder education and awareness. Overall, the primary objective for Ground Hornbill conservation will include the establishment and registration of a national management plan for Ground Hornbills and their savanna habitat in the context of South Africa's National Environmental Management: Biodiversity Act (2004). With a Ground Hornbill Conservation Action plan in place and clear priorities identified, the future approach to the conservation of these magnificent birds will be better coordinated and more focussed on addressing the key issues that will contribute to securing their future.

THE CBSG PHVA WORKSHOP PROCESS

The workshop ran for three and a half days. The morning of the first day was dedicated to presentations covering the current status of research, monitoring, harvesting and reintroduction and its results, as well as the current status of work in the associated private nature reserves. Thereafter the PHVA, as outlined below, began.

The PHVA Workshop process comprised a series of plenary and working group sessions in which working groups tackled tasks designed to facilitate free thinking, brain-storming, discussion and debate, issue-tackling and, finally, consensus building and project development. After an initial plenary brain-storming session, the key issues facing the survival of the Ground Hornbill in South Africa were listed which gave rise to the establishment of the following five working groups:

- Biology Working Group
- Ecology Working Group
- Education, Awareness and Legislation Working Group
- Threats Working Group
- Population Dynamics and Modelling Working Group

Overarching themes which all groups dealt with to a certain extent included:

- Conflict and poor communication between various conservation groups
- Financial constraints
- Lack of coordination of activities and data
- A poor knowledge-base

Working groups then spent the next three days tackling issues specific to their group, and systematically worked through the tasks assigned that included drafting a situation overview, compiling problem statements, developing and prioritising solutions and goals, and finally, working out detailed action plans and steps that will result in achieving the goals identified.

Intermittent plenary sessions enabled working groups to present the results of their discussions and obtain the input of all participants, which resulted in additional debate and insight from members of other working groups.

On the final day, a group integration exercise was performed and common themes across all the groups' solutions and goals were identified. The whole group convened and contributed the five most important goals of their respective working groups to a list which each person then individually rearranged in order of priority. The five most important solutions and goals across all the working groups can be summarised as follows:

1. Coordinated research on habitat requirements and associated limiting factors with regards to choice of nest sites, availability of foraging areas and effect of rainfall, rainfall distribution on habitat and availability of prey species.
2. Establishment and registration of a Ground Hornbill management plan in the context of the National Environmental Management: Biodiversity Act (2004), to challenge and oppose changes in land-use that will negatively affect Ground Hornbills.
3. Investigate further the impact of natural nest repair and modification, nest boxes, supplementary feeding, second chick / egg removal, double clutching, cross fostering, group supplementation, reintroduction of individuals / groups and group splitting / manipulation on productivity and recruitment.
4. Verify currently used sexing and ageing characteristics (colouration and morphology) both in captivity and in the field. Consider changes in the characteristics with age.
5. Education and awareness campaign to encourage tolerance and a working relationship with landowners and the general public.

FINAL PLENARY SESSION: THE WAY FORWARD

The final plenary of the workshop was dedicated to allowing the entire forum to work through issues that faced the Ground Hornbill conservation community at that time. These included differing opinions about various research and conservation activities being undertaken, poor communication between groups, disparity between the stakeholder groups, poorly coordinated activities and a lack of integration of the available data. A full report on this last plenary session is available in Section 4, Final Plenary: Way Forward.

The discussion centred around issues that the PHVA process had uncovered, namely the lack of available data on the species' biology and ecological needs, the lack of understanding of the causes of decline in the species, and the lack of coordination between various conservation groups due to a lack of agreement as to where priorities for conserving the species lay. A suggestion was made to discontinue the harvesting of second chicks for approximately two years to allow for more effective data collection. This was however met with concern from some who felt that the loss of even a single collection season could negatively impact on the development of a viable captive breeding flock with sequential ages, including adults, for future reintroduction. This was due in particular to the fact that few individuals were collected during each harvest and that the birds only reach adulthood at 5 – 10 years of age. The group also raised the issue of a need to better understand the genetic variations between sub-populations and a need to improve the collation of data, making sure all data are available for improved decision-making.

Some participants felt that a re-evaluation of all current research and field projects should be undertaken, whereas others felt that existing projects should go ahead unhindered, as all projects contributed to a common goal. It was however agreed that communication, coordination of activities and the dissemination of information must be increased. It was also agreed that all current projects should continue but expansion of these projects and the establishment of new initiatives should only be done in accordance with scientific fact.

Consensus was reached by all on the following points regarding the way forward:

1. All agreed that supplementation and harvesting could continue, but in conjunction and collaboration with a research project which would be developed to provide empirical data.
2. All agreed that vastly increased levels of coordination and communication for continued cooperation was important.
3. All projects must work together and contribute towards the bigger picture.
4. A small group of experts would be convened once the workshop was complete to discuss a way forward to integrate the harvesting and research and from there to make decisions as to which nests could be used, for which projects and how these could work together.

A re-evaluation of the Ground Hornbill's national IUCN Red List status will be investigated after the PHVA, in which experts will re-evaluate the species according to the Red List criteria using the new data. The species is currently classified as Vulnerable in South Africa according to the *Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland* (Barnes 2000) but it is thought that it may be eligible for an upgrade of its conservation status to Endangered.

Participants in the Southern Ground Hornbill PHVA Workshop 2005

SOUTHERN GROUND HORNBILL PHVA

7 – 11 February 2005

Southern African Wildlife College

WORKSHOP REPORT

SECTION 2:

PRESENTATIONS

KERRYN MORRISON – ENDANGERED WILDLIFE TRUST GROUND HORNBILL WORKING GROUP (EWT / GHWG)

The Ground Hornbill Working Group (GHWG) is a Working Group of the Endangered Wildlife Trust (EWT). It was established in August 2004, at a suggestion from the Mabula Ground Hornbill Project and The Green Trust. Although conservation of the Southern Ground Hornbill (*Bucorvus leadbeateri*) is central to the EWT / GHWG, the species also acts as a flagship for the savanna ecosystem, which is considered by the EWT and conservationists to be of mounting concern.

The objectives for the EWT / GHWG between August 2004 and the PHVA were to:

- Establish fully the GHWG within the EWT operational framework;
- Obtain the database of individuals and organisations developed by the Mabula Ground Hornbill Project and expand this further on an ongoing basis; and
- Organise the PHVA workshop.

Immediate future objectives for the EWT / GHWG are:

- Finalise and distribute the PHVA document. The outcomes of the PHVA will serve as the basis for the operations and objectives of the EWT / GHWG.
- Annually review the PHVA outcomes to ensure that any new information is added to the actions required and that the actions are adapted accordingly
- Develop a business plan for the EWT / GHWG;
- Develop an operational structure for the EWT / GHWG, to support the objectives of the group. This will include at least an Advisory Group.
- Investigate formal or informal partnerships with all of the key players in Ground Hornbill conservation in order to ensure that the solutions and activities indicated in the PHVA are implemented. Any activities and solutions not being implemented will be addressed by the EWT / GHWG.

Acknowledgements:

The EWT / GHWG thanks The Green Trust and Sasol for funding and the Mabula Ground Hornbill Project, the National Zoological Gardens and the Johannesburg Zoological Gardens for support and funding for the PHVA.

DEREK ENGELBRECHT AND JOHAN VAN WYK - CURRENT STATUS OF THE LIMPOPO SOUTHERN GROUND HORNBILL RESEARCH PROJECT IN LIMPOPO PROVINCE

The aim of the project is three-fold:

1. To determine the present distribution and status of the Southern Ground Hornbill in the Limpopo Province;
2. To investigate the biology and ecological requirements of the species outside formally protected areas;
3. To establish what constraints may affect the species' long-term survival in the Limpopo Province.

In 2004, a survey was undertaken to determine the present distribution of the Southern Ground Hornbill in the Limpopo Province. Time and financial constraints limited the 2004 survey to the north-western Limpopo Province. The area covered included the area west of the N1 highway and north of the Soutpansberg Mountain range to the Limpopo River. The Thabazimbi area was included due to sightings in that area. Areas not included in the survey were not visited physically but we contacted various stakeholders who might be able to provide us with information. These included the Soutpansberg Birding route, various private landowners in the area and local bird clubs.

The survey indicated that there are only 5 - 7 groups in the north-western Limpopo Province. An intensive awareness campaign (media, private landowners, rural communities and various NGO's) have paid dividends as regular feedback is received from residents in the area about the whereabouts of the group. Once the distributions of the different groups are known, a monitoring programme will commence.

ANDREW DEACON - CURRENT STATUS OF MONITORING IN KRUGER NATIONAL PARK

Monitoring of Ground Hornbills by Cybertracker in the KNP

Louis Liebenberg developed the CyberTracker (CT) System for application in conservation, as a user-friendly interface developed for PalmOS computers. The system allows literate as well as non-literate field workers to record customized observations with latitude (lat) and longitude (long) coordinates (http://www.cybertracker.org).

The database was customized as an icon-based interface with English and Shangaan descriptions for the collection of the following lat / long data. An important part of the information for Ground Hornbills is imbedded in the following data sets:

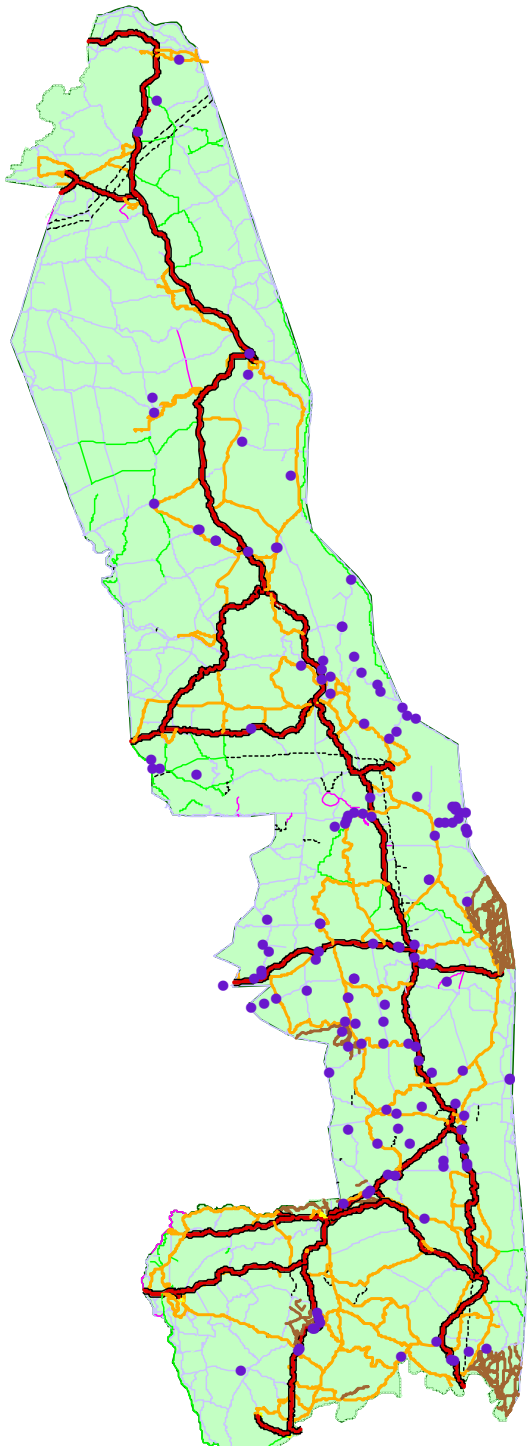
- Daily field ranger patrol information include type of patrols (foot, bicycle, and vehicle), area covered, field observation times and field rangers involved in the patrol.
- Species distribution include mega-herbivores, ungulates, carnivores, small mammals certain birds (including Ground Hornbills) and reptiles.

Field rangers from each section in the KNP are deployed on a daily basis to patrol selected areas with up to 4 CT units. Observations, from the different categories stated above, are recorded throughout the patrols including the routes travelled and time taken. On the field ranger's return, the section ranger downloads the patrol data to his / her desktop, CT Ranger Diary Database and reviews the observations of the day. At the end of every month each of the 22 section rangers exports their CT data for that month and emails the small .ctz file to scientific services' Geographic Information Systems (GIS) Lab in Skukuza. The data is then collated from the GIS Lab and imported into an Access database where it is cleaned, summarized and made accessible to all users through the KNP network.

The field data collected through the CT KNP Ranger Diary system aims to benefit both the management and scientific research of KNP. The objectives of the CT system are to provide all section rangers with a tool for area-integrity-management and also to help provide answers to the various research questions, outlined as objectives and associated Threshold of Potential Concern (TPC) in the new KNP Management Plan.

The CyberTracker system has proven to be an indispensable tool for field data collection in the Kruger National Park. The easy-to-use icon-based interface has the potential to all but eliminate the time consuming practice of data capture, allowing more time for scientific research. This research, which is fed into the KNP's adaptive management practices and policies, aids in the better understanding by KNP managers and scientists of the dynamic natural facets and fluxes of our National Park.

Ground Hornbills 2003 Cybertracker



Graphic 1: Distribution of Ground Hornbill in the KNP in 2003

ANN TURNER - CURRENT STATUS OF HARVESTING AND REINTRODUCTION PROGRAMME

A large scale nest search and population count has been in progress in the Eastern Cape, North West and Limpopo Provinces. It appears that numbers are considerably down in these areas from what was previously thought and found considerable intolerance to window breaking with increased building in the rural areas, with whole groups being shot and poisoned. Hence of prime importance are a large scale and penetrating public awareness and education campaign imperative.

A video showing the feeding process of a chick on a nest has been captured on film - Delecia Gunn at Loskop Dam.

The alpha female at Mabula in her fourth year has spent a month in the artificial nest, which perhaps shows that hand-reared birds do not imprint and given the right circumstances can and will breed.

GROUND HORNBILL PROJECT BIRDS:

1999 – 3 chicks harvested at KNP by Alan Kemp and brought to Mabula April, 1999.
- Punda Maria – Male, now at Haenertsburg (since deceased).
- Tschwane – Male, the bird broke its back when 2 years old and was euthanised.
- Footpath – Male, predation by Caracal at 10 months old.

2000 – 3 chicks from KNP.
- Kingfisher – Female, alpha female at Mabula
- Shingwedzi – Male, died of poisoning after being caught in a leopard trap (Mabula)
- 1 chick – died before 18 days old (National Zoo)
- Storm – wild male from Tzaneen, rehabilitated from poisoning – alpha male at Mabula

2001 – 1 chick harvested from KNP – died before 18 days (National Zoo).

2002 – 2 chicks harvested from KNP, 2 chicks from Timbavati – all died before 7 days old (Montecasino Bird Park)
Poison – wild male donated to Mabula after poisoning.
A workshop was held on hand-rearing at Maropeng and Donna Sweet was sent from San Diego Zoo to assist.

2003 – 3 chicks harvested from KNP
- Bataleur – male, now at Shamwari
- Shiloweni – male, killed by Leopard in APNR during release programme when 9 months old.
- Tschwane – female, predated by Martial eagle at Mabula

1 chick harvested from the APNR farm Jonniesdale, died of impaction at Johannesburg Zoo at 19 days old.

2004 – 4 chicks harvested from KNP
- Mudzi – sex unknown, 4 months old died of predation – Serval on Mabula
- Lindanda – female, at Haenertsburg
- Orpen – female, now at Shamwari
- Imbali – male, at Mabula

1 male chick harvested from APNR from the farm Tandatula was hand-reared after a hip dislocation, is a show bird at Montecasino.

Dudu a wild female with a broken leg, possibly 20 years old, from Timbavati (December 2003) was rehabilitated by Dr Stephen van der Spuy at Montecasino. Now in a breeding programme at Umgeni River Bird Park was vetted and found to be growing follicles in ovaries only now (February 2005).

TOTAL HARVESTED BIRDS: 20
TOTAL WILD BIRDS: 3
TOTAL HARVESTED BIRDS DEAD: 13
TOTAL NOW IN PROJECT PROGRAMME: 10

Ground Hornbill harvested and hand-reared by the Ground Hornbill Project

From December 1998 to February 2005

Age	0 - 20 DAYS	20 - 86 DAYS	86 DAYS - 1 YEAR	1 - 2 YEARS	2 - 3 YEARS	3 - 6 YEARS
Mortality Rate (%)	35	0	23	30	0	0
Survival Rate (%)	65	100	77	70	100	100
No. of mortalities	7	0	3	3	0	0
No. of Survivors	3	13	10	7	3	2

Table 1: Total number of chicks harvested during the period: 20

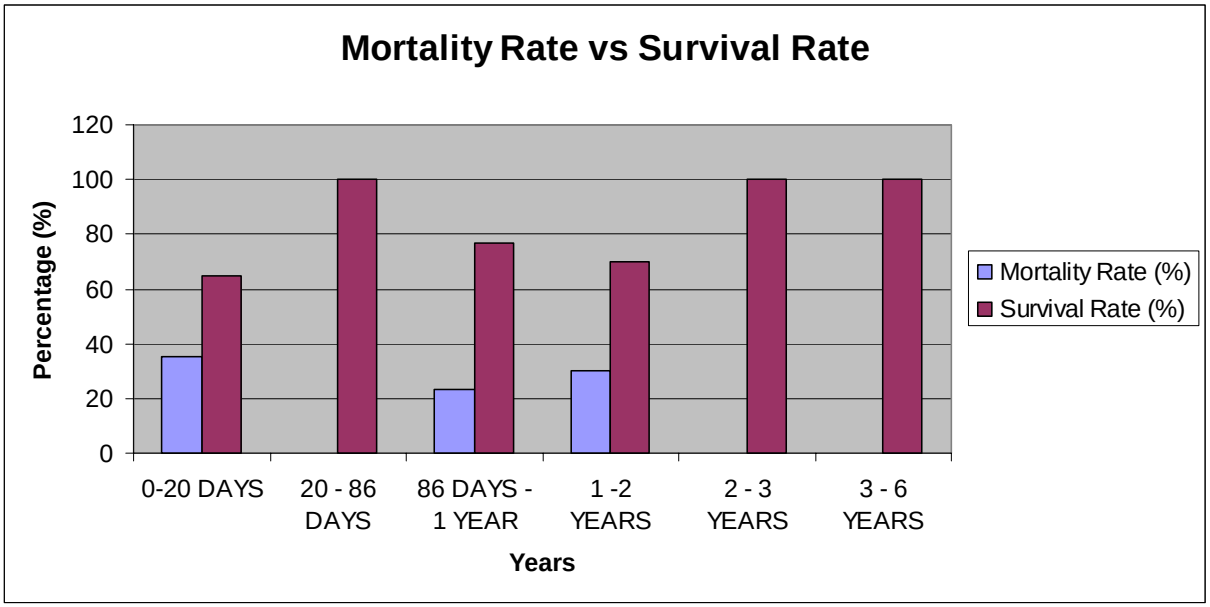


Figure 1: Mortality and survival rates of harvested chicks.

MORNE DU PLESSIS - CURRENT STATUS OF RESEARCH AND CONSERVATION WORK IN THE ASSOCIATED PRIVATE NATURE RESERVES (APNR)

Professor Morné A. du Plessis (Director) with the assistance of Adin Ross-Gillespie (Senior Ground Hornbill Project Researcher 2004 / 2005) and Gustav Roux (Ground Hornbill Project Researcher 2004)

Introduction

The Percy FitzPatrick Institute of African Ornithology (hereafter referred to as "the Fitztitute") has overseen the Ground Hornbill research work of Yuval Erlich in the APNR since 2003. However, with the relocation of Yuval to the USA during mid 2004, the Fitztitute has assumed full responsibility of the activities of the APNR Ground Hornbill Project (hereafter referred to as "the GH Project"). The Fitztitute, as one of only six recognised national research Centres of Excellence in all of the sciences (i.e. including health, natural, physical and social sciences) and all of technology (i.e. all the engineering disciplines), clearly offers the conservation fraternity with the highest level of scientific credibility possible. This proud reputation is built on a 44-year track record as a fine postgraduate research institute at the University of Cape Town.

Long-term goals

The primary goal of the APNR Ground Hornbill Project is to formulate and implement guiding policies for the effective conservation of the species based on sound scientific principles. Despite considerable work (largely done by Dr Alan Kemp in the Kruger National Park (KNP) over the past 30 years, there are still significant gaps in our knowledge of the basic reproductive biology of the species, and filling these gaps is of the highest priority. For instance, without uniquely marked individuals it is impossible to make firm conclusions regarding survival and reproductive success of individuals in free-living groups. These data are vital to our full understanding the scale of the conservation problem that we might be facing with this species in South Africa.

Further, we need to better understand Ground Hornbills' use of space, and the factors that limit their distribution. Recent experiments conducted by Yuval Erlich that lead to the rapid occupation and successful use of artificial nests in the APNR, favours the explanation that nest sites are limiting. However, rigorous testing of alternative hypotheses has yet to be done. For example, we have yet to understand what an artificial densification at the present scale might ultimately have on reproductive success of groups. It is therefore imperative that we carefully monitor and compare the outcomes of breeding events in the APNR with those under more natural conditions in the KNP.

Thus, we aim to critically re-examine the underlying assumptions of present conservation efforts. Mature Ground Hornbills may forego breeding attempts for several years, but is this perceived reluctance to breed indeed due to a lack of suitable nest sites, or could poor rainfall, low food availability or other factors be to blame? Conservation efforts underway elsewhere include the harvesting and captive-rearing of second-born chicks, based on the assumption that these chicks would invariably perish under natural conditions. While this may well be the case, limited circumstantial evidence indicates that groups might occasionally successfully raise two chicks to fledging age. A secondary goal of the project is to use Ground Hornbills as a model species to further our theoretical understanding of the phenomenon of cooperative breeding in vertebrates. While this might seem like a rather esoteric research goal, we seek to understand the causes of the delayed dispersal mechanism in this species. Is the available habitat purely saturated, or are we dealing with a situation in which sub-adults simply are not able to forage efficiently enough to sustain both themselves and dependent young? Answers to these questions will guide future practical conservation approaches in providing us with sound information upon which to base (or adapt) future conservation interventions.

Short-term goals – 2004 / 5 breeding season

Ground Hornbills breed in the summer months following good rains, and the present breeding season is well underway. We are presently monitoring 26 known nest-sites in the APNR, 9 of which are already active, and intend to establish data on the approximate timing and outcome of each breeding attempt. There are also clear signs of intense interest and / or activity at a few more nests, so we anticipate to report more comprehensively on the outcome of this breeding season by March 2005.

Unfortunately, the collection of important high resolution data (i.e. day-by-day progress of nests) by direct observation is also quite problematic: If nests are visited too frequently, the repeated disturbances may prompt groups to abandon the breeding attempt. For this reason, we are restricting the frequency of visits to active nests during the current 2004 / 5 breeding season. Remote surveillance cameras (as used previously by Yuval Erlich) to monitor Ground Hornbill nests in the APNR allow very detailed observation with minimal disturbance, but involve significant investments of time. We shall be seeking ways during the next (i.e. 2005 / 6) breeding season of sustaining our effort in collecting data on the broader APNR Ground Hornbill breeding season, whilst simultaneously accumulating high resolution data at relatively few focal nests.

Aside from the collection of new data, there are numerous additional tasks to be accomplished this season. Existing records of distribution and breeding success within the APNR must be collated, and hours of surveillance footage has yet to be reviewed and analysed. Given the wide distribution, low density, and relatively shy disposition of Ground Hornbills in the APNR, it is obvious that the success of this project will be strongly contingent on local enthusiasm and support for project objectives. Such support can come in various ways, but perhaps most importantly in terms of continued permission of landowners for us to work on their individual properties, regular reports of any sightings of Ground Hornbills by owners, staff and visitors to APNR (083-381-7555).

