DEPARTMENT OF FORESTRY, FISHERIES AND THE ENVIRONMENT

NO. 2754 **18 November 2022**

NATIONAL ENVIRONMENTAL MANAGEMENT: BIODIVERSITY ACT, 2004
(ACT NO. 10 OF 2004)

CONSULTATION ON THE DRAFT BIODIVERSITY MANAGEMENT PLAN FOR THE SOUTHERN GROUND-HORNBILL (*Bucorvus leadbeateri*)

I, Barbara Dallas Creecy, Minister of Forestry, Fisheries and the Environment, hereby publish the Draft Biodiversity Management Plan for Southern Ground-hornbill (*Bucorvus leadbeateri*), under section 43(1)(b) and (c) read with section 99 and 100 of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004), for public comment, as set out in the Schedule.

Members of the public are invited to submit written comments on the Draft Biodiversity Management Plan for Southern Ground-hornbill (*Bucorvus leadbeateri*) within 30 (thirty) days from the date of publication of the notice in the ***Gazette or in the newspaper, whichever date is the last date,*** to any of the following addresses:

By post to: The Director General: Department of Forestry, Fisheries and Environment
Attention: Ms Humbulani Mafumo
Private Bag X447
PRETORIA
0001

By hand at: Environment House, 473 Steve Biko Road, Arcadia, Pretoria, 0083

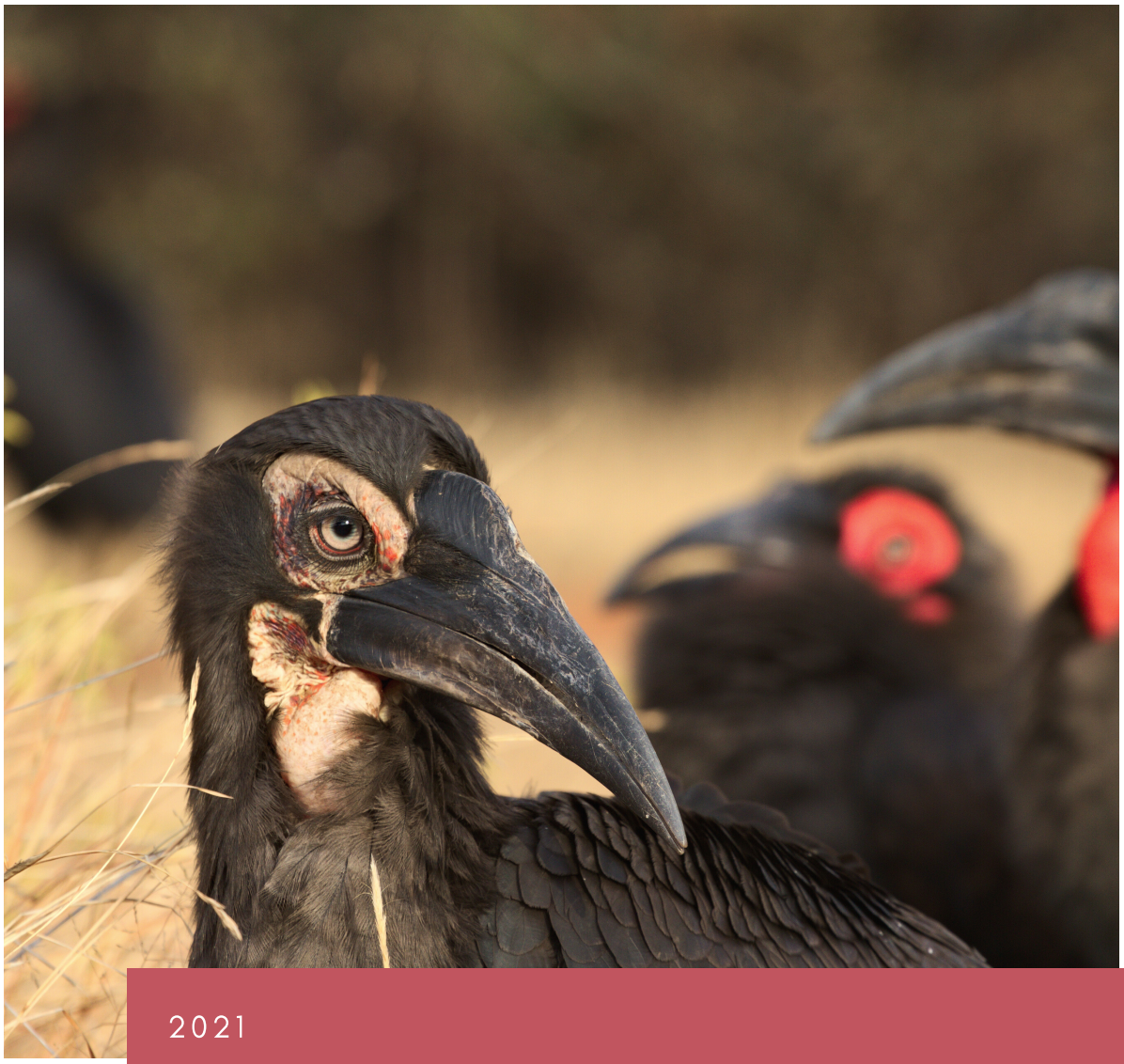
By email: ConservationManagement@environment.gov.za

Any inquiries in connection with the Draft Biodiversity Management Plan for Southern Ground-Hornbill (*Bucorvus leadbeateri*) can be directed to Ms Humbulani Mafumo at Tel. 012 399 9586, or through email: humbu.mafumo@dffe.gov.za.

An electronic copy of the Draft for Biodiversity Management Plan for Southern Ground-hornbill (*Bucorvus leadbeateri*) can be downloaded from the link: http://www.environment.gov.za//Documents/.

Comments received after the closing date may not be considered.

BARBARA DALLAS CREECY
MINISTER OF FORESTRY, FISHERIES AND THE ENVIRONMENT



2021

DRAFT BIODIVERSITY MANAGEMENT PLAN FOR THE SOUTHERN GROUND-HORNBILL *Bucorvus leadbeateri* IN SOUTH AFRICA

Proposed lead agency:
South African National Biodiversity Institute

Editors:
Lucy Kemp, Coral Birss, Hanneline Smit-Robinson, Antoinette Kotze, Gareth Tate, Rob Little

This plan was developed jointly by the following contributing organisations:

Department of Forestry, Fisheries and the Environment, Mabula Ground Hornbill Project, South African National Biodiversity Institute, FitzPatrick Institute of African Ornithology, BirdLife South Africa, Endangered Wildlife Trust, South African National Parks, Mpumalanga Tourism and Parks Agency, Limpopo Department of Economic Development, Environment and Tourism, Gauteng Department of Agriculture and Rural Development, Department of Economic Development and Environmental Affairs, Ezemvelo KwaZulu-Natal Wildlife, Eastern Cape Parks and Tourism Agency, Eastern Cape Department of Economic Development, Environmental Affairs and Tourism, University of KwaZulu-Natal, Montecasino Bird Gardens, Johannesburg City Parks: Joburg Zoo, Umgeni River Bird Park, CapeNature, the IUCN SSC Hornbill Specialist Group and Conservation Planning Specialist Group.

Citation: *Kemp, L.V., Birss, C., Smit-Robinson, H.A., Kotze, A., Tate, G and R.M. Little. 2020. Biodiversity Management Plan for the Southern Ground-Hornbill in South Africa. Jointly developed by the South African Southern Ground-Hornbill Action Group and the Department of Environment, Forestry and Fisheries. Version 1.0*


forestry, fisheries
& the environment
Department:
Forestry, Fisheries and the Environment
REPUBLIC OF SOUTH AFRICA


MABULA
GROUND HORNBILL
PROJECT


SANBI
Biodiversity for Life
South African National Biodiversity Institute


FitzPatrick Institute of
African Ornithology


BirdLife
SOUTH AFRICA
Giving Conservation Wings


ENDANGERED
WILDLIFE TRUST


South African
NATIONAL PARKS


Mpumalanga
TOURISM AND PARKS AGENCY


LIMPOPO
PROVINCIAL GOVERNMENT
DEPARTMENT OF
ECONOMIC DEVELOPMENT, ENVIRONMENT & TOURISM


UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA


GAUTENG PROVINCE
Agriculture and Rural Development
REPUBLIC OF SOUTH AFRICA


Province of the
EASTERN CAPE
ECONOMIC DEVELOPMENT,
ENVIRONMENTAL AFFAIRS AND TOURISM


EZEMVELO
KZN WILDLIFE
Conservation, Partnerships & Ecotourism


UNIVERSITY OF
KWAZULU-NATAL
INYUVESI
YAKWAZULU-NATALI


MONTECASINO
BIRD GARDENS


ADVENTURE PROVINCE
Eastern Cape
PARKS & TOURISM AGENCY


CapeNature


Joburg
Joburg
City Parks
Joburg
ZOO


Umgeni River Bird Park
"Inspire to Conserve"


IUCN
SSC
Hornbill
Specialist
Group


CONSERVATION
PLANNING
SPECIALIST GROUP
Changing the Future for Wildlife

TABLE OF CONTENTS

FOREWORD – Dr Alan Kemp

Initial fieldwork on the Southern Ground-Hornbill started over 50 years ago in the Kruger National Park but, in the last decade, there has been a surge in both research and conservation activities, theses and publications on the species, particularly in South Africa, of which this Biodiversity Management Plan (BMP-S) is the latest collation. Initially, the research constituted field studies of behaviour, home range size and population dynamics and, as it proceeded, began to explore the previous, current, national and sub-Equatorial ranges of the species. These studies highlighted at least four aspects of the species' biology that have proved significant in subsequent biological studies and conservation actions. First, the total range in South Africa had decreased historically by an estimated 50-70%. Second, each cooperatively breeding group, led by an alpha breeding pair, permanently occupies an extensive home range (70-250 km^2) and hence exists at a low overall density. Third, no more than a single chick is raised during the summer breeding season, but any second-hatched chick dies early of neglect, is redundant to the population's dynamics and hence available as extra stock for management interventions. Fourth, suitable nest holes in natural cavities may be inadequate or lacking in a group territory, but can be successfully refurbished or replaced with artificial nests.

Based on these discoveries, a programme of wild-harvesting, captive-breeding and hand-rearing of newly-hatched second chicks was initiated in 1999, followed by an attempt to re-establish a new group at Mabula Private Game Reserve in part of the original range of the species. Southern Ground-Hornbills are a large, long-lived species that take 8-10 years to reach maturity, so such artificial management is inevitably slow but, by now, chick-rearing and juvenile reintroduction are efficient, three groups have been re-introduced at different historical localities and a younger neighbouring group already established alongside each of them. Over the same period, a range of studies, including under- and post-graduate theses, have extended our knowledge of the species biology, both nationally and internationally, so that this BMP-S is based on a complete revision of our previous knowledge and experiences.

All these efforts have been informally coordinated at a national level by a national Action Group, led by a member-elected chairperson. It has included, among others, field and laboratory researchers, veterinarians, husbandry experts, ecologists, government and non-governmental organisations, conservation managers, landowners and community representatives, both local and visiting. In 2005, the first Population and Habitat Viability Assessment (PHVA) was held under independent local facilitators, a multi-authored national Recovery Plan was published in 2011 and by 2017 a second PHVA was conducted with an IUCN SSC facilitator and population modeler. This draft BMP-S in 2020 is the latest national conservation management plan for the species and, most importantly, it has included input and buy-in from all major provincial and national conservation agencies in the Limpopo, Gauteng, Mpumalanga, KwaZulu-Natal and Eastern Cape Provinces where the species still occurs or has occurred.

Incidentally for the species, from my perspective of being actively involved in its study and conservation from their inception, management of the species has almost always been collaborative between various *in-* and *ex-situ* organisations, private, provincial, national, and both local and international. Currently, there are only an estimated 400-450 breeding females left in the wild in South Africa, each one living within its territorial group. Over half of these groups occur within the area of the Greater Kruger National Park, the remainder scattered across smaller conservation areas, private and commercial landowners, and various rural communities, while any natural em- and immigration is only expected via Botswana, Zimbabwe, Mozambique and Swaziland. The species used to occur across the northern and eastern savannas of South Africa, but a gap has developed south of the Kruger National Park and extended into northern KwaZulu Natal and Swaziland, while a substantial population, still being documented, has survived in the rural areas of KwaZulu Natal and the Eastern Cape, especially the areas of previous apartheid *homelands*.

The permanent residency of each group on their territory is both an advantage and a disadvantage. It means that conservation managers do not have to pay particular attention to plans for age, seasonal or breeding movements, but rather can concentrate on sustaining the security and ecology of each known territorial aggregation or isolated territory. The national monitoring plan proposed in the BMP-S addresses this range-wide requirement and will provide an important index of the success of national and regional conservation measures. Attempts to manage the stability, and hopefully, the expansion and recolonization of populations, depends much more on management, even re-creation, of local or individual territories, especially by eliminating known and newly discovered threats to the species. Given the average extensive size of one territory, albeit those managed by a game ranger, neighbouring farmers, a village or a community, it will require as much their commitment as that of any biologists involved, and this BMP-S will go a long way to directing, justifying and facilitating the various inter-organisational and inter-personal interactions and the associated funding that are involved and required.

EXECUTIVE SUMMARY

One of only nine African savanna hornbill species, the Southern Ground-Hornbill (*Bucorvus leadbeateri*: hereafter SGH) is listed as being of both international and national conservation concern (Taylor, Peacock & Wanless, 2015; BirdLife International, 2018; NEMBA), and is known across its sub-equatorial range as the *rain bird* or *thunder bird* by indigenous people who share its habitat. The species is one of just two species in the genus *Bucorvus*.

The species is an apex predator and thus ecologically important, as well as holding immense cultural value to most of the language groups across its range. It is a typical K-selected species that breed slowly and cooperatively with massive spatial requirements. The life-history traits, social structures and behaviours of the SGH interest both scientists (Kemp, 1988; Kemp & Kemp, 1980, 2007; Chiweshe, 2007) and followers of traditional lore (Msimanga, 2000; Coetzee & Wilkinson, 2007; Muiruri & Maunda, 2010; Bruyns, Williams & Cunningham, 2013). Coincidentally, these are the same traits that make them ill-suited for survival under the growing ecological pressures of the Anthropocene (Crutzen, 2006). It is the long-lived, slow-breeding nature of the species that prevents it from being able to maintain stability against the myriad of anthropogenic threats that it faces.

The SGH is proposed to be one of the swiftest declining bird species in South Africa. The species is listed as regionally Endangered in South Africa, Lesotho, Swaziland and Namibia (Taylor, Peacock & Wanless, 2015) and globally Vulnerable (Birdlife International, 2018). In South Africa, the population range declined to less than 50% in just 15-20% of a hornbill generation (Kemp, 2017). It is projected that, in Kenya, Zimbabwe and Botswana, populations also meet the criteria for being listed as Endangered (Simmons, Brown & Kemper, 2015). In South Africa, the species has strongholds in only the largest protected areas (e.g. the Greater Kruger National Park) and in areas where cultural protection is still strong (i.e. southern KwaZulu-Natal).

A 2nd Population and Habitat Viability Assessment (PHVA) workshop held in August 2017 reviewed the knowledge base for the species, to ensure that conservation planning is sound and evidence-based, and to maximise limited conservation resources in terms of strategic capacity, funding and effort. In recognition of the immediate need for a legislated, nationally co-ordinated, conservation action plan at the PHVA workshop, the Mabula Ground Hornbill Project (MGHP) and the South African National Biodiversity Institute (SANBI) initiated a primary workshop to initiate the development of this Biodiversity Management Plan (BMP-S).

Section 9(1)(a)(i) and 43 of NEMBA 2004 (Act no 10 of 2004) provides for the issuing of national norms and standards for the management and conservation of South Africa's biodiversity and its components. To this effect, the department developed the Norms and Standards for the development of BMP for Species (BMP-S), which were gazetted in March 2009 (Department of Environmental Affairs and Tourism 2009). The purpose of these norms and standards is to provide a national approach and minimum standards for the development of a BMP-S.

This document was produced as a result of that workshop, held between 13-15 May 2018, with four subsequent regional workshops in 2019. The BMP-S for the SGH will be subject to iterations brought about through realistic and relevant management dynamics. As such, it is important that those responsible for the implementation of this BMP-S recognise the need for, and apply, active adaptive management where necessary. This document is based on the outcomes of the 2nd PHVA (Kemp & Bruford, 2018), and includes elements of the Single Species Recovery Plan (Jordan, 2011) that required further attention.

Stakeholder engagement during several workshops identified threats and challenges, including persecution for window-breaking, falling foul of poison bait set out for so-called pest species, electrocution on transformer boxes, loss of nest hollows, and trade, both for aviculture and for traditional belief-based use.

VISION FOR THE FUTURE OF SOUTHERN GROUND-HORNBILLS:
An increasing and healthy population with an increased conservation and cultural value in the Southern Ground-hornbill.

AIM: to improve the conservation status of the SGH and secure its survival in perpetuity in the wild

This is underpinned by the following **GOALS**.

1. Conservation of the SGH population.
2. Mitigate and manage the impact of current threats, including emerging diseases.
3. Long-term monitoring of SGH population dynamics and habitat.
4. Aligned legislation and mandates.
5. Effective communication, collaboration and coordination among stakeholders.

The prioritised **STRATEGIC OBJECTIVES** of the SGH BMP-S are as follows:

i. Protect the remaining wild population to allow for population stability and initiate growth from the current estimated 439 groups supporting breeding females to the criteria needed to down list the species from Endangered to Vulnerable.
ii. A target of 5% growth in the number of pentads where groups are reported per annum, through a combination of reintroduction, artificial nest provision, range-expansion, custodianship or enhanced monitoring, is required to meet this objective by 2042.
iii. Long-term monitoring of SGH through citizen science and the Custodianship Programme.
iv. Strong integration of cultural and ecological values in the conservation of the species.
v. Effective communication, collaboration and coordination between stakeholders and the public for SGH conservation.

The implementation of this BMP-S will benefit the following**:**

i. The SGH population is stabilised as a basis for population growth.
ii. The population is ecologically healthy and secure.
iii. Indigenous knowledge systems will be formally incorporated into conservation planning.
iv. The threats affecting various other threatened species that utilise the savanna and grassland biomes, for example, African wild dog *Lycaon pictus*, vulture species and Secretary birds *Sagittarius serpentarius,* will be addressed through the implementation of this BMP.

The BMP-S for the SGH is aimed at **identifying**, **allocating** and **undertaking** the required, identified actions to enable stakeholders to contribute to the overall desired outcome for the species. This will enable the long-term survival of the species in nature and thereby ensuring that South Africans take responsibility for supporting a viable future for this Endangered species.

The BMP-S process for the SGH has so far included 42 representatives from various groups of role-players and has prioritised a set of threats and commensurate actions towards achieving the overall aim and objectives of the BMP-S, the overall aim is to improve the conservation status of the SGH and secure its survival in perpetuity in the wild.