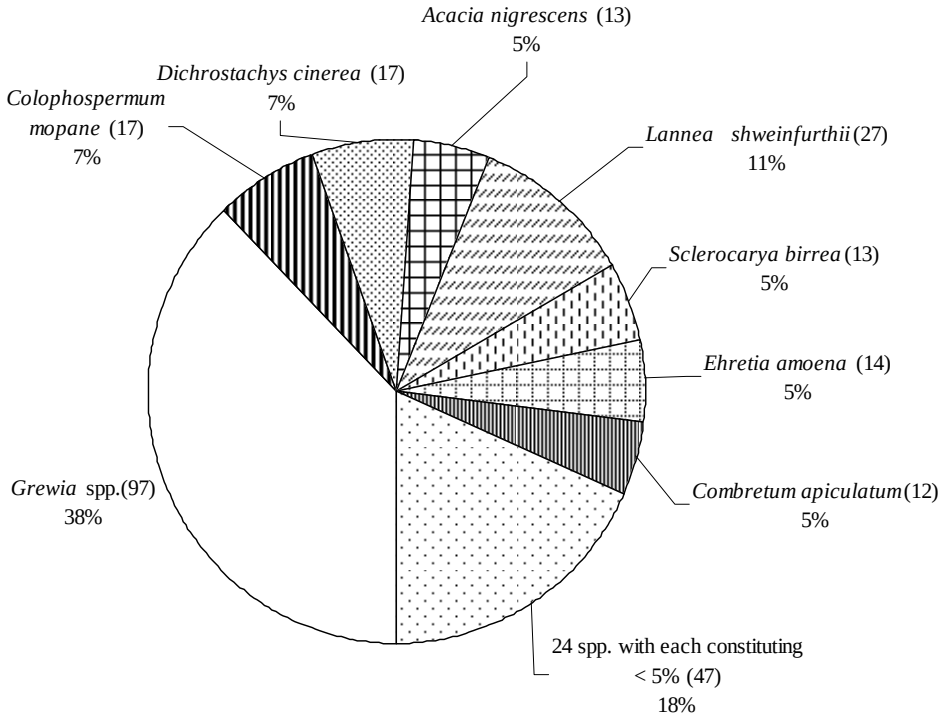
It is a key objective of the project to foster good relations with APNR wardens, local landowners, camp managers and other involved parties, and we understand that regular feedback is vital to this process. We shall aim to produce a quarterly update of our activities in the APNR. Lastly, if time allows, we will follow-up on earlier attempts to habituate target groups to the presence of observers without making beggars out of them. Habituated groups would not only provide much greater insight into all aspects of the birds' behaviour, but would also improve the quality of sightings afforded to residents and guests of the APNR.

MICHELLE AND STEVE HENLEY - THE POTENTIAL INFLUENCE OF ELEPHANTS ON SOUTHERN GROUND HORNBILL NESTING SITES

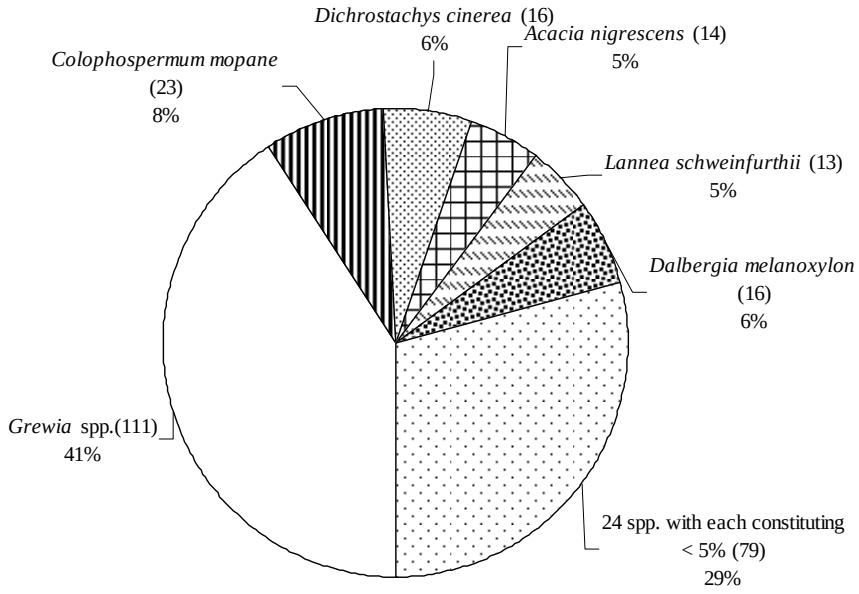
Elephants are quite clearly ecosystem engineers, and although they are only one of many species that have the capacity to modify their environment, the impact of elephants is frequently obvious to man and so they are typically considered to be a keystone species. It has been proposed that elephants could have an influence on the number of nesting sites available to Southern Ground Hornbills (*Bucorvus leadbeateri*).

Vegetation monitoring results during the dry season (Greyling 2004)

Fifty of the 92 woody species recorded in the 250 food- and 90 control plots within the APNR were not utilised by elephants. A narrow range of 6 - 8 plant species made up 70 - 80% of the diet of elephants. *Grewia* species were the principal food to both family units and bull groups as this set of species made up 41% of the diet utilised by family units and 38% of the diet utilised by bull groups (Figure 1).



(a)



(b)

Figure 2: Relative dietary contributions of woody plant species that were utilised by (a) bull groups and (b) family units of elephants during the dry season. The number of individual plants of each species is given in brackets.

Results show that both bull groups and family units utilised only 9% of the 5 780 individual woody plants that were available to them in the study plots. Six woody plant species i.e. *Albizia harveyi, Colophospermun mopane, Dalbergia melanoxylon, Dichrostachys cinerea, Grewia* species and *Lannea schweinfurthii* were identified as plants favoured by both types of social unit. In addition, bull groups favoured *Sclerocarya birrea*. These seven woody species were utilised during 72% and 70% of all feeding events by bull groups and family units respectively. *Grewia* species, aesthetically an unimportant species but with high availability, has proven to be the staple food plant for both bull groups and family units in the study area.

An estimated phytomass removal of more than 50% was found in 36% and 22% of the woody species utilised by bulls and breeding herds respectively. Bull groups had a greater impact on the structure of the vegetation as they removed larger proportions of phytomass per plant and engaged in activities such as uprooting, felling and branch breaking, more frequently than family units. Bull groups felled trees more often than family units (Table 1). Trees were defined as perennial woody plants with a single main stem and a distinct upper crown (Van Wyk and Van Wyk 1997). Single-stemmed plants with basal measures > 6 cm were used to distinguish trees from shrubs according to the guidelines given by Walker (1976). Trees were felled by either bull groups or family units to access smaller plant parts such as twigs, bark, heartwood or the roots. As all uprooting events by family units included only shrubs (*Grewia* spp.), these were excluded from the analysis. Bull groups also selected for taller trees compared to family units. All the above indicate that bulls groups have a greater potential for alteration of vegetation structure within the APNR.

Family units			Bull groups		
Tree species	Feeding mode	Number felled	Tree species	Feeding mode	Number felled
Albizia harveyi	MBA[1]	1	*Acacia exuvialis*	MBA	1
Acacia robusta	MBA	1	*Acacia nigrescens*	MBA	3
			Colophospermum mopane	MBA	1
			Combretum apiculatum	UR[2]	2
			Lannea schweinfurthii	MBA	6
			Lannea schweinfurthii	UR	4
			Pappea capensis	MBA	1
			Sclerocarya birrea	MBA	3
			Ziziphus mucronata	UR	1
Total number of trees felled		2	Total number of trees felled		22
Total number of trees utilised		80	Total number of trees utilised		93

[1]MBA = Main stem breakage to access smaller canopy parts
[2]UR = Uprooting to consume the roots

Table 2: The number of individual trees felled or uprooted by family units or bull groups of elephant.

Information required in relation to Ground Hornbill nesting sites

From the above mentioned it becomes clear that the following information would be required before a relationship between the impact of elephants on mature trees and the number of nesting sites available to Ground Hornbills can be determined:

1) All tree species used by Ground Hornbills as nesting sites need to be ranked according to their frequency of use. According to our knowledge, mature woody species felled by elephants do not overlap with preferred Ground Hornbill nesting sites.
2) Feeding modes in which bulls break large branches to gain access to smaller plant parts (refer to Table 2) may be important when considering woody species such as *Acacia nigrescens, Diospyros mespiliformis, Lonchocarpus capassa* and *Schotia brachypetala.* Such feeding activities by elephants may be beneficial to creating nesting cavities for Ground Hornbills. These feeding events by elephants need to be documented and followed over time to determine whether they do result in suitable nesting cavities for Ground Hornbills.
3) Long-term studies need to be launched to determine at what rate mature trees are being lost to the system and what are possible causes (i.e. elephants, fire, climatic changes, episodic flooding along rivers etc.).
4) Factors influencing the regeneration of trees favoured both by elephants for browsing and by Ground Hornbills for nesting sites should be investigated. If we do not understand what is preventing the recruitment of these species into the mature canopy phase, then low densities of elephants will not alleviate the perceived problem. For example, if frequent fires are keeping young trees in a 'fire-trap' or if seedlings are heavily browsed by impala, then low elephant densities will not affect the replacement of mature species to the system in the long run.
5) Preliminary results from our elephant movement study within the APNR suggest that bulls occupy a non-musth range outside the range of breeding herds. The patterns of bull impact upon tall trees relative to their musth status needs to be evaluated and the implications of this in terms of the spatial arrangement of elephants and Ground Hornbills (elephants are unlikely to have a consistent impact across the landscape).
6) The interaction between fire and elephants on Ground Hornbill nesting trees. Bark stripping may increase the vulnerability of individual trees to fire. Alternatively trampling around the base of a tree by elephants may reduce the intensity of fires around the tree stem.

Suggestions:

1) If mature tree mortality is primarily caused through bark stripping by elephants, then wire netting can be place around the stem of trees that have Ground Hornbill nesting sites in them. Bird wire (13mm mesh, 1.8m tall) is wrapped around the tree trunk about 50cm off the ground to a height of approximately 230cm. On average 1.25m of wire is used per tree. The ends of the netting are stapled on the tree trunk with 25mm wire fencing staples. The wire is inconspicuous and the costs are low (R20 per tree, excluding labour). This technique has been applied by Save the Elephants and has successfully prevented the bark-stripping of *Acacia* spp. in East Africa. The same technique is currently being investigated on an experimental plot in the Timbavati Private Nature Reserve and has thus far yielded positive results as no bark-stripping has occurred on 'treated' trees.
2) Artificial nesting sites could be strategically placed in trees not favoured by elephants and which may prove to be too challenging to fell such as *Combretum imberbe*.
3) All trees with nesting sites could become important indicators of elephant impact and could be monitored specifically for elephant damage whilst monitoring Ground Hornbill nests. This could become an important source of information and could provide operational guidelines in future. The following guidelines are given below when recording elephant impact:

The tree with the Ground Hornbill nest should be recorded by species and height category. We assume that the GPS coordinate will be documented. The following eight height classes of woody species can be distinguished: 0 to <0.5m, 0.5 to <1m, 1 to <1.5m, 1.5 to <2m, 2 to <2.5m, 2.5 to <3m, 3 to <5m and >5m. The basal circumference measurement should be taken whether multi- or single-stemmed. A combined circumference measurement can be taken for all the stems of a multi-stemmed species that are closer than 5 cm apart. Where the stems of a multi-stemmed species are further than 5cm apart they should be measured individually. A single circumference measurement for a multi- stemmed species can then be calculated as the mean of the stem measurements.

All breakage events can be categorised according to the feeding modes in which they occurred (Table 2). Estimates of damage by elephants, which refers to the percentage of stems that were removed, can be made according to Anderson and Walker's (1974) categories: 0%, 1 - 10%, 11 - 25%, 26 - 50%, 51 - 75%, 76 - 90%, 91 - 99% and 100%. When different types of feeding events occur on an individual plant, an overall estimate of the damage should be given. Feeding modes in which the main stem is pushed over or broken should be considered to represent 100% damage. Uprooting events in which all the stems are first removed or flattened can also be classified as 100% damage. If the plant is left intact and only a proportion of the roots are utilised at a distance away from the main stem, damage can be estimated as with the bite and breakage events of branches. For all leaf-stripping feeding modes the damage can be estimated as being no more than 10%. A distinction should be made between new and old damage (i.e. damage incurred prior to the most recent feeding bout).

Feeding mode	Plant part consumed	Description	Data collected
Uprooting	The whole root, the pith of a root or the bark of a root	Roots are utilised after either uprooting the whole plant or pushing the main stem over.	- Number of roots removed per plant
Main stem breakage	These events refer to breakage without consumption	Main stem snapped off or pushed over at the base.	- One main stem breakage event is recorded per plant
Large branch breakage	These events refer to breakage without consumption as only smaller branches, which are then broken off these larger branches, are utilised in some way	Large branch breaking is distinguished from main stem breaking when the stem forks into two or more branches below the breaking point (Gadd 1997).	- Breakage height (if possible). - Number of large branches broken per plant
Branch breakage	Heartwood or bark	Heartwood / bark is removed on the proximal end of the broken branch. These branch breakage events involve smaller branches than those mentioned previously.	- Number of branches broken per plant
Branch biting	Twigs with or without leaves	Utilised twigs are consumed after direct bites to the larger broken branches or by twigs that are severed with the trunk and then consumed. All whole bites are thus recorded as twig usage.	- Number of branches bit or broken per plant
Leaf-stripping	Leaves	Leaf-stripping usually occurs when branchlets are very flexible and often include new growth.	- One leaf-stripping event can be recorded per plant, as the possible number of leaf-stripping events that could have occurred per individual plant can not be distinguished

Table 3: Categorisation and description of the different feeding modes of elephants.

SOUTHERN GROUND HORNBILL PHVA

7 – 11 February 2005

Southern African Wildlife College

WORKSHOP REPORT

SECTION 3:

WORKING GROUP REPORTS

Biology Working Group Report

PARTICIPANTS

1. Morne du Plessis (Percy FitzPatrick Institute of University of Cape Town)
2. Dawn du Plooy (Umgeni River Bird Park)
3. Mike Jordan (IUCN Reintroduction Specialist Group)
4. Alan and Meg Kemp (Naturalists and Nomads)
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7. Shaun Wilkinson (Umgeni River Bird Park).

INTRODUCTION

Many aspects of the demography, life-history, biogeography and behaviour of the Ground Hornbill are currently inadequately understood. This information is vital for the formulation of effective conservation strategies to stabilise or increase the population. We have identified the most significant gaps in our knowledge, and proposed research projects to address these.

PROBLEM STATEMENTS

PROBLEM STATEMENT 1

THE EFFECTS IN VARIATION (SPATIAL AND TEMPORAL) OF TERRITORY QUALITY AND SIZE ARE NOT UNDERSTOOD (HERE TERRITORY QUALITY CAN ENCOMPASS AVAILABILITY OF SUITABLE NEST SITES AND PROXIMITY TO NEIGHBOURS).

Solution 1

Conduct research to investigate spatial and temporal home range use. This should be carried across contiguous groups representing the various land-use types across which Ground Hornbills occur.

Action Step 1:
Design the project and establish the logistic framework [experimental design; identify suitable study site(s); obtain necessary permits (access / ethical clearance / transport of samples / capture / ringing / veterinary procedures)].

Responsibility: Percy FitzPatrick Institute.
Timeline: By mid 2005.
Obstacles: Availability of suitable student / staff member(s).
Collaborators: Landowners / parks authorities.
Measurable Outcome: Completion of a detailed project proposal.

Action Step 2:
Source funding and equipment.

Responsibility: Percy FitzPatrick Institute.
Timeline: Late 2005.
Obstacles: Funding.

Collaborators: EWT, NRF and other funding agencies.
Measurable Outcome: Initiation of the project.

Action Step 3:
Conduct research.

Resources Needed: Vehicle, transmitters, tracking equipment, accommodation, laptop, GPS.
Responsibility: Percy FitzPatrick Institute.
Timeline: By mid 2009.
Obstacles: Potential deterioration of relationships with landowners / authorities.
Collaborators: Landowners, reserve managers, ADU (Donella Young), other academic institutions (e.g. Limpopo - Derek Engelbrecht, Rhodes – Adrian Craig); volunteers; EWT / GHWG.
Measurable Outcome: Completion of the project.

Action Step 4:
Disseminate results.

Responsibility: Percy FitzPatrick Institute, EWT, EWT / GHWG.
Timeline: Mid 2009 - mid 2010.
Collaborators: EWT / GHWG.
Measurable Outcome: Publication and distribution of results.

Solution 2

Determine what constitutes territory quality.

Action Step 1:
Design the project and establish a logistic framework [experimental design; identify suitable study site(s); obtain necessary permits (access / ethical clearance / transport of samples / capture / ringing / veterinary procedures)].

Responsibility: Percy FitzPatrick Institute.
Timeline: By mid 2005.
Obstacles: Availability of suitable student / staff member.
Collaborators: Landowners / parks authorities.
Measurable Outcome: Completion of a detailed project proposal.

Action Step 2:
Source funding and equipment.

Responsibility: Percy FitzPatrick Institute.
Timeline: Late 2005.
Collaborators: EWT, NRF, and funding agencies.
Measurable Outcome: Initiation of the project.

Action Step 3:
Conduct research

Resources Needed: Vehicle, accommodation and laptop.
Responsibility: Percy FitzPatrick Institute.
Timeline: End 2006.

Collaborators: Landowners, reserve managers, other academic institutions (e.g. Limpopo, Rhodes); EWT / GHWG.
Measurable Outcome: Completion of the project.

Action Step 4:
Disseminate results

Responsibility: Percy FitzPatrick Institute, EWT, EWT / GHWG.
Timeline: Mid 2007.
Collaborators: EWT / GHWG.
Measurable Outcome: Publication and distribution of results.

Solution 3

Investigate spatial and temporal variation in territory quality. Ideally this should be carried out across contiguous groups, representing the various land-use types across which they occur.

Action Step 1:
Design the project and establish logistic framework [experimental design; identify suitable study site(s); obtain necessary permits (access / ethical clearance / transport of samples / capture / ringing / veterinary procedures)].

Responsibility: Percy FitzPatrick Institute.
Timeline: By end 2006 (contingent on completion of Solution 2).
Obstacles: Availability of a suitable student / staff member.
Collaborators: Landowners / parks authorities.
Measurable Outcome: Completion of a detailed project proposal.

Action Step 2:
Source funding / equipment

Responsibility: Percy FitzPatrick Institute.
Timeline: Mid 2007.
Obstacles: Funding.
Collaborators: EWT, NRF, and other funding agencies.
Measurable Outcome: Initiation of the project.

Action Step 3:
Conduct research

Resources Needed: Vehicle, transmitters, tracking equipment, accommodation, laptop and GPS.
Responsibility: Percy FitzPatrick Institute.
Timeline: Mid 2010.
Obstacles: Potential deterioration of relationships with landowners / authorities.
Collaborators: Landowners, reserve managers, ADU (Donella Young), other academic institutions (e.g. Limpopo - Derek Engelbrecht, Rhodes – Adrian Craig); Volunteers; EWT / GHWG.
Measurable Outcome: Completion of the project.

Action Step 4:
Disseminate results.

Responsibility: Percy FitzPatrick Institute, EWT, EWT / GHWG.

Timeline: End 2010 – end 2011.
Collaborators: EWT / GHWG.
Measurable Outcome: Publication and distribution of results.

Solution 4

Establish the relationship between territory quality and density dependence.

Action Step 1:
Design the project and establish the logistic framework [experimental design; identify suitable study site(s); obtain necessary permits (access / ethical clearance / transport of samples / capture / ringing / veterinary procedures)].

Responsibility: Percy FitzPatrick Institute.
Timeline: End 2006 (concurrent with Solution 3).
Obstacles: Availability of suitable student / staff member(s).
Collaborators: Landowners / parks authorities.
Measurable Outcome: Completion of a detailed project proposal.

Action Step 2:
Source funding and equipment

Responsibility: Percy FitzPatrick Institute.
Timeline: Mid 2009.
Obstacles: Funding.
Collaborators: EWT, NRF, and funding agencies.
Measurable Outcome: Initiation of the project.

Action Step 3:
Conduct research.

Resources Needed: Vehicle, transmitters, tracking equipment, accommodation, laptop and GPS.
Responsibility: Percy FitzPatrick Institute.
Timeline: End 2010.
Obstacles: Potential deterioration of relationships with landowners / authorities.
Collaborators: Landowners, reserve managers, ADU (Donella Young), other academic institutions (e.g. Limpopo, Rhodes); volunteers; EWT / GHWG.
Measurable Outcome: Completion of the project.

Action Step 4:
Disseminate results

Responsibility: Percy FitzPatrick Institute, EWT, EWT / GHWG.
Timeline: End 2011.
Collaborators: EWT / GHWG
Measurable Outcome: Publication and distribution of results

All of the above mentioned objectives should be tackled concurrently and data collection should be maximised during this period for possible use in later projects

PROBLEM STATEMENT 2
THE SEX RATIOS AND AGE STRUCTURES OF THE BIRDS ARE NOT UNDERSTOOD DUE TO THE INABILITY TO CONCLUSIVELY SEX OR AGE INDIVIDUALS IN THE FIELD, HAVING MAJOR IMPLICATIONS WITH UNDERSTANDING DEMOGRAPHY.

Solution 1

Verify currently used sexing and ageing characteristics of colouration and morphology both in captivity and in the field. Consider changes in the characteristics with age.

Action Step 1:
Collate standardised information on sexing and ageing characteristics of known-sex captive birds (national and international; zoos and museums) – repeat at annual intervals if possible.

Resources Needed:	Communication equipment and funds.
Responsibility:	Delicia Gunn.
Timeline:	Mid 2006.
Obstacles:	Cooperation of collaborators.
Collaborators:	Alan Kemp, Eugene Marais (National Zoo), Stephen v/d Spuy (Johannesburg Zoo), Dawn du Plooy (URBP), other zoos.
Measurable Outcome:	Present preliminary findings at the 4th International Hornbill conference in November 2005. Publications will be made available and distribution of findings.

Action Step 2:
Verify proposed sexing and ageing techniques in wild Ground Hornbills.

Resources needed:	DNA sexing kits / access to laboratory facilities.
Responsibility:	Percy FitzPatrick Institute.
Timeline:	2010.
Obstacles:	Cooperation of collaborators and establishing trapping techniques in order to access wild Ground Hornbills.
Collaborators:	Genetics lab Pretoria (Paulette Bloomer), other labs and other people with access to wild Ground Hornbills.
Measurable Outcome:	Publication and distribution of findings.

Action Step 3:
Review the results arising from Action Step 2 and develop protocol for easy *in-situ* (or *ex-situ*) sexing of individuals.

Responsibility:	EWT / GHWG.
Timeline:	2011.
Collaborators:	Percy FitzPatrick Institute, genetics lab at the University of Pretoria (Paulette Bloomer) and other labs. Other people with access to wild birds, Alan Kemp, Eugene Marais (National Zoo), Stephen v/d Spuy (Johannesburg Zoo), Dawn du Plooy (URBP) and other zoos.
Measurable Outcome:	Publication and distribution of protocol document.

PROBLEM STATEMENT 3
COOPERATIVE BREEDING, LONG LIFE SPANS AND SLOW (AND LATE) REPRODUCTION, RESULT IN LOW POPULATION TURNOVER AND THIS RENDERS THE SPECIES PARTICULARLY VULNERABLE TO THREATS.

Solution 1

Investigate further the impact of:
1) Group size;
2) Group composition and dynamics;
3) Skills acquisition (feeding, breeding, defence);
4) Impact of extra pair copulations, if any;
5) Pair bonding;
6) Dominance effects (allofeeding, hormones and with holding food);
7) Territoriality (calls and displays);

on productivity and recruitment.

Action Step 1:
Design project(s) and establish a logistic framework [experimental design; identify suitable study site(s) – KNP; obtain necessary permits (access / ethical clearance / transport of samples / capture / ringing / veterinary procedures)]

Responsibility: Percy FitzPatrick Institute.
Timeline: By mid 2008.
Obstacles: Availability of suitable student and staff member(s)
Collaborators: Landowners and parks authorities.
Measurable Outcome: Completion of a detailed project proposal.

Action Step 2:
Source funding and equipment.

Responsibility: Percy FitzPatrick Institute.
Timeline: Late 2008.
Obstacles: Funding.
Collaborators: NRF, DEAT, and funding agencies.
Measurable Outcome: Initiation of the project.