The aim will be achieved through the following actions:

1. Improve the conservation status of SGH and improve its protection as part of meeting international biodiversity objectives through applied conservation action.
2. Address the threats responsible for declines in SGH population sizes.
3. Expand educational and awareness campaigns to improve public knowledge about the SGH and the importance of its role in the ecosystem and cultural heritage.
4. Identify and conduct research to generate knowledge and provide information relevant to conservation management requirements, both *in*- and *ex-situ*.
5. Improve and enforce legislation on SGH threats within its distribution range.

The specificity of the operational goals and actions that are captured under the objectives is required to ensure that progress with implementation of the BMP-S can be tracked and those to whom responsibilities have been allocated can be held accountable for delivery. The National Environmental Management: Biodiversity Act (NEMBA), 2004 (Act No. 10 of 2004) specifies that all BMP-S be revised five years after approval. This BMP-S for the SGH is the first in a series of five-year iterations where each BMP-S will measure the success of the previous BMP-S and make the necessary revisions. This will be done to ensure that the plan for the next five years is appropriate and applicable to any changes which may have occurred.

ACKNOWLEDGMENTS

This plan was jointly developed at a stakeholder's workshop organised by the Mabula Ground Hornbill Project (MGHP) and South African National Biodiversity Institute (SANBI) attended by South African members of the South African Southern Ground-Hornbill Action Group and invited stakeholders (see Appendix C for the full list of participants). Without their dedication to the species and this process, developing this plan would not have been possible.

Cape Nature is thanked for the excellent facilitation skills of Coral Birss. Lucy Kemp (MGHP) and Antoinette Kotze (SANBI) kindly facilitated and organised the workshop. Core sponsors of the MGHP funded travel and accommodation costs for the facilitator and participants: Disney Conservation Fund and San Diego Zoo Global.

The plan represents the consensus view of those at the workshop. They represented the:
Department of Forestry, Fisheries and the Environment,); Eastern Cape Department of Economic Development and Environmental Affairs and Tourism; South African Hunters and Game Conservation Association; Gauteng Department of Agriculture and Rural Development; Endangered Wildlife Trust; FitzPatrick Institute of African Ornithology; Children and Nature Conservation Trust Zimbabwe; Montecasino Bird Gardens; Pan-African Association of Zoos and Aquaria; BirdLife South Africa; University of KwaZulu-Natal; Mabula Ground Hornbill Project; IUCN Species Survival Commission Hornbill Specialist Group; and SANBI.

As not all relevant stakeholders were able to attend the first workshop, Dr Kemp facilitated additional SGH BMP-S Actions and Relevant Agreements Workshops held at Howick (Ezemvelo KwaZulu Natal Wildlife: EKZNW), Loskop Nature Reserve (Mpumalanga Tourism and Parks Agency: MTPA), Modimolle (Limpopo Department of Economic Development, Environment and Tourism: LEDET) and Skukuza (South African National Parks: SANParks). These participants, representing EKZNW, MTPA and SANParks, are also thanked for their input and support.

The BMP-S document represents the consensus view of the workshop, and not necessarily that of the editors, organizations or sponsors represented at the workshop(s).

Dr Alan Kemp is thanked for invaluable inputs and the expert review.

The editorial committee (L. Kemp, C. Birss, H. Smit-Robinson, A. Kotze, G. Tate and R. Little,) would also like to acknowledge: Marilyn Aitken, Vivienne Williams, Joseph Heymans, Melissa Whitecross, Kyle-Mark Middleton, Craig Whittington-Jones, Yvette Ehlers-Smith, Derek Engelbrecht and Brent Coverdale (on behalf of EKZNW) are thanked for their contributions to the final draft.

ACRONYMS AND ABBREVIATIONS

AEWA CMS	Agreement on the Conservation of African-Eurasian Migratory Waterbirds Convention of Migratory Species
APNR	Associated Private Nature Reserves
AOO	Area of Occupancy
a.s.l.	above sea level
AZA	Association for Zoos and Aquariums
B-Tech	Bachelor of Technology
BMP-S	Biodiversity Management Plan for Species
CITES	Convention on International Trade in Endangered Species
Cytb	Cytochrome b
CBD	Convention on Biological Diversity
DE	Department of Energy
DFFE	Department of Environment, Forestry and Fisheries
DNA	Deoxyribonucleic acid
DPhil	Doctor of Philosophy
DoTa	Department of Traditional Affairs
DRC	Democratic Republic of Congo
DRDLR	Department of Rural Development and Land Reform
EAZA	European Association of Zoos and Aquariums
EC DEDEAT	Eastern Cape Department of Economic Development, Environmental Affairs and Tourism
ECPTA	Eastern Cape Parks and Tourism Agency
EKZNW	Ezemvelo KwaZulu-Natal Wildlife
EOO	Extent of Occupancy
EWT	Endangered Wildlife Trust
FAO	Food and Agriculture Organization
GAPDH	Glyceraldehyde 3-phosphate dehydrogenase
GDARD	Gauteng Department of Agriculture and Rural Development
HEI	Higher Education Institutions
IUCN	International Union for Conservation of Nature
KNP	Kruger National Park
KZN	KwaZulu-Natal

LEDET	Limpopo Department of Economic Development, Environment and Tourism
MGHP	Mabula Ground Hornbill Project
MTPA	Mpumalanga Tourism and Parks Agency
MCP	Minimum Convex Polygon
MSc	Master of Science
MTech	Master of Technology
MtDNA	Mitochondrial DNA
NCD	Newcastle Disease
NDA	National Development Agency
NEMA	National Environmental Management Act
NEM: BA	National Environmental Management Biodiversity Act
NEM: PAA	National Environmental Management Protected Areas Act
NGO	Non-Governmental Organisation
NZG	National Zoological Gardens
NWPPWG	National Wildlife Poison Prevention Working Group
OAU	Organisation of African Unity
PAAZA	Pan African Association of Zoos and Aquaria
PFIAO	Percy FitzPatrick Institute of Africa Ornithology
PhD	Doctor of Philosophy
PCoA	Principal Components Analysis
PHVA	Population and Habitat Viability Assessment
PPMV-1	Pigeon paramyxovirus
QDGC	Quarter Degree Grid Cell
SABAP2	South African Bird Atlas Project 2
SACNASP	South African Council for Natural Scientific Professions
SAHGCA	South African Hunters and Game Conservation Association
SANBI	South African National Biodiversity Institute
SANParks	South African National Parks
SGH	Southern Ground-Hornbill
SOP	Standard Operating Procedure
SSC	Species Survival Commission
Tmax	Full temporal data set
ToPS	Threatened or Protected Species

TTT	Thunderbird Task Team
UCT	University of Cape Town
UFS	University of the Free State
UKZN	University of KwaZulu-Natal
UL	University of Limpopo
UP	University of Pretoria
USA	United States of America
WITS	University of the Witwatersrand
WG	Working Group
WLTP	Women's Leadership and Training Programme
WRSA	Wildlife Ranching South Africa

GLOSSARY OF DEFINITIONS, SCIENTIFIC AND TECHNICAL TERMS

In this BMP-S, unless the context indicates otherwise, a word or expression defined in the National Environmental Management: Biodiversity Act (NEM: BA, Act 10 of 2004) or Protected Areas Act (NEM: PAA, Act 57 of 2004) has the same meaning.

"Biodiversity Management Plan for species" means a species management plan in terms of section 43 of the National Environmental Management: Biodiversity Act (Act No. 10 of 2004).

"Collaborators" means the parties approached to assist or included in the process to complete the actions of the Biodiversity Management Plan.

"Dispersal" means the movement of SGH individuals from out of the group and territory, potentially to another group or available territory.

"*Ex-situ* conservation" means the conservation of wild organisms and/or their genetic resources off-site or outside of their natural habitats.

"Generation length" means the turnover rate of breeding individuals in a population.

"Fledgling" means the stage where an SGH is ready to leave the nest, the stage between the chick and adult phases.

"Habitat" is the natural home of the species. Often depending on the vegetation, topography and climate of the area.

"*In-situ* conservation" means the conservation of biodiversity in the wild through the management of ecosystems and habitats natural to SGH, the maintenance of viable populations or the recovery to viability by populations of the species in their natural surroundings.

"IUCN Red Data List" means the global list providing information on a species' risk of extinction (usually by taxonomic unit), prepared under auspices of the International Union for Conservation of Nature.

"K-selected" species possess relatively stable populations fluctuating near the carrying capacity of the environment. These species are characterized by having only a few offspring but investing high amounts of parental care.

"Monitoring" The collection and analysis of repeated observations, counts or measurements to evaluate the change in status, distribution or integrity, to track the impacts of directed management implemented to achieve a stated management objective.

"Protected area" any of the protected areas referred to in Section 9 of the National Environmental Management: Protected Areas Act, 2003 (Act No. 57 of 2003).

"Rehabilitation" means the return the SHG to its natural state, as it would be in the wild.

"Stakeholder" means a natural or juristic person that has an interest in, or maybe affected by, a particular obligation or decision or activity relating to or resulting from a management plan, either as individuals or representatives of a group and including landowners where appropriate.

"Species" means a kind of animal, plant or other organisms that do not normally interbreed with individuals of another kind, and includes any sub-species, geographic race, strain, hybrid or geographically separate population.

"Threat" means any action or species that causes a decline in and compromises the future survival of one or more populations of a species, or anything that has a detrimental effect on the species. Threats can be human-induced or natural. The BMP-S should focus on mitigating human-induced threats to the species.

"Viable" when referring to a population, means a population that has the ability to persist (and/or multiply over many generations) in the long-term without human intervention or assistance. When referring to habitat, it means suitable to the survival and persistence of the species.

"Working group" means a number of individuals invited to form a group, in order to complete an action or actions set out in the Biodiversity Management Plan.

LIST OF TABLES

LIST OF FIGURES

1. INTRODUCTION

One of only nine African savanna hornbill species, the Southern Ground-Hornbill (*Bucorvus leadbeateri*: hereafter SGH) is listed as being of conservation concern (Taylor *et al*. 2015). It is known across its range as the *rainbird* or *thunder bird* by indigenous people who share its habitat. The SGH is one of just two species in the genus *Bucorvus*. Both species are top-order predators and thus ecologically important, besides holding immense cultural value to most indigenous language groups across its range. Both are typical K-selected species and have several significant life history characteristics, each independently increasing their vulnerability to extinction: they are diurnal, long-lived, large, conspicuous, apex avian predators, with large spatial needs that result in low densities and therefore small population sizes per unit area (Kemp, 1995a). For the SGH, these features, together with its cooperative breeding and other complex social structures, combine to produce a naturally slow rate of reproduction and recruitment (Purvis *et al*., 2000). Added to this, the species faces many anthropogenic threats (BirdLife International, 2018), each growing in scale as human population growth expands across sub-equatorial Africa.

The SGH has been described as one of the swiftest declining bird species in South Africa (Underhill, 2014). The species is formally listed by IUCN Red List criteria as globally Vulnerable (BirdLife International, 2018), but regionally Endangered in both South Africa (Taylor & Kemp, 2015) and Namibia (Simmons, Brown & Kemper, 2015), with populations in decline in most other adjacent range states (Kemp, 2017). In South Africa, it is also listed as a Threatened or Protected Species (ToPS), and thus accorded national protection (in terms of section 56(1) of the NEMBA, with permits required in terms of restricted activity (in terms of section 11), and yet populations are still declining and are already occupy less than 50% of their historical range in just 15-20% of a generation (Kemp, 2017).

The SGH has strongholds in only the largest protected areas (i.e. the Greater Kruger National Park) and in areas where cultural protection is still vigorous (i.e. southern KwaZulu-Natal). The remaining groups inhabit mixed-land-use commercial farmlands (crop cultivation, viticulture, forestry, livestock and game) and communal farming areas.

Ground-Hornbills act as “flagship species” for savanna and grasslands since they require large areas and significant protection measures that help to conserve a wide range of biodiversity with similar savanna and grassland requirements. Ground-hornbills are a vital part of our national heritage and have spiritual and experiential value for many people.

1.1. THE NEED FOR A BMP-S FOR THE SOUTHERN GROUND-HORNBILL

A full review of the conservation biology of the species (Kemp, 2017) highlighted the need for increased coordination and implementation of proposed conservation actions from various conservation plans and suggestions (Morrison, *et al*. 2005; Jordan, 2011; Kemp & Bruford, 2018). Since the 1st Population and Habitat Viability Assessment (PHVA: an IUCN SSC Conservation Planning Specialist Group product), held in 2005, much research has been conducted and published on the SGH, including six PhD and seven MSc studies, including through the reintroduction and captive breeding programmes. All this contributed to an extended knowledge base, and it was considered prudent to incorporate these data into a revised PHVA model to assess if current conservation planning is still relevant and evidence-based, and to ensure that strategic conservation resources are applied sustainably to the persistence of the species.

Stochastic population modelling conducted during the 2nd PHVA showed clearly that the species' most important threats are anthropogenic, and that if poisoning is not addressed (both from agrochemicals and lead-based ammunition), the species will disappear from areas where such poisoning occurs. Under this scenario, protected areas, including large national parks and reserves, and non-protected areas where cultural protection remains vigorous, are expected to be the only SGH refugia that will persist with minimal conservation intervention. The PHVA shows the commitment of various stakeholders to various conservation actions that were deemed priorities by the group. Two chief priorities emerged:

1) That a BMP-S was required to ensure that the conservation of the species became a formal legislated priority for South Africa, rather than being efforts solely conceived and driven by NGOs and academics.

2) That collaborative and integrated management among and between stakeholders, as well as public support, is required for effective management of the population, and a more comprehensive forum was proposed as the vehicle for this.

A BMP-S is thus essential, given the Endangered Red-list status, the requirement for inter-agency cooperation towards shared objectives for the conservation of the species, standardised monitoring, collaborative research, increased participation by diverse landowners, and opportunities as a flagship species where, given the vast spatial requirements, conservation efforts will also improve the outlook for other threatened species. It is also BirdLife South Africa's designated Bird of the Year for 2020.

This BMP-S, informed by the 2nd PHVA (Kemp & Bruford, 2018), was jointly developed by members of the South African Southern Ground-Hornbill Action Group and invited experts and representatives of many stakeholder organisations (see Acknowledgements). Also, to ensure the long-term survival of the species in the wild, NEMBA provides for monitoring and reporting on the progress with implementation of the plan.

1.2 VISION AND DESIRED STATE

During the 2nd PHVA held in 2017 (Kemp & Bruford, 2018), the following vision statement was defined for the species:

To stabilize and then reverse the decline of the Southern Ground-Hornbill (*Bucorvus leadbeateri*), with the aim to achieve its conservation down-listing within South Africa, and to support other range-state conservation efforts.

This vision was underpinned by four specific goals, which guided the development of the PHVA and the BMP-S.

- A stabilized and growing Southern Ground-Hornbill population.
- Mitigation of threats, especially those common to other species e.g. poisoning and lead toxicosis.
- Strong integration of cultural and ecological values of the species.
- Long-term monitoring of the Southern Ground-Hornbill through a national monitoring plan, using citizen science and a local and regional Custodianship Programme.

Thus, the **DESIRED STATE** developed during the BMP-S stakeholder-engagement workshop is the following:

Southern Ground-Hornbills co-exist harmoniously with the people of South Africa due to positive changes in attitudes and behaviour, resulting in increased pride in and custodianship of a stable Southern Ground-Hornbill population persisting in a risk- free landscape.

1.3 OBJECTIVES OF THE BMP-S

The prioritised strategic objectives of the Southern Ground-Hornbill BMP-S to meet the target of 5% growth in the number of pentads where groups are reported per year are as follows:

1. BMP-S uptake, adoption and implementation are driven by DFFE.
2. Combine and prioritise valid actions from the SGH Single Species Recovery Plan and the 2nd SGH PHVA, to produce a final state-of-the-art conservation plan for the species.
3. Ensure effective and consistent communication, collaboration and coordination between stakeholders and the public for Southern Ground-Hornbill conservation, within the Thunderbird Task Team (TTT) Collaborative Conservation branding.
4. Ensure implementation of and accountability for actions within the BMP-S.
5. Implement standardised monitoring and promote collaborative research to inform adaptive management.
6. Consistently and uniformly implement legislation, regulations, policies, guidelines and protocols.

1.4. BENEFITS OF THE BMP-S

The envisaged benefits of implementing the BMP-S are:

- An ecologically healthy SGH population that remains stable and increasing, even in non-protected habitats.
- Scientifically-sound population management is implemented, both *in*- and *ex-situ*, representing the full extent of the local genetic diversity.
- Private and government sector support and investment in SGH conservation.
- SGH conservation must be institutionalised, to ensure institutional membership of the TTT is continuous.
- The support of owners, managers and inhabitants of the land on which SGH are permanent residents is obtained.

1.5 ANTICIPATED OUTCOMES OF THE BMP-S

The SGH BMP-S aims to identify and allocate the required, identified actions to enable stakeholders to contribute to the overall desired outcome of ensuring the long-term survival of the species in the wild.

The outcomes that will ensure this:

- Clear management goals and timeframes for their achievement;
- Key role players and stakeholders identified;

- Acceptance and support of the BMP-S by stakeholders;
- Defined and accepted roles and responsibilities by stakeholders and role players;
- Institutionalise the SGH as a more formal grouping of SGH stakeholders than the current Action Group to ensure swift action on PHVA/BMP-S recommendations;
- A plan that comprehensively and concisely covers all aspects related to the conservation of the SGH, with realistic set targets for each five-year iteration;
- Identified key performance indicators to assess progress towards defined goals;
- Threat mitigation, including for the benefit of non-target species;
- Guidance of *ex-situ* conservation efforts for the species;
- Opportunities for job creation, capacity building and education for all communities that share the landscape with SGH;
- Documentation and expansion of inherent cultural protection; and,
- Publication of scientific papers and popular articles emanating from research and conservation actions.

2. SPECIES BIOLOGY AND BACKGROUND INFORMATION

2.1 SPECIES ECOLOGY AND BIOLOGY

The information below is drawn largely from the most recent species review (Kemp 2017).

2.1.1 Taxonomic description

Order: Bucerotiformes
Family: Bucorvidae
Genus: One of two species in the genus *Bucorvus* (Gonzalez *et al.*, 2013a).
Taxon name: *Bucorvus leadbeateri* Vigors, 1882
Taxonomic level: species

The Southern Ground-Hornbill (*Bucorvus leadbeateri*) exhibits many unique, primitive and vestigial characteristics at the base of the Bucerotiform clade. The female does not seal herself into a nest cavity (Kemp 1995), no functional carotid artery is present (Garrod, 1876), shoulder nerve structures are reduced (Howell, 1937), 15 instead of the 14 neck vertebrae present as in other hornbills (Kemp, 1995), and an extra tendon runs from the pelvis to the femur (Fisher, 1946). Their limb structure allows them to walk efficiently, whereas most other hornbills prefer to hop, except for small members of the subgenus *Tockus* within the genus *Tockus* (Garrod, 1876; Kemp & Kemp, 1980a; Gonzalez *et al.*, 2013a).