Action Step 3:
Conduct research

Resources needed: Vehicle, transmitters, tracking equipment, accommodation, laptop, GPS, traps and rings, surveillance equipment, playback equipment, access to hormone assay and genetic laboratories and field assistants.
Responsibility: Percy FitzPatrick Institute.
Timeline: End 2011.
Obstacles: Potential deterioration of relationships with landowners and authorities, high mortality in study population (catastrophe etc.).
Collaborators: Hormone assay and genetic labs, landowners, universities (Limpopo), labs, zoos and rehabilitation centres.
Measurable Outcome: Completion of the project.

Action Step 4:
Disseminate results

Responsibility: Percy FitzPatrick Institute, EWT, EWT / GHWG.

Timeline: Mid 2012 – end 2014.
Collaborators: EWT / GHWG
Measurable Outcome: Publication and distribution of results

Solution 2

Investigate further the impact of:
1) Natural nest repair and modification;
2) Nest boxes;
3) Supplementary feeding;
4) Second chick / egg removal;
5) Double clutching;
6) Cross fostering;
7) Group supplementation;
8) Reintroduction of individuals / groups;
9) Group splitting / manipulation;

on productivity and recruitment (the above are ranked least invasive to most invasive).

Action Step 1:
Design project(s) and establish logistic framework [experimental design; identify suitable study site(s) – APNR?; obtain necessary permits (access / ethical clearance / transport of samples / capture / ringing / veterinary procedures)].

Responsibility: IUCN SSC and RSG.
Timeline: By mid 2006.
Obstacles: Availability of suitable personnel / availability of suitable captive and wild populations.
Collaborators: Percy FitzPatrick Institute, Mabula, PAAZAB, zoos, captive rearing organisations.
Measurable Outcome: Completion of a detailed project proposal(s).

Action Step 2:
Source funding and equipment.

Responsibility: IUCN SSC and RSG.
Timeline: Late 2007.
Obstacles: Funding.
Collaborators: Mabula, EWT / CBSGSA, EWT, international zoos and conservation NGOs.
Measurable Outcome: Initiation of the project(s).

Action Step 3:
Conduct research

Resources needed: For reintroductions: vehicle, transmitters, tracking equipment; for chick harvesting: vehicle and ladder.
Responsibility: Percy FitzPatrick Institute.
Timeline: End 2012 or later.
Obstacles: Potential deterioration of relationships with landowners / authorities, high mortality in study population (catastrophe etc.).

Collaborators: Mabula, RSG, PAAZAB, landowners, universities (Limpopo) labs, zoos and rehabilitation centres.
Measurable Outcome: Completion of the project.

Action Step 4:
Disseminate results

Responsibility: Percy FitzPatrick Institute, Mabula, EWT, EWT / GHWG, Reintroduction Specialist Group.
Timeline: Contingent on completion of research (Action Step 3).
Collaborators: Mabula, RSG, PAAZAB, landowners, universities (Limpopo), labs, zoos and rehabilitation centres.
Measurable Outcome: Publication and distribution of results.

PROBLEM STATEMENT 4
NOT ENOUGH IS KNOWN ABOUT SOUTHERN GROUND HORNBILL DISPERSAL BEHAVIOUR AND ITS IMPLICATIONS FOR LOCAL PERSISTENCE OF GROUPS.

Solution 1

Investigate and perfect techniques for the trapping and marking of Southern Ground Hornbills.

Action Step 1:
Conduct field trials of various methods

Resources needed: Cannon-nets, traps, cages, anaesthetics, models, vehicle and patience!
Responsibility: Percy FitzPatrick Institute and Alan Kemp.
Timeline: Mid 2006.
Obstacles: Not being able to trap the birds and mortality during capture. Obtaining the landowner's permission to trap the birds may be a problem and infrequency of capture.
Collaborators: Veterinarian (Stephen v/d Spuy), KNP Game Capture Team and veterinarian services; Mabula, EWT / GHWG, ADU, ex-poachers and traditional users of Ground Hornbills.
Measurable Outcome: Publication and distribution of protocols.
Solution 2

Institute a standardised marking and re-sighting programme for Ground Hornbills.

Action Step 1:
Institute a standardised marking and re-sighting programme for Ground Hornbills.

Resources needed: Staff, funding, computer facilities and material.
Responsibility: Donella Young (ADU), Percy FitzPatrick Institute.
Timeline: Mid 2006.
Obstacles: Not being able to find a suitable technique for sustainable marking and re-sighting as well as difficulty in marking birds.
Collaborators: EWT, EWT / GHWG, Shaun Wilkinson (URBP) – to contact transponder manufacturers.
Measurable Outcome: Publication and distribution of protocols.

Solution 3

Establish and coordinate a (inter)national reporting and awareness scheme.

Action Step 1:
Establish and coordinate a (inter)national reporting and awareness scheme.

Resources needed:	Staff, funding, computer facilities and material.
Responsibility:	SAFRING, ADU and Percy FitzPatrick Institute.
Timeline:	End 2006.
Obstacles:	Lack of cooperation or coordination, enthusiasm and support in reporting sightings.
Collaborators:	EWT, EWT / GHWG.
Measurable Outcome:	Publication and distribution of protocols.

Solution 4

Establish a collaboration and information exchange scheme with research projects involving Southern Ground Hornbills outside of South Africa

Action Step 1:
Establish a collaboration and information exchange scheme with research projects involving Southern Ground Hornbill outside of South Africa

Resources needed:	Staff, funding, computer facilities and material.
Responsibility:	EWT / GHWG.
Timeline:	Mid 2005.
Obstacles:	Identifying appropriate institutions or individuals outside of South Africa.
Collaborators:	ADU, Percy FitzPatrick Institute, universities and BirdLife SA.
Measurable Outcome:	Publication and distribution of protocols.

It was highlighted that a monitoring programme for Ground Hornbills was important and should be developed.

PROBLEM STATEMENT 5
DO NOT KNOW WHETHER THE OBSERVED GAPS IN THE DISTRIBUTION OF THE SPECIES LEAD TO GENETIC ISOLATIONS OF SUB-POPULATIONS (HABITAT FRAGMENTATION / PATTERNS OF GENE FLOW).

Solution 1

Initiate a population genetic study to understand current and historical gene flow in South Africa.

Action Step 1:
Design project(s) and establish logistic framework [experimental design; identify suitable study site(s); obtain necessary permits (access / ethical clearance / transport of samples / capture / ringing / veterinary procedures)].

Responsibility:	Percy FitzPatrick Institute.
Timeline:	By mid 2005 (proposal already in draft).
Obstacles:	Poor project design.
Collaborators:	University of Pretoria.
Measurable Outcome:	Completion of an updated, detailed project proposal(s).

Action Step 2:
Source funding and equipment.

Responsibility:	Percy FitzPatrick Institute and University of Pretoria.
Timeline:	Late 2005?
Obstacles:	Funding.
Collaborators:	International zoos, conservation NGOs and EWT / GHWG.
Measurable Outcome:	Initiation of the project(s).

Action Step 3:
Conduct research.

Resources needed:	Access to genetics laboratory.
Responsibility:	Percy FitzPatrick Institute and University of Pretoria
Timeline:	Late 2006.
Obstacles:	Adequate specimens.
Collaborators:	Museums, zoos, rehabilitation centres, landowners, wBRC, universities (Limpopo) and labs
Measurable Outcome:	Completion of the project.

Action Step 4:
Disseminate results.

Responsibility:	Percy FitzPatrick Institute, University of Pretoria and EWT.
Timeline:	Mid to late 2007.
Collaborators:	Everyone else who was involved earlier in the process.
Measurable Outcome:	Publication and distribution of results.

Solution 2

Explore the genetic structure of the species across its entire range, including those in captivity.

Action Step 1:
Design project(s) and establish logistic framework [experimental design; identify suitable study site(s); obtain necessary permits (access / ethical clearance / transport of samples / capture / ringing / veterinary procedures)].

Responsibility:	Percy FitzPatrick Institute / University of Pretoria.
Timeline:	By mid 2005 (proposal already in draft).
Obstacles:	Poor project design.
Collaborators:	Tim Crowe (University of Cape Town) and Rauri Bowie (Stellenbosch University)?
Measurable Outcome:	Completion of an updated and detailed project proposal(s).

Action Step 2:
Source funding and equipment.

Responsibility:	Percy FitzPatrick Institute and University of Pretoria.
Timeline:	Late 2005.
Obstacles:	Funding.

Collaborators: International zoos and conservation NGOs, EWT / GHWG.
Measurable Outcome: Initiation of the project(s).

Action Step 3:
Conduct research.

Resources needed: Access to genetics laboratory.
Responsibility: Percy FitzPatrick Institute and University of Pretoria.
Timeline: Late 2006.
Obstacles: Adequate specimens.
Collaborators: International museums and zoos, rehabilitation centres and other labs.
Measurable Outcome: Completion of the project.

Action Step 4:
Disseminate results.

Responsibility: Percy FitzPatrick Institute, University of Pretoria and EWT.
Timeline: Late 2007.
Collaborators: Everyone else who was involved earlier in the process.
Measurable Outcome: Publication and distribution of results.

Whenever a Ground Hornbill is being handled and biomaterials collected, additional material should be collected for banking in a Biobank for future use and reference.

PROBLEM STATEMENT 6
THE FACT THAT SOUTHERN GROUND HORNBILLS ARE COOPERATIVE BREEDERS COMPLICATES *EX-SITU* CONSERVATION STRATEGIES (CAPTIVE REARING, REINTRODUCTIONS, SKILLS ACQUISITION THROUGH LEARNING, ETC.). THE EFFECTIVENESS OF THESE *EX-SITU* TECHNIQUES AS POTENTIAL CONSERVATION TOOLS MAY BE LIMITING.

Solution 1

Collate existing information on captive husbandry.

Action Step:
Collate existing information on captive husbandry.

Resources needed: Time
Responsibility: Delicia Gunn (Mpumalanga Parks Board).
Timeline: Mid 2006.
Collaborators: Shaun Wilkinson (URBP); Local (e.g. Mabula) and international captive rearing organisations (e.g. EAZA, AZA, etc.).
Measurable Outcome: Accumulation of sufficient information to proceed on to (Solution 3).

Solution 2

Establish communication channels amongst stakeholders involved with captive husbandry.

Action Step:
Establish communication channels amongst stakeholders involved with captive husbandry.

Responsibility: EWT / GHWG.
Timeline: End 2005.
Obstacles: Lack of communication and professional jealousy.
Collaborators: All stakeholders.
Measurable Outcome: High levels of cooperation.

Solution 3

Produce a Captive Husbandry Manual and current studbook.

Action Step:
Produce a Captive Husbandry Manual and current studbook.

Responsibility: Delicia Gunn (Mpumalanga Parks Board).
Timeline: End 2005.
Obstacles: Time.
Collaborators: Shaun Wilkinson (URBP); local (e.g. Mabula) and international captive rearing organisations (e.g. EAZA, AZA, etc.)
Measurable Outcome: Husbandry manual and studbook.

Ecology Working Group Report

PARTICIPANTS

1. Eugene Marais (National Zoological Gardens)
2. Errol Peterson (Umbabat Private Nature Reserve)
3. Donella Young (Avian Demography Unit, University of Cape Town)
4. Ian Sharp (Department of Environmental Affairs: Limpopo Province)
5. Johan van Wyk (Limpopo Parks Board)
6. Nick Theron (Mabula Ground Hornbill Project).

INTRODUCTION

The Ground Hornbill is found in the savanna biome. The biome is currently under extreme threat due to changes in land-use, poor land management, human encroachment and effects of climate change. In order to address this, our working group was tasked to investigate aspects of habitat requirements for the species, current status of habitat, methods of obtaining information and reasons for possible decline in suitable habitat. The lack of a management plan in accordance with the National Environmental Management: Biodiversity Act is of concern.

PROBLEM STATEMENT 1
LACK OF KNOWLEDGE ABOUT HABITAT AND ECOLOGICAL REQUIREMENTS OF THE GROUND HORNBILL.

Solution 1

Coordinated research on habitat requirements and associated limiting factors regarding:

- Choice of nest sites.
- Availability of foraging areas.
- Affect of rainfall and rainfall distribution on habitat and availability of prey species.

Minimum: Determine what knowledge is available and compile a database.
Maximum: Identify gaps in research about Ground Hornbill habitat requirements.

Action Step 1:
Collate completed research

Resources Needed: Access to different databases.
Responsibility: Percy FitzPatrick Institute (Dian Spear).
Timeline: March - October 2005.
Obstacles: Access to unpublished data.
Collaborators: Alan Kemp and Carl Vernon.
Measurable Outcomes: A completed database to identify future research needs.

Action Step 2:
Coordinate existing and future research.

Resources Needed: Completed database (mentioned above in Action Step 1) and identified needs as well as personal time in communication, coordination and supervision.

Responsibility: Percy FitzPatrick Institute (Dian Spear).
Timeline: Ongoing.
Obstacles: Availability of suitable researchers and funding.
Collaborators: Universities and other tertiary institutions.
Measurable outcomes: Completed projects and published research results.

Solution 2

Determine the adaptability of Ground Hornbills to modified habitats that were previously unsuitable.
Minimum: Evaluate criteria of areas that appear unsuitable but to which Ground Hornbills have adapted.
Maximum: Apply criteria to unsuitable areas that can be utilised by Ground Hornbills.

Action Step 1:
Research the adaptability of Ground Hornbills to modified habitats that were previously unsuitable.

Resources Needed: Researchers, funding, transport and applicable equipment.
Responsibility: Percy FitzPatrick Institute (Dian Spear).
Timeline: Ongoing.
Obstacles: Funding and suitable researchers.
Collaborators: Universities and other tertiary institutions.
Measurable Outcomes: Completed projects and published results.

PROBLEM STATEMENT 2
CHANGES IN LAND-USE AND POOR MANAGEMENT RESULTING IN THE LOSS OF PREFERRED HABITAT.

Solution 1

Establishment and registration of a Ground Hornbill Management Plan in context of the National Environmental Management: Biodiversity Act, in order to challenge and oppose changes in land-use.
Minimum: Educate landowners about invasive plants.
Maximum: Control of alien plant species in Ground Hornbill habitat.

Action Step 1:
Compile a Ground Hornbill Management Plan.

Resources Needed: Access to the National Environmental Management: Biodiversity Act and all relevant data e.g. PHVA and publications.
Responsibility: EWT / GHWG.
Timeline: First draft to be completed by December 2005.
Obstacles: Time and funding.
Collaborators: Specialists in relevant fields (Alan Kemp, Errol Pietersen).
Measurable Outcomes: A draft Ground Hornbill Management Plan.

Action Step 2:
Register the Ground Hornbill Management Plan.

Resources Needed: Draft Management Plan.

Responsibility: EWT / GHWG.
Timeline: January 2006 - April 2006.
Obstacles: Finance, administrative delays and indecisions
Collaborators: DEAT and Kallie Erasmus (Environmental lawyer suggested by Errol Pietersen).
Measurable Outcomes: An approved Ground Hornbill Management Plan.

Action Step 3:
Implementation of the Management Plan.

Resources Needed: The Ground Hornbill Management Plan, funding, transport and human resources.
Responsibility: EWT / GHWG.
Timeline: Immediate – ongoing.
Obstacles: Finances and human resources.
Collaborators: IUCN SSC Hornbill Specialist Group, provincial conservation agencies, national government and NGOs.
Measurable Outcomes: Effective implementation of the Ground Hornbill Management Plan.

Action Step 4:
Monitor the effectiveness of the Ground Hornbill Management Plan.

Resources Needed: Human resources, funding, data from annual census, data from land management practice surveys (every 3 - 5 years).
Responsibility: EWT / GHWG.
Timeline: Annually.
Obstacles: Public / stakeholder resistance, difficulty in obtaining data
Collaborators: from the EWT / PWG, farmer unions, provincial departments.
Measurable Outcomes: Annual report.

Passed on to Education Group

Solution 2
Education and promotion of sound land management practises within agricultural, forestry and game industries
Minimum: Annual awareness / education programme / campaign in relevant industries
Maximum: Regular contact with relevant industries and parties

Solution 3

Support and facilitate the eradication and removal of alien invasive plants from known Ground Hornbill distribution.
Minimum: Registered and compiled Ground Hornbill Management Plan.
Maximum: Challenging unfavourable land-use practises.

Action Step 1:
Planning and prioritisation of areas to be cleared.

Resources Needed: Human resources, funding, access to other databases (e.g. agriculture) and mapping.
Responsibility: EWT / GHWG.

Timeline: December 2005.
Obstacles: Time and funding.
Collaborators: Department of Agriculture, Working for Water, DWAF, and poverty relief programmes.
Measurable Outcomes: Work Plan.

Action Step 2:
Implementation and monitoring of the plan.

Resources Needed: Human resources, funding and other institutions.
Responsibility: EWT / GHWG.
Timeline: January 2006 onwards.
Obstacles: Resilience of alien vegetation, discontinuing of collaborative organisations.
Collaborators: Department of Agriculture, Working for Water, poverty relief programmes.
Measurable Outcomes: Hectares cleared per year.

PROBLEM STATEMENT 3
After discussion the following problem statement and solutions were passed on to the Biology Working Group.

LACK OF STANDARDISATION OF CRITERIA AND METHODOLOGY FOR MONITORING OF GROUND HORNBILLS.

a) Develop a national protocol for the monitoring of Ground Hornbills encompassing scientific, ethical and social aspects

   This protocol will be used to direct and guide all aspects of Ground Hornbill monitoring and or data collection, e.g. population trends, food selection, habitat requirements and breeding success. This protocol should form part of the management plan.

b) (Not part of our brief but we feel it is important) Develop a protocol for harvesting, rearing, captive breeding and re-introduction.

PROBLEM STATEMENT 4
After discussion the following problem statement and solutions were passed on to the Education Working Group

LACK OF COMMUNICATION AND COORDINATION BETWEEN STAKEHOLDERS.

a) EWT / GHWG to coordinate and facilitate communication between and within stakeholder groups on a regular basis.

b) (May overlap with other groups). Monthly newsletter should be distributed more widely and communication placed in as many other significant publications and communicates with farmer organisations and conservancies.

PROBLEM STATEMENT 5
REDUCTION OF LARGE TREES AND / OR DESTRUCTION OF OTHER POTENTIAL (CLIFFS AND BANKS) NEST SITES RESULT IN A DECREASE IN AVAILABLE NESTING AND ROOSTING SITES.

Solution 1

Collate existing and future research on the effect of elephant damage as well as other negative impacts on nesting sites. In addition, implement measures to conserve known existing nest sites.

Minimum: Identify known existing nests and formulate a project prospectus.
Maximum: Publish and communicate all findings of the research in order to develop a management plan for the conservation of nest sites.

Action Step 1:
Conduct a literature review.

Resources Needed:	Access to published and unpublished data, human resources and funding.
Responsibility:	Percy FitzPatrick Institute and / or other tertiary institutions.
Timeline:	April 2005 - December 2005.
Obstacles:	Possible delays due to shortage of researchers / students.
Collaborators:	Tertiary institutions and stakeholders.
Measurable Outcomes:	Completed literature study.

Action Step 2:
Refer to research by Greyling, M.D. and Henly, S. (2005), regarding protection of large trees from African Elephant (*Loxodonta Africana*) damage. Implement the measures above.

Resources Needed:	Information on the impact of elephants and other factors on nesting sites.
Responsibility:	EWT / GHWG.
Timeline:	January 2006 – ongoing.
Obstacles:	Lack of implementation of measures and lack of information on impacts and / or mitigation.
Collaborators:	Research institutions and landowners, all people and organisations working with Ground Hornbills.
Measurable outcomes:	Implementation of mitigation measures where feasible and possible.

Action Step 3:
Monitoring of implemented measures.

Resources Needed:	Time and funding.
Responsibility:	EWT / GHWG.
Timeline:	January 2006 – ongoing.
Obstacles:	Lack of implementation.
Collaborators:	All people and organisations working with Ground Hornbills.
Measurable outcomes:	Report on the project.

Solution 2

Research on historical nest areas and the present distribution of Ground Hornbill to determine the viability of erecting artificial nest boxes. Artificial nest boxes can be used to replace known destroyed nests.
Minimum: Identify areas where artificial nest can be utilised.
Maximum: Provision / installation of artificial nest sites.

Action Step 1:
Conduct a literature review.

Resources Needed:	Access to published and unpublished data, human resources and funding.
Responsibility:	Percy FitzPatrick Institute and / or other tertiary institutions.
Timeline:	April 2005 - December 2005.
Obstacles:	Possible delays due to shortage of researchers / students.
Collaborators:	Tertiary institutions and stakeholders.
Measurable Outcomes:	Completed literature study.

Action Step 2:
Erect nesting boxes as per proven methodology and monitor the effectiveness.

Resources Needed:	Human resources and funding.
Responsibility:	EWT / GHWG.
Timeline:	July 2006.
Obstacles:	Funding.
Collaborators:	Stakeholders, sponsors, raise finance through “adopt-a-nest” strategy.
Measurable Outcomes:	Erected nest boxes.

Solution 3

Closer liaison of EWT / GHWG with law enforcement agencies to ensure application of the law regarding deforestation and its effect on Ground Hornbills.
Minimum: Establish contact between mentioned parties.
Maximum: Successful collaboration and effective law enforcement.

Action Step 1:
Creating awareness amongst law enforcement agencies on all levels of governance and maintain continued liaison.

Resources Needed:	Law enforcement agencies.
Responsibility:	EWT / GHWG.
Timeline:	June 2005 onwards.
Obstacles:	Resistance and apathy.
Collaborators:	NGOs and media.
Measurable Outcomes:	Meaningful dialogue.

Passed on to Education Working Group

Solution 4

Mitigate reduction in potential nest sites.

- Investigate alternative energy sources and promote their use (only to be implemented if the reduction of trees in rural areas is proven to have caused a decrease in nesting and roosting sites).
- Outreach programmes focusing on rural and farming communities emphasising the importance of the protection of large and potential nesting trees for the survival of Ground Hornbill and further providing incentives to maintain nesting areas by declaring them areas of significance, e.g. plaques.

Minimum: Identify the communities to be effected
Maximum: Implement programmes

PROBLEM STATEMENT 6
DENSIFICATION OF THE WOODY COMPONENT OF GROUND HORNBILL PREFERRED HABITAT AS WELL AS AFFORESTATION OF GRASSLANDS.

Solution 1

Search for existing data on aspects specifically related to Ground Hornbill habitat conservation. Research has been done regarding management practises that may be applicable to hornbill conservation. Research such as the judicious use of fire, bush control etc.
Minimum: Initiate a literature review.
Maximum: Compile a database of published and unpublished material.

Action Step 1:
Conduct a complete literature review.

Resources Needed:	Access to published and unpublished data, human resources and funding.
Responsibility:	Percy FitzPatrick Institute and / or other tertiary institutions.
Timeline:	April 2005 - December 2005.
Obstacles:	Possible delays due to shortage of researchers / students.
Collaborators:	Tertiary institutions and stakeholders.
Measurable Outcomes:	Completed literature study.

Solution 2

Research to establish causes and extent of densification e.g. increased carbon levels and poor land management practises such as overgrazing.

Minimum: Review past completed research.
Maximum: Mapping areas of densification concern.

Action Step 1:
Conduct a research project on causes and extent of densification as a possible threat to Ground Hornbill habitat.

Resources Needed:	Human resources and funding.
Responsibility:	Percy FitzPatrick Institute and / or other tertiary institutions.

Timeline: January 2006 - December 2008.
Obstacles: Availability of suitable students and funds.
Collaborators: Tertiary institutions and stakeholders.
Measurable Outcomes: Clarification on the role played by densification within Ground Hornbill habitat.

Solution 3

Re-establish suitable habitat using fire / bush clearing. The implementing of sound management practises so that current hornbill habitats can be conserved (possible poverty relief projects).
Minimum: Listing past and existing programmes dealing with fire and bush clearing.
Maximum: Evaluating the above as to which was the most effective and apply to areas of concern in order to re-establish suitable habitat.

Action Step 1:
Prioritise optimum areas to implement sound management practises.

Resources Needed: Human resources and funding.
Responsibility: EWT / GHWG.
Timeline: 2009 onwards (after research has been completed).
Obstacles: Opposition from stakeholders.
Collaborators: Stakeholders.
Measurable Outcomes: Work plan.

Action Step 2:
Implementation of work plan

Resources Needed: Human resources and funding.
Responsibility: EWT / GHWG.
Timeline: 2009 onwards (after research has been completed).
Obstacles: Opposition from stakeholders.
Collaborators: Stakeholders and poverty relief.
Measurable Outcomes: Cleared land.

Action Step 3:
Monitoring

Resources Needed: Human resources and funding.
Responsibility: EWT / GHWG.
Timeline: Ongoing.
Obstacles: Funding and human capacity.
Collaborators: Stakeholders and poverty relief.
Measurable Outcomes: Cleared land.

PROBLEM STATEMENT 7
CHANGES IN HABITAT COULD HAVE RESULTED IN INCREASED TERRITORY SIZES AND MORE COMPETITION BETWEEN AND WITHIN GROUPS FOR AVAILABLE HABITAT.

Solution 1

Establish whether habitat changes have increased territory sizes and competition. It needs to be determined whether the carrying capacity of available habitat is decreasing.

Minimum: Undertake a current evaluation of the existing habitat coupled with the existing Ground Hornbill population as well as looking at historical data.
Maximum: Undertaking a medium term study of the habitat change in a recorded area coupled with population density.

Action Step 1:
Conduct a literature review

Resources Needed: Access to published and unpublished data, human resources and funding.
Responsibility: Percy FitzPatrick Institute and / or other tertiary institutions.
Timeline: April 2005 - December 2005.
Obstacles: Possible delays due to shortage of researchers / students.
Collaborators: Tertiary institutions and stakeholders.
Measurable Outcomes: Completed literature study.

Action Step 2:
Conduct appropriate research project

Resources Needed: Human capacity and funding.
Responsibility: Percy FitzPatrick Institute and / or other tertiary institutions.
Timeline: January 2006 - December 2008.
Obstacles: Availability of suitable students and funds.
Collaborators: Tertiary institutions and stakeholders.
Measurable Outcomes: A published research project.

PROBLEM STATEMENT 8
LOW POPULATION NUMBERS AND LOW DENSITIES WITHIN THEIR LIMITED DISTRIBUTION OVER A VAST AREA RESULT IN DIFFICULTIES IN OBTAINING DATA.

Solution 1

Start an awareness campaign to observe Ground Hornbills in areas of concern.
Minimum: Awareness campaign.
Maximum: Positive results from an evaluation on awareness campaign.

Action Step 1:
Role out of awareness campaign (with specific reference to Limpopo River Valley).

Resources Needed: Human capacity, funding and promotional printed material.
Responsibility: EWT / GHWG.
Timeline: April 2005 onwards.
Obstacles: Logistics, funds and non-resident landowners.
Collaborators: Provincial conservation authorities and stakeholders.
Measurable Outcomes: Increased awareness amongst landowners in the areas concerned.

Solution 2

Involve more stakeholders in gathering information (training of farm owners / labourers where Ground Hornbills occur to assist in gathering sound data).
Minimum: Identify and contact stakeholders.
Maximum: Many suitably trained stakeholders actively gathering information.

Action Step 1:
Identify interested people through an awareness campaign as mentioned above.

Resources Needed:	Human resources and funding.
Responsibility:	EWT / GHWG.
Timeline:	Run concurrently with awareness campaign.
Obstacles:	Logistics, funds, resistance and / or non-resident landowners.
Collaborators:	Provincial conservation authorities and stakeholders, NGOs, Tertiary institutions and bird clubs.
Measurable Outcomes:	Committed volunteer to gather information.

Action Step 2:
Train volunteers to effectively gather information.

Resources Needed:	Human resources, funding.
Responsibility:	EWT / GHWG.
Timeline:	Run concurrently with awareness campaign.
Obstacles:	Logistics, funds, resistance and / or non-resident landowners.
Collaborators:	Provincial conservation authorities and stake holders, NGOs, tertiary institutions and ADU.
Measurable Outcomes:	Equip and trained volunteers.

Action Step 3:
Ongoing monitoring and coaching of volunteers.

Resources Needed:	Human resources and funding.
Responsibility:	EWT / GHWG.
Timeline:	Run concurrently with awareness campaign.
Obstacles:	Logistics, funds, resistance and / or non-resident landowners
Collaborators:	Provincial conservation authorities and stakeholders, NGOs and tertiary institutions.
Measurable outcomes:	Sustained interest and quality data.

Action Step 4:
Process data and provide feedback to volunteers.

Resources Needed:	Data processing: ADU.
Responsibility:	EWT / GHWG.
Timeline:	Run concurrently with awareness campaign.
Obstacles:	Logistics, funds, resistance and / or non-resident landowners.
Collaborators:	Provincial conservation authorities and stakeholders, NGOs and tertiary institutions.
Measurable Outcomes:	Processed usable data, annual report of EWT / GHWG and newsletters to volunteers.

Point moved to Biology Working Group

Solution 3
More use of technology e.g. satellite tracking and any other applicable technology.

PROBLEM STATEMENT 9
PEOPLE'S PET THEORIES CAN CLOUD OR DERAIL VALID CONSERVATION PROGRAMMES

Solution 1

Protocols should reflect that only theories that had been tested by scientific research can be implemented. All unproven theories need to be verified.

Action Step 1:
Develop and comply with protocol developed for Ground Hornbill work.

Resources Needed:	Funding.
Responsibility:	EWT / GHWG.
Timeline:	August 2005 - ongoing
Obstacles:	Lack of compliance to protocol.
Collaborators:	All stakeholders.
Measurable Outcomes:	A scientifically researched protocol.

PROBLEM STATEMENT 10
CLIMATIC CHANGES THAT RESULT IN CHANGES IN HABITAT COMPOSITION.

Solution 1

Identifying areas that are less likely to be affected by climatic change, and utilise these as prime habitat areas.

Action Step 1:
Conduct a literature review.

Resources Needed:	Access to published and unpublished data, human resources and funding.
Responsibility:	EWT / GHWG.
Timeline:	April 2005 - December 2005.
Obstacles:	Possible delays due to shortage of researchers / students.
Collaborators:	Appropriate tertiary institutions.
Measurable Outcomes:	Completed literature study.

Action Step 2:
Conduct appropriate research project.

Resources Needed:	Human Resources and funding.
Responsibility:	EWT / GHWG.
Timeline:	January 2006 - December 2008.
Obstacles:	Conflict of scientific opinion.
Collaborators:	Appropriate tertiary institutions.
Measurable Outcomes:	Identified areas least affected by climatic change.

Solution 2

An understanding of processes affecting climate change is important e.g. desertification.
Minimum: Analyse historical data.
Maximum: Monitoring climate and habitat to determine prime habitat areas.

Action Step 1:
Conduct a literature review.

Resources Needed:	Access to published and unpublished data, human resources, funding.
Responsibility:	EWT / GHWG.
Timeline:	April 2005 - December 2005.
Obstacles:	Possible delays due to shortage of researchers / students.
Collaborators:	Appropriate tertiary institutions.
Measurable Outcomes:	Completed literature study.

PROBLEM STATEMENT 11
LACK OF AWARENESS OF THE DISAPPEARANCE OF THE SAVANNA BIOME.

Solution 1
Create a “song-and-dance” about disappearance of savanna biome.

Action Step 1:
Create and implement an awareness campaign focussing on Ground Hornbill as a flagship species for the savanna biome.

Resources Needed:	Human resource (language), music and dance skills, conservation NGOs working in savanna.
Responsibility:	EWT / GHWG.
Timeline:	December 2005 onwards.
Obstacles:	Resistance to change, perceptions, language, funding / sponsorships.
Collaborators:	Department of Arts and Culture, Young Minds Drama Group, Theatre for Africa, DEAT, Water Affairs, game industry, NGOs WESSA, EWT etc.
Measurable Outcomes:	Successful awareness campaign contributing to survival of the savanna biome.

Education, Awareness and Legislation Working Group Report

WORKING GROUP PARTICIPANTS

1. Edward Farrell (Conservation Leadership Group – EWT)
2. Sindephi Spogter (Traditional Healer)
3. Reuben Ngwenya (National Zoological Gardens)
4. Keith Paterson (Mondi Shanduka)
5. Ann Turner (Ground Hornbill Project Mabula)
6. Delicia Gunn (Mpumalanga Parks Board)
7. Doug Burden (Mondi Shanduka)

INTRODUCTION

Much good work has already been done by the Mabula Ground Hornbill Project to promote the conservation of the Southern Ground Hornbill. This work has however been confined to a relatively small section of the key stakeholder public and needs to be extended to many other stakeholder groups.

The PHVA Education, Awareness and Legislation Working Group therefore focussed its attention on identifying further stakeholder communities and addressing issues around legislation and education leading to action plans which when implemented will positively increase the vital public awareness which may be the prime factor in stopping the decline of the species.

PROBLEM STATEMENTS

PROBLEM STATEMENT 1

There is a general lack of awareness of the threats facing Ground Hornbills in the general public, but specifically in key stakeholder communities where Ground Hornbills historically occurred and in areas in which they are now in decline:

- Municipal, national and provincial government departments;
- Trade Unions;
- Rural communities;
- Landowners, farmer's associations, farm managers, local workers;
- CBOs, NGOs; and
- Traditional leaders and traditional healers.

Solution 1

Information dissemination, for example the Mabula type information posters / brochures to be extended to schools / clubs / community organisations in relevant Ground Hornbill areas (still to be identified) and listed. Awareness programmes need to be expanded using relevant methods aimed at specific target communities as in the table below:

	Word of mouth	Print / News Letters / Advert	Radio	TV / Video	Official Representative	Exhibit / shows	PRA
1. Rural Communities	x	x	x				x
2. Municipal Government					x	x	
3. Traditional Healers	x				x		x
4. Landowners, Farmers Associations, Farm Workers	x	x		x		x	
5. CBOs	x	x			x	x	x
6. NGOs	x	x	x			x	
7. Provincial Government					x	x	
8. National Government					x		
9. Trade Unions	x	x			x		

PRA = Participatory Rural Appraisal

Action Step 1:
Continue with and expand on existing information campaign: produce material.

Resources Needed: Literature (posters) translated into vernacular: Xhosa, Zulu, Shangaan, North Sotho and Afrikaans.
Brochures (English and Afrikaans).
Responsibility: Southern Ground Hornbill Project: Mabula.
Timeline: February 2004 to August 2005.
Obstacles: Finance and translators.
Collaborators: EWT / CLG
Measurable Outcomes: Publications ready for distribution by August 2005.

Action Step 2:
Distribute printed material to rural communities, traditional leaders and healers, landowners, CBOs, NGOs and Trade Unions.

Resources Needed: Map of Ground Hornbill distribution both past and present, localities (map) for schools as basis for distribution and distribution network.
Responsibility: Mabula.
EWT / CLG
Timeline: September 2005 - September 2007.
Obstacles: Lack of collaboration.
Collaborators: Department of Education (National): schools, National Conservancies Association, landowners, EWT / CLG, BEEP, municipalities and WESSA.
Mabula field officer, BirdLife SA / local bird clubs, provincial conservation authorities, zoos, Southern Ground Hornbill Action Group, organisers of exhibitions and shows
Measurable Outcomes: **Minimum:** Material to 50% of above list.
Maximum: 100% distribution

Solution 2

Expand media (printed media, radio, television) awareness and coverage locally, nationally and internationally.

Action Step 1:
Ensure media coverage (newspapers, magazines, radio and TV)

Resources Needed:	Press releases.
Responsibility:	EWT / GHWG. Mabula manager.
Timeline:	Ongoing.
Obstacles:	Lack of topical news and therefore interest from media (capacity: staff)
Collaborators:	Local radio stations, regional newspapers, magazines, local and international TV
Measurable Outcomes:	Amount of media coverage / year.

Solution 3

Access municipalities' IDPs and educate and motivate for inclusion of Ground Hornbill conservation issues at the local and district level

Action Step 1:
Contact and workshop with local and provincial government officials with regards to the integration of the Ground Hornbill PHVA action plan into IDPs in Ground Hornbill areas.

Resources Needed:	Contact details of above personnel and PHVA Workshop report.
Responsibility:	EWT / GHWG in coordination with stakeholders.
Timeline:	By October 2005.
Obstacles:	Capacity issues with conservation authorities.
Collaborators:	Provincial conservation authorities, South African Local Government Association (SALGA).
Measurable Outcomes:	PHVA issues addressed in IDPs.

Solution 4

Project endorsement through community engagement, includes farmers, rural communities, conservancies and other land-use associations where talks / exhibits can take place. The use of SSGs (Site Support Groups) at known roosting / nesting / foraging sites, needs to be set up within the communities described above.

Action Step 1:
Produce / assemble mobile exhibit material for use at exhibitions / shows.

Resources Needed:	Exhibit materials (posters, videos, "Shingwedzi", etc.)
Responsibility:	EWT / GHWG. Mabula.
Timeline:	March 2005 – ongoing.
Obstacles:	Manning capacity, storage space and transport.

Collaborators: Exhibit organizers e.g.: WESSA, conservancies, farmers associations and zoos.
Measurable Outcomes: Number of exhibits / year.

Action Step 2:
Use theatrical groups, mobile videos, high profile (celebrity) endorsement to further conservation awareness in communities.

Resources Needed: Drama groups (e.g. Haenertsburg Young Minds Drama Group), relevant script, mobile monitor equipment, videos and celebrity.
Responsibility: Mabula.
Timeline: March 2005 – ongoing.
Obstacles: Logistics.
Collaborators: EWT / CLG, corporate business and traditional structures
Measurable Outcomes: Number of performances per year and annual review.

Action Step 3:
Ensure correct engagement of rural community structures through the PRA process.

Resources Needed: Skilled facilitators.
Responsibility: EWT / GHWG in coordination with stakeholders.
Timeline: Immediate (KwaZulu-Natal) and ongoing.
Obstacles: Lack of skilled facilitators and trainers.
Collaborators: Farmer support group (University of KwaZulu-Natal), tribal authorities, Ezemvelo KwaZulu-Natal Wildlife and traditional healers.
Measurable Outcomes: Number of PRA meetings per year.

Solution 5

Recognition of good land-use practice through incentivised custodianship programme.

Action Step 1:
Develop a set of criteria to regulate the awarding of 'Custodian Boards" for responsible Ground Hornbill conservation.

Resources Needed: Other working groups criteria and PHVA Action Plan.
Responsibility: EWT / GHWG.
Timeline: July 2005 - ongoing.
Obstacles: Landowner buy-in.
Collaborators: Other EWT Working Groups, farmer's associations and rural community organisations.
Measurable Outcomes: Audited adherence to criteria.

PROBLEM STATEMENT 2
ENVIRONMENTAL EDUCATION AND COMMUNITY SUPPORT IS RARELY FOCUSSED / RELEVANT OR PROACTIVE AND SHOULD INCLUDE COMMUNITY 'BUY-IN'. THIS IS DUE TO A LACK OF UNDERSTANDING OF AND RESPECT FOR LOCAL CULTURAL AND TRADITIONAL BELIEFS AND VALUES. FURTHERMORE, IT IS NOT ALWAYS BASED ON CURRENT INFORMATION REGARDING THE THREATS FACING GROUND HORNBILLS.

Solution 1

Identify relevant schools and communities to target (using Ground Hornbill distribution information).

Action Step 1:
See Problem 1, Solution 1, and Action Step 2 with regard to resources, collaborators and measurable outcomes: list of schools in relevant areas.

Solution 2

Access the latest information and findings on savanna biome and Ground Hornbill issues.

Action Step 1:
Proactively communicate on latest savanna biome (including Southern Ground Hornbill) threats and issues with biologists and monitors to ensure that the latest 'best-man-practice' options are being discussed with target groups.

Resources Needed: Universities and research community.
Responsibility: EWT / CLG.
Timeline: March 2005 - ongoing.
Obstacles: Communication.
Collaborators: Research community.
Measurable Outcomes: Information.

Solution 3

Integrate environmental education programmes, on Ground Hornbills and other associated savanna species conservation into school curriculum, in cooperation with teachers, Departments of Education, provincial conservation authorities and NGOs (EWT / CLG, BEEP, WESSA – Eco-Schools and Share-Net).

Action Step 1:
Incorporate Ground Hornbill information into curriculum, which is aligned with Outcomes-Based Education requirements for Department of Education.

Resources Needed: Outcomes-Based Education curriculum.
Responsibility: EWT / CLG.
Timeline: July 2005.
Obstacles: Time and capacity.
Collaborators: WESSA, Share-net, Eco-schools, BEEP, zoos and museums.
Measurable Outcomes: Curriculum containing Ground Hornbill information.

Solution 4

Workshop environmental education project with a committee of community members to ensure community input and buy-in before project commences. Include community leaders to seek their endorsement of education projects.

Action Step 1:
Refer Problem 1, Solution 4, and Action 3 with regard to PRA process.

Solution 5

Make environmental education community based by engaging all members of community through formation of eco-clubs, conservation action programmes, poster competitions, etc.

Action Step 1:
Develop and start environment / eco-projects in communities in association with the PRA process.

Refer to Problem 1, Solution 4, Action Step 3.

Solution 6

Actively develop and engage in community support projects.

Action Step 1:

Resources Needed:	Facilitators for community project support.
Responsibility:	Community driven.
Timeline:	Ongoing.
Obstacles:	Lack of community 'buy-in'.
Collaborators:	EWT / GHWG, EWT / CLG and businesses.
Measurable Outcomes:	Success of projects.

PROBLEM STATEMENT 3
THERE IS CONFLICTING LEGISLATION, LACK OF ENFORCEMENT AND IGNORANCE ON THE PART OF NATIONAL / PROVINCIAL AND LOCAL AUTHORITIES, OR LEGISLATION PERTAINING TO GROUND HORNBILL AND RELATED CONSERVATION REQUIREMENTS – ALL OF WHICH HAS RESULTED IN A LACK OF PUBLIC KNOWLEDGE AND INVOLVEMENT.

Solutions 1

Have Ground Hornbill registered as a species requiring "special management protection" with appropriate local authorities (Municipality IDPs and provincial conservation authorities).

Action Step 1:
Ensure that the product of this workshop is incorporated into the IDP of relevant municipalities.

Resources needed:	Ground Hornbill PHVA Workshop report, time and staff.
Responsibility:	EWT / GHWG.
Timeline:	Immediate and ongoing.
Obstacles:	Lack of capacity amongst local authorities.
Collaborators:	All relevant state authorities and other interested parties.
Measurable Outcomes:	Ground Hornbill Action Plan incorporated into IDPs.

Solution 2

Lobby and educate officials (SAPS / magistrates / public prosecutor) regarding enforcing current legislation pertaining to Ground Hornbill conservation.

Action Step 1:
Partner with all local SAPS stations / magistrates and prosecutors offices to ensure understanding and implementation of regulations / ordinances / acts regarding conservation of rare, threatened and endangered species in Ground Hornbill areas.

Resources: Relevant acts / ordinances.
Responsibility: EWT / GHWG and local coordinators.
Timeline: Immediate and ongoing.
Obstacles: Intellectual capacities of authorities.
Collaborators: SAPS, judiciary, provincial conservation authorities and other agents working to same ends.
Measurable Outcomes: Successful prosecutions.

Action Step 2:
Make authorities aware of legal non-compliance with regard to rare, threatened and endangered species conservation, each time they occur.

Resources Needed: Cooperation of NGOs, copies of all relevant environmental legislation
Responsibility: EWT / GHWG (Local chapters).
Timeline: Immediate – ongoing.
Obstacles: Lack of manpower and ignorance of legislation.
Collaborators: NGOs, interested groups, conservancies and Ezemvelo KwaZulu-Natal Wildlife (Honorary officers)
Measurable Outcomes: Successful prosecutions.

Solution 3

Campaign for a uniform classification of Ground Hornbill in all provinces across all areas they occur.

Action Step 1:
Approach and supply DEAT with information / analysis on Ground Hornbill research, with intention of clarifying its status.

Resources Needed: PHVA Workshop Report (Vortex model), National Environmental Management: Biodiversity Act
Responsibility: EWT / GHWG.
Timeline: June 05 – Dec 05
Obstacles: Lack of information, Institutional capacity.
Collaborators: DEAT (local and national), provincial conservation authorities.
Measurable Outcomes: Change in status.

Action Step 2:
Communicate and promote opportunities legislation provides, and so assist landowners in utilising these opportunities.

Responsibility: EWT / GHWG; EWT KwaZulu-Natal Biodiversity Programme; i.e. all principal coordinators of EWT / GHWG and other EWT working groups where possible.
Resources: Time; information and distribution.
Timeline: Commence immediately - ongoing.
Obstacles: Access to legislation and relevant forums.
Collaborators: Provincial conservation authorities; appropriate interest groups; local government and DEAT.
Measurable Outcomes:

Solution 4

Identify the need for increased / sounder legislation for the protection of Ground Hornbills and their required habitat.

Action Step 1:
Monitor and identify gaps / shortcomings in existing legislation pertaining to Ground Hornbills.

Responsibility:	Local EWT / GHWG coordinators.
Resources:	Time, information and legislation.
Timeline:	Immediate and ongoing.
Obstacles:	Access to information and legislation.
Collaborators:	State prosecutors; EWT / GHWG members and interested and / or affected parties
Measurable Outcomes:	List of shortcomings and programme to address

Solution 5

Ensure that the product of this workshop is submitted to DEAT, local government; BirdLife SA; local provincial conservation authorities – as part of a 'best management practice'

Action Step 1:
The product of this workshop to be workshopped with the above mentioned groups as well as relevant local and district municipalities.

Responsibility:	EWT / GHWG
Resources:	Time and access to the National Environmental Management: Biodiversity Act
Timeline:	Immediate
Obstacles:	Manpower
Collaborators:	Interested and affected parties, including Provincial Conservation Honorary Officers
Measurable Outcomes:	Ground Hornbill National action plan as part of each relevant municipal IDP.

PROBLEM STATEMENT 4
THERE IS NO CLEAR MEASURE TO MONITOR THE EFFECTIVENESS OF THE EDUCATION AND AWARENESS INTERVENTIONS TAKEN TO DATE TO CONSERVE GROUND HORNBILLS.

Solution 1

Set up a protocol to monitor each aspect of Ground Hornbill conservation in South Africa, and ensure its implementation.

Action Step 1:
Implement a "pre-and-post intervention survey" to monitor the level of awareness in key stakeholder communities.

Resources Needed:	Survey document and checklist.
Responsibility:	EWT / GHWG.
Timeline:	Immediate – ongoing.
Obstacles:	Sampling logistics.
Collaborators:	Universities, corporate businesses (sponsorship).
Measurable Outcomes:	Responses to survey.

Threats Working Group Report

WORKING GROUP PARTICIPANTS

1. Dee de Waal (Mabula Ground Hornbill Project)
2. Antony Collett (Shamwari Game Reserve)
3. Thomson Phakalane (National Zoological Gardens)
4. Derek Engelbrecht (University of the Limpopo)
5. Mark Jones (Umgeni River Bird Park)
6. Stephen van der Spuy (Johannesburg Zoological Gardens)
7. Christie Potgieter (Singisi Forest Products)
8. Tim de Jongh (DEAET Eastern Cape)
9. Scott Ronaldson (Timbavati Private Nature Reserve)

INTRODUCTION

Due to the habits, habitat and distribution of the Ground Hornbill they come into conflict with man and become vulnerable to a wide range of threats both natural and human inflicted. Evidence suggests that these threats are responsible for the decline of Ground Hornbill numbers. The importance of gathering information and supplementing the current data cannot be over emphasised. The current database is made up of people's personal encounters with a variety of causes of mortality amongst Ground Hornbill.

PROBLEM STATEMENTS

PROBLEM STATEMENT 1
THE LACK OF KNOWLEDGE OF THE THREATS RELATED TO MORTALITIES ACROSS THE DIFFERENT AGE GROUPS.