The genus *Bucorvus* follows a north-south biogeographical dichotomy, with Northern (or Abyssinian) Ground-Hornbill *B. abyssinicus* in savannas north of and *B. leadbeateri* south of the equator, likely caused by the separation of savannas through the expansion of equatorial rainforest (as suggested by Crowe & Kemp, 1988). The only area of overlap in their ranges is small (Kemp, 1995) and falls within a multi-species east African suture zone (Lorenzen *et al.*, 2012).

2.1.2 Distribution

The SGH has been reported in sixteen range-states: South Africa, Namibia, Botswana, Zimbabwe, Swaziland, Mozambique, Malawi, Angola, Zambia, Democratic Republic of Congo (DRC), Rwanda, Burundi, Kenya, Uganda and Tanzania, with one record for Zanzibar (Kemp 1995) and one for Lesotho (Maphisa *in litt*). Coarse range-distribution maps, based on historical, mostly museum-specimen localities, including that for the other *Bucorvus* species that occur north of the equator, *B. abyssinicus* (Kemp 1995; Sanft *et al.* 1849; Snow 1978) show the species to be parapatric (Fig. 1). The area of range overlap in southern Kenya and Uganda is small (Musila, 2007; Odull & Byaruhanga, 2009), with each species essentially found on either side of the equator and overlap attributed to dispersal rather than breeding individuals (Kemp 1995), with *B. abyssinicus* restricted to dry grasslands in northwest and *B. leadbeateri* to moister rangelands in the southwest Kenya (Musila, 2007). No reports of hybridization to date.

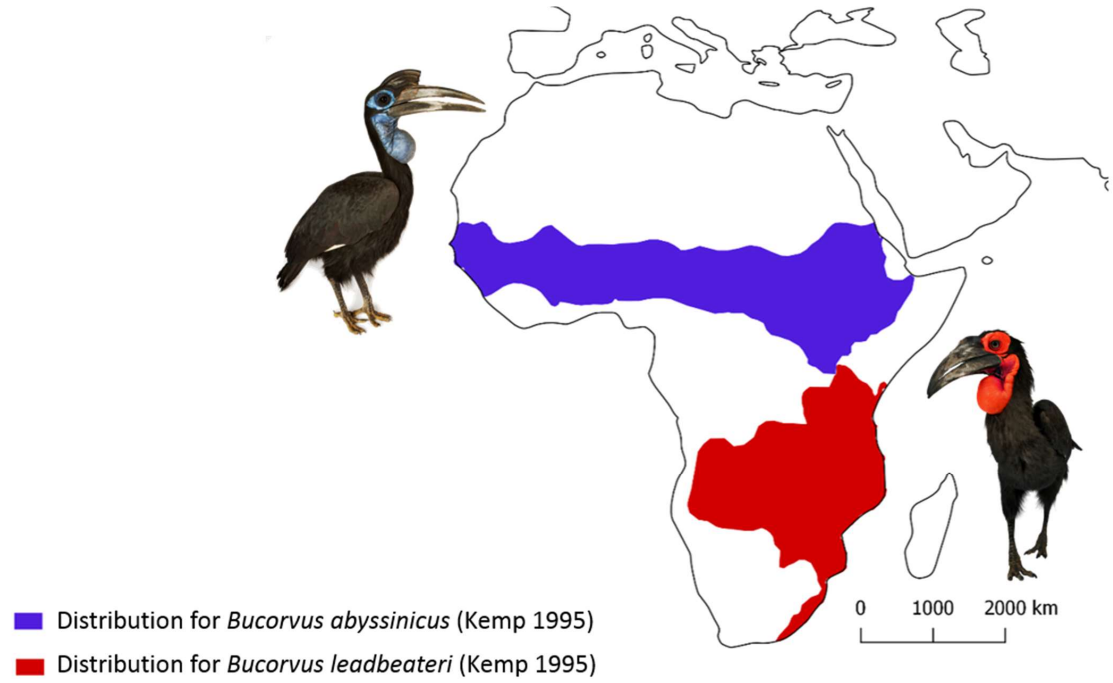


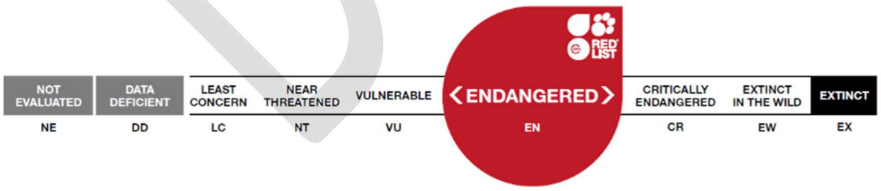
Figure 1. Map of range distribution for both ground-hornbill species after Kemp (1995).

2.1.3 Conservation status

Full range: The IUCN Red List status of SGH is Vulnerable (BirdLife International, 2019) with population declines for Kenya (BirdLife International, 2014), Malawi (Kalimira, 2007), Mozambique (Parker, 1999, 2005), Zambia (BirdLife International, 2014), Zimbabwe (Chiweshe, 2007; Maasdorp, 2007; Witteveen *et al.*, 2013), Botswana, and Swaziland (Parker, 1994), with declines best enumerated and most dire for South Africa (Kemp & Webster, 2008; Underhill, 2014; Taylor & Kemp, 2015) and Namibia (Simmons, Brown & Kemper, 2015).

Figure 2. Proposed range-state conservation status using IUCN Red List criteria for each range state where Southern Ground-Hornbill occupancy has been recorded (Kemp 2017).

South Africa: In South Africa, the species is regionally listed as **Endangered** (Taylor *et al.*, 2015).



2.1.4 Genetic status

The phylogeography of the SGH was assessed across their entire range by assessing patterns of variation in mitochondrial DNA (mtDNA: CO1, Cytb and ND2), nuclear DNA (GAPDH) gene sequences, and at 16 microsatellite loci. Phylogeographic reconstruction of these sequences refutes the previous distinction of two possible

subpopulations based solely on mtDNA (Cytb) (Kemp 2017). The microsatellite loci assessed for SGH individuals from across the range showed some variation, with an average of 3.188 alleles per locus and a mean observed heterozygosity of 0.545. Population difference, using STRUCTURE and Principal Component Analysis (PCoA), revealed poor differentiation between samples from the southern and northern extremes of the range, with South African individuals being more distinctive. Results suggest that SGH are homogeneous, close to panmictic, with low levels of restriction to gene flow and some isolation by distance. These findings may make conservation management of the species less complicated as individuals from directly neighbouring countries would not need to be managed separately. However, as a precautionary measure, an analysis including additional markers to determine adaptive variation is being conducted (MGHP/SANBI), to ensure that the same pattern holds and elucidate any risks of mixing individuals from extremes of the range for captive-breeding purposes, such as pairing breeding stock from South Africa with birds from Tanzania.

2.1.5 Life history and reproduction

The SGH has several significant life history characteristics, each independently increasing its vulnerability to extinction: it is diurnal, long-lived, large, conspicuous and a top-order avian predator, with large spatial needs that result in low densities, and small populations per unit area (Kemp, 1995). These features, together with cooperative breeding, living in territorial groups and other complex social structures, combine to result in naturally slow rates of breeding and recruitment (Purvis *et al.*, 2000). Added to this, the species faces several anthropogenic threats (BirdLife International, 2019), each growing in scale and intensity as human development expands across sub-equatorial Africa. Populations are consistently shown to be less vulnerable in larger protected areas (Chiweshe, 2007; Broms, Johnson & Altwegg, 2014), where known anthropogenic threats are absent or minimal. If habitat can be restored, or improved, by the provision of nest cavities and maintenance of wide-open foraging areas, it may be possible to raise populations to higher densities, allowing for enhanced population resilience in areas beyond the borders of formal protection. This would also assist conservation managers in deciding how densely reintroduced groups might be released into viable habitat where the population has become locally extinct.

2.1.6 Habitat requirements and resource assessment

2.1.6.1 Critical habitat

Ground-hornbills are resident on strictly defended territories in savanna, grassland and open woodland, foraging in open habitats within these biomes, from sea-level (Nupen *in litt*; pers. obs.) to altitudes as high as 3000 m a.s.l. (Kemp 1995). This generalised habitat description, however, does not describe the critical habitat factors that allow for the long-term survival of breeding groups at the highest density, for which data on factors that drive high/low productivity/density or create sources or sinks are needed.

A fine-scale focus on the needs of family groups at several research sites in South Africa found seasonal variation in the use of territories with a reduction in home range sizes during the summer wet season (Wyness, 2011; Zoghby *et al.* 2015). This is the time when ground-hornbills are breeding, anchored to the nest as central place foragers as they regularly provision the female, and later the offspring (Dickens 2010; Wyness 2011; Theron *et al.* 2013). Daily travel distances averaged seven kilometres per day but were greater during the summer, despite being constrained to their nest, and lowest in early winter when ground-hornbills ranged across their full territory. One group failed

late into a nesting attempt and resumed foraging again over a wider area, but with the lowest mean seasonal daily distances travelled, suggesting resources are indeed more abundant in summer (Zoghby, 2015).

Group size appears to not correlate with habitat type, but large groups (> 3 birds) reared more chicks successfully than groups comprising only 2-3 individuals (Wilson 2010). Even if group size changes with time, territory size did not, suggesting that food is not a limiting factor. While group size does not appear to be an indicator of habitat quality (Kemp e*t al.* 1989), group persistence might (Hulley & Craig, 2007). It has been suggested that at the southern extreme of the range in the Eastern Cape of South Africa, the available habitat was only visited during periods of overflow following high productivity in neighbouring areas and thus should not be considered as key or core habitat. This may hold around all margins of the range as similar patterns are reported for the arid Madikwe, in north-western South Africa.

2.1.6.2 Habitat requirements

Ground-Hornbills do not drink water, so proximity to water bodies is not vital (Kemp & Kemp, 1980b). However, distributions are often associated with drainage lines and water holes, where vegetation is usually taller and more established with large trees (Zoghby *et al.* 2015; Zoghby *et al.* 2016) and prey numbers higher. It is suggested that some populations are linked via corridors along large drainage lines in Zimbabwe (Chiweshe, 2007), congruent with patterns found in the northern Limpopo Province of South Africa, where groups are only encountered along the Mogalakwena and Limpopo Rivers, and historically the Crocodile and Olifants Rivers (Engelbrecht *et al.*, 2007). This can be attributed to the higher biodiversity and herbivore and prey biomass expected in and around water bodies/courses, and the presence of the larger riparian trees needed for roosting and nesting. Broms (2014) however, found no significant correlation with any habitat variables when analysing atlas data.

Ground-Hornbill groups show a marked preference for riparian zones to rest in during the heat of the day, attracted to the denser shade provided here, particularly during the hot summer season (Zoghby *et al.*, 2015). The shade is vital for a large black bird that forages on the ground and exhibit signs of heat stress over 25°C. Their deeply black feathers may not reflect light (Mullen & Pohland, 2007) and, at temperatures below 8°C, they prefer to be in the open and exposed to the sun. When temperatures rise to 25°C they initiate heat-loss behaviours: raising feathers, moving into the dense shade, specifically the riparian zone, and at extremes flying up to perch to avoid ground-radiation and allow heat loss via the bare underwings (Kemp, 1995b; Dickens, 2010). Mortality due to combinations of heat and drought is suspected to reduce populations to levels that take decades to recover (Paolilo, 1993; Newton, 2003; Chiweshe, 2007), and may have contributed to virtual but temporary extirpation of ground-hornbills in the arid Limpopo River Valley of South Africa (Theron *et al.*, 2013). Ground-hornbills need to offload heat through their bill and facial skin from just 26^0C (Van Vuuren. et al 2020).

Ground-Hornbills are faunivorous and scavenge, particularly on smaller prey items. They need to find and catch enough food throughout the day and the year within the boundaries of their territory, including during inter-annual extremes of high and low rainfall and temperature, and therefore habitat must be able to provide for this. SGHs are opportunistic generalist feeders, eating whatever prey species they can catch, predominantly invertebrates, but also includes snakes, scorpions, small mammals and birds, crustaceans. This wide-ranging diet may conceal more selective feeding by season, age or habitat than has been so far reported, but it a favourable life-history trait that removes the need for territorial habitat to include specific food sources and negates the need to choose reintroduction sites with specific food species. They forage as a group, wandering through their territory, catching or excavating any items they encounter. There are likely areas that are preferred at specific times of the year,

correlated to known patterns of invertebrate emergences and other spatiotemporal variations, something that satellite tracking with simultaneous ground-truthing will be able to determine. For example, in the Kruger National Park (KNP) in winter, groups dig for prey around waterholes where increased dunging leads to increased dung beetle larvae concentrations (Kemp and Kemp 1980), especially in rhino and elephant middens and dung piles.

Safety is an issue for a species with high immature mortality rates (70%; Kemp, 1995a), with juveniles being highly dependent on group support. Predation by large cats is the most likely risk (including leopard *Panthera pardus;* lion *P. leo* (Kemp, 1996); cheetah (*Acinonyx jubatus*; pers. obs); caracal *Caracal caraca*); serval(*Leptailurus serval*, and African wild cats *Felis silvestris* (Scott, 1999), and even domestic dogs (Ezemvelo pers. comm.). Attacks and kills by large avian predators, such as Martial (*Polemaetus bellicosus*) and Crowned (*Stephanoaetus coronatus*) eagles, have also been noted (Kemp A, pers comm.). Perceived predation risk plays an important role in microhabitat selection for several savanna species (Valeix *et al*., 2011) and although ground-hornbills are capable of rapid take-off, they still prefer to remain in open areas where visibility is better and quick escape is possible.

Nest sites are important, not just for breeding but also social interactions within the group, and are used for multiple decades if available and persistent (Ranger, 1928). Nests are natural cavities in a tree (in forest edge or fragments, or lone large trees), a rocky cliff or an earth wall (with self-excavation into earth banks reported for a pair in captivity using their bills and feet to dig (Fairfield, 1973) and in the wild (A. Mngomezulu pers. comm.). Nests above 6 m high, with a wall 6 cm thick or greater are preferred (Carstens *et al*., 2019a), although Combrink *et al.* (2017) found no unknown or finer details of nest structure or microclimate that may affect success. Nests were more successful when the proportion of open woodland surrounding the nest site was higher, which may implicate foraging success, although this was less important if nests were artificial (Wilson & Hockey, 2013; Carstens *et al*., 2019b).

Kemp and Begg (1996) found that most nests were located in trees in open areas with bare ground, or with grass of short to medium height, and that the nest was placed among only a few other prominent, large or dead trees, with the more successful nests surrounded by the most open habitat (Wilson & Hockey, 2013). In combination, these results suggest that the placement of artificial nests within territories could be optimised by placing them close to areas of short, open ground cover and/or open woodland. Besides, they should be constructed with walls > 6 cm and be placed at a height of 6 m or greater (Carstens *et al*., 2019b).

Apart from the need for large trees for the provision of nesting cavities, SGH is also reliant on large trees or cliffs in the landscape for roosting (Zoghby et el. 2016). This duel importance of large trees is a strong motivator for management of the savanna for the persistence of mature trees, even if they are stands of exotic trees e.g. *Eucalyptus*.

2.1.6.3 Vegetation structure

Analysis of habitat use using satellite telemetry found that disturbed bare areas, with an associated higher mean grass biomass, were favoured (Wilson, 2010). It was suggested that these areas may provide the best foraging opportunities as (i) grass biomass was assumed to be a surrogate for food availability, (ii) detectability of prey is less constrained, and (iii) low stem density allows the ground-hornbills to move around with greater ease (Wilson, 2010), implying safety and/or energetic concerns. Wyness (2011) was unable to provide a mechanistic link between vegetation structure and habitat preference but suggested that marked seasonal patterns of habitat preference indicated that physical vegetation characteristics must have an influence. Thus, it appears vegetation structure may be of more significance than composition, as it is for many bird species (Lack, 1933; Macarthur, 1965).

Repeatedly in the literature, in papers ranging from sighting records (Mundy 2003) to nest productivity (Wilson & Hockey, 2013), the overriding commonality is the presence of expansive areas of open habitat. Specifically, short grass less than 50 cm in height (Knight, 1990), with a noted preference for *Cynodon* species (Maasdorp, 2007), a grass that dominates grazing lawns. SGH habitat is even described as rangeland (Musila, 2007), implying the importance of grazed ground cover, be it maintained by grazing game species or domestic livestock. Subjectively, Kemp and Kemp (1980) found that groups appeared to occupy and spend much time on well-grazed areas. Further support for this hypothesis comes from further north in the range, where the species is reported to thrive in areas where grass levels are kept short by cattle grazing (Wilfred, 2007). This need for well-grazed areas has also been reported for Wattled Cranes (*Bugeranus carunculatus*), where conservation management promotes the use of cattle grazing where this can be well managed (Short & Rushworth, 2004).

It has been hypothesised that, in Zululand, an increase in grass cover after removal and/or reduction of bulk grazers, such as cattle or buffalo, decreased the viability of habitats and led to localised population reductions (Kemp, A, unpublished report). Initially, it was proposed that to promote species persistence and growth a reduction in grazing was necessary (Seddon, 2011) but, given the new insights from communal grazing areas, this may not hold, at least for SGH. In some tribal trust areas of Zimbabwe, where the main habitat use is grazing and subsistence cropping, i.e. low and open habitat (Witteveen *et al*., 2013), the species is at a higher density than in protected savannas. Although in Botswana the species was shown to be more prevalent on wildlife reserves than in cattle farming areas, this analysis was based on atlas data with only a quarter-degree resolution that may not adequately reflect habitat structure, which is measured at a finer scale (Herremans, 1998). Even when trapping the species, more success was had in wide-open areas where the ground-hornbills were more at ease and prepared to be more inquisitive than in thicker vegetation (Kemp L. pers. obs.).

High rainfall in the South African Lowveld (> 500 mm over a six-month breeding season) resulted in a decrease in reproductive success, with groups being most successful in years when rainfall ranged from 300 - 500 mm (Wilson, 2010). This was for a population heavily dependent on artificial nests where higher breeding success was attributed to artificial nests being less prone to flooding than natural nests, but it may be that summers of better rainfall lead to a denser ground cover vegetation, which increases the risk of ambush predation and reduces terrestrial foraging ability. Elsewhere within the range, where rainfall is consistently over 500 mm within a breeding season, viable populations occur at higher densities, and so this rainfall threshold may be a correlation rather than a proximate factor.

Ground-Hornbills are often reported to move into freshly burnt areas to forage opportunistically on any maimed or burnt prey items (Runo, 2001), sometimes before the embers have even cooled (Kemp, L. pers. obs.). A study in

the KNP found that savannas have a short fire-return time, with post-fire habitats recovering rapidly, and even severe fires not disturbing bird communities significantly (Mills, 2004). Insect communities as a whole, rather than individual species, remain robust enough to support bird communities, possibly because most savanna insectivores are generalists that feed on a wide range of insect species (Mills, 2004). Woody vegetation on savannas is also not always as fire-affected as a ground cover. However, this does not hold for extreme fire policies, such as complete suppression or high frequency 'hot' fires, which alter habitat structure. It has been found that the dual and combined disturbances of fire and herbivory are necessary to limit woody tree and shrub cover, and so facilitate coexistence of a matrix of large roost trees and large open groundcover areas in the savannas (Staver *et al*., 2013), vital for ground-hornbills. Recent range-contractions appear largely to correlate with areas of bush encroachment and/or densification (Loftie-Eaton, 2014).

At the other extreme, frequent large fires prevent areas of heavy grazing from persisting in the landscape, limiting the spread of grazing-adapted grasses, a favoured ground-hornbill habitat. In the long term, if fires were frequent, intense and widespread enough, then grazer-created lawn-grass patches should disappear, such as in Hluhluwe-iMfolozi Park (Archibald *et al*., 2005). Frequent burning, an outdated management policy for many South African parks for the latter half of the 20th century, may have resulted in the legacy of bunch-grass dominated landscapes in these savannas (Bond & Archibald, 2003), with the loss of lawn grass species leading to cascade effects on associated biota. This holds for cattle rangelands where fires have long been used to manipulate animal movements and provide good forage (Hall 1984), and more recently patchy fires in rangelands have been advocated as a management tool to increase heterogeneity (Fuhlendorf & Engel, 2001).

An analysis of exploratory dispersals showed that, at the extreme southern fringes of the range, occasional influxes of ground-hornbills are reported, always during the breeding season (Hulley & Craig, 2007). This may represent dispersal movements by particular social classes within the population into the mediocre habitat, during either optimal condition within the habitat or exceptionally productive environmental conditions in neighbouring areas, or both, but these colonisations were not persistent. This may be the first indication of dispersal from regions of high productivity (sources) into regions of low productivity (sinks).

2.1.7 Known diseases

Little is known of the baseline health parameters for the species. However, the *ex-situ* conservation community has provided insights into what infectious diseases are relevant to SGH (clostridial enteritis, presumptive osteoarthritis (Anderson *et al*., 2013), Marek's Disease (Cho & Kenzy, 1975), *Aeromonas hydrophilia* (Ocholi & Kalejaiye, 1990), West Nile Virus (Komar, 2003). They also can supply data on which are successful treatments (Anderson *et al*., 2013; Koeppel & Kemp, 2015) or treatments to be avoided that lead to fatality (Anderson *et al*., 2013). The genus is susceptible to stress caused by capture and handling, leading from immunodeficiency to fatalities (Ocholi & Kalejaiye, 1990). Captive-reared individuals show no resistance to Newcastle Disease (pigeon paramyxovirus PPMV-1, n=2) (Abolnik *et al*., 2008) but outbreaks are known to occur in areas where wild populations of ground-hornbills occur (Kemp, L pers. obs.). A species-specific vaccine for Newcastle Disease has been developed to support the reintroduction programme (Koeppel & Kemp, 2020). When species-specific information is not available, it is also possible to look at disease from a cladistic perspective to identify potential risks, as has been successfully done for the Coraciiformes (Smith, 2003). Reports of zoonotic *Salmonella*, affecting both ground-hornbills and humans, have been published for the species (Smith *et al*., 2014).

2.1.8 Ex-situ populations

Initially, much emphasis was placed on the development of a captive insurance population, to release offspring as part of the reintroduction programme. When it became apparent that the long-term holding of this species is not the most effective way to grow the reintroduction programme, that it comes with a risk of captive-selection influencing the survival chances of reintroduction candidates, and that there are insufficient facilities in South Africa to be able to hold genetically viable populations, it was decided by the stakeholder group during the 2nd PHVA to focus on the harvest of wild chicks that would naturally die, rather than try and continue to grow the scope of the captive holdings.

At present (2020) all captive birds, including future reintroduction stock is numbered at 87, housed at 15 facilities, and managed according to a Pan African Association of Zoos and Aquaria (PAAZA) Conservation Stud Book.

2.1.9 Species' role in the ecosystem

- The SGH, given its extensive spatial requirements, is both an umbrella, and a flagship species.
- SGH's only ecosystem dependency, besides an adequate food supply, is on large tree species that naturally form large hollows for nesting (e.g. *Ficus*, *Adansonia* spp.) and for roosting.
- Several ectoparasites occur only on *Bucorvus* spp; including two host-specific Mallophaga genera of the amblyceran family, Menoponidae described thus far: *Bucerophagus africanus* (Bedford) 1929 (Bedford, 1929; Balter, 1968) with eggs laid on the neck and upper breast and cemented to the feather shaft (Balter, 1968) and *B. productus* (Bedford, 1929) and *Chapinia africana* (Bedford, 1929, Clay & Rothschild, 1938) and *C. unilaterii* (Canaris & Gardner, 2003). *Bucorvellus docophorus* (Ischnocera: Philopteridae) has also been described only for the *Bucorvus* genus (Clay & Rothschild, 1938; Elbel, 1964).
- Mutualism: Some avian species such as bee-eaters, drongos and flycatchers follow groups of SGH to catch flushed insects.
- SGH is known to steal prey from some raptor species, and vice-versa, besides being versatile and not fastidious in their prey selection and thus diet.
- They are culturally revered for their ability to kill and eat venomous snakes.

2.1.10 Utilisation of the species

National utilisation

Live specimens

Within South Africa, live trade appears to be restricted to exchange between aviculture institutions and zoos, managed by the PAAZA studbook. It is unknown whether there is the illegal trade in wild-caught specimens locally, but some inconsistencies have emerged, in that SGH are sold as other species, or vice-versa.

Body parts

Trade for the traditional use of body parts is considered a significant threat to SGH (Williams *et al*., 2013), especially in the context of the myriad other threats that SGH face. In South Africa, body parts are reported from all major traditional medicine markets (Johannesburg's Faraday Market, Durban's Warwick Junction Market, Zululand's Mona Market; (Mander, Diederichs, *et al*., 2007; Mander, Ntuli, *et al*., 2007; Whiting, Williams & Hibbitts, 2011)). In one market, three carcasses were present (Whiting, Williams & Hibbitts, 2011), a significant number given that the loss of just four individuals per year drives decline (Morrison *et al*., 2005). No data exist for the extent of the traditional use of parts locally (i.e. that does not go through a market), but evidence of this use is common (Trail, 2007), and the rural use of the species is well and widely documented (Nevill, 1984; Chiweshe, 1998; Maasdorp, 2007; Williams *et al*., 2013; Coetzee, Nell & van Rensburg, 2014; Coetzee, Nell & Rensburg, 2014). To date, the only Range State where SGH is known to be routinely eaten as bushmeat is Mozambique (L. Kemp & M. Stalmans in prep.). Methods of the capture of wild-caught individuals are snaring, catapults, removal of females from nests, hunting with dogs and poison (Bruyns, Williams & Cunningham, 2013), and pursuit on horseback until exhausted (L. Kemp pers. comm.). It is proposed that, for ground-hornbills, use as traditional medicine outside of high-density population areas is influenced by cultural value, not by economic value as found in larger traditional medicine markets in major cities (Williams *et al*., 2013). No stockpiles are known to exist and nor are any expected given the low density of the species.

International trade

Live specimens

International trade is primarily in the form of live trade for zoos and private collections, and parts, most commonly as taxidermy specimens or skulls. Data are difficult to find elsewhere as neither *Bucorvus* species is yet to be CITES-listed and thus no data are available on CITES, TRAFFIC or FAO databases. Data from the US Fish and Wildlife Services show 48 individuals imported over the period 1999 to 2006, of which only seven were declared as captive-bred (Trail, 2007). An internet search revealed that the species is readily available for sale, with two traders suggesting that any quantity can be met. Method of the harvest of wild-caught birds, as reported in interviews with traders, is by the capture of whole groups, removal of brooding females from nests with juveniles, or use of snares and poisons. Reports suggest increasingly more sophisticated methods of capture are being used: one example is a puppy in a noosed cage as bait, essentially a *bal chatri* trap. All methods have a high risk of injury and it must be assumed that a percentage of caught specimens die before being traded. Data for other hornbill species show that capture, transport and quarantine mortality rates range from 10 - 43% (Nilsson, 1985; MAFF, 1990), though maybe as high as 60% (Leader-Williams & Tibanyenda, 1996).

The trade in wild specimens is most often reported from Tanzania, though sometimes the catch-all 'Africa' is used. Of concern were three separate adverts (China, Russia and Germany) that offered an unlimited number of

specimens for sale. Prices range from USD 20 for live birds to USD 3500 for a taxidermy mount. By ageing the birds from the casque development, and bill size and colour, it is clear that the majority of specimens are adults. One juvenile skull, however, is so underdeveloped that the chick is likely to not have fledged (Kemp 2017). It has been reported that much live trade is conducted through the United Arab Emirates and Oman and that many birds will also be kept by Asian zoos, but also by private holders in Europe and the Middle East (K. Brouwer, in litt). In the two largest regulated zoo associations, the Association for Zoos and Aquariums (AZA) in the United States of America and the European Association of Zoos and Aquaria (EAZA), only 179 wild-caught founders are reported through their studbook reporting mechanisms. No sex skew was found. The regulated zoo community is likely to play a minimal part in the trade. The inclusion of the SGH in CITES Appendix II will allow for the undertaking of non-detriment findings, as well as the monitoring of trade and a better understanding of market forces, especially what is driving the annual quotas of more than 400 individuals in Tanzania. Once the quotas are provided, birds are reportedly caught regardless of whether there is a demand or not. An analysis of past trade in Tanzania for over three years (1998 – 2001) found that only 47% of *Bucorvus* caught were sold (Kiondo & Clamsen, 2002). The rest remain in trader holding grounds. Trade is supposedly restricted to Tanzania, the only Range State to offer annual quotas for export. However, exports of wild-caught birds from Zimbabwe and South Africa into the United States of America (US Fish and Wildlife data) have been reported (Trail, 2007), as well as from one other unspecified non-African country. Traders report that China and the Middle East are the major markets for live birds but will not assist with details. Structured zoo communities such as the AZA and EAZA organisations are moving towards developing sustainability in their institutions to remove the need for wild harvest, especially given the SGH's threatened conservation status, slow-breeding, complex social structure and numerous other threats

Body parts

Body parts are also reported from markets in Zimbabwe, Kenya, Tanzania, Malawi, Zambia, Zimbabwe, and Mozambique (Bruyns, Williams & Cunningham, 2013; Coetzee, Nell & van Rensburg, 2014), while use in the Democratic Republic of the Congo, Angola, Namibia, and Botswana could not be confirmed (Coetzee, Nell & van Rensburg, 2014). Parts favoured are brain, head, heart, feathers, intestine and bones (Bruyns, Williams & Cunningham, 2013). Bodies are reported to be brought into the market either opportunistically or as a commission (Bruyns, Williams & Cunningham, 2013). Mounted (taxidermy) specimens are available for sale and in most cases, the origin is unknown, although some skulls for sale online are listed as Tanzanian.

Impact of trade

The removal of significant numbers of breeding-age adults from a population may have a larger overall impact than the removal of a similar number of juveniles. A loss of breeding-age adults, especially females, may result in an immediate decline in the reproductive capacity of the population as a whole. This problem may be especially acute for species with slow recruitment rates (Leader-Williams & Tibanyenda, 1996). In addition, the loss of experienced mentor birds from a group puts the younger, less experienced members of the group in danger of not acquiring required skills for survival and breeding.

2.2 POPULATION STATISTICS AND TRENDS

2.2.1 Habitat preference and projected historical range and trends

An analysis (conducted by Kemp 2017) used 7837 unique locality records for SGH, of which 233 were derived from the first bird atlas (SAPAB 1; 1987 – 1992 as Quarter-Degree Gird Cells: QDGC), and 133 QDGC derived from 349 pentads from the South Africa Bird Atlas Project 2 (SABAP 2). SABAP2 records for SGH only accounted for 61% (350 pentads) of total recorded occupancy. Additional sighting records solicited and collated by the MGHP database contributed a further 39% (571 pentads) of records, which enhanced coverage (Fig. 3). This yielded only 2.9% more QDGS than were used for the previous 2008 analysis (Kemp & Webster, 2008), despite the additional seven years' worth of atlas data available and increased solicitation of sighting records. There are now essentially two populations, the population south of Swaziland almost entirely separated from the northern Lowveld and Bushveld population and those of neighbouring countries (SABAP 2). All records for South Africa (covering 425 QDGC or 255 275 km^2) from 1823 (near Port Elizabeth; Vernon, 1986) to 2015, were assessed by biome and bioregion and finer-scale vegetation units (Fig. 4).

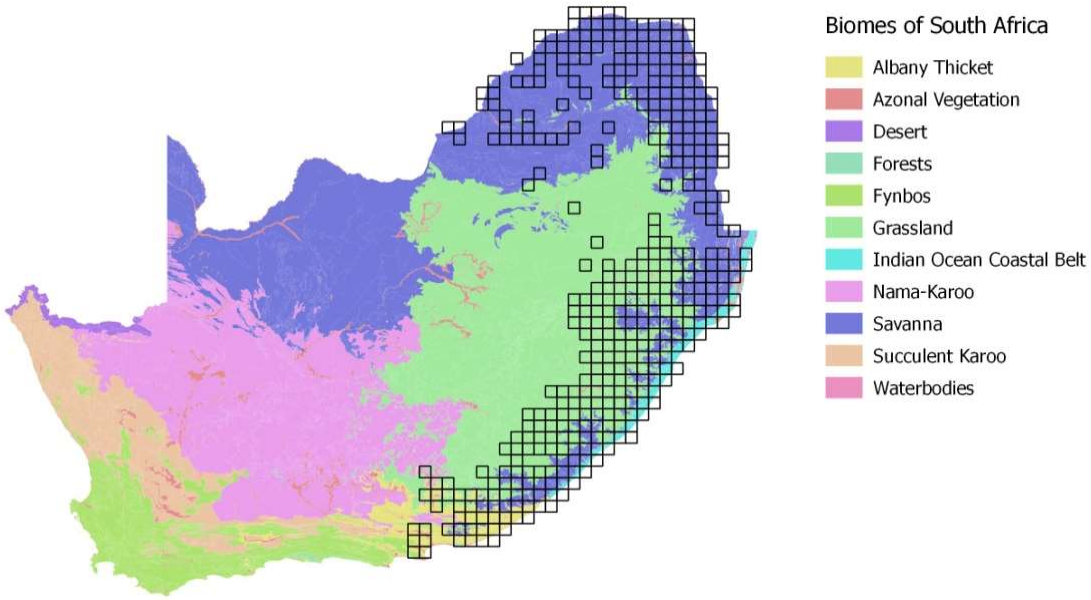


Figure 3. Map of all Southern Ground-Hornbill records (1823 – 2015) at a scale of quarter-degree grid cells) across the biomes of South Africa (National Vegetation Map 2012).

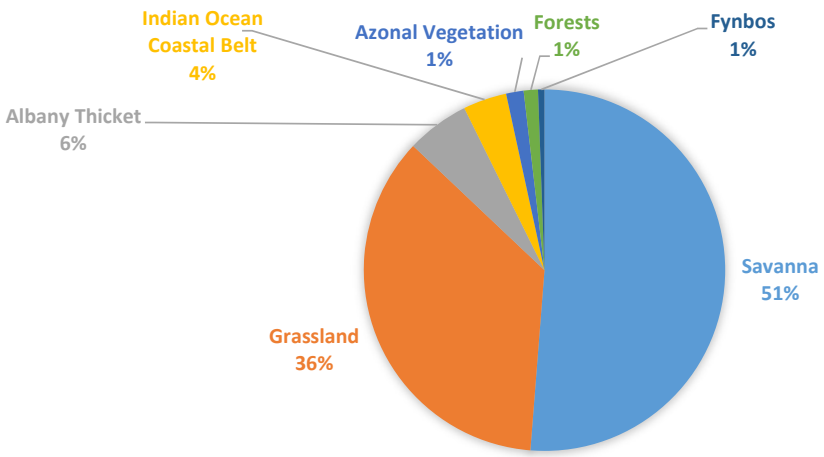


Figure 4. The proportion of biomes occupied by Southern Ground-Hornbills recorded for all sighting's records collated, the earliest being 1823 (National Vegetation Map 2012).

Within the predominantly savanna (51%) and grassland (36%) biomes, SGHs were found (95.8% of total habitat coverage) within nine finer-scaled bioregions (Fig. 5). The remaining 4.5% of occurrence records are minimally represented (each < 0.05% of the total coverage) and considered as marginal, or an artefact of the scale of analysis: Estuarine, Seashore, Eastern Strandveld, Azonal Forests, Waterbodies, Inland Saline Vegetation, Lower Karoo, Upper Karoo, Freshwater Wetlands and Dry Highveld Grassland. The sub-escarpment bioregions of mopane, Indian Ocean Coastal belt and sub-escarpment grassland bioregions were nearly fully occupied by SGHs.

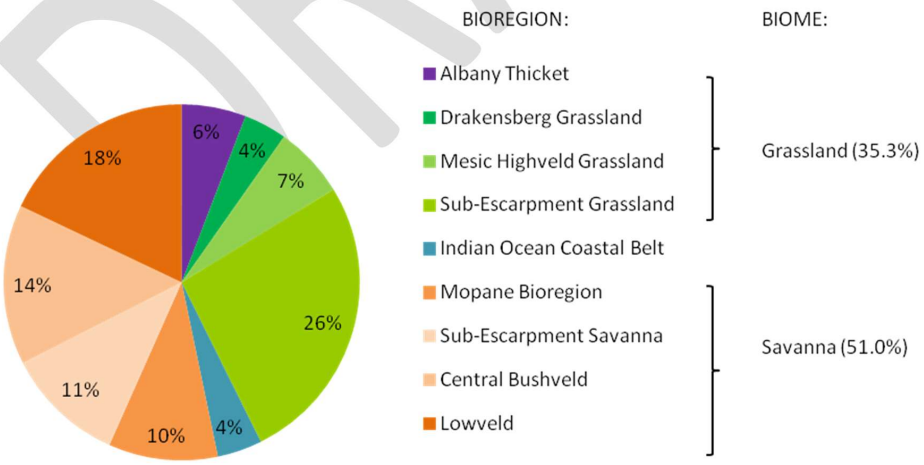


Figure 5. Representative proportions of bioregions important to Southern Ground-Hornbills per biome.