Solution 1

Create a mortality database.

Action Step 1:
Create a computerised database that records all past and future mortalities.

Resources Needed:	Professional time and personnel (IT equipment, email, telephone and fax).
Responsibility:	EWT / GHWG.
Timeline:	Commence looking at it in February 2005, commencing in April 2005 and continue on an on-going basis.
Obstacles:	Obtaining data will be difficult due to vast and often remote areas. Some difficulty may be experienced in obtaining data from some collaborators.
Collaborators:	National parks, provincial conservation authorities, Avian Demography unit, BirdLife SA, EWT / SACWG, private nature reserves, provincial nature reserves, Eskom, Telkom, private bird clubs / societies, NGOs and Honorary Rangers
Measurable Outcomes:	Key threats which can be addressed by a proper management programme.

PROBLEM STATEMENT 2
PRIMARY AND SECONDARY POISONING MAY CONTRIBUTE TO THE OBSERVED REDUCTION IN GROUND HORNBILL.

Solution 1

An education and awareness campaign to promote the responsible use of poison.

Action Step 1:
Liaise with the Poison Working Group (EWT / PWG).

Resources Needed:	Professional time and personnel (IT equipment, email, telephone and fax).
Responsibility:	EWT / GHWG.
Timeline:	February 2005 and ongoing.
Obstacles:	Ignorance and resistance to change current negative practices.
Collaborators:	EWT / PWG, chemical companies, landowners, provincial conservation agencies and DEAT.
Measurable outcomes:	A measurable drop in mortality rates caused by poison.

Solution 2

Promote the use of environmentally responsible / acceptable poisons.

Action Step 1:
Liaise with the EWT / PWG.

Resources Needed:	Professional time and personnel (IT equipment, email, telephone and fax).
Responsibility:	EWT / GHWG.
Timeline:	February 2005 and ongoing
Collaborators:	EWT / PWG, chemical companies, landowners, provincial conservation agencies and DEAT
Measurable outcomes:	The responsible use of acceptable poisons promoted by the EWT / PWG and fewer reports of poisonings.

PROBLEM STATEMENT 3
DUE TO THEIR NATURAL CURIOSITY, TERRITORIAL AGGRESSION AND HUMAN ENCROACHMENT INTO THEIR TERRITORIES AND THEIR TENDENCY TO BREAK WINDOWS THEY ARE BEING SHOT AND PERSECUTED.

Solution 1

Education and awareness campaign to encourage tolerance and a working relationship with landowners and the public in general.

Action Step 1:
Establish a helpline and advertise to the public that they may phone for general information and advice regarding Ground Hornbill.

Resources Needed:	Professional time and personnel (IT equipment, email, telephone and fax). Require more pamphlets and posters for distribution.
Responsibility:	Mabula.
Timeline:	Already in progress but requires further promotion.
Obstacles:	Limited personnel, people may not be prepared / capable of paying for the phone call and not having access to phones.
Collaborators:	50/50 SABC TV, Sasol, bird clubs, private and provincial reserves, education centres, zoos, museums and other media e.g. radio and TV.
Measurable outcomes:	Data gathered from incoming calls.

Action Step 2:
Distribute and create awareness of the protocol outlining the mitigation measures for Ground Hornbills breaking windows, developed by the Mabula Ground Hornbill Project.

Resources Needed:	IT equipment, digital camera, printing company (funding).
Responsibility:	Mabula.
Timeline:	Start April 2005 - ongoing.
Obstacles:	Funding. Logistics of distribution and non-conformers
Collaborators:	Modek (polycarbonate glass), Alnet (shade cloth), birding clubs, associates of the Mabula, Department of Agriculture, provincial conservation agencies and DEAT.
Measurable outcomes:	Decrease in complaints and bird mortality.

Solution 2

Encourage innovative ways to prevent window breaking e.g. polycarbonate window panes (Modek), shade cloth shutters, painting windows, stainless steel mirrors and wire on nails.

Action Step 1:
Practical training for key role players on window breaking solutions

Resources Needed:	People's time.
Responsibility:	Mabula.
Timeline:	February - December 2005.
Obstacles:	Logistics in terms of distances and the cost of getting people that need training trained.
Collaborators:	SA Wildlife College syllabus, DEAT, Department of Agriculture, provincial conservation agencies, all potential trainees that can reach out to the general public, farmers and Percy FitzPatrick Institute.
Measurable outcomes:	Decrease in the number of windows broken and the number of courses requested and run.

Solution 3

Catch and relocate "problem groups" which are in danger of persecution due to continuing conflict between these birds and people. This solution must only be used as a last resort.

Action Step 1:
Develop and establish a catch and relocate protocol.

Resources Needed:	Professional time, personnel, IT equipment, email, telephone and fax.
Responsibility:	EWT / GHWG.
Timeline:	March 2005 - March 2006.
Obstacles:	Lack of knowledge on capture methods and logistics. Suitable "safe" areas for release of captured "problem groups".
Collaborators:	Mabula, zoos, Percy FitzPatrick Institute and rehabilitation centres.
Measurable outcomes:	Protocol printed out and being distributed.

PROBLEM STATEMENT 4
DECLINE IN THE NUMBERS OF GROUND HORNBILL DUE TO CULTURAL USES.

Solution 1

Conduct research on the extent of the use of Ground Hornbill in the cultural framework, consulting traditional healers and dealers

Action Step 1:
Literature search on the extent of use pertaining to traditional trade and consultation with Traditional Healers Association.

Resources Needed:	Personnel, IT equipment, transport and fuel costs and translator.
Responsibility:	University of Limpopo – Derek Engelbrecht.
Timeline:	March 2005 to March 2006.
Obstacles:	Lack of information sharing (secrecy), historical data and bridging of language gaps.
Collaborators:	Traditional Healers Association – Sindephi Spogter, Alan Kemp, Mabula, cultural departments within universities, local municipalities and provincial conservation agencies.
Measurable outcomes:	A report on the findings.

Solution 2

Education and awareness campaign to highlight the plight of the Ground Hornbill.

Action Step 1:
Utilise information gathered from the research project to target key figures (people) involved in the usage of Ground Hornbill.

Resources Needed:	Translator and travelling costs.
Responsibility:	EWT / GHWG.
Timeline:	April 2006 to ongoing.
Obstacles:	Secrecy on certain aspects of the market, finding the collectors and market. Distance between markets.
Collaborators:	Mabula, Traditional Healers Association, local municipalities, provincial conservation agencies and SA Police Services
Measurable outcomes:	Follow-up Ground Hornbill body parts being used for cultural purposes.

Dismissed as a solution

Solution 3

Implement control permit system to regulate "harvesting" for cultural uses of birds.

Action Step 1:
The group has discussed this again and has come to the decision that this should not occur at all. The justification for this is that hand-reared birds do not possess the same "power" as wild birds and the same was tried with the vultures and was unsuccessful.

PROBLEM STATEMENT 5
DECLINE IN NUMBERS DUE TO MOTOR VEHICLE COLLISIONS WITH GROUND HORNBILL.

Solution 1

Road signs indicating the presence of Ground Hornbill as well as setting speed limits in appropriate areas

Action Step 1:
Identify key areas where signs are required and have the signs manufactured

Resources Needed:	Professional time, personnel, IT equipment, email, telephone, fax, funding and personnel time.
Responsibility:	EWT / GHWG.
Timeline:	June 2005 to June 2007.
Obstacles:	Not receiving the required funding and the laborious process of getting the required authority from the different provinces.
Collaborators:	Signage company, Department of Roads, Kruger National Park manager, reserve managers and district and local municipalities.
Measurable outcomes:	Number of signs erected and a decrease in road fatalities.

Action Step 2:
Creating awareness with the general public to the dangers of feeding Ground Hornbill in the wild

Resources Needed:	Funding, personnel time, professional time, personnel, IT equipment, email, telephone and fax.
Responsibility:	EWT / GHWG.
Timeline:	May 2005 and ongoing.
Obstacles:	Lack of funding and non-compliance
Collaborators:	SANParks, private game reserve and signage company.
Measurable outcomes:	Number of signs produced, number of signs erected and number of reserve and parks complying.

Solution 2

Pamphlets and car sticker campaign at the gates of protected areas.

Action Step 1:
Design and distribute pamphlets and stickers to create awareness with the general public with regard to Ground Hornbill road deaths

Resources Needed: Funding and personnel.
Responsibility: EWT / GHWG.
Timeline: March 2005 - March 2006.
Obstacles: Funding and difficulty in distribution (logistics).
Collaborators: Signage company, designers and Parks and reserve personnel.
Measurable outcomes: Reduced fatalities and injuries.

PROBLEM STATEMENT 6
THE LONGEVITY AND CHARISMATIC NATURE OF THE GROUND HORNBILL RESULT IN THEM BEING A SOUGHT AFTER SPECIES BY ANIMAL TRADERS AND COLLECTORS, ETC.

Solution 1

Research into the extent of the legal and illegal trade, as well as the source and dispersal of Ground Hornbill in the trade. Data obtained could raise the species conservation status.

Action Step 1:
Gather and monitor information on the legal and illegal trade of Ground Hornbill.

Resources Needed: Professional time, personnel, IT equipment, email, telephone and fax.
Responsibility: EWT / GHWG.
Timeline: February 2005 February 2006.
Obstacles: Difficulty in obtaining the information.
Collaborators: Importers / exporters, Department of Customs and Excise, zoos, bird parks, pet shops / dealers, provincial conservation agencies, DEAT and TRAFFIC.
Measurable outcomes: A report on the status of legal and illegal trade.

Solution 2

Better monitoring and control of birds in the trade.

Action Step 1:.
Inserting microchips in captive Ground Hornbills

Resources Needed: Transponders and relevant personnel.
Responsibility: EWT / GHWG.
Timeline: February 2005 and ongoing.
Obstacles: Cost, lack of personnel to reach all birds and obtaining the specialised equipment.
Collaborators: Trained personnel, bird parks, zoos, breeders, state vets and private vets.
Measurable outcomes: The actual number of microchips inserted and more data obtained on the trade in Ground Hornbills.

Action Step 2:
Ensure better monitoring and control pertaining to the trade of Ground Hornbills.

Resources Needed: Professional time, personnel, IT equipment, email, telephone and fax.

Responsibility:	EWT / GHWG.
Timeline:	March 2005 - March 2006.
Obstacles:	Lack of cooperation and information pertaining to the illegal trade of birds.
Collaborators:	State vets, private vets, provincial conservation authorities, DEAT, Customs and Excise officials and SAPS.
Measurable outcomes:	More info on the trade of Ground Hornbills.

Solution 3

Develop a protocol on the captive management and trade in Ground Hornbills.

Action Step 1:
Research and write a protocol setting guidelines for captive management, quarantine requirements, health checks and sourcing all information from relevant parties regarding trade

> Also refer to the biology section of this document for overlapping statements

Resources Needed:	Professional time, personnel, IT equipment, email, telephone and fax.
Responsibility:	EWT / GHWG.
Timeline:	March 2005 - September 2005.
Obstacles:	Disagreement amongst the collaborators.
Collaborators:	DEAT, Provincial conservation agencies, Percy FitzPatrick Institute, bird parks, breeders, zoos
Measurable outcomes:	A complete policy on the captive management and trade in Ground Hornbills.

Solution 4

Education and awareness campaign to understand the plight of the Ground Hornbill

Action Step 1:
A media release to highlight the issues concerning the trade in Ground Hornbills

Resources Needed:	Professional time, personnel, IT equipment, email, telephone and fax.
Responsibility:	EWT / GHWG.
Timeline:	December 2005 to Jul 2006.

*Can only be done once the extent of the trade has been researched (Solution 1)

Obstacles:	Lack of cooperation from media / press.
Collaborators:	Newspapers (major and local), 50/50 SABC TV and relevant magazines e.g. *Birds and Birding*, hobbyist magazines, TV news.
Measurable outcomes:	A noticeable decrease in trade and cooperation and information from those parties involved in trade.

PROBLEM STATEMENT 7
DUE TO THEIR LIMITED DISTRIBUTION, DISEASE COULD RESULT IN A MAJOR DECLINE IN GROUND HORNBILL NUMBERS.

Solution 1

Research into normal biological values e.g. blood parameters, parasite load, as a future reference

Action Step 1:
Collection of samples

Resources Needed:	Trained personnel, specialised equipment, time and labs.
Responsibility:	EWT / GHWG.
Timeline:	October 2005 - October 2010
Obstacles:	Difficulty in obtaining samples and expensive testing equipment
Collaborators:	Johannesburg Zoo (Stephen v/d Spuy), vets, Onderstepoort and Percy FitzPatrick Institute.
Measurable outcomes:	A set of normal values.

Solution 2

Investigate new parameters for quarantine methods with regards to imported birds.

**This has been covered by the protocol written for trade and captive management.*

PROBLEM STATEMENT 8
GROUND HORNBILL DEATHS AND INJURY DUE TO COLLISIONS OR CONTACT WITH POWERLINES

Solution 1

Liaison between the EWT / GHWG and the EWT / Eskom Strategic Partnership regarding Ground Hornbill powerline interactions to determine the impact of powerlines on Ground Hornbills.

Action Step 1:
Obtain information from the EWT / Eskom Strategic Partnership database for Ground Hornbill powerline interactions.

Resources Needed:	Professional time, personnel, IT equipment, email, telephone and fax.
Responsibility:	EWT / GHWG
Timeline:	March 2005 - September 2005.
Obstacles:	Data not easily attainable.
Collaborators:	EWT / Eskom Strategic Partnership, Eskom and Telkom
Measurable outcomes:	Increased data availability on the extent of electrocutions and collisions and increased mitigation measures in Ground Hornbill areas.

Action Step 2:
Provide the EWT / Eskom Strategic Partnership with relevant data on Ground Hornbill habits and habitats so that it can be incorporated into their protocol.

Resources Needed:	Professional time, existing personnel with the possibility of additional personnel, IT equipment, email, telephone and fax.
Responsibility:	EWT / GHWG.
Timeline:	February 2005 - February 2006 and then ongoing.

Obstacles: Lack of available information and liaison with landowners.
Collaborators: EWT / PWG, Eskom, Telkom, SANParks, private nature reserves, provincial nature reserves, DEAT, provincial conservation agencies, farmers and local communities.
Measurable outcomes: A better knowledge of Ground Hornbill fatalities.

Action Step 3:
Encourage recording and reporting of powerline – Ground Hornbill interactions to the EWT / Eskom Strategic Partnership.

Resources Needed: Professional time
Responsibility: EWT / GHWG.
Timeline: February 2005 - February 2006 and then ongoing.
Obstacles: Lack of cooperation and reporting
Collaborators: EWT / PWG, Eskom, Telkom, SANParks, private nature reserves, provincial nature reserves, DEAT, provincial conservation agencies, farmers and local communities.
Measurable outcomes: A better knowledge of Ground Hornbill fatalities.

Solution 2

Closer working relationship with the EWT / Eskom partnership, so highlighting the areas and habitat where powerlines pose a (significant) threat to Ground Hornbills.
Action Step 1:
The group feels that this solution has been covered adequately in Solution 1

PROBLEM STATEMENT 9
DUE TO THEIR LARGE TERRITORY SIZE, THEY ENCOUNTER THE ENTIRE SPECTRUM OF PREDATORY SPECIES. THEY ARE THEREFORE PRONE TO PREDATION.

Solution 1

More research to be done on the extent of predation at nest sites, due to the vulnerability of the birds during long incubation and fledgling periods when breeding.

Action Step 1:
Research project on the predation issues to be done at the nest sites.

Resources Needed: Personnel time, IT Equipment and GPS.
Responsibility: EWT / GHWG.
Timeline: October 2005 - October 2010.
Obstacles: Finding nest sites, timing of actual observations and continuity of sightings.
Collaborators: University of Limpopo, Percy FitzPatrick Institute, Zoos and Mabula.
Measurable outcomes: Actual reliable figures on predation and formulation of remedies.

Solution 2

Data needs to be collected on the number of adult fatalities caused by predation and what predators are causing fatalities.

Action Step 1:
Collect data on which predators prey on adult Ground Hornbill

Resources Needed:	Field researchers and IT equipment.
Responsibility:	EWT / GHWG.
Timeline:	June 2005 - June 2010.
Obstacles:	Lack of cooperation and lack of signs as to which predator was involved and difficulty in finding Ground Hornbill carcases that have been preyed upon.
Collaborators:	Percy FitzPatrick Institute, University of Limpopo, field / section rangers and zoos.
Measurable outcomes:	Database of the predators involved.

PROBLEM STATEMENT 10
HUMAN INTERFERENCE AT NEST SITES

Solution 1

Determine thresholds for human involvement at nest sites.

Action Step 1:
Establish a protocol for nest site visitations.

Resources Needed:	People formulating the protocol as well as the data.
Responsibility:	EWT / GHWG.
Timeline:	October 2005 ongoing.
Obstacles:	Uncertainty of the effects of interference.
Collaborators:	Alan Kemp, zoos, Percy FitzPatrick Institute, Shamwari Game Reserve, Mabula and the ADU.
Measurable outcomes:	Reports / data from the field.

We did consider our change of land-use and loss of nest sites as threats, but both these topics are extensively covered by other groups.

Population Dynamics and Modelling Working Group Report

WORKING GROUP PARTICIPANTS

1. Kerryn Morrison (EWT Ground Hornbill Working Group)
2. Dian Spear (Percy FitzPatrick Institute of University of Cape Town)
3. Mandy Momberg (Pilanesberg National Park)
4. Brenda Daly (EWT / CBSGSA).

INTRODUCTION

The working group was tasked with developing a baseline model for the Ground Hornbill that best encapsulates the reality of the current population dynamics for the Southern Ground Hornbill. Some of the parameters included in this baseline are best guesses due to the lack of data. Once consensus was reached with all workshop delegates, and all agreed that the baseline data best projected the status quo in South Africa, a number of key areas were identified in a plenary session, for further investigation. The baseline data were then used to predict the outcome of different scenarios using the key areas identified. The objective of this exercise was to improve decision-making in respect of management needed to maintain a viable Ground Hornbill population over time.

Objectives for modelling included:

1. Preventing any further population decline.
2. Determining which factors played a significant role in population dynamics, e.g. age-specific mortality rate.

This population model was designed to assess the viability of the Southern Ground Hornbill population in South Africa. At the workshop the Population Dynamics and Modelling Working Group began developing the baseline model by reviewing the data compiled in the Southern Ground Hornbill PHVA Briefing Book. Initial data were sourced from the briefing book and then verified with experts at the workshop.

VORTEX BASELINE MODEL PARAMETERS

The final values used in the baseline model are described below (VORTEX 9.51).

Following the PHVA, two technical flaws were found in the model. One of the main concerns of the model was that the deterministic growth rate, assuming no stochastic fluctuations, no inbreeding depression, no limitation of mates, no harvest and no supplementation, was negative. This implied that the rates of reproduction and survival were not adequate to allow for population growth in the absence of random fluctuations and other destabilizing processes. Unless the population acted as a sink or was declining due to having reached carrying capacity, both of which we were unsure of, it was highly unlikely that a population would behave in this manner. The other flaw was in the equation that was used for the % of adult females breeding, 0.5*(MIN(1.(385/F))*100. If F was ever 0, the equation would not be valid.

In order to correct and improve the model, the flaws were corrected and the baseline model run again, together with a few more scenarios. The input variables were distributed to the PHVA

participants following the workshop as well as to a number of peer reviewers, which included Carl Vernon, Dr Warwick Tarboton and Prof Steven Piper, before the scenarios were run again.

Input parameters for the baseline model were as follows (*the input variables which changed, and the reasons for the change, following the PHVA have been noted in italics below*):

Number of iterations: 500
500 independent iterations for each scenario were run.

Number of years: 250
Being long lived birds with a life expectancy of approximately 50 - 70 years (Kemp 1995); the population was modelled for 250 years to include more than 3 life spans (longevity).

Extinction definition: Only one sex remains
The definition of only 1 sex remaining is used for sexually reproducing species like Ground Hornbills, which represents true biological extinction from which there can be no recovery.

Number of populations: 1
The South African population was assumed to be a single population for the baseline model due to the mixing of subpopulations; however various scenarios were run which included two or three populations.

Inbreeding depression: Vortex default 3.14
Even though blood samples for genetic studies have been collected from KNP for the University of Pretoria, no results have been published to date. As no data were available the Vortex default inbreeding depression was modelled, with 3.14000 lethal equivalents per individual, comprised of 1.57000 recessive lethal alleles, and 1.57000 lethal equivalents, not subject to removal by selection.

Concordance between environmental variation in reproduction and survival: Yes
If true then a good year for reproduction is also a good year for survival, environmental variation (EV) in reproduction and mortality will be concordant. The default value of 0.5 was used as some positive correlation is found by not overall.

Number of catastrophes: 1
A single catastrophic event was modelled. Frequency and extent of occurrence was based on an assumption that drought occurred once in every 25 years, or a 4% chance of a drought occurring annually.

The severity was entered as a multiplicative factor for reproduction and survival, so a severity factor of 1 means no effect, 0 means no reproductive and / or survival, and then there is anything in between for partial negative effects. A value over 1 means a beneficial "catastrophe" to the population.

The multiplicative effect on reproduction was 0.5 and survival was 0.8. Kemp, A.C., Joubert, S.C.J. and Kemp, M.I. (1989), estimated that there was a 50 percent reduction in reproduction and a 20% mortality rate (80% survival) in a drought year.

(Based on data from Kemp, A.C. and Kemp, M.I (1991), on the proportion of groups laying each summer in the KNP, the one outlier that occurred was assumed to be during a drought year. The deviation of this value from the mean of the other years suggests a multiplicative effect on reproduction of 0.2 and with a rethink of the multiplicative effect on survival it was modelled at 0.9, as mortality due to drought is probably minimal and is highly unlikely to be as high 0.8. With a low average adult mortality of 2% per annum derived from adult turnover in groups, it was suggested

that adults have the ability to survive "normal" catastrophes but may impact more heavily on shorter lived birds).

Drought was modelled as the only catastrophe for the baseline model, although both high rainfall (flooding nests) and diseases were proposed.

Mating system: Long-term Monogamous mating
Long-term Monogamous mating is when a species forms long term monogamous pair bonds. Ground Hornbill's are cooperative breeders and form a pair bond staying together until one dies. A dominant breeding pair and a number of helpers make up the group of between 2 and 11+ individuals (with an average of 3 – 5 individuals in South Africa).

Age of first offspring for females: 15 years
The age of first offspring is the average age at which females and males produce offspring, not the earliest that they become sexually mature or the age at conception. The model uses the mean age of first reproduction rather than the earliest recorded age of offspring production. The age of first reproduction could be as young as 5 years, but is more likely to be around the age of 10 years (Kemp 1987), the Working Group members took the minimum age of first breeding to be around 6 years (Kemp (KNP) and Vernon (Eastern Cape) *pers. comm.*) and added 9 years, as a group fledges on average 1 juvenile every 9 years (Kemp 1998).

(The finding by Kemp (1998) that Ground Hornbill fledge on average 1 chick every 9 years, includes also groups which never bred during the 20 year study period. It was therefore suggested that adding 9 onto the minimum age of first reproduction may be a bit high. For the remodelling therefore, the age of first offspring for females was reduced from 15 to 11, i.e. the minimum age of first reproduction (6) + the average fledging rate / 2 (4.5, rounded upwards to 5))

Age of first offspring for males: 17 years
This figure was taken as an estimate from the working group members, being 8 (minimum age of reproduction) + 9 (a group fledges on average 1 juvenile every 9 years) (Kemp 1998).

(*For the reasons mentioned above under age of first offspring for females, a similar calculation was made for males, i.e. 8 + 4.5 (rounded off to 5) = 13)*

Percentage of adult males in the breeding pool: 50
This includes the percent of males which are physically, physiologically and socially capable of breeding, the degree of monopolization of mating opportunities. Assuming a mean group size of 3.6 (Kemp and Kemp 1980; Vernon 1986), with 1 female, 1 adult male and a helper, there would be 50% males in the breeding pool.

Sex ratio at hatching (percent males): 50
General consensus from the group.

Maximum age of reproduction: 50 years
The group agreed that 50 years was a viable age, the range however, was 40 - 70, with an average of 35 - 40 years (Kemp 1995).

Maximum number of progeny per year: 3 eggs
This was based on the fact that a female Ground Hornbill will lay and hatch up to 3 chicks (Kemp and Begg 1996). The "hatching stage" was used as the stage at which offspring are produced. For birds, offspring can be defined as eggs, hatchlings or fledglings, depending upon the available data. The working group chose hatching so as to include the chick harvesting and reintroduction programme in the model. The number of offspring produced was 3 and the rate of mortality for the first year was taken at 68%, allowing for the high loss of second and third chicks.

Distribution of clutch size:
Of those females producing progeny:

19.50 percent of females produce 1 progeny in an average year
80.00 percent of females produce 2 progeny in an average year
0.50 percent of females produce 3 progeny in an average year

The values above were based on eggs laid and assumed to have hatched (Kemp and Begg 1996).

It is uncommon for Ground Hornbills to lay two clutches in a season. However, the birds will lay a second clutch if the first clutch is lost very early in the breeding season. The birds lay one to three eggs and all will often hatch, although the second and third a few days after the first. The second and third chicks generally die of starvation. However, it has been proposed that they may actually raise two chicks to fledging if the nest and group of helpers is big enough. However it has been suggested that the survival of one chick is not too dependent on the number of helpers, and a chick can be raised with just the alpha male and female.

Density-dependent reproduction: Blank
Modelling density-dependent reproduction of Ground Hornbill was a challenge as the number of groups that can breed is probably limited by the number of nesting sites available. Therefore the number of breeding adults may remain the same over time, while the number of adults in the breeding pool may increase or decrease.

The number of breeding females can be no more than the number of nesting sites. It was therefore suggested that the density dependent breeding utility be left blank and instead a function be placed directly into the input box for percent females breeding. Please see below.

Percent adult females breeding: =0.5(MIN(1.(385/F))*100*
The 0.5 is the proportion of females breeding based on laying (54% laid in the Kruger National Park (Kemp and Begg 1996)). The MIN in the equation is there to ensure that the % breeding do not increase beyond 100%. 385 is the number of nest sites estimated to be available in South Africa, i.e. 1500 (population) / 3.5 (average group size) * 90% (estimated proportion with a nest Kemp *pers. comm.*). F is the number of females. In fact, the equation works out to be 36% (385 / 525)*0.5 = 36% which is close to the 40% that was originally used for this factor. The environmental variation (EV) in the percentage of adult females breeding is 25 % reproducing each year.

The proportion of females breeding is limited by the number of territories that have suitable breeding cavities, as well as whether or not a group attempts to breed. Ground Hornbills require large cavities in either trees or in cliff faces in which to breed. To support this theory, in areas where large nest boxes have been placed in trees Ground Hornbills have started using them immediately.

(*As noted above, the equation is flawed as if F ever was 0, the equation would not work. In addition, the equation never allows for more than 50% of females to breed in any one year. It was also suggested following the workshop that there are probably more than 385 nesting sites in South Africa, but an estimated figure was not known.*

In the remodelling, the percent adult females breeding were then increased to 53% (Kemp and Kemp 1991). Of the 9 figures for the proportion of groups breeding in any one season, 8 were used to determine the mean number of groups breeding, and the one outlier was taken for the drought / catastrophic year. The EV was then worked out from the range of the percentage of groups breeding each year, i.e. EV = 12)

Mortality: See below

Mortality of females

Age class	Mean annual mortality	Environmental variation
0 – 1	68%	5%
1 – 2	30%	5%
2 – 3	20%	5%
3 – 4	10%	5%
4 – 5	10%	5%
5 – 6	30%	5%
6 – 7	2%	1%
7 – 8	2%	1%
8 – 9	2%	1%
9 – 10	2%	1%
10 – 11	2%	1%
11 – 12	2%	1%
12 – 13	2%	1%
13 – 14	2%	1%
14 – 15	2%	1%
15<=age<=50	2%	1%

Mortality of males

Age class	Mean annual mortality	Environmental variation
0 – 1	68%	5%
1 – 2	30%	5%
2 – 3	20%	5%
3 – 4	10%	5%
4 – 5	5%	1%
5 – 6	5%	1%
6 – 7	2%	1%
7 – 8	2%	1%
8 – 9	2%	1%
9 – 10	2%	1%
10 – 11	2%	1%
11 – 12	2%	1%
12 – 13	2%	1%
13 – 14	2%	1%
14 – 15	2%	1%
15 – 16	2%	1%
16 – 17	2%	1%
17<=age<=50	2%	1%

Survival rates for Ground Hornbill are not accurately known, but are suspected to be in the region of 98.5% for adults and between 25 - 31% from fledging to adulthood (Kemp 1988). Mortality for both male and females from age 0 - 1, used 40% survival from a single egg clutches (base on 20% single egg clutches) and 80% 2 egg clutches (with a 50% reduction because the first chick dies), and similarly with 3 egg clutches, assuming that they only ever raise 1 even if double clutching occurs.

The female mortality rate from age 5 - 6 years was set at 30% as it is around this age that the females leave the group and hence their mortality would be high (Kemp *pers. comm*.). This produces a skewed adult sex ratio.

Initial Population Size (N): *1500*
There is a published estimate of between 1500 and 2000 birds (Kemp 2000), and from available data we similarly put the limits between 1290 and 2380 birds in between 410 and 700 groups. Vortex was set to reflect a stable age distribution.

Carrying capacity (K): *3000*
Available nesting sites probably influence K, although little is know about this. Habitat loss is a major problem for the birds, resulting primarily from the loss of nests through agriculture, bush encroachment and bush clearing. It was estimated by the PHVA plenary group that the amount of habitat left for Ground Hornbill would support 3000 individuals and not more as even though the habitat may be available, it is probably not suitable for Ground Hornbills. A change in carrying capacity was left out in the baseline model, but has been incorporated into a scenario.

The maximum number of individuals that can occupy the habitat, with a standard deviation to represent EV in carrying capacity is 50.

(*EV was left out in the remodelling process as Vortex incorporates normal environmental variation in breeding as well and hence, placing a value here, would elevate the EV beyond normal).*

Conclusion

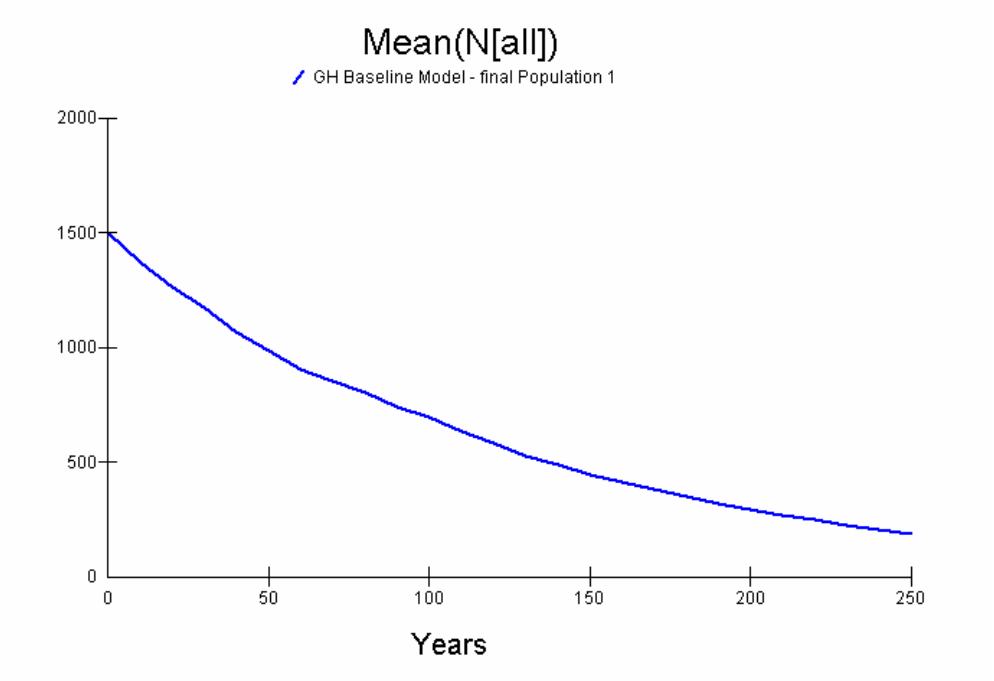

Figure 3: Baseline model from PHVA workshop

With the fledging rate for Ground Hornbill being one chick every 9 years, a relatively late age of first reproduction and a high impact of catastrophe on the population, their recovery rate and resilience to disasters are very low.

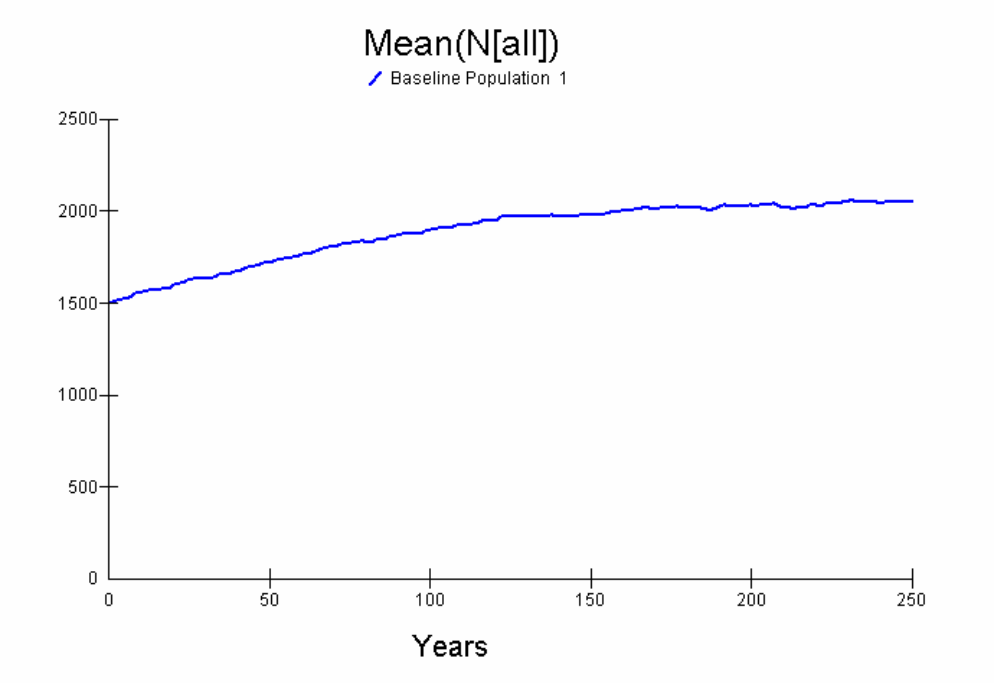

Figure 4: *Baseline model following the correction and improvement of the model*

The population appears to be increasing. However, no mortality due to direct or indirect persecution, suck as poisoning, powerline electrocutions, and cultural use, amongst others were included in the model. Mortality factors are included as a scenario further on in this section.

Comments from the first plenary discussion at the PHVA, once the baseline model had been developed, included:

1. The group suggested that all parameters be manipulated until they show a potentially stable population.

2. Sensitivity Analysis:
   - Sensitivity of all parameters in the Vortex model needs to be determined.
   - Conservation areas should be modelled separately from areas outside of conservation areas, as different threats are found outside of protected areas.
   - The level of genetic mixing between KNP and APNR is unknown. The source-sink effect of populations should also be taken into account.

3. Artificial Nest Boxes:
   - Site selection for nest box placement is critical, as social behaviour plays a vital role in nest site selection.
   - It was assumed that nest boxes would be in place for the bird's life span. However, consideration must be given to the limited lifespan of the artificial nest boxes.
   - When adding artificial nests, consideration must be given that not all nest boxes will be used for breeding. The potential creation of new breeding groups and densification (placement of more groups in an area) should also be considered as result of the establishment of artificial nest boxes.
   - It should be noted that protected area management may not accept the manipulation of populations through the establishment of artificial nests e.g. KNP.

- Consideration should be given to the fact that artificial nest logs are highly visible and that the Ground Hornbills therefore could be at an increased risk from predation.

4. Source-sink approach:
   - Consideration must be given to bordering countries such as Mozambique, Botswana and Zimbabwe which are not included in the model. Countries to the north could be a source and could be replenishing the South African population. Alternatively, the populations bordering South Africa could be a sink e.g. the KNP population could be stable and could therefore possibly be a source for Zimbabwe and Mozambique.

5. Supplementation:
   - The plenary suggested that the population model be supplemented with 5, 10, 20 birds etc. each year, to establish the number of birds required for a supplementation programme to take effect and the population to become stable or sustainable.
   - The possibility existed that the larger chick would be taken by a predator or could be out competed by the smaller chick, leaving the smaller chick in the nest.

6. Persecution:
   - The plenary suggested that the effects of direct persecution on the Ground Hornbill population through any of the following variables: poisoning, shooting, illegal trade and powerline electrocution and collision, amongst others – be modelled.

7. Food availability:
   - The plenary suggested that the modelling of food availability was important. However, it was decided that this had already been taken into account in the environmental variation in mortality and breeding parameters i.e. variation in rainfall leading to variation in breeding success.
   - Food supplementation to Ground Hornbill groups has previously been carried out with positive effect, in order to encourage breeding. Supplemental feeding during the nesting season, i.e. providing food at nests could potentially decrease first year mortality. However in captivity, observations showed that although there was more than sufficient food available at the time that two chicks hatched in captivity in 2004 the female chose to feed only the first chick leaving the second to die of starvation.

SENSITIVITY ANALYSIS

Growth rate (r) was calculated by Vortex for the baseline values entered. In order to obtain a measure of sensitivity of each parameter in the model, 10 simulations were run for each input parameter in the model at a 10% increase (inc) and then at a 10% decrease (dec) from the Vortex baseline input data in separate exercises. The growth rates from each were then compared to the baseline growth rate (r).

The difference between the growth rates obtained when increasing the baseline variable by 10% and the growth rate obtained when decreasing the baseline input variable by 10% was determined. The figure was divided by the baseline growth rate to get a relative measure of sensitivity sen_{rel}.

Formula: $$sen_{rel} = \frac{r(inc) - r(dec)}{r \times 0.02}$$

Where sen_{rel} is the relative measure of sensitivity; r(inc) is the growth rate calculated when a parameter is increase by 10%; r(dec) is the growth rate calculated when a parameter is decreased by 10%; and 0.02 equals the average of the increase and decrease and 0.0 is factoring in the percentage.

The sensitivity of parameters gave an indication of the impact that the variable had on the population dynamics. Those that had a significant impact were those for which research was required or around which management options could be investigated.

Factor	Baseline	10% increase	10% decrease	proportion increase	proportion decrease	proportion average
Mortality 0 - 1 combined	**-0.0105**	**-0.023**	**-0.006**	**-119**	**43**	**-81**
Catastrophe severity of survival	**-0.0105**	**-0.006**	**-0.018**	**43**	**-71**	**57**
Mortality 0 - 1 Females	**-0.0105**	**-0.017**	**-0.006**	**-62**	**43**	**-52**
Maximum age of reproduction	**-0.0105**	**-0.009**	**-0.019**	**14**	**-81**	**48**
Proportion females breeding	**-0.0105**	**-0.006**	**-0.014**	**43**	**-33**	**38**
Age of first offspring - female	-0.0105	-0.013	-0.007	-24	33	-29
Age of first offspring - males	-0.0105	-0.014	-0.009	-33	14	-24
Mortality 2 - 3 male	-0.0105	-0.008	-0.013	24	-24	24
Mortality 1 - 2 female	-0.0105	-0.013	-0.009	-24	14	-19
Catastrophe severity of reproduction	-0.0105	-0.012	-0.008	-14	24	-19
Frequency of catastrophe	-0.0105	-0.014	-0.011	-33	-5	-14
Mortality 5 - 6 female	-0.0105	-0.01	-0.007	5	33	-14
Mortality 2 - 3 female	-0.0105	-0.013	-0.01	-24	5	-14
Mortality 4 - 5 female	-0.0105	-0.008	-0.011	24	-5	14
Mortality 3 - 4 combined	-0.0105	-0.015	-0.012	-43	-14	-14
Percentage males in breeding	-0.0105	-0.013	-0.01	-24	5	-14
Mortality 1 - 2 males	-0.0105	-0.01	-0.012	5	-14	10
Mortality 4 - 5 male	-0.0105	-0.012	-0.01	-14	5	-10
Carrying capacity	-0.0105	-0.012	-0.01	-14	5	-10
Initial population size	-0.0105	-0.012	-0.01	-14	5	-10
Mortality 2 - 3 combined	-0.0105	-0.014	-0.012	-33	-14	-10
Mortality 0 - 1 males	-0.0105	-0.011	-0.012	-5	-14	5
Mortality 1 - 2 combined	-0.0105	-0.012	-0.011	-14	-5	-5
Mortality adults combined	-0.0105	-0.01	-0.009	5	14	-5
Number of nests	-0.0105	-0.011	-0.01	-5	5	-5
Mortality adult female	-0.0105	-0.01	-0.011	5	-5	5
Mortality 3 - 4 male	-0.0105	-0.01	-0.011	5	-5	5
Mortality adult male	-0.0105	-0.011	-0.01	-5	5	-5
Mortality 5 - 6 combined	-0.0105	-0.011	-0.01	-5	5	-5
Mortality 5 - 6 male	-0.0105	-0.012	-0.013	-14	-24	5
Mortality 4 - 5 combined	-0.0105	-0.013	-0.012	-24	-14	-5
Mortality 3 - 4 female	-0.0105	-0.01	-0.01	5	5	0

Table 4: Sensitivity analysis table.

Conclusion:

With reference to the Table 4 (above) the most sensitive parameters for the baseline model were:

- The reduction of mortality of male and female chicks of the 0 – 1 age group (i.e. the successful hatching and survival of the second chick), as would be expected due to the almost certain loss of any second and third chicks that hatch.
- Catastrophe severity of survival
- Maximum age of reproduction
- Proportion of females breeding

Based on the variables that were most sensitive in the model produced at the PHVA, sensitivity tests were run in the reworked model

The reduction of mortality of male and female chicks of the 0 – 1 age group
Outlined below under scenarios

Maximum age of reproduction
Outlined below under scenarios

Catastrophe severity of survival
Two scenarios were run:

- *Decreasing the catastrophic severity on survival from 0.9 to 1.0*
- *Increasing the catastrophic severity on survival from 0.9 to 0.8*

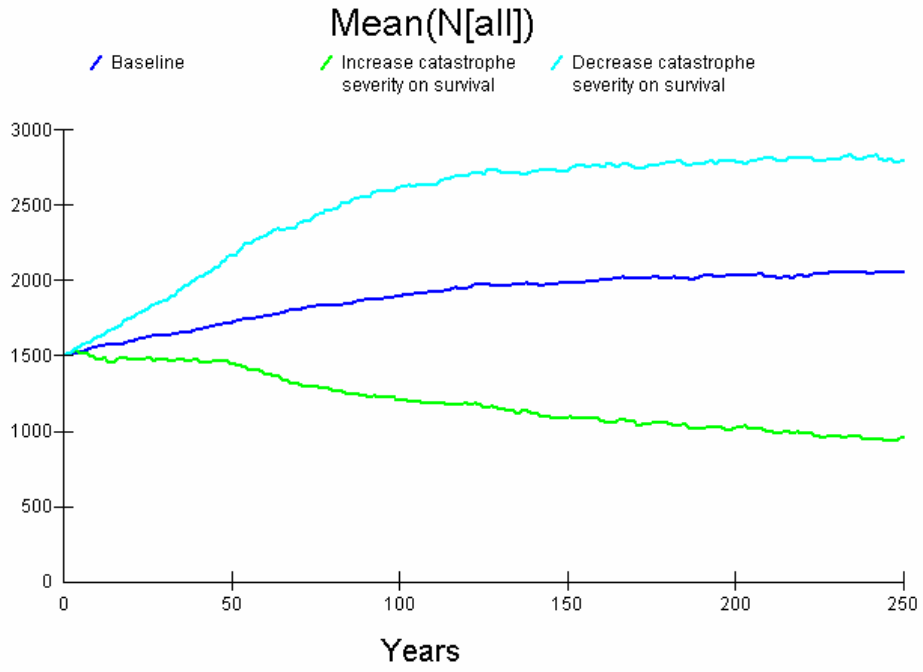

Figure 5: *The variation of impact on survival that a catastrophe could have compared to the corrected and improved baseline model.*

Conclusion

A 10% increase in mortality due to a catastrophe is significant enough to cause the population to decline. Similarly, a 10% decrease in mortality is significant enough to allow the population to increase to carrying capacity and to stabilise at that population size. It can therefore be concluded that the impact of a catastrophe on survival plays an important role in the dynamics of a population. It also highlights the importance of obtaining a better understanding of the impacts of drought on Ground Hornbills, especially on survival.

Proportion of females that breed
Two sensitivity scenarios were run from the reworked baseline model:

- *Proportion of females that breed increased by 10%*
- *Proportion of females that breed decreased by 10%*

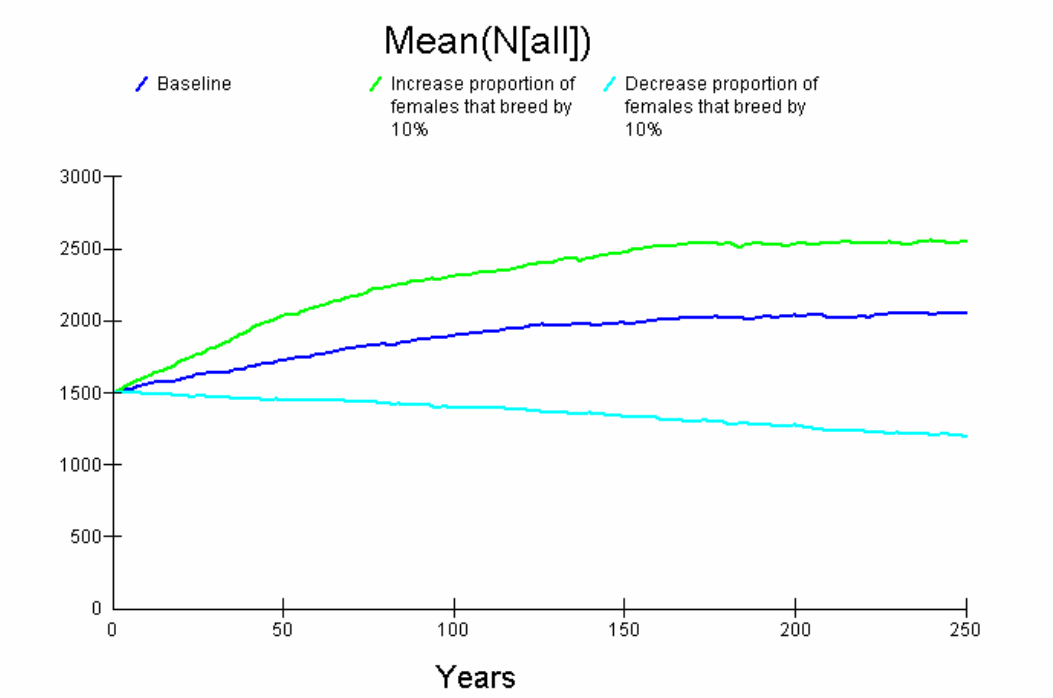

Figure 6: *The variation on the proportion of females that breed compared with the corrected and improved baseline model.*

Conclusion

Even a 10% decline in the proportion of females breeding could cause the population to decline. This is particularly concerning in view of the fact that suitable nesting sites have been proposed as a limiting factor for the population. In addition, habitat loss and the loss of suitable nesting sites are occurring at a currently undetermined rate. This outcome highlights the need for better information on the loss and recruitment of nesting sites and suitable habitat.