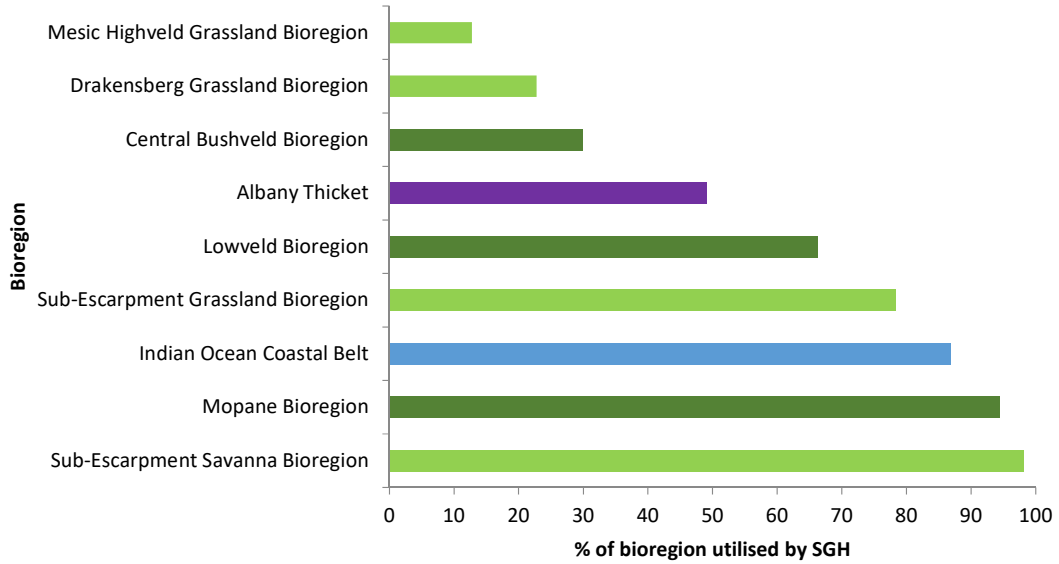


Figure 6. The proportion of Southern Ground-Hornbill records per vegetation bioregions of South Africa.

Assessing these regions at the provincial level (Fig. 6), to allow for the guidance of provincial monitoring programmes, showed the Lowveld to be important in Mpumalanga (much of which is within the borders of the Greater KNP). In KwaZulu-Natal and the Eastern Cape, however, the most important habitat was sub-escarpment grassland, a bioregion little protected and increasingly transformed.

At the finest scale of habitat analysis, 118 vegetation units accounted for 85% of the habitat extent, but with the greatest proportion only 5.5% (Granite Lowveld), which suggested little habitat preference at this scale of analysis as the top 10 most inhabited unit types combined only accounted for 28% (ranging from 1.5 – 5.5 %) of the total habitat inhabited. Analysis of range extent over time was thus conducted at bioregion.

Range and population trends: To assess population trends over time for the species, the QDGC scale was used to ensure comparative analyses with both current and historical records. Unlike for other range states, there is sufficient comparative data for three time periods as shown in Figure 7.

Using habitat extent to assess range change

Kemp and Webster (2008) used habitat extent, at biome scale, to determine the possible full historical range (T_{max}) and found this to be 516 QDGC or approximately 410 000 km^2. Using the finer scale analysis available with the National Vegetation Map, it was possible to refine this analysis to bioregions (based on the sum of the total areas for bioregions known to be, or have been, occupied by ground-hornbills: 454 235 km^2), and exclude bioregions minimally utilised (those containing less than 0.5% of the entire recorded occurrence), giving a more conservative estimate of 221 187 km^2 as the likely historical occupancy).

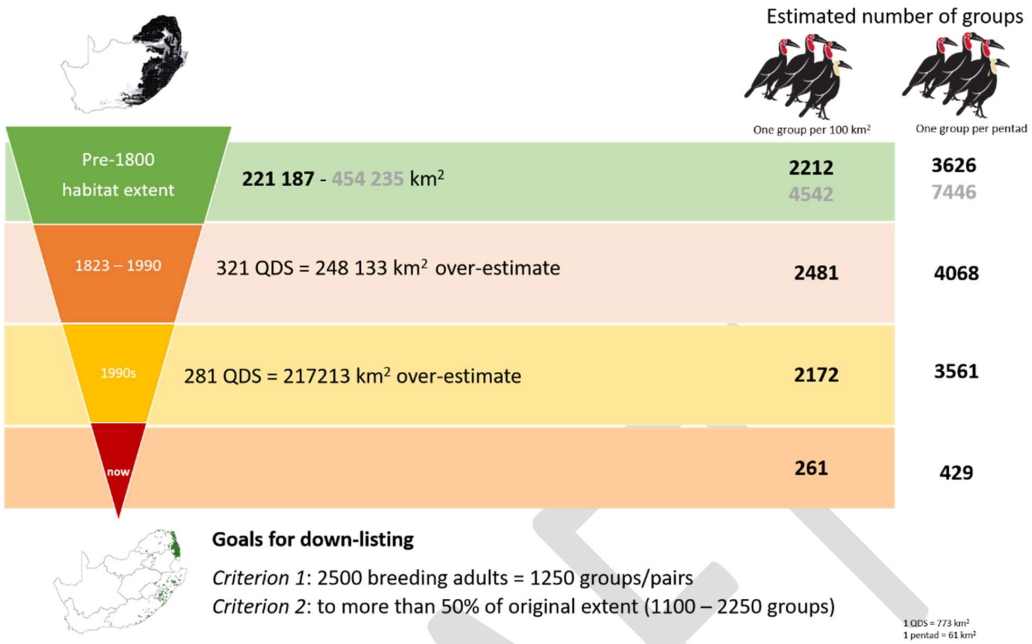


Figure 7. Estimated number of groups over four time periods, with the minimum number of groups needed to downlist the species from Endangered to Vulnerable.

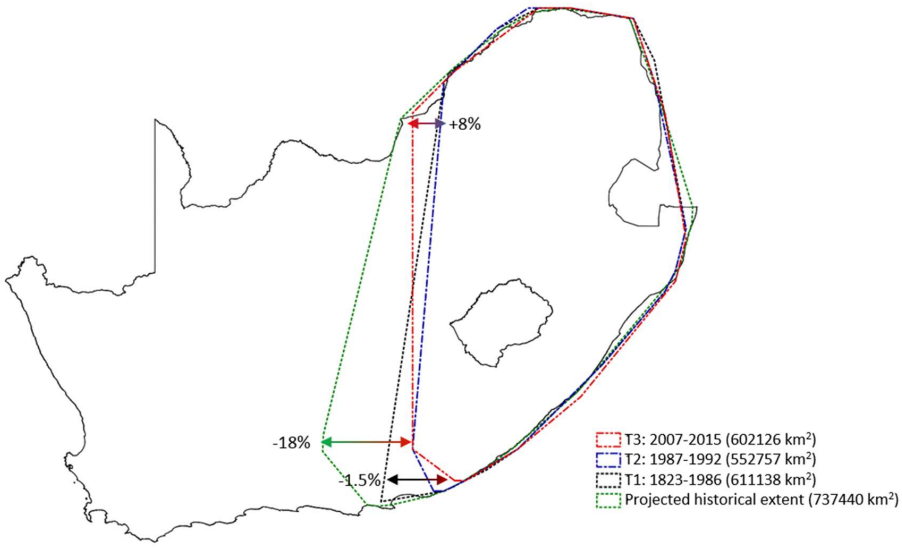


Figure 8. Minimum convex polygons (MCP) for Southern Ground-Hornbill occurrence records in South Africa over time (years).

Using a kernel density analysis (Fig. 9) to define the Area of Occupancy (AOO), declines were found for both the full extent of the range (23% at a 95% kernel isopleth) and for the core of the population (27% at a 50% kernel density isopleth). The core population has possibly been fragmented, into one in the Lowveld-KNP area and a second largely in KwaZulu-Natal Province.

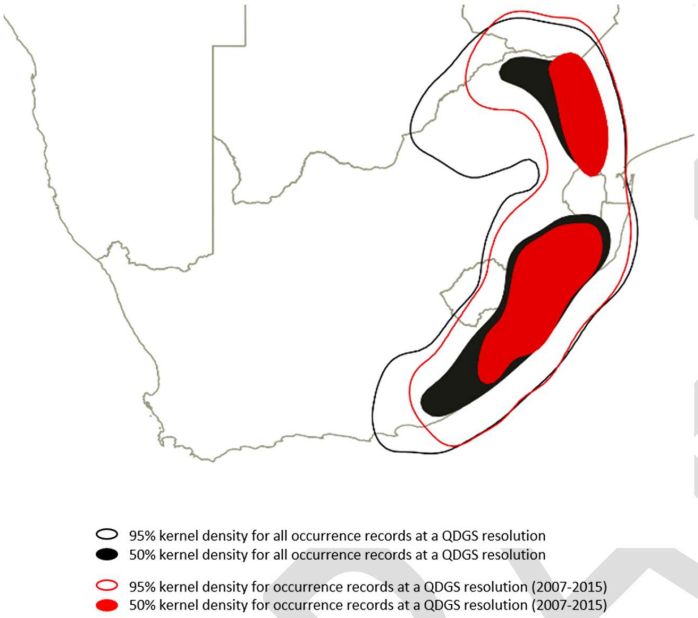


Figure 9. Density kernels of all occurrence records across time (years) compared with those for the current distribution (2007-2015) for records analysed at a QDGC scale.

The overall small loss (4%) of the 95% density kernel belies the extent of loss of core habitat in the Eastern Cape, and gains quantified for the first time for the Limpopo River population as it recolonises its historical range, possibly from Zimbabwe (for more in-depth analysis see Kemp 2017).

The current IUCN Red Data listing of Endangered (Taylor and Kemp, 2015) was based largely on the Kemp and Webster (2008) analysis, whereby the following criteria were met:

- **A2bcd**: Reduction in population size based on an observed population size reduction of 50% over the last three generations, where the reduction or its causes may not be ceased or reversible based on:
  (b) an index of abundance appropriate to the taxon;
  (c) a decline in area of occupancy, the extent of occurrence and/or quality of habitat;
  (d) actual or potential levels of exploitation.

- **4bcd**: An observed, estimated, inferred, projected or suspected population size reduction of ≥ 50% over any three-generation period up to a maximum of 100 years in the future, where the time must include both the past and the future, and where the reduction or its causes may not have ceased OR may not be understood OR may not be reversible, based on:

(b) an index of abundance appropriate to the taxon;
(c) a decline in area of occupancy, the extent of occurrence and/or quality of habitat;
(d) actual or potential levels of exploitation.

- **C1**: Population size estimated to number fewer than 2500 mature individuals and an estimated continuing decline of at least 20% within two generations, whichever is longer, (up to a maximum of 100 years in the future).

This analysis of range contraction (Kemp 2017) concurs with, and spans the required 50% contraction criterion (4bcd) for Endangered but suggests a borderline assessment. If taking fine-scale pentad data into account, range contraction is greater than 50% and, given the scale of decline (15-20%) in just the last half-generation, with no indications of conservation action yet affecting slowing the decline, a conservative approach would be to accept that the range contraction is greater than 50% and that the current listing of Endangered should remain.

2.2.2 Population estimations

Kemp (2000) estimated a population of 1500 - 2000 mature individuals based on an average group density of one group per 100 km^2 and an average group size of 3.6. The modelling conducted for the 1st PHVA (2005) used an estimate of 410 - 700 groups, or 1290 - 2380 individuals, of which 1500 individuals would meet the threshold requirements for the number of mature (hence breeding) individuals. Kemp and Webster (2008) used SABAP 1 reporting rates to estimate a population of 2516 adults in 1992, with a likely historical population of 3124 mature individuals or 1560 groups.

To estimate the current population, based on current (2009 - 2019) occurrence data, with the following assumptions maintained:

1) The average density per group in South Africa has a required area of 60 - 100 km^2 (note this is not based on individual group home ranges/ territory sizes but several regional estimates of population density);
2) An average group size of 3.6 individuals is still used, to allow comparison with previous estimates.

Regardless of the territory range used, the population estimates calculated from various assumptions about density fall within the same range, and population contraction remains consistent at 64 - 82% if all bioregions were fully occupied or 44 - 73% for the minimum extent of the range. This concurs with the IUCN Red List Criterion C1 for listing as Endangered, with both range and population contractions showing the same trend. The pentad (estimated at 61 km^2) also makes an excellent proxy for monitoring groups/territories as they cover roughly the same area.

2.3 RESEARCH

Different aspects of SGHs are increasingly being researched. This research has now yielded twenty-six papers, six PhD, six MSc, one M. Tech, and three BSc. Honours/ B. Tech projects. Research has included distribution, conservation status, genetics, fine- and broad-scale habitat use, nest utilisation, use of artificial nests, vocalisations, parasites, Newcastle Disease, reintroductions, captive-rearing, dispersal, population dynamics and so on. Mark-recapture studies have been undertaken since 1991 (tattoo) and 2005 (leg bands) in the Associated Private Nature Reserve (APNR), and in 2009 in the KNP. See reference list for all reports, theses, and publications.

Ongoing research is being conducted by various stakeholders on populations in the KNP, APNR, Sabi Sands Game Reserve, Limpopo River Valley and Zululand and former Transkei (South Africa), Gorongosa National Park (Mozambique), Matobo district (Zimbabwe) and northern Namibia. These efforts have yielded a greater knowledge base for the species, reaffirmed many earlier findings, and highlighted difficulties in rapid and meaningful data generation for such a low-density and long-lived species. This research, until 2017, was collated in an in-depth review of the species and its conservation biology (Kemp, 2017). These research findings and recommendations are incorporated into the relevant sections of this document, and additional ongoing projects added.

Long-term datasets of breeding productivity, territory size and group dynamics:

- Kruger National Park (1966 – 2015): Transvaal Museum, FitzPatrick Institute of African Ornithology UCT, Mabula Ground Hornbill Project, Endangered Wildlife Trust.
- Associated Private Nature Reserves: (2002 – ongoing), FitzPatrick Institute of African Ornithology, UCT;
- Limpopo River Valley (2006 – ongoing), Mabula Ground Hornbill Project.

Current research projects:

- Breeding productivity and density in an altered mixed mosaic landuse habitat: Melmoth and northern KwaZulu-Natal: (2010 – ongoing): MGHP.
- Breeding productivity and density in an altered/ enhanced savanah complex: Sabi Sands Wildtuin: (2014 – ongoing)- SSW/ MGHP.
- Using cultural value as a conservation tool: Southern KwaZulu-Natal: (2012 – ongoing), MGHP/ Women's Leadership and Training Programme
- Habitat use and cultural value: Southern KwaZulu-Natal: (2017 – ongoing), Univ. of KwaZulu-Natal.
- Impact of climate change of nestling survival/ vocalisations/ social structures within groups - Associated Private Nature Reserves: (2000 – ongoing), FitzPatrick Institute of African Ornithology, UCT.
- Lowveld range-expansion project feasibility study - MGHP/ SANParks/ WITS
- Understanding local extinction of SGH in eSwatini and feasibility of restoration – MGHP/ Univ of eSwatini

2.4 SOCIO-ECONOMIC CONTEXT

The species is occasionally reported in traditional medicine markets. Community benefits are the high cultural value of SGH. The most widespread and prevalent value of the species is the belief in their ability to predict, signal or bring the summer rains (Godfrey, 1941; Hockley & Archer, 1966; Vernon, 1974; Kioko et al. 2015; Kuckertz, 1983; Nevill, 1984; Vernon, 1986b; Chiweshe, 1998; Msimanga, 2000; Maasdorp, 2007; Muiruri & Maunda, 2010; Orlove *et al*., 2010; Koopman, 2011; Simelane, 2011; Brunton & Badenhorst, 2013; Chisadza, Tumbare & Nhapi, 2013; Okonya & Kroschel, 2013; Coetzee, Nell & Rensburg, 2014; Rusinga *et al*., 2014; Jiri, Mafongoya & Chivenge, 2015), so vital to a subsistence farmers' survival. Accordingly, whole birds, alive or dead, or just some part, such as a feather, are reported to be placed in a riverbed to avert drought and crops are planted 'when the birds call'. This power is believed to be so strong that the live bird, carcass or feather(s) must be removed later from the site, lest floods prevail. Their rain-related powers also extend to being able to avert lighting strikes (Derwent & Mander, 1997; Koopman, 2011; Coetzee, Nell & Rensburg, 2014). Already concern has been expressed, by the people who rely on them for climate prediction (Rusinga *et al*., 2014), taking the declining population of SGH as a sign of climate change that enabled them to know when it is worth preparing fields.

There is trade in the species, both at a local level for traditional medicine and ritual practise (Anon, 1998; Msimanga, 2000; Kalimira, 2007; Maasdorp, 2007; Bruyns, Williams & Cunningham, 2013; Witteveen *et al*., 2013; Coetzee, Nell & van Rensburg, 2014), and across international borders for the zoo and aviculture trade (Trail, 2007). Across the range of the species, it has been reported that where cultural practices are respected there is inherent protection for the species (Trail, 2007). However, in areas where cultural taboos are less rigid the species becomes prey to traders and their suppliers, either opportunistically or as directed trade. It is difficult to quantify the scale of trade across the whole range, as the species is not listed by the Convention on International Trade in Endangered Species (CITES) and thus no formal reporting structures exist. Use of body parts is reported at a local scale but trade is reported for formal traditional medicine markets, not for domestic use. A continent-wide analysis found the species to be sold in two countries, in South Africa (Ngwenya, 2001) and Zimbabwe (Maasdorp, 2007; Bruyns, Williams & Cunningham, 2013) but used in a further three (Kenya, Swaziland and Namibia) (Williams *et al*., 2013). The scale of use reported from a market in western Zimbabwe was very low, but this is a region with strong cultural protection for the species (Bruyns, Williams & Cunningham, 2013). In South African markets carcasses are uncommon, with only 10% of traders stocking parts (Whiting, Williams & Hibbitts, 2011).

2.5 CONSERVATION MEASURES

BirdLife International (2014) suggested priority actions that have already been initiated in South Africa, and to some extent in Zimbabwe, to; (i) conduct population surveys and establish monitoring programmes, (ii) begin awareness campaigns to prevent persecution, (iii) identify key stronghold habitats and prevent degradation and research the effectiveness of artificial nest-sites. In South Africa, these actions are in line with priorities drawn from initial stakeholder engagement to ensure sufficient research and action were invested in the species, with a total of 71 research and conservation interventions identified (Morrison *et al.*, 2005). Several have been reiterated as priorities in the SGH Single Species Action Plan (Jordan 2011), with additional actions bringing the total list to 74 interventions. Only 13 have been completed, with 52 still in progress and a further nine still to be initiated.

In South Africa, conservation efforts started in earnest in the late 1990s, when it first became apparent that the species was in serious decline (Theron, Turner & de Waal, 2007). By this stage, basic population parameters and biology were unknown, except for a long-term study in a large protected area, the KNP (Kemp & Kemp, 1980; Kemp, 1988, 1995a; Kemp, Joubert & Kemp, 1989; Kemp & Begg, 1996, 2001). Several conservation strategies were and continue to be tested and implemented, with successful reintroduction (Kemp *et al*., 2020) and artificial nest hollow (Carstens *et al*., 2019a) protocols being developed.

Knowledge retention, however, is weak and more emphasis must be placed on scientific support for, and documentation of, decision-making processes, actions and outcomes. In South Africa, of the group that formed the initial stakeholder engagement a decade ago, only six of the original 35 participants are still involved, and insights have been lost due to having insufficient data collection, analysis and storage mechanisms in place. However, this group has been composed of people interested in supporting a future for this species, rather than formal representatives from government structures. The conservation of this species will require a long-term commitment and sustainable programmes supported with both finances and human resources. It will require the development of a 'community of practice' (Cundill, Roux & Parker, 2015) to ensure that the programme is truly able to benefit from the trans-disciplinary community of stakeholders and to be transparently cooperative. It is vital that data, even anecdotal, be accumulated and stored efficiently, and shared widely and transparently.

2.5.1 Development of coordinated conservation for the species

Conservation efforts for the SGH have until recently been guided by the Southern Ground-Hornbill (*Bucorvus leadbeateri*) Species Recovery Plan for South Africa (Jordan 2011) and largely implemented by the activities of the National SGH Action Group.

National Southern Ground-Hornbill (SGH) Action Group (2001 – 2017)

This group was formed in 2001 when the dilemma of multiple interests involved in SGH conservation was threatening to derail efforts to recover the species. This grouping was not a constituted group but aimed to coordinate and direct SGH conservation in South Africa, based initially on meetings conducted several times a year, which led to a national Species Recovery Plan compiled by all parties in 2011. Chairpersons are elected for two-year terms: Ann Turner (2001-2010), Kate Carstens (nee Meares) (2010), Andre Botha (2011 – 2012), Lucy Kemp (2012 - ongoing). During this period the 1st Population and Habitat Viability Assessment was conducted in 2005.

2005 Population and Habitat Viability Assessment

SGH conservation was defined by four themes: 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. A national management plan for SGHs and their savanna habitat in the context of South Africa's National Environmental Management: Biodiversity Act (2004) was a priority, with clear priorities identified for coordinated and focussed conservation. This led to the plan discussed below.

2011 SGH Single Species Recovery Plan

The main aim of this Recovery Plan is to halt the decline in population size and range contraction of the SGH in South Africa, ultimately to contribute to an increase in numbers and range expansion. Halting the decline in the SGH would result in the return of the species to favourable conservation status and the down-listing nationally from Endangered to Vulnerable or even of Least Concern. However, the SGH has an exceedingly long estimated generation time (3 generations over 100 years), and so down-listing based upon a short-term halt in the decline would be inappropriate and inconsistent with estimates of decline, which should be based, or projected, over 100 years for Red-listing purposes for this species.

With a review of the Plan, two objectives were completed and four objectives are still relevant and included in this BMP-S:

1. Generate an increase in the SGH population by expanding their occurrence into parts of their historical range, from where it has become locally extinct.

2. Collect information on population threats and mortalities for SGH and determine their importance.

3. Investigate and implement *in-situ* and *ex-situ* management and conservation interventions to increase SGH populations in South Africa, and neighbouring countries that could potentially act as a sink or source for South African birds.

4. Increase awareness of the SGH and the threats acting upon the species, to increase tolerance towards the species and reduce persecution.

2017 Population and Habitat Viability Assessment

In addition to preparing a BMP-S, and relevant to the timeframes of this BMP-S, the immediate priorities defined within the stakeholder process are:

1. Establish a more **formal grouping** of SGH stakeholders than the current Action Group, to ensure swift action on the 2nd PHVA recommendations.
2. Roll-out the **monitoring plan** already established for EKZNW across the country, to all relevant provincial and other conservation authorities.
3. Establish a **national poison forum** with other stakeholders, to address wildlife poisoning interventions beyond those focused on ground-hornbills.
4. Fully support the **national lead task team** to address lead toxicosis beyond efforts focused on SGH.
5. Characterise, encourage and expand **cultural protection** as it is currently manifested in South Africa.

2.5.2 Working Group/Thunderbird Task Team (2018 – ongoing)

This group facilitates and coordinates the implementation of the outcomes and activities emanating from the 2nd PHVA and supporting actions for this BMP-S. This group will support the SGH BMP-S Steering Committee in coordinating the activities of the BMP-S, assisting implementation and facilitating accountability of the implementing agencies, by their annual reporting requirements.

Objectives and responsibilities:

- Establish a central repository for data and relevant information;
- Facilitate and implement data sharing between different parties;
- Perform a coordinating function to reduce the duplication and overlap of work/research;
- Perform a conflict management function between different stakeholders;
- Review and monitor the outcomes of the PHVA (or as defined within the BMP-S);
- Create a platform for prioritising research;
- Facilitate partnerships between stakeholders, and find relevant new stakeholders;
- Support and review funding initiatives; and
- Implement adaptive management (monitoring and evaluation) to ensure a positive feedback loop.

2.5.2 Current conservation tools

1. **Artificial nests**: these have been tested and found to be a viable conservation tool, with a marked increase in the number of chicks fledging into a study area if the density of nest provision is considered (Carstens, 2019).
2. **Harvest of redundant chicks from wild nests**: the harvest of second-hatched chicks that would naturally die in the wild, and are therefore redundant and their harvest has no negative impact on the remaining wild population (Carstens 2017; Combrink *et al.* in press). There is no reduction in fitness in these doomed chicks (Kemp, Kemp & Turner, 2007; Kemp, 2017). These chicks thus form the basis of the stock for captive breeding and reintroductions.

3. **Reintroductions**: This has been trialled as a conservation tool, and after a decade of experimental reintroductions, is a viable tool for growing sub-populations where the species has become extinct within its historical range, so long as full new groups are created, rather than augmentation of individuals into existing groups (Kemp *et al*., 2020).
4. ***Ex-situ* management**: A small *ex-situ* population is managed as a PAAZA African Preservation Programme, with a studbook.
5. ***Education campaign for behaviour change***: An education outreach campaign is conducted in areas where SGH persist beyond the borders of national parks, within protected areas, but also in areas where the SGH have become locally extinct and must be re-introduced to the communities as well as the landscape. The campaign is based on the Connect-Understand-Act model. (Squires, Lowry & Banks, 2016) and the community-based social marketing model (Asah & Blahna, 2013).
6. ***Custodianship***: The MGHP works with individual landowners to mitigate threats and protect groups at a territory and nest-site level, in turn recognising and promoting their commitment to a future for SGH.

2.6 CONSERVATION STATUS AND LEGISLATIVE CONTEXT

2.6.1 International obligations

2.6.1.1: African Convention for the Conservation of Nature and Natural Resources

In 1969, before any reports of declines, the Organisation of African Unity (OAU) signed the African Convention for the Conservation of Nature and Natural Resources, under which both B*ucorvus* ground-hornbill species are fully protected by national laws of signatory states (of which South Africa is one) from any hunting, killing, capture or collection as an Annex 1, Class A species (Burhenne, 1970).

2.6.1.2 The Convention on Biological Diversity (CBD)

South Africa is a Party to the CBD. Parties to the CBD adopted the Strategic Plan for Biodiversity 2011-2020, in 2010 in Nagoya, Japan, to inspire broad-based action in support of biodiversity over the following decade by all countries and stakeholders. In recognition of the urgent need for action, the United Nations General Assembly also declared 2011 - 2020 as the United Nations Decade on Biodiversity. The Strategic Plan is comprised of a shared vision, a mission, strategic goals and 20 targets, and serves as a framework for the establishment of national and regional targets, promoting the three objectives of the CBD. The development and implementation of this BMP-S address ***Strategic Goal C: Improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity***. This BMP-S specifically aims to contribute to Target 12: By 2020 the extinction of known threatened species has been prevented and their conservation status, particularly to those in decline, has been improved and sustained. This target specifically related to IUCN-listed threatened species and has two components:

- Preventing extinction: those species that are currently threatened do not move into the extinct category; and,
- Improving the conservation status of threatened species: Improved conservation status would entail a species increasing in population to a point where it moves to a lower threat status. Progress towards this target would help reach other targets contained in the Strategic Plan, including Target 13. Further actions

taken towards this target could also help to implement commitments related to the species-focused multilateral agreements such as CITES (CBD 2013).

2.6.1.3 The World Heritage Convention

The World Heritage Convention is a Convention concerning the protection of the world's cultural and natural heritage. It provides for the identification, protection and preservation of cultural and natural heritage, including the habitats of threatened species around the world considered of outstanding value to humanity. Countries submit places for designation under the World Heritage List. SGH is known to now occur in two South African World Heritage Sites: the Mapungubwe Cultural Landscape and Maloti-Drakensberg Park, and were historically recorded for the iSimangaliso Wetland Park and Barberton Makhonja Mountains.

2.6.1.4 IUCN Red List

The species is listed as globally Vulnerable but Endangered in South Africa, Lesotho, Swaziland, and Namibia; (BirdLife International, 2018).

2.6.1.5 Lusaka Agreement

Although not one of the seven Parties that have formally ratified the Agreement, South Africa is one of three other countries that are signatories to the Lusaka Agreement (1996). The Lusaka Agreement is a treaty between many African nations that seeks to "reduce and ultimately eliminate illegal trade in wild fauna and flora and to establish a permanent Task Force for this purpose."

2.6.2 National legislation

2.6.2.1 National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) – (NEMBA)

NEMBA gives effect to the constitutional commitment to take reasonable legislative measures that promote conservation by providing for the management and conservation of biological diversity and the sustainable use of indigenous biological resources. Chapter 3 provides for the planning and monitoring of biodiversity. Sections 43 (1)(b) and (c) provide for any person, organisation or organ of state, desiring to contribute to biodiversity management, to submit to the Minister for approval a draft BMP-S for an indigenous or migratory species warranting special conservation attention. Section 44 empowers the Minister to enter into an agreement with any person, organisation or organ of state for the implementation of a BMP-S.

Concerning the regulation of restricted activities involving SGH, NEMBA further empowers the Minister in terms of:

- Section 56, to publish, by notice in the Gazette, a list of critically endangered species, endangered species, vulnerable species or protected species;
- Section 57, to:
    - regulate the carrying out of restricted activities involving a listed threatened or protected species or a CITES-listed species using a permit,

- prohibit the carrying out of a restricted activity involving a listed threatened or protected species, if such activity harms the survival of the species, or
- exempt a person from the requirement of a permit concerning a listed threatened or protected species or a CITES-listed species.

NEMBA further enables the issuing authority in terms of section 88(2)(e) to defer a decision to issue a permit or, in terms of section 92(a) to refuse a permit, in terms of section 93 to cancel a permit, or in terms of section 93B to suspend a permit, in certain circumstances.

2.6.2.2 National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004): Threatened or Protected Species (ToPS) Regulations, 2007

The ToPS Regulations, 2007, promulgated in terms of NEMBA came into force in February 2008. The regulations provide for the protection of species that are threatened or in need of protection to ensure their survival in the wild and give effect to the Republic's obligations.

A permit is required for a person to carry out a restricted activity concerning SGH. These restricted activities include hunting, capturing, killing, importing or exporting into or from South Africa, having in possession or exercising physical control over any SGH; breeding, translocating, moving, selling, donating or accepting any SGH or any of its products or derivatives as a gift. It is compulsory in terms of the ToPS Regulations for the owner of a sanctuary, breeding facility, commercial exhibition facility, or for a wildlife trader to register his/her facility. However, the registration does not authorize the carrying out of any restricted activity; the afore-mentioned persons thus still need to obtain the relevant permit issued in terms of Chapter 7 of NEMBA.

2.6.2.3 National Environmental Management: Protected Areas Act, 2003 (Act 57 of 2003) (NEMPAA)

NEMPAA provides for the protection and conservation of ecologically viable areas representative of South Africa's biodiversity and natural landscapes and seascapes in protected areas. Protected areas in South Africa offer a viable tool for habitat protection and the protection and maintenance of ecologically viable numbers of SGH and their associated species and habitats.

2.6.3 Other relevant South African legislation

Apart from the National Environmental Management Act No. 107 of 1998 (NEMA), its related Specific Environmental Management Acts and the nine provincial conservation acts/ordinances are the regulatory instruments for the regulation of animal species in South Africa, noting that nature conservation is a concurrent national and provincial mandate. Supporting decision-making instruments include National Norms and Standards and Provincial Conservation and Regulatory Policies.

Province	Provincial legislation

Gauteng (including KwaNdebele and Bophuthatswana)	Listed as Protected Game (Schedule 2) and Wild Animals to which the provisions of section 43 apply (Schedule 5), in terms of the Nature Conservation Ordinance, 12 of 1983 *Gauteng Nature Conservation Ordinance, 1983 (2005 amendment); Gauteng Nature Conservation Act, 2014.*
Limpopo (including Venda and Gazankulu) and Lebowa	Listed as a Specially Protected Wild Animal (Schedule 2) in terms of the Limpopo Environmental Management Act, 7 of 2003; Limpopo Environmental Management Act, 2003 *Limpopo Nature Conservation Ordinance, 1983 – Limpopo Environmental Management Act, 2003; Gazankulu Nature Conservation Act, 5 of 1975, Venda Nature Conservation Act, 10 of 1973.*
North West (including Bophuthatswana and Lebowa)	Listed as Protected Game (Schedule 2) and Wild Animals to which the provisions of section 43 apply (Schedule 5), in terms of the Nature Conservation Ordinance, 12 of 1983. *Cape Nature Environmental Conservation Ordinance, 19 of 1974; North West Nature Conservation Ordinance, 1983; Bophuthatswana Nature Conservation Act, 1973; Lebowa Nature Conservation Act, 1973, and tribal rule.*
Mpumalanga (including Gazankulu and KaNgwane)	Listed as Protected Game (Schedule 2) n terms of the Mpumalanga Nature Conservation Act, 10 of 1998 *Mpumalanga Ordinance, 1983 - Mpumalanga Nature Conservation Act, 10 of 1998; Mpumalanga Nature Conservation Act Regulations 1999; Mpumalanga Nature Conservation Policy 2004.*
Free State (including Qua Qua)	Listed as Protected Game (Schedule 1) Section 2, in terms of the Nature Conservation Ordinance, 8 of 1969. *Free State Nature Conservation Ordinance, 8 of 1969; Qua Qua Nature Conservation, 5 of 1976; Nature Conservation Regulations 1983.*
KwaZulu-Natal (incl. Kwazulu)	Specially protected in terms of the Nature Conservation Ordinance, 15 of 1974 *KwaZulu Nature Conservation Act, 29 of 1992 - KwaZulu-Natal Nature Conservation Management Act, 9 of 1997; Natal Nature Conservation Ordinance, 15 of 1974, as amended; KwaZulu Nature Conservation Act, 8 of 1975; KwaZulu-Natal Environmental, Biodiversity and Protected Areas Management Bill, 2014.*
Northern Cape (including Bophuthatswana)	Listed as a Protected Wild Animal (Schedule 2) in terms of Nature and Environmental Conservation Ordinance, 19 of 1974 *Northern Cape Nature Conservation Ordinance, 19 of 1974; Nature and Environmental Conservation Regulations, 955 of 1975; Northern Cape Nature Conservation Act, 2009; 2016.*

Eastern Cape (incl. Ciskei and Transkei)	Listed as a Protected Wild Animal (Schedule 2) in terms of the Cape Nature and Environmental Conservation Ordinance, 19 of 1974. *Eastern Cape Nature Conservation Ordinance, 19 of 1974; Nature Conservation Regulations 955 of 1975; Ciskei Nature Conservation Act, 10 of 1987; Transkei Decree 9 of 1992.*
Western Cape	Listed as a Protected Wild Animal (Schedule 2) in terms of the Western Cape Nature Conservation Laws Amendment Act, 3 of 2000 *Western Cape Nature Conservation Ordinance, 19 of 1974; Western Cape Nature Conservation Regulations 955 of 1975; Western Cape Nature Conservation Board Act, 15 of 1998; Western Cape Nature Conservation Laws Amendment Act, 3 of 2000; Western Cape Biodiversity Bill 2019.*

Other Acts, such as the Animals Protection Act, 71 of 1962 as amended, which regulates animal welfare in South Africa is also applicable to wildlife. The Animal Health Act, 7 of 2002, Animals Diseases Act, 35 of 1984, Medicines and Related Substances Control Act, 101 of 1965, and the Animal Matters Amendment Act, 42 of 1993, which all fall within the jurisdiction of the Department of Agriculture, Forestry and Fisheries, may also prove relevant to SGH conservation as they play a significant role in veterinary care of animals, as well as their translocation.

3. PLANNING FRAMEWORK

3.1 THE PLANNING CONTEXT

The SGH BMP-S has a logical structure with a 5-year time horizon. The plan has a long-term vision and a shorter-term conservation goal covering the period of this plan. By achieving the short-term goal, progress will be made towards realising the longer-term vision. To achieve this a combination of the IUCN Guidelines for Species Conservation Planning and the Guidelines contained in the Norms and Standards for BMP-S were also used. Focus on addressing anthropogenic threats was used to guide workshop processes. Each of the steps required by the Norms and Standards for BMP-S was followed.

Figure 13. Action Plan and Monitoring Framework derived from IUCN Species Survival Commission schematic for species

3.2 KEY ROLE PLAYERS

Key role players and stakeholders in the conservation management of SGH are the following:

- Those government departments and agencies (at a national, provincial and local level) that have been mandated in terms of legislation, to protect this species, and to implement the actions identified in this plan to ensure the long-term survival of this species in the wild.
- Other government departments and agencies involved in regulating activities that may impact on achieving the conservation objective for the species.
- Private landowners (commercial farmers, wildlife ranchers);
- Communal land managers (Traditional authorities/ councils);
- Researchers and research institutions involved with research relevant to the species.
- Non-governmental organisations, at both a national and international level providing funding for management implementation, research, students and projects.
- Organisations that are involved in developing and implementing various aspects of the SGH BMP-S.