SCENARIOS

1. ARTIFICIAL NEST BOXES

Scenario description:

The following formula was used to incorporate nest sites as a limiting factor:

Formula: $\% Br = \frac{\text{Minimum } (1, nn) \times PBr}{F} \times 100$

Where % *Br* is the percentage of females breeding; *nn* is the number of nests; *F* is the number of adult females; *PBr* is the probability of a group breeding if it has a territory with a suitable nesting site.

Assuming that nest sites were not limiting, the percentage of females breeding annually was set at 50 % to compare whether limiting nest sites would have an impact on the population dynamics.

Conclusion:

No difference was found. No further testing of this scenario was done.

(*This was not remodelled as the number of nesting sites was not set to be a limiting factor)*

2. SOURCE-SINK APPROACH

Scenario description:

The scenario was based on the fact that the South African population was in a decline and could be considered a sink. Botswana, Zimbabwe and Mozambique could therefore be considered as potential sources, so a supplementation via immigration into South Africa was proposed. This scenario was modelled as an immigration of ten birds either in the form of individual adults or within three groups (consisting of an adult male, adult female and juvenile) annually for the duration of the simulation (250 years).

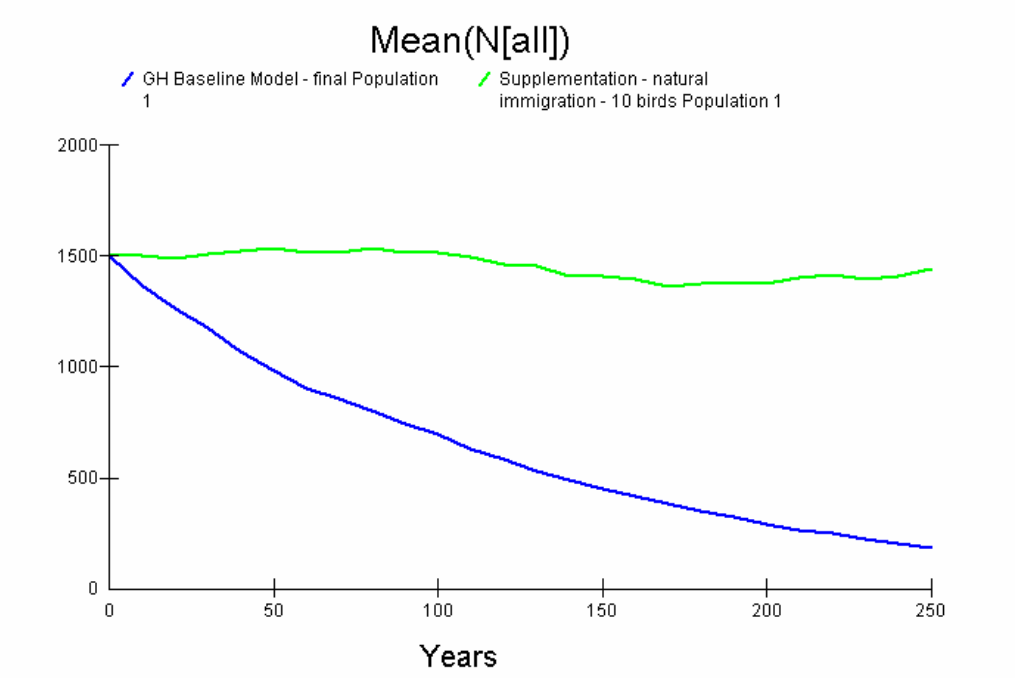

Figure 7: The effects of supplementation of the population through immigration from neighbouring populations to South Africa

(*This was not remodelled in the improved model).*

Plenary discussion:

It was agreed that natural immigration was probably happening and that the current data available could include this, but it was highlighted that no data exists to quantify it.

The baseline model, however, took that the population in South Africa was a closed population. Furthermore the model did not consider the emigration effects either, as the assumption was that the South Africa was the sink for Ground Hornbills due to the proposed decline in the population. It

was more likely that young adults were immigrating into the South African population than groups or individuals dispersing. This should to be taken into consideration as an increase in groups will increase the number of breeding groups.

Conclusion:

The current population seems to remain stable around the initial population size. More information is needed on the immigration and emigration in order to verify this finding.

3. SUPPLEMENTATION

Scenario description:

Juvenile supplementation: Two year old birds with a sex ratio of 1:1

- 10 juveniles annually for 20 years
- 15 juveniles annually for 50 years
- 20 juveniles annually for 50 years
- 30 juveniles annually for 50 years
- 20 juveniles annually for 250 years

Adult supplementation: One adult and one juvenile were supplemented to a wild adult of the opposite sex to the one being supplemented, with a sex ratio of 1:1

- 10 individual birds for 20 years
- 15 individual birds for 20 years
- 20 individual birds for 20 years
- 30 individual birds for 20 years

No supplementation scenarios were run in the reworked model as the baseline population was not in decline.

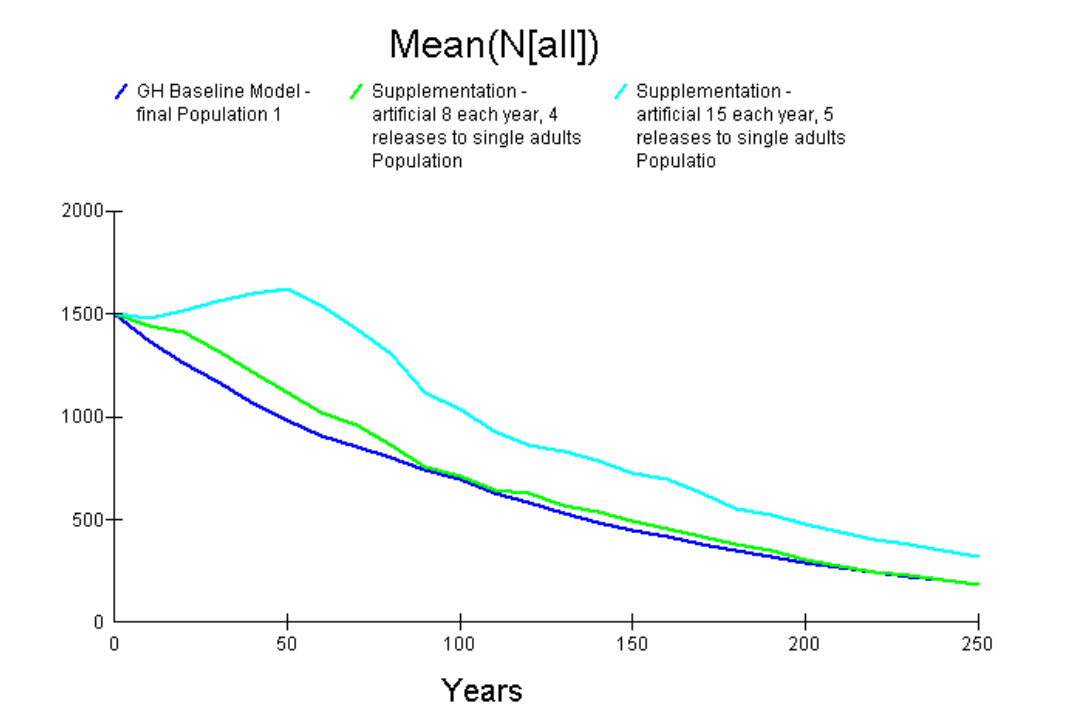

Figure 8: The effects of supplementing single adults to the population compared with the baseline model.

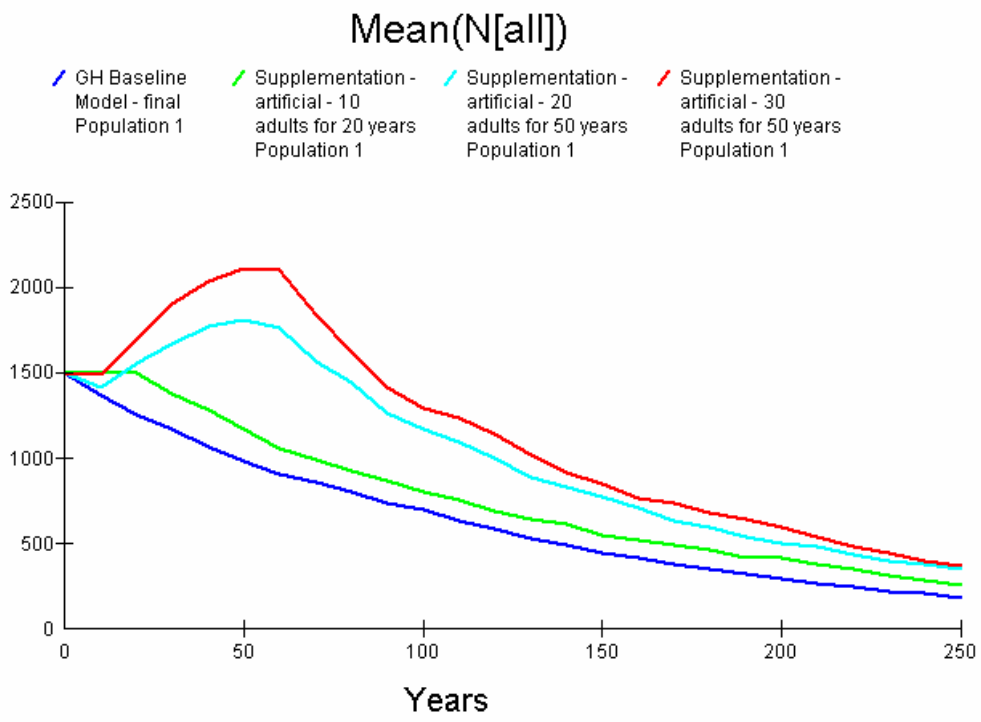

Figure 9: The effects of supplementing a varying number of adults to the population.

Plenary discussion:
The group suggested that supplementation be run for 50 years instead of 20 years, as the latter is merely one third of a single generation. It was also noted that the supplementation of adult birds could not happen for the next eight years, due to the lack of adult birds available for release from the current captive population.

Group splitting and manipulation should be considered. Adding single adults to the population could have this effect, i.e. filling spatial gaps between groups.

There was discussion about minimum and maximum group size, with regard to increasing and decreasing helpers and the impact on breeding success. However, more research was required before this could be modelled.

The plenary suggested that the threshold at which supplementation enabled a stable population group should be determined, i.e. increase the number of birds that need to be supplemented in order to stabilize the population. This would facilitate target setting to determine the degree of supplementation required to stabilise the population.

Conclusion:

During the supplementation years the population maintained a stable status but as soon as the supplementation was halted the population once again declined. Supplementation therefore increased and maintained the population numbers as long as it was being done. However, the underlying cause of the decline was obviously not being addressed in order that the population could maintain itself on its own.

4. PERSECUTION

Scenario description 1:

The following direct mortality scenarios were tested on the baseline model. A direct mortality was taken as any death resulting from direct or indirect persecution.

Direct mortality - 4 birds (1 family and 1 female) once every 2 years for 50 years
Direct mortality - 8 (2 family groups of 3 and 2 others) once every 2 years for 50 years
Direct mortality - 8 annual (2 family groups of 3 and 2 others) 50 years
Direct mortality - 16 annually (4 family groups and 4 individuals) for 50 years

The mortality was run annually for 50 years to allow for time to hopefully mitigate for the threats to the birds.

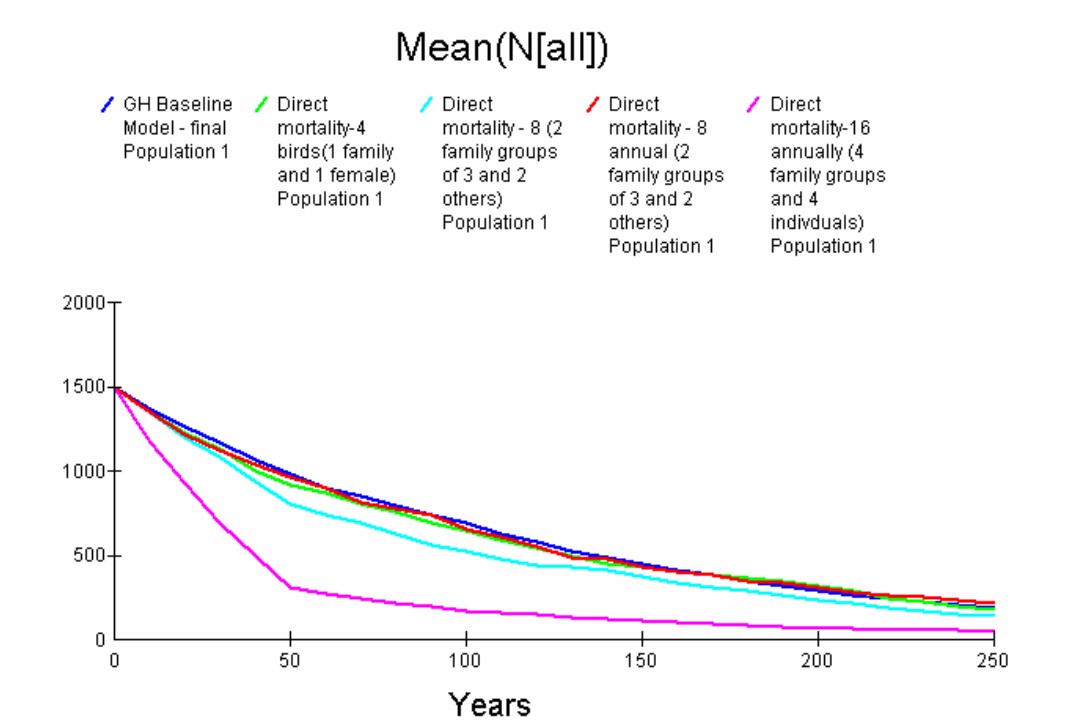

Figure 10: The effects of varying extents of mortality on the population

Plenary discussion:

The suggestion was to model a reduction in poisoning – this would amount to investigating reductions in mortality rates, specifically age specific mortality.

Scenario description:

Using the reworked baseline model, the following scenarios were run for direct mortalities:

Direct mortality - 4 birds (1 family and 1 female) annually for 50 years
Direct mortality - 8 (2 family groups of 3 and 2 others) annually for 50 years

Direct mortality - 16 annually (4 family groups and 4 individuals) for 50 years

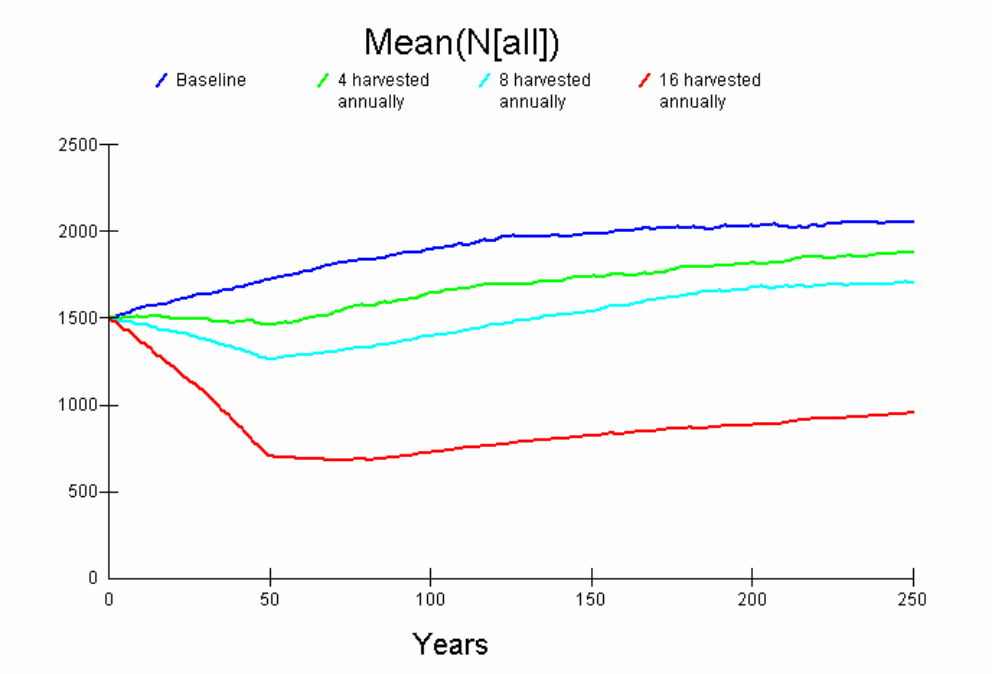

Figure 11: *Annual harvesting / mortality compared with the revised baseline model.*

Conclusion:

Mortality resulted in the population declining at a faster rate, which increased as more birds were removed and had an increasing impact on the population. Even three birds lost annually resulted in an immediate decline in the population, forcing the population into a negative growth rate. This is of particular concern as an estimated number of mortalities annually are unknown, although mortalities are known to occur, sometimes even involving whole groups (i.e. 3 birds or more).

5. AGE SPECIFIC MORTALITIES

Scenario description:

The group suggested that a decline in age specific mortalities should be modelled. The following parameters were manipulated:

- Age 0 – 1 years at 10% decrease for male and female at 100 iterations
- Age 0 – 1 years at 15% decrease for male and female at 100 iterations

- Female mortality age 5 – 6 years at 10 % decrease at 100 iterations
- Female mortality age 5 – 6 years at 15 % decrease at 100 iterations

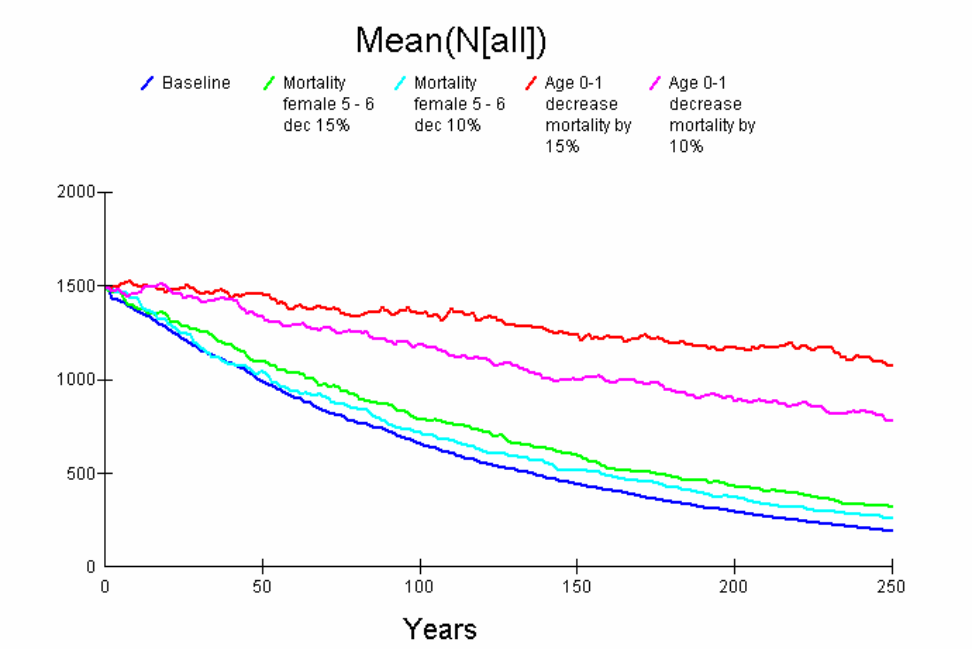

Figure 12: The impact of varying degrees of mortality in age specific age classes (using the original baseline model).

Conclusion:

Decreasing mortality will have a positive effect on the population. However, the greatest effect was shown by decreasing the mortality rate in the Age 0 – 1 class.

This scenario was run using the reworked model as a baseline in the following ways:

- *Age 0 – 1 years at 10% decrease for male and female at 100 iterations*
- *Age 0 – 1 years at 10% increase for male and female at 100 iterations*
- *Female mortality age 5 – 6 years at 10 % decrease at 100 iterations*
- *Female mortality age 5 – 6 years at 10 % increase at 100 iterations*

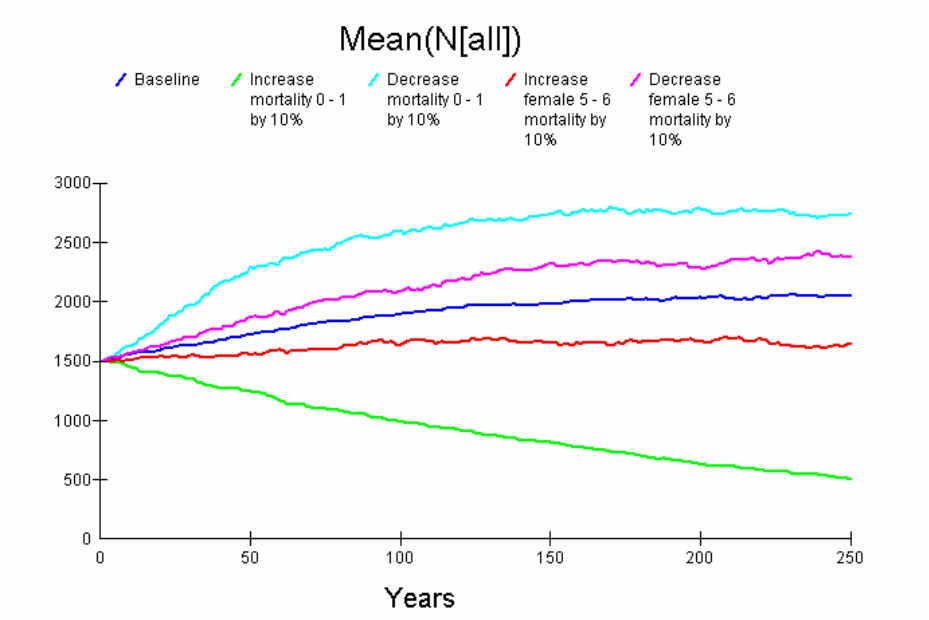

Figure 13: *The effects of varying mortality rates in the age class 0 – 1 for males and females and for females in the distributing age class 5 – 6, on the population (using the revised baseline model).*

Conclusion

The affect of decreasing or increasing mortality in the age class 0 – 1 years is much greater than decreasing or increasing mortality in the female 5 – 6 year age class, when females leave the group. Increasing the mortality in the age class 0 – 1 years caused the population to decline dramatically. Under natural conditions, there is a limited action that can be taken to increase the survival of the second and third chicks. However, data on the mortality rates needs to be obtained.

6. LENGTH OF BREEDING PERIOD

The maximum age of reproduction was increased 10 from 50 to 60. The age of first breeding for both males and females was decreased by 9 years, to 6 years for females and to 8 years for males to test whether this would have a significant impact on the population.

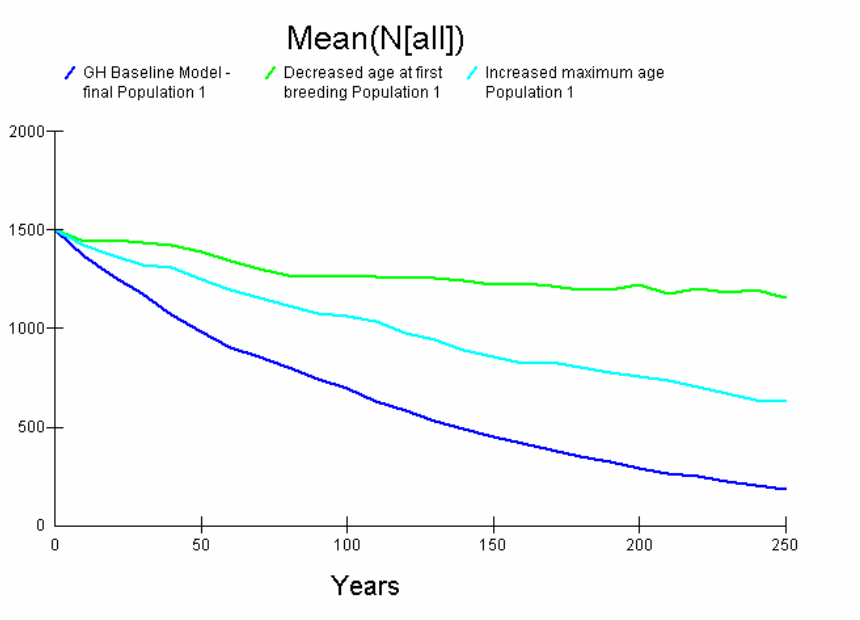

Figure 14: The effects of increasing the breeding period in Ground Hornbills on the original baseline model.

A suggestion was made that the maximum breeding age could be a bit high and that it was probably closer to 25 years.

Two scenarios for the age at first breeding were also run:

- *Increase age at first breeding to 15 for females and 17 for males*
- *Decrease age at first breeding to 6 for females and 8 for males*

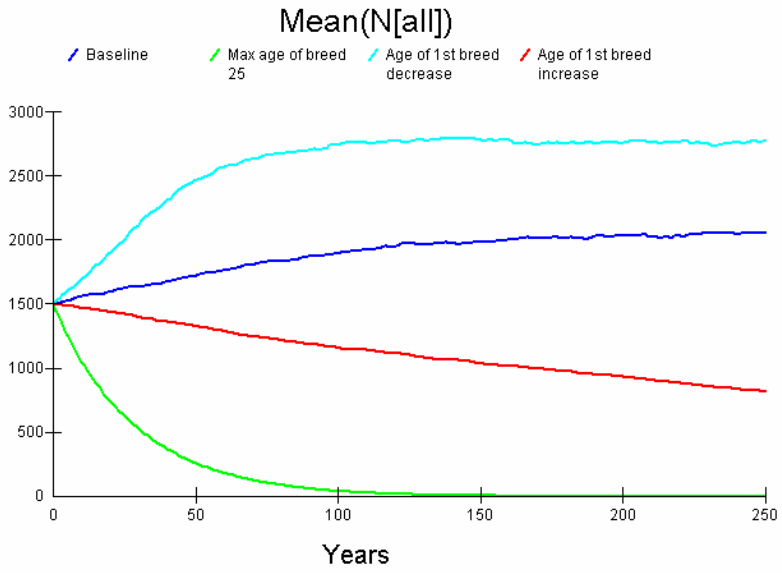

Figure 15: *A decrease in the maximum age reproduction and both an increase and decrease in the age of first reproduction (using the revised baseline model).*

Conclusion:

Both models showed that any increase in the lifespan of breeding, whether through the age of first reproduction or through the maximum age of reproduction, would improve the long term viability of the population.

In the reworked model, if Ground Hornbills bred at a younger age, the population would increase quickly to the carrying capacity and then maintain itself around that figure. However, a decrease in the breeding lifespan of the birds would cause the population to decline.

3rd Plenary session for the Vortex team:

Consensus was reached within the group that many of the scenarios modelled were seen as "buying time" for the birds and that it only kept the numbers stable.

Modelling additional scenarios following the PHVA

1. Environmental Variation in reproduction and survival

Scenario setting

It was suggested following the PHVA that the EV in reproduction and survival may not be concordant and that EV may not necessarily impact on all individuals of a population in the same way due to vastly differing climatic conditions. It was argued that a good year for reproduction could be due to a good previous year's conditions such as good conditions during the mating season. These could then decline drastically later in the season and lead to a failure in fledging or survival after fledging.

EV being concordant was then removed from the baseline model.

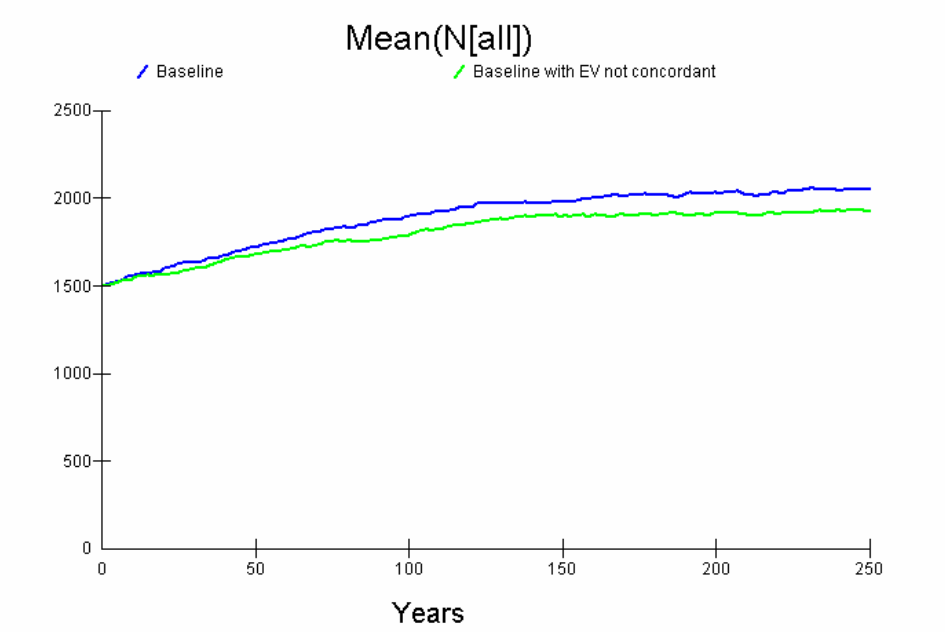

Figure 16: *The impact of environmental variation being concordant and not concordant with reproduction and survival (using the revised baseline model).*

Conclusion:
There was very little difference to the population growth whether EV was concordant in reproduction and survival or not.

CONCLUSION

In the reworked baseline model, the South African Ground Hornbill population is not in the serious state of decline that was suggested at the PHVA workshop. However, a few of the variables are of particular concern, and could change this scenario significantly. In addition, little data are available to confirm the actual situation. It will therefore be important to remodel the situation as new information arises and as the situation with Ground Hornbills becomes better understood. It needs also to be borne in mind that the data used in the modelling was based on that obtained from the Kruger National Park – a protected area.

The proportion of females breeding is strongly linked to the number of suitable nesting sites available and has a strong influence on the population dynamics of the species. Habitat loss is occurring throughout the non-protected range of Ground Hornbills, but is poorly understood. In addition, the loss and recruitment of nesting sites is not understood at all.

Little is known about the average age of first breeding and the longevity of the species, and yet, these two variables play a significant role in the population dynamics. A better understanding of this is important when modelling the population trends of the species.
Of particular concern is the fact that the population will start declining with the loss of just 4 individuals a year. It is therefore imperative that their threats are better understood and mitigation measures put in place to resolve them.

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List of Acronyms

ADU	Avian Demography Unit (of the University of Cape Town)
APNR	Associated private Nature Reserves
AZA	American Association of Zoos and Aquaria
BEEP	Biodiversity Environmental Education Programme
CBSG	Conservation Breeding Specialist Group (of the IUCN)
CBO	Community Based Organisation
CLG	Conservation Leadership Group of the Endangered Wildlife Trust
DEAT	Department of Environmental Affairs and Tourism
DWAF	Department of Water Affairs and Forestry
EAZA	European Association of Zoos and Aquaria
EWT	Endangered Wildlife Trust
GHWG	Ground Hornbill Working Group (of the EWT)
IDP	Integrated Development Plans
IUCN	World Conservation Union
KNP	Kruger National Park
NRF	National Research Foundation
PAAZAB	Pan African Association of Zoos and Aquaria
PRA	Participatory Rural Appraisal
PWG	Poison Working Group (of the EWT)
RSG	Reintroduction Specialist Group (of the IUCN)
SANParks	South African National Parks
SGH	Southern Ground Hornbill
SSC	Species Survival Commission (of the IUCN)
SSG	Site Support Groups
URBP	Umgeni River Bird Park
WAZA	World Association of Zoos and Aquaria
WESSA	Wildlife and Environment Society of South Africa
WWF-SA	World Wildlife Fund (South Africa)

SOUTHERN GROUND HORNBILL PHVA

7 – 11 February 2005

Southern African Wildlife College

WORKSHOP REPORT

SECTION 4:

FINAL PLENARY: WAY FORWARD

Management strategy developed during an open discussion: final plenary session on the way forward.

The entire group convened for a final plenary of two hours, in which a number of concerns and issues facing the entire Ground Hornbill conservation community were discussed. The purpose of this final plenary discussion was to determine a way forward which would ensure greater collaboration between role-players, improved coordination of activities and increased buy-in for the outcomes of the PHVA in order to ensure implementation of the conservation plan.

The floor was opened with a suggestion to discontinue the harvesting of Ground Hornbill chicks for approximately two years due to concern that the harvesting may be detrimental to the collection of accurate biological data of the species. In these two years, it was suggested that a concerted effort should be made to better understand the biology and genetics of Ground Hornbills. This was disputed by some who felt that no time should be wasted in attempts to establish a viable captive breeding flock for supplementing non-viable wild flocks.

It was agreed by the group that supplementation of the existing wild population should be seen purely as “buying time” for the birds and that it could only potentially maintain stable population numbers for an interim period. This may help until the threats facing the birds, and the causes of decline are identified and addressed, or a better understanding of some of the aspects of the biology of the species is obtained. However, the Vortex modelling also showed clearly that supplementation would probably not be the saving factor for Ground Hornbills.

Several of the factors contributing to the breeding biology of the bird are still relatively unknown. It was agreed that through combined efforts, data could be sourced and clarity reached on certain aspects. Raw data which have not been analysed are available from the Kruger National Park and surrounding areas through research undertaken by Alan Kemp, and this could be used as a starting point. Once the breeding biology is more clearly understood, the group will be able to move forward with more certain management actions. It was reiterated that a coordinated approach and commitment from the entire group is important to ensure that the process works effectively. Consensus was reached on the suggestion that by combining the efforts of the harvesting team and researchers, the conservation of the species could be enhanced. Therefore, it was agreed that both groups should respect and support each other’s roles and assist where possible. Strong communication, transparency and inclusively will be required for this to happen.

A two year genetics project was recommended to determine the genetic variation between the South African population and populations occurring in the more northern parts of Africa. It was suggested that if great variation was found then a very different approach should be taken to conserving the local population. It was also suggested that all management decisions should be based on scientific fact and not assumption.
The supplementation experts at the workshop were worried that a breeding season may be lost due to other research priorities, but biologists in the workshop stated that due to the lack of capacity, not all nests could be used in research projects anyway. Therefore, it was agreed that some the nests will be identified for research and other nests can be used for harvesting. It was however stressed that these nests need to be agreed upon and clearly identified to avoid cross-over and confusion. It was thus agreed that a research project be drawn up, including both the harvested and non-harvested nests, in order to maximise the opportunity for data collection to better understand the biology of the birds. Both the biologists and the harvesters can assist each other with data collection, observations and communication and thus, these projects although independent of each other, should not operate in isolation of each other.

Many of the workshop participants felt that a re-evaluation of current research projects and a consolidation of available data were paramount, so as to place all Ground Hornbill conservationists

in a better position to make improved management decisions. Many of the participants also felt that all existing projects should be allowed to continue unhindered as all projects were at least contributing to a common goal. However, communication, coordination of activities and the dissemination of information needed to be increased. It was therefore agreed that all current projects should continue but expansion of these projects and the establishment of new initiatives should be done in accordance with scientific fact only.

All participants agreed that communication and coordination are important to streamline activities and ensure that conservation actions are as effective as possible.

Consensus was reached by all on the following points regarding the way forward:

1. All agreed that supplementation and harvesting could continue, at least in status quo, but in conjunction and collaboration with a research project which would be developed to provide empirical data.
2. All agreed that the vastly increased levels of coordination and communication for continued cooperation was important.
3. All projects must work together and contribute towards the bigger picture.
4. A small group of experts would be convened once the workshop was complete to discuss a way forward to integrate the harvesting and research and from there to make decisions as to which nests could be used, for which projects and how these could work together.

SOUTHERN GROUND HORNBILL PHVA

7 – 11 February 2005

Southern African Wildlife College

WORKSHOP REPORT

SECTION 5:

APPENDICES

Appendix 1: Ground Hornbill PHVA Participant List

Name	Affiliation	Tel no.	Fax no.	EMail	Address	Photograph
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Meg Kemp	Private	012 804 7637	012 804 7637	leadbeateri@hotmail.com	Postnet Suite 38, Private Bag X19, Menlo Park, 0102	
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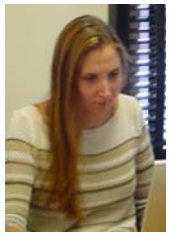
Brenda Daly	EWT	011 486-1102	011 486-1506	brendad@ewt.org.za	Private Bag X11, Parkview, 2122	
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Appendix 2: Participants Goals and Hopes

Workshop participants were asked to write down the answers to the following two questions:

1. What do you want to accomplish at this workshop?
2. What do you think you can contribute to this workshop?

I wish to accomplish	I wish to contribute
Identify priorities and action plans for the conservation of Ground Hornbills and get it through to regulating authorities and other stakeholders.	My experience of birds outside of formally protected areas in the Limpopo Province and knowledge of the threats facing birds in the Limpopo Province.
Drawing together experience and current knowledge on their habitat and evaluation of priorities in the conservation of Ground Hornbills. A way forward, this will continue to be evaluated and monitored.	Experience of coordinating a monitoring project involving many people on the ground in local communities. Some current information from CAR counts.
The start of a stable relationship between all parties who have the future of Ground Hornbills as their priority.	Secure the presence of Ground Hornbills for future generations and share my knowledge with all present especially captive breeding.
A coordinated strategy aimed at understanding the limiting factors for Ground Hornbills conservation and a synergetic strategy as to how these limiting factors are going to be overcome.	An open mind and 25 years of wildlife conservation and management.
What needs to be done collectively to be able to conserve Ground Hornbills better in South Africa, by sharing information.	Participant constructively in the debate / discussion that will lead to the action that needs to be taken to conserve the Ground Hornbill in South Africa.
A practical, effective strategy for the sustainable conservation Ground Hornbills and their required habitat.	Whatever I can in the context of my background. Help build partnerships (forestry industry / conservancies / NGOs.
A plan for Ground Hornbill conservation involving people in all fields, in a friendly way.	My experience in working with Ground Hornbills.
A workable plan to save the species.	Cement a liaison between all parties so that we happily work together to achieve our objectives.
A coherent national plan for Ground Hornbill conservation that focuses on the development of positive forms of human-hornbill interactions.	Whatever experience and insight might have come from past conservation of Ground Hornbills.
That I will have a clear mandate, to take back to my department for us to start implementation. That this mandate will be formulated in such a way that it will be taken seriously and will indeed be implemented.	My time, support and practical management knowledge.
I hope that all the attendees of this workshop will realise a common goal and work together to establish a protocol towards the successful conservation of the	I would like to contribute the knowledge I have gained through working on population viability analysis on Ground Hornbills for my Masters thesis.

Ground Hornbill.	
I hope all involved in the Ground Hornbill conservation will develop clear objectives and ideas on how to conserve the species.	As I am only starting out in this field, I can offer my services in doing research in the field with more knowledge gained from the workshop.
I hope the workshop will generate a comprehensive, considered and well balanced plan-of-action towards ultimately realising the effective conservation of the Ground Hornbill.	I hope to contribute scientific rigour to the proceedings to ensure that a decision taken are tempered by due consideration of sound, empirically supported principles and bring some fresh data from ongoing research in the APNR.
An appraisal of the key threats and conservation strategies for Ground Hornbills and a prioritisation and direction for future conservation activities.	A clear understanding of the issues and consideration to be taken into account when re-introducing or supplementing Ground Hornbills into the wild and how this may fit into an integrated conservation strategy if appropriate.
That the true status of the Ground Hornbill will be established and that realistic conservation measures will flow out of the workshop proceedings.	Since I am only here for one day of the workshop, I hope to supply some information that will contribute to the proceedings of the workshop.
I hope that information will be shared and that will help us to improve Ground Hornbill management.	Information from the workshop will help me to search for more methods of keeping Ground Hornbills in captivity.
All of us working together as a unit to the benefit of the Ground Hornbill.	Hopefully some knowledge, as far as the threats that Ground Hornbills are facing today and maybe be able to broaden on people's thoughts and ideas through the workshop.
I hope that there will be a better understanding of the problems faced by Ground Hornbills and there will be an agreement on steps or actions that need to be taken to ensure the long term survival of this species.	My general knowledge. Breeding of these birds for re-introduction
A clear picture will develop as to the way forward and what steps or measures should be introduced to facilitate the effective conservation of the species.	Data collected while working in KNP and nesting sites etc. as well as experiences from the captive situation.
A management plan that will ensure the survival of the Ground Hornbill and its natural environment.	Give input with regards to the veterinary needs of Ground Hornbills (i.e. disease / injury etc.) Transfer experience with regard to the captive management of Ground Hornbill.
To have a better understanding of the plight of the Ground Hornbill. Working with other people to advance the Ground Hornbill project.	Share captive breeding and husbandry aspects.
I'm hoping there will be more information gathered and put together with all the specialists in whichever field in order to get a better understanding of the Ground Hornbill. Their distributions wild and captive, breeding behaviours, social	Any knowledge that I may share and receive from people in the same field.

behaviours to establish security in preserving conserving the species.	
Greater understanding and clarity of Vortex Modelling.	Objectivity and “outsiders” input.
Gain a better understanding of the biology of the Ground Hornbill. Develop an action plan for the conservation of these birds.	Ideas and experience in the process.
Develop a set of priorities for Ground Hornbill conservation and habitat. Gain buy-in and acceptance of a way forward. Make friends made and develop a network.	I wish to assist with the modelling side My sense of optimism to see things move forward with everyone on board. Ensure housekeeping goes according to plan.
The way forward for Ground Hornbill whether it’s captive breeding, scientific involvement or education. That all the different groups work together.	Participation as a protection area manager.
An effective management programme that will be easily understood and implemented.	As an Ecologist, would like to present ideas on habitat preservation and management to ensure more suitable areas become available for Ground Hornbills.
Collaboration, people working together and communicating.	Sharing with other participants about indigenous knowledge systems and moral regeneration.
Ground Hornbill conservation issues can be agreed on, prioritised and that I will be able to use the information in biodiversity focussed environmental education.	Environmental education and community experience.
Clear understanding of the roles different organisations play in the Ground Hornbill world and the best way forward with regard to the conservation of the species with all the different groups working together to best achieve this goal.	What I have learnt over the past 6 months about our captive bred ‘wild’ release group on Mabula. Information about the status of Ground Hornbill in the Limpopo Province.
That clear priorities are established for the future conservation of the species and that all parties involved with Ground Hornbills get to share any information and knowledge that they have.	The skills and knowledge that I have obtained from hand-rearing as well as working with a group of free roaming Ground Hornbills.
Practical conservation measures that can be put into place for the future of the species and information on what I can do to assist the Working Group.	Share information available from our area and ideas on wild birds.
All bodies together sharing knowledge and data finding a way forward for Ground Hornbills.	The small group at Shamwari and believe that they will be of great value to the wild birds in the area.
To have a defined conservation strategy and implementation network for Ground Hornbills.	To give inputs on the current status of the Ground Hornbill north of the Soutpansberg Mountain.

Appendix 3: The Endangered Wildlife Trust and CBSG Southern Africa

Endangered Wildlife Trust

The Endangered Wildlife Trust (EWT) is one of the largest non-governmental conservation organisations in southern Africa and was established in 1973. Widely recognised by its prominent red cheetah spoor logo, the EWT conserves biodiversity through the hands-on conservation of threatened species and their habitats, in a sustainable and responsible manner. Coordinating more than 90 field-based conservation projects and with 18 specialist Working Groups operating throughout Southern Africa, Endangered Wildlife Trust programmes cover a wide variety of species and eco-systems and play a pivotal role in conserving southern African biodiversity and natural resources.

The Endangered Wildlife Trust with its access to a rich and diverse range of conservation expertise established CBSG Southern Africa in partnership with the CBSG, SSC / IUCN in 2000. Nine CBSG regional networks exist worldwide, including CBSG Indonesia, India, Japan, Mesoamerica, Mexico, Sri Lanka, Europe and South Asia. Regional CBSG networks are developed in regions requiring intensive conservation action and each network operates in a manner best suited to the region and local species. CBSG tools are adapted according to the needs and requirements of regional stakeholders and species and local expertise is utilised to best effect. Each regional network has developed its own unique conservation identity.

CBSG Southern Africa's mission is: *To catalyse conservation action in southern Africa by assisting in the development of integrated and scientifically sound conservation programmes for species and ecosystems, building capacity in the regional conservation community and incorporating practical and globally endorsed tools and processes into current and future conservation programmes*.

CBSG Southern Africa, operating under the banner of the Endangered Wildlife Trust is a non-profit, non-governmental organisation, serving the needs of the *in-situ* and *ex-situ* conservation community in southern Africa through the provision of capacity building courses, species and organisational Action Planning, Population and Habitat Viability Assessment (PHVA) and Conservation Assessment and Management Planning (CAMP) workshops, communication networks, species assessments and a host of other CBSG processes for species and ecosystem conservation. CBSG Southern Africa works with all stakeholders in the pursuit of effective biodiversity conservation throughout southern Africa.

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CONSERVATION BREEDING SPECIALIST GROUP
SOUTHERN AFRICA

Appendix 4: Workshop Programme

7th February - 11th February 2005

Southern African Wildlife College, Hoedspruit

Monday 7th	**February 2004 –**	**Day 0**
15h00 - 18h00	Delegates arrive at the SA Wildlife College	
19:00 – 21:00	**DINNER**	

Tuesday 8th	**February 2004 –**	**Day 1**
07:30 – 08:30	**BREAKFAST**	
8:30 – 9:00	Registration	
9:00 – 9:30	Welcome and introductions	
9:30 – 10:30	EWT / GHWG Current status of research in Limpopo Province (Derek Engelbrecht) Current status of monitoring in Kruger National Park (Andrew Deacon) Current status of harvesting and reintroduction programme (Ann Turner) (10 minutes each)	
10:30 – 11:00	**TEA BREAK**	
11:00 – 12:00	Introduction to the CBSG, CBSG Southern Africa and the workshop process	
12:00 – 13:00	Plenary Session: Identify key issues	
13:00 – 14:00	**LUNCH BREAK**	
14:00 – 14:10	Current status of research in the APNR (Morne du Plessis)	
14:10 - 14:30	Formation of Working Groups and overview of task one	
14:30 – 15:30	Working groups convene and begin on first task	
15:30 – 16:00	TEA BREAK (FUTURE BREAKS SELF-REGULATED)	
16:00 – 16:30	Working Group sessions	
16:30 – 17:30	Plenary – First Working Group Reports	
19:00 – 20:00	**DINNER**	

Wednesday 9th	**February 2004 –**	**Day 2**
07:30 – 08:30	**BREAKFAST**	
8:30 – 9:30	Working groups convene to make changes to first reports	

9:30 – 10:30	Plenary on goals / solutions and filters
10:30 – 11:00	**TEA BREAK and group photos taken**
11:00 – 13:00	Working groups convene and begin second task
13:00 – 14: 00	**LUNCH BREAK**
14:00 – 15:00	Plenary session to present and discuss goals / solutions
15:00 – 15:30	Working Groups convene to continue with second task
15:30 – 16:00	**TEA BREAK**
16:00 – 17:30	Working Groups convene and finalise second task
19:00 – 20:00	**DINNER**

Thursday 10th	**February 2004**	**-**	**Day 3**

07:30 – 08:30	**BREAKFAST**
8:30 – 9:30	Plenary session to complete task two
9:30 – 10:30	Discussion of third task: Strategies and Action plans
10:30 – 11:00	**TEA BREAK**
11:00 – 13:00	Working Groups reconvene to carry on with task three
13:00 – 14:00	**LUNCH BREAK**
14:00 – 15:00	Plenary Session to report back on task three
15:00 – 15:30	**TEA BREAK**
15:30 – 17:30	Working Groups reconvene to carry on with task three Plenary session to finalise task three
19:00 – 20:00	**DINNER**

Friday 11th	**February 2004**	**-**	**Day 4**

07:00 – 08:00	**BREAKFAST**
8:00 – 10:30	Working Groups reconvene to finalise reports Group integration: Prioritise all solutions
10:30 – 11:00	**TEA BREAK**
11:00 – 12:30	Plenary session to present working group reports, discuss management recommendations and report completion Workshop closure and survey
13:00 – 14:00	**LUNCH BREAK**

Delegates depart