National Government and Conservation Agencies	Department of Forestry, Fisheries and the Environment (DFFE); South African National Biodiversity Institute (SANBI);

	South African National Parks (SANParks)
	Department of Energy (DE)
	National Development Agency (NDA)
	Department of Rural Development and Land Reform (DRDLR)
Provincial Government Departments and Conservation Agencies	Eastern Cape Department of Economic Development, Environmental Affairs and Tourism (EC/D DEDEAT);
	Eastern Cape Parks and Tourism Agency (ECPTA);
	CapeNature (facilitation);
	Gauteng Department of Agriculture and Rural Development (GDARD);
	Limpopo Department of Economic Development, Environment and Tourism (LEDET);
	Mpumalanga Tourism and Parks Agency (MPTA);
	Ezemvelo KZN Wildlife (EKZNW)
	State Veterinary Services
Higher Education Institutions	University of the Free State (UFS);
	University of Cape Town (UCT);
	University of KwaZulu-Natal (UKZN);
	University of Limpopo (UL);
	University of Pretoria (UP);
	University of the Witwatersrand (WITS)
Captive institutions	Montecasino Bird Gardens
	Johannesburg Zoo
	Umgeni River Bird Park
	Hoedspruit Endangered Species Centre
	Zaagkuilsdrift Bird Sanctuary
	Ubhetyana-o-Africa
	Lory Park
	National Zoological Garden of South Africa (NZG)
Non-Government	BirdLife South Africa (Birdlife SA)
	Children and Nature Conservation Trust, Zimbabwe
	Mabula Ground Hornbill Project (MGHP)
	Endangered Wildlife Trust (EWT)
	Wildlife Ranching South Africa (WRSA)
	South African Hunters and Game Conservation Association (SAHGCA)
	Women's Leadership and Training Programme (WLTP)
	Pan-African Association of Zoos and Aquaria (PAAZA)
	National Wildlife Poison Prevention Working Group (NWPPWG), and Lead Task Team (LTT)
Other	Sabi Sands Wildtuin (SSW)
	Associated Private Nature Reserves (APNR)
	Private game reserves
	ESKOM
	Municipalities

3.3 STAKEHOLDER ENGAGEMENT

Identified interested and affected parties were invited to participate in the initial SGH BMP-S workshop via e-mail in January 2018 (see Appendix A for the invitation). The list of participants and provisional agenda for the workshop

is attached as Appendix B, and includes experts on SGH, representatives of conservation management agencies, representatives of wildlife ranching and hunting associations, private landowners and researchers (many of whom also participated in the 2nd PHVA workshop in 2017).

Invitees were requested to participate in the workshop to facilitate the drafting of a BMP-S for SGH and were also requested to recommend additional stakeholders who they thought could contribute to the proposed workshop.

The Stakeholder Workshop was held on 15 - 17 May 2018. The workshop included presentations on the current state of knowledge for SGH. The group as a collective developed the Desired State and identified the key threats to the long-term survival of SGH in nature. Break-away groups led by designated facilitators then compiled objectives and action plans for each threat. The proceedings of the workshop were used to compile the draft BMP-S for SGH. This draft was compiled by MGHP with an editing committee from PFIAO, Cape Nature, BirdLife SA, EWT and SANBI.

MGHP was tasked to further lead four workshops to ensure full inclusivity before the adoption of a strategy based on the outcomes of the BMP-S workshop and to contribute to developing mechanisms to enable the achievement of the objectives of the BMP-S (see appendix C for invitee list and attendance register). Once the draft was completed it was circulated to all participants for comment, before being submitted to the DFFE for gazetting for public participation (for a minimum of 30 days). Stakeholders involved in the initial workshop were provided with the draft SGH BMP-S, and encouraged to provide further inputs via the public participation process to be included in the final draft, to ensure transparency.

The final draft of the plan, once approved by DFFE, will be compiled and submitted, within 90 days of receipt of comments, to the Minister for approval.

3.4 RELEVANT AGREEMENTS

Taking the implementation of this BMP-S forward, the key role players have all accepted their various roles and responsibilities and consider the plan to be a document binding them to these. As such, additional agreements are not required, although it will be necessary to monitor implementation very carefully and introduce relevant agreements where these are deemed necessary. The basis of future inter-agency cooperative agreements will be defined by the Terms of Reference of membership of Project Thunderbird and additional formal Memoranda of Understanding and/or protocols between agencies to tackle sub-objectives that may be required.

In addition to the literature cited in the references below, the following are also relevant:

- NEMBA (Act No.10 of 2004)
- Provincial Conservation Legislations
- Norms and Standards for BMP-S (March 2009)
- TOPS

3.5 IDENTIFICATION OF LEAD AND IMPLEMENTING AGENCIES

SANBI is proposed as the overall lead agency for the SGH BMP-S, and the workshop identified additional implementing agencies (government agencies e.g. SANParks), and collaborators (NGOs and other stakeholders) for

the respective actions under each Objective Target. The workshop and all stakeholders present concluded and reached consensus on all identified actions under each objective target. It should be noted that although EC DEDEAT, KZN EKZNW and LEDET could not attend the original workshop MGHP took individual workshops to each of these provinces, and to SANParks, to ensure action plans were developed with their consensus, input and comments. This exercise informed further discussion and final agreement on who the respective lead and responsible agencies are, as well as the collaborators.

3.6 VERIFICATION FOR QUALITY OF CONTENT AND CONTEXT

The BMP-S has been compiled with input from other stakeholders including relevant specialists in the field. The process was overseen by DFFE. This document is also based on the recommended actions from the Single Species Recovery Plan and Population and Habitat Viability Assessment. To ensure this is done adequately, the expert review was sought and was reviewed by Dr Alan Kemp for verification of the quality of content and context.

Dr Alan Kemp started studying hornbills in the KNP as a postgraduate student in 1966, but from 1972 focused his attention entirely on the SGH. From then, until he retired from the Bird Department of the Transvaal (now Ditsong) Museum of Natural History in 2001, he continued long-term data collection and conducted several auxiliary projects on the SGH (35 years). During this time, he developed a wider interest in the conservation biology of hornbills, especially the SGH. By 1999, as he was closing his research projects, he initiated an effort to raise, release and breed redundant second-hatched chicks that could be harvested with no impact on the wild parent populations. This expanded into an NGO, the MGHP that now has a national footprint and primary leadership role in the conservation of this species, and which extends across the SGH's total range in subequatorial Africa. His original studies on the SGH identified several of the basic information, principles and approaches that are now being applied to conservation of the SGH, and he has relished keeping up with the numerous new studies, discoveries, techniques, ideas, conferences, theses and publications that have resulted or are underway. He is registered as a Natural Scientist with SACNASP, in the fields of Zoology and Ecology. Before he retired, he started an IUCN SSC Hornbill Specialist Group, which Dr L Kemp has revived and is now the African co-chair. He was the editor of the ornithological journal Ostrich (now African Journal of Ornithology) for three years and further developed his editorial and critical skills over the years by refereeing articles for various scientific journals, examining post-graduate theses (MSc., PhD.) and helping non-English speakers (Afrikaans, Thai) with drafting their research. He has also prepared and published several books on hornbills and birds of prey, including for Oxford University Press.

4. BIODIVERSITY MANAGEMENT PLAN

4.1 LEAD AND IMPLEMENTING AGENCIES

4.1.1 Lead agency

SANBI is proposed as the lead agency, supported by DFFE and the Thunderbird Task Team.

4.1.2 Steering Committee

The Thunderbird Task Team should become formalised as a DFFE SGH BMP-S Working Group and a steering committee can be proposed from within this group to oversee administration, governance and implementation.

4.1.3 Implementing Agencies

DFFE	Regulation, monitoring, evaluation and annual reporting
SANParks	Population monitoring, reporting, legislative oversight, education and awareness, permits, research
ECPTA	Population monitoring, reporting, legislative oversight, education and awareness, permits, research
EC DEDEAT	Population monitoring, reporting, legislative oversight, education and awareness, permits, research
SANBI	Coordination of implementation, research, monitoring, reporting and research facilitation
MPTA	Population monitoring, reporting, legislative oversight, education and awareness, permits, research, rearing.
LEDET	Population monitoring, reporting, legislative oversight, education and awareness, permits, research
EKZNW	Population monitoring, reporting, legislative oversight, education and awareness, permits, research
GDARD	Permits
DE	Education and awareness
NDA	
DRDLR	
SAVC	Veterinary reporting and research

4.1.4 Collaborating Agencies

MGHP	Population management, monitoring, research facilitation and reporting
BirdLife SA	Transformer box mitigation: BirdLife South Africa/ ESKOM/ Education materials
WLTP	Community liaison and training
SAHGCA	Awareness, custodianship
WRSA	Awareness, custodianship

PAAZA and all captive facilities	Captive-breeding for reintroduction and current captive stock for education.
NWPPWG	Policy change, awareness, outreach, advocacy
EWT	Research
HEIs	Research (committee to approach various HEIs with project proposals)
Private game reserves	Awareness, custodianship

4.1.5 Relevant agreements

There is formal inter-agency agreement as far as the conservation of SGH is concerned between the PFIAO and MGHP, and research agreements between MGHP and SANParks. Implementing agencies will formalise governance responsibilities as assigned with provinces. A Memorandum of Understanding is in place between MGHP and BirdLife SA, with MGHP being a BirdLife SA Species Guardian for the population management, monitoring, research facilitation and reporting of SGH in South Africa.

4.2 IDENTIFIED THREATS AND CHALLENGES

Threats were defined according to the Conservation Measures Partnership's Open Standards for the Practice of Conservation. The threats are then listed in order of priority from the greatest perceived risk to the population to the lowest (which it must be noted is still considered a considerable threat to the population).

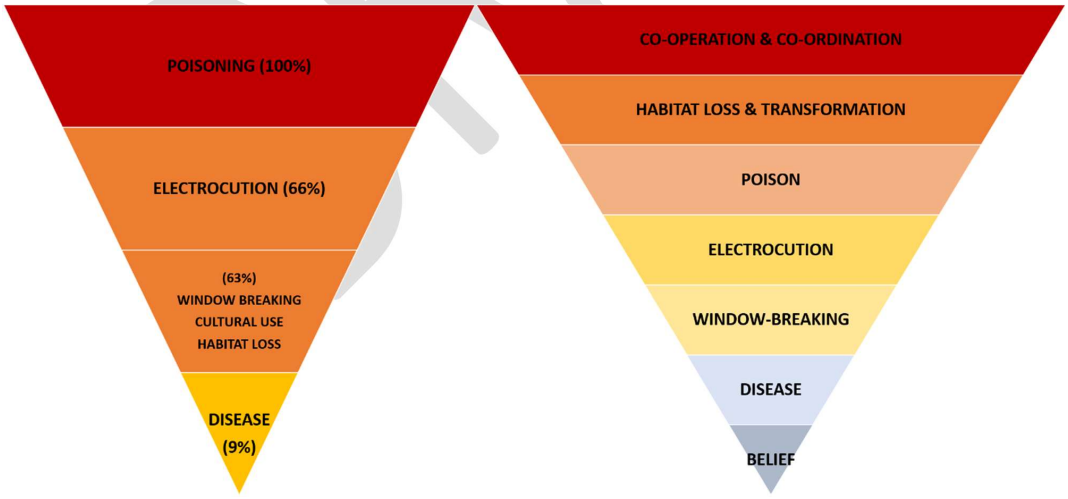


Figure 10.a) the prioritisation of threats by prevalence amongst participant concerns and b) prioritisation after discussion and analysis of scope, severity, irreversibility.

4.2.1 THREAT: Poisoning

SGH are faunivorous and scavenge, particularly on smaller prey items, and therefore will ingest meat that may contain poisons, which can lead to severe illness or mortality of individuals or multiple members within the same group. A review, using all existing poisoning data, highlighted what land-use types pose a higher poisoning threat to SGH (Table 1) and, which chemicals are implicated (Table 2). Indirect methods of poisoning include:

- Incorrect/off-label/illegal use of agrochemicals/pesticides by livestock and game ranchers who deliberately lace carcasses with toxins to remove predators (i.e. jackal, hunting dogs), which leads to secondary poisoning of scavenging SGH.
- Domestic use of pesticides that are then ingested as secondary poisoning by SGH (i.e. rodenticide, Red-billed Quelea control). Use of veterinary drugs in livestock, which is then ingested by SGH through the consumption of meat or faeces.
- Ingestion of any offal or winged or injured prey after a hunt, where spent lead ammunition or its fragments may be present leading to lead toxicosis.

It is not just the risk of mortality, but the effects of poisons on the health and survival prospects of SGH after ingestion.

Table 1. Relative risks of poison to SGH according to habitat use and behaviour (from Kemp & Verdoorn, 2013).

HABITAT USED	RISK				POSSIBLE EVENTS
	Very high	High	Med.	Low	
Natural: minimal management	?			X	Deliberate: traditional medicine collection
Natural: significant management	?	X			Deliberate: damage caused by SGHs Secondary: predator poisoning, rodenticide
Agricultural: crop production			?	X	Accidental: spray drift with resultant poisoned prey and uncontrolled Red-Billed Quelea control
Agricultural: extensive livestock			X		Accidental: predator poisoning, disused dip tanks
Agricultural: mixed crop & livestock			X		Accidental: spray drift, predator poisoning, disused dip tanks
Agricultural: mixed livestock & game			X		Accidental: predator poisoning, disused dip tanks
Communal: pastoral livestock				X	Deliberate: *belief-based use* collection Accidental: disused dip tanks
All areas			X		Toxic effluents in natural water bodies

Table 2 Chemical agents identified as a risk to SGH per poisoning type (from Kemp & Verdoorn, 2013).

Event/Chemical agents	Al	Ca	NF	Me[1]	EG	Ox	Me[2]	Pa	CP	CF	Fe	CY	OT
Predator poisoning	■	■	■		■	■							
Deliberate SGH poisoning	■	■			■								
Belief-based harvesting	■	■	■	■		■	■			■			
Crop production				■		■	■	■	■				
Red-billed Quelea control							■	■			■	■	
Disused dip tanks										■			■
Water pollution													■

Key: Al = aldicarb, Ca = carbofuran, NF = 1080, Me[1] = methomyl, EG = ethylene glycol, Ox = oxamyl, Me[2] = methamidophos, Pa = parathion, CP = chlorpyrifos, CF = chlorfenvinphos, Fe = fenthion, CY = cyanophos, OT = others (Clostridium, heavy metals, acids, organochlorines).

Type of Poisoning	Lead toxicosis	Off-label / illegal acquisition and use of agrochemicals	Secondary poisoning
Scope	All areas where shooting using lead ammunition occurs	National scale	National scale
Severity	High in affected areas	High – nationally available even in most rural areas	High – i.e. strychnine in Limpopo Valley
Irreversibility	High	High	High
Summary Threat Rating	**65**	**65**	**65**
Comments	South Africa is a signatory to the AEWA CMS requirement to reduce lead use. Lead Task Team of the WPPWG A large body of literature showing risks to both human and avian ingestion of lead. Provincial nature conservation removes lead ammunitions from culling and hunting operations.	Enforcement and awareness required.	Awareness, legislation required and development of new and improved substances, greater engagement with the veterinary fraternity and the WPPWG.

4.2.2 THREAT: Cultural use

SGH is culturally revered throughout their range, however, this cultural belief system relies on some offtake from the SGH population.

Threat	Hunted for medicinal use	Hunted in times of drought
Scope	Low (<5%)	Low (<5%)
Severity	Low (<5%)	Low (<5%)
Irreversibility	100%	100%
Comments	All current literature suggests low numbers of carcasses being found in traditional markets, engagement with communities	Only occurs in times of drought, ritual only performed by specific members of the communities, impossible to generalise belief systems across areas (feathers, carcass, live staked bird, sweat), very powerful if not managed will cause floods. Differences in belief structure have different effects on SGH population dynamics and persistence.

	suggests offtake is opportunistic.	Without this importance, it is unlikely these birds would have persisted across KZN and the Eastern Cape. At what level is offtake sustainable or what segment of the population?

* surveillance for novel/ imported threats

4.2.2 THREAT: Persecution for window-breaking

SGH are actively persecuted for breaking windows (Vernon 1986; Kemp 1995; Maasdorp 2007b; Forsberg 1994), and occasionally for predation on poultry. These birds will attack their reflections in windows (Oatley, 1967; Vernon, 1982; Forsberg, 1994) or shiny reflective surfaces (such as metallic coloured vehicles), which results in broken window panes, often in large quantities as they move from pane to pane. This puts the whole group at risk of injury from broken glass but also leads to intense conflict with humans. Persecution by irate land-owners or communities leads to direct mortality or reduced productivity, with confirmed reports of a community burning the resident SGH group's nest (Blouberg, Limpopo) due to window-breaking at a local school, or stoning a nest causing abandonment, again due to broken windows at the nearest school (Melmoth, KwaZulu-Natal). This behaviour is universal and reported from across their range. Mitigation to prevent them from seeing their reflections is the only way to reduce the human-wildlife conflict, with a temporary and cheap solution using a solution of wood ash or paint on the panes (Chiweshe, 2007) and a more permanent one using perforated one-way-vision vinyl film, though a high-end, attractive solution is yet to be sourced for lodges and the like (MGHP unpublished data). Experiments in the use of commercial acoustic bird-scarers failed (MGHP unpublished data).

Threat	Persecution for window-breaking
Scope	No scientific data are available other than that it is widespread.
Severity	Damage is high and actual persecution is moderate at most, probably 5% of the population in South Africa, however within this group severity is high.
Irreversibility	Low – if 5% of the population is killed every year it will take time to reverse the situation.
Comments	Variation in geographical area risk is relative to cultural beliefs and attitudes to use mortal response or not.

4.2.3 THREAT: Disease

The species has shown susceptibility to Newcastle Disease and very likely also Avian Influenzas. These diseases may enter wild populations due to naturally occurring outbreaks or due to poor biosecurity by the poultry industry. However, as the species readily coexist in rural communities, subsistence farming also poses a risk, especially as dead stock is more likely to be disposed of improperly.

Threat	Disease
Scope	Low known threat; potentially high - two cases of individual birds (NW Province)
Severity	Individual to the group level

Irreversibility	It is 100% reversible, with identification of the prevalence and vaccination (orally), however, it is not treatable.
Comments	Two positive reports in NW Province, risk to reintroduced birds because they are captive-reared. Difficult to recover carcasses from NCD mortalities. It may be difficult to vaccinate wild birds, and it is not known how many repeat booster applications are needed. However, vaccines may be possible in the future.

4.2.6 THREAT: Electrocution

The emerging threat posed by energy provision (e.g. transformer boxes) and energy generation (e.g. wind farms) infrastructure, through 1) electrocution and 2) potential collision.

Who: Utility companies (e.g. Eskom, municipalities) and Independent Power Producers (IPPs).

Why: The need to expand/increase energy infrastructure equals an increased risk to birds, which could lead to either death or injury.

Threat	**Transformer boxes**	**Distribution poles**	**Powerlines**	**Wind turbines**
Scope	Moderate	Low	Low	Unknown
Severity	Moderate	Low	Low	Unknown
Irreversibility	Very high	Very high	Low	Unknown
Comments	Changing infrastructure would benefit the species; further research required to quantify the threat (modelling of many transformer boxes over distribution range of species). Central incidents register (Eskom-EWT Partnership).	Personal observations; no reported records in Central incidents register (Eskom-EWT Partnership). Changing infrastructure would benefit the species.	Personal observations; young birds landing on powerlines; collision risk: one collision recorded on Central incidents register (Eskom-EWT Partnership).	Knowledge gap on potential collision or flying at risk height; Species-specific guidelines to be developed for SGH; turbine; Improve monitoring protocol to influence turbine placement; tracking to determine flight height (altitude) (GPS or satellite transmitters); test avoidance behaviour; territorial display could potentially be mitigated through shutting down on-demand of turbines; monitoring of the use of habitat under turbines through field observations;). ; then model overlap between wind resource and species' distribution range to assess the potential threat of wind turbines to species in South Africa.

4.2.7 THREAT: Habitat loss and fragmentation

SGH require vast expanses of suitable habitat to forage and to breed successfully (SGH in South Africa have displayed home ranges of up to 250 km^2). They also have a specific set of habitat requirements/parameters to persist (10 – 40 % bush cover etc.).

The total loss of critical core SGH habitat across southern Africa has been directly associated with range decreases in the species. Much of this is irreversible (urbanisation and industrialisation) and closely linked with the precipitous human population increases and expansion in Africa. Another major threat is the alteration and fragmentation of suitable habitat linked with land-use changes and management practices (livestock, fire etc.) Although some groups have been able to survive in some transformed/degraded landscapes, this habitat is largely unusable to the species.

Threat	**Habitat loss**	**Habitat degradation/alteration and fragmentation**	**Loss of nesting and roosting sites**
	Complete irreversible loss of habitat.	• Monoculture • Land-use changes • Pollution • Bush encroachment/alien invasive plant species • Land management practices • Agricultural infrastructure (i.e. dip tanks)	• Elephants • Removal of large forestry trees • Collection of large dead hollow trees for firewood
Scope	High (<75%)	Very High (<80%)	Low
Severity	High	High	Low - medium
Irreversibility	Very low/not possible (0-5%)	Medium	Low
Comments	Urbanisation and development	May be potential to manage and improve land-use changes and management practices to restore suitable habitat for SGHs.	Artificial nests can be built and supplied. Further research required to understand the importance of roost sites.

4.2.8 CHALLENGE: To implement nation-wide monitoring

Participants were concerned that it is difficult to census such a species occurring at a naturally low-density. This would lead to uncertainty about the value of conservation action or surveillance for localised declines. However, the proposed monitoring plan developed by MGHP and EKZNW, as accepted at the 2nd PHVA in 2017, was presented and again accepted as a valid, low-cost manner of nation-wide population monitoring. See Appendix F for the details of this monitoring plan.

4.2.9 CHALLENGE: Insufficient communication between agencies involved in SGH research and conservation and various government agencies (both national and provincial)

This was raised as a challenge since the 1st PHVA (2005) and again at the 2nd PHVA (2017), that there was a need for greater communication, coordination of activities and the dissemination and sharing of information.

4.2.10 CHALLENGE: Capacity constraints

Capacity constraints may be a challenge and agencies must indicate if this is so for in their response to DFFE when receiving their letters requesting implementation.

5. ACTION PLAN AND MONITORING FRAMEWORK

The SGH BMP-S incorporated the IUCN-SSC framework for conservation planning (see Fig. 11) and was used to guide stakeholder engagement and planning workshops to define the objectives, and the actions to achieve the collaboratively-defined desired state. These actions, as identified for each objective, will need to be implemented by the identified lead and implementing agencies, to mitigate the identified threats (habitat loss, poisoning, electrocution, disease and belief-based off-take) and challenges (effective communication and collaboration among stakeholders).

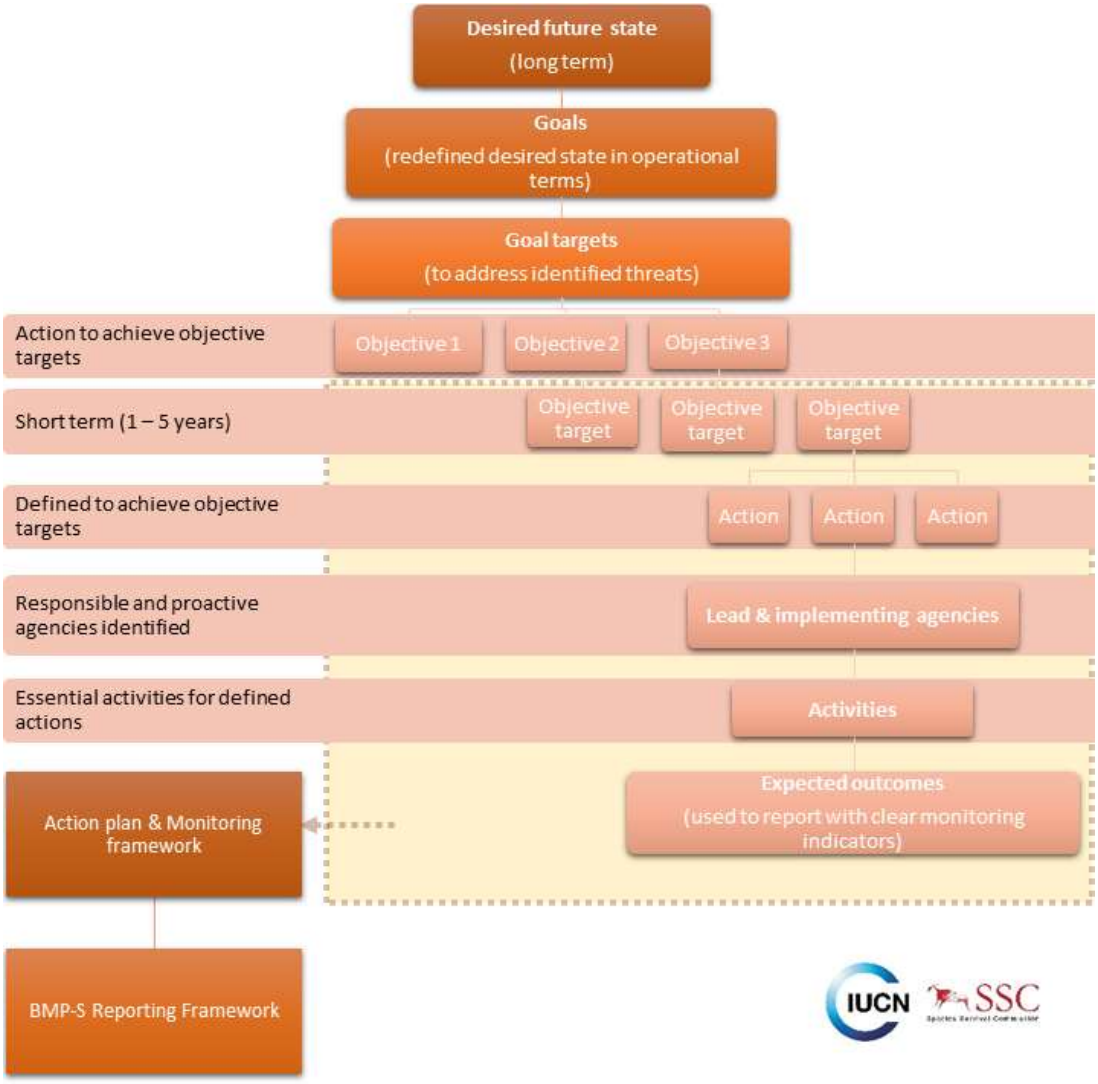


Figure 111. Action Plan and Monitoring Framework adapted from the IUCN SSC schematic for species conservation planning methodology.

5.1 Objective 1: TO ESTABLISH AND MAINTAIN EFFECTIVE COMMUNICATION AND AWARENESS BETWEEN AND AMONG STAKEHOLDERS AND THE PUBLIC.

5.1.1 Objective Target: Establish and maintain productive partnerships for SGH conservation

ACTION 5.1.1	**FORMALISE INTER-AGENCY COLLABORATION TO COORDINATE AND REVIEW THE IMPLEMENTATION OF THE SGH BMP-S.**	
Lead agencies: **Implementing agencies:** **Collaborators:**	SANBI ECPTA; EC DEDEAT; EKZNW; MPTA; LDEDET; GDARD; SANParks; DFFE MGHP, Birdlife SA; HEIs	
Essential activities:	• Establish a Steering Committee • Develop Terms of Reference (ToR) for SGH BMP-S Working Groups • Inter-agency agreements identified and initiated.	
Expected Outcome in 5 yrs.:	• Operational Steering Committee with accountable reporting. • Effective inter-agency collaboration and coordination. • Accountability on BMP-S implementation and impact.	
Monitoring and Evaluation:	• Steering committee established • Terms of reference for SGH WG • Annual M&E reports. • Inter-agency agreements.	
Funding / Resources	**Timeframe**	**Measurable Indicators / Outputs**
Each agency to commit budget for and fund their commitment.	Within year one.	1. Steering Com meetings with minutes. 2. SGH WG Terms of Reference 3. Annual M&E Report.
Challenges: Continuity and continued participation. Cost of participation / create an improved mechanism for virtual communication e.g. video conferencing		

ACTION 5.1.2	**DEVELOP PRODUCTIVE PARTNERSHIPS WITH STAKEHOLDERS FOR SGH CONSERVATION**
Lead agencies: **Implementing agencies:** **Collaborators:**	DFFE ECPTA; EC DEDEAT; EKZNW; MPTA; LDEDET; GDARD; SANParks; SANBI, DFFE MGHP, Birdlife SA

Essential activities:	• Stakeholder matrix with existing programmes and required critical interventions developed.
	• Stakeholder engagement strategy with clear targets and responsibilities developed.
	• Develop and package stakeholder-specific resource content and tools as approved by SC.
	• Investigate and guide the development of appropriate incentives for participation in SGH conservation.
	• Facilitate safe spaces for SGH in core habitat.
	• Develop and implement management guidelines for:
	  ○ Elephant damage to nests
	  ○ Bush encroachment and invasive species control
	  ○ Land use practices
	  ○ Disturbance of nesting and roosting sites.

Expected Outcome in 5 yrs.:	• Multi-stakeholder involvement in SGH conservation. • Public more informed through flagship environmental awareness programmes. • Effective management plans implemented, effective mitigation of impacts of land use, SGH habitat conservation, community empowerment to support conservation activities.	
Monitoring and Evaluation:	• The number of stakeholder engagements. • Awareness tools/brochures developed. • Awareness interventions implemented.	
Funding / Resources	**Timeframe**	**Measurable Indicators / Outputs**
Each agency to fund its commitment	Within one year of gazetting Then ongoing.	• Awareness and educational campaigns. • Distribution of awareness tools/brochures. • Voluntary stewardship/custodianship sites identified and established • Best practice guidelines for land management in SGH habitat developed.
Challenges: Funding		

5.2 Objective 2: TO SIGNIFICANTLY IMPROVE THE HEALTH AND BREEDING POTENTIAL OF THE WILD SGH POPULATION

5.2.1 Objective Target: To reduce poisoning of SGH in South Africa by improved reporting and monitoring network for all SGH poisoning events in South Africa with a measurable reduction in agrochemical poisoning events relating to SGH in South Africa.

ACTION 5.2.1.1	**Improve reporting of all SGH mortalities to the national mortality database**	
Lead agencies:	DFFE	
Implementing agencies:	ECPTA; EC DEDEAT; EKZNW; MPTA; LDEDET; GDARD; SANParks; SANBI; DFFE ; SAVC	
Collaborators:	MGHP, Birdlife SA	
Essential activities:	• Centralised population monitoring (MGHP) and mortality database. • Data sharing agreements: MGHP custodians of a national database.	
Expected Outcome in 5 yrs.:	• An effective model for assessing and mitigating impacts of agrochemicals on SGH.	
Monitoring and Evaluation:	• Annual report to NWPPWG, and all WG, by MGHP.	
Funding / Resources	**Timeframe**	**Measurable Indicators / Outputs**
Agency operational budget.	• Annually	• National mortality database.
Challenges: Standardised reporting.		

ACTION 5.2.1.2	**Collection of data on the prevalence of lead in SGH**
Lead agencies:	DFFE
Implementing agencies:	ECPTA; EC DEDEAT; EKZNW; MPTA; LDEDET; SANParks; SANBI, DFFE ; SAVC
Collaborators:	MGHP, Birdlife SA, EWT, SAHGCA, WRSA; HEIs

Essential activities:	• An opportunistic sampling of blood (from living birds) or, liver, bone, eggshells collected from nests. • SOP for sample/specimen collections developed (including chain-of-custody and post mortems) • Monitoring protocol and programme implemented. • Develop and implement non-lead ammunition campaigns.	
Expected Outcome in 5 yrs.:	• Lead prevalence database established. • Stakeholder interest in non-lead ammunition improved. Hunters switched from lead ammunition to non-toxic alternatives.	
Monitoring and Evaluation:	• Standardised reporting of samples collected. • Annual report on lead-prevalence to stakeholders.	
Funding / Resources	**Timeframe**	**Measurable Indicators / Outputs**
Agency operational budget.	• Ongoing	• Biobank samples • Sample collection SOP developed. • National lead prevalence database established.
Challenges: Limited sampling opportunities and funding for post mortems.		

ACTION 5.2.1.3	**Report on SGH poisoning and collaborate with the National Wildlife Poison Prevention Working Group (NWPPWG), including the Lead Task Team (LTT) and Pesticide Task Team (PTT)**	
Lead agencies:	DFFE	
Implementing agencies:	ECPTA; EC DEDEAT; EKZNW; MPTA; LDEDET; GDARD; SANParks; SANBI, DFFE	
Collaborators:	MGHP, Birdlife SA, EWT, LTT	
Essential activities:	• Develop and implement training modules for dealing with poisoned/injured SGH. • Report SGH poisoning to NWPPWG. • Conduct poison response and site training (all birds-of-prey), including management of carcass retrieval and disposal. • SOP for veterinary care and rehabilitation of affected individuals developed.	
Expected Outcome in 5 yrs.:	• Improved conviction of offenders • Reduction in poisoning impacts on SHG.	
Monitoring and Evaluation:	• Annual report on poisoning to stakeholders.	
Funding / Resources	**Timeframe**	**Measurable Indicators / Outputs**
Agency operational budget.	• Annually and ongoing	• Training modules developed. • SOP for veterinary care and rehabilitation developed. • The number of stakeholders trained. • Annual poisoning report. • Stakeholder engagements.
Challenges: available capacity		

ACTION 5.2.1.4	**Raise awareness relating to the impacts of agrochemicals (illegal/off-label) and lead ammunition on SGH.**
Lead agencies:	DFFE
Implementing agencies:	ECPTA; EC DEDEAT; EKZNW; MPTA; LDEDET; SANParks; SANBI, DFFE
Collaborators:	MGHP, Birdlife SA, LTT

Essential activities:	• Develop and distribute awareness material relating to the impacts of agrochemicals (illegal/off-label) and lead ammunition on SGH. • Engage and assign SGH Custodians. • Update and review SGH Custodianship Programme material and training modules. • Research and publish articles on the prevalence and impacts of agrochemicals and lead ammunition.		
Expected Outcome in 5 yrs.:	• Effective mitigation measures for the impacts of agrochemicals and lead ammunition on SGH implemented. • Reduction in SGH agrochemical and lead poisoning. • Improved knowledge of the prevalence and impacts of agrochemicals and lead ammunition.		
Monitoring and Evaluation:	• The trend in SHG agrochemical and lead poisoning instances.		
Funding / Resources	**Timeframe**	**Measurable Indicators / Outputs**	
Agency operational budget.	• Within 2 years of gazetting • Custodianship training annually	1. Awareness material and training modules developed and distributed to SGH Custodians 2. SGH Custodianship engagements and agreements in place 3. Publications (popular and peer-reviewed) on the prevalence and impacts of agrochemicals and lead ammunition.	
Challenges: Sourcing funding to ensure Custodian Programme can be fully implemented and maintained.			

5.3 Objective 3: TO REDUCE SGH OFFTAKE FOR BELIEF-BASED USES

5.3.1 Objective Target 1: SGH are culturally revered throughout their range, however, these cultural belief systems rely on some offtake from the SGH population and so we seek a measurable reduction in illegal off-take in SGH and co-management of off-takes by traditional leaders to reduce illegal offtake of SGH.

ACTION 5.3.1.1	**Expand cultural protection in South Africa, through engagements with indigenous knowledge systems and traditional leaders**
Lead agencies: **Implementing agencies:** **Collaborators:**	DFFE ECPTA; EC DEDEAT; EKZNW; MPTA; LDEDET; SANParks; SANBI, DFFE MGHP, Birdlife SA, HEIs, Traditional Leadership Councils, WLTP, Traditional Healers Council, DoTA, All relevant language group community leaders.
Essential activities:	• Research and publish findings on cultural perceptions and values. • Stakeholder and community engagements. • Co-management conservation plans developed and implemented. • Community engagement strategy developed and implemented. • Capacity assessment of community leadership structures. • Capacity development of community leadership structures for sustainable management and off-takes of SGH. • SGH awareness and training
Expected Outcome in 5 yrs.:	• Effective implementation of cultural protection for SGH • Community involvement and co-management of SGH off-takes

	• Enhanced awareness and appreciation for SGH.	
Monitoring and Evaluation:	• Pre and post perception surveys • Off-take trends	
Funding / Resources	**Timeframe**	**Measurable Indicators / Outputs**
Agency operational budget.	• Within 1 year of gazetting • Within 1 year of gazetting and ongoing • Within 3 years of gazetting and ongoing • Within 5 years of gazetting and ongoing	• Publications (popular and peer-reviewed) on cultural perceptions and values of SGH. • Off-take assessments. • The sustainable off-take simulator developed and implemented. • Community engagements and training. • Facilitated co-management agreements.
Challenges: Sensitive approach required to prevent any perverse outcomes.		

5.4 Objective 4: TO REDUCE SGH MORTALITIES DUE TO PERSECUTION IN RESPONSE TO WINDOW DAMAGE

5.4.1 Objective Target: To enhance communities and landowner awareness concerning SGH window damage, and change attitudes of affected parties away from lethal or injurious actions against SGH.

ACTION 5.4.1.1	**Improve mitigation measures against the impacts of breaking windows by SGH and implement protocols on how to protect windows from being broken by the birds**	
Lead agencies: **Implementing agencies:** **Collaborators:**	DFFE ECPTA; EC DEDEAT; EKZNW; MPTA; LDEDET; SANParks; SANBI, DFFE MGHP, Birdlife SA, HEIs, Traditional Leadership Councils, WLTP, Traditional Healers Council, DoTA	
Essential activities:	• Establish and maintain a SGH window-breaking register database. • Research and publish findings on cost-effective mitigation measures against the impacts of breaking windows by SGH. • Develop and distribute awareness material relating to breaking of windows by SGH in areas of risk, such as at schools, with affected communities, private landowners and SGH Custodians. • Develop and implement Immediate Response and Mitigation Protocols. • Foster relationships with industrial suppliers of mitigation materials and facilitate provisioning to high-risk areas.	
Expected Outcome in 5 yrs.:	• Reduced impacts of window-breaking by SGH • Reduced SGH mortalities due to persecution in response e to window damage.	
Monitoring and Evaluation:	• The trend in SGH window-breaking incidents.	
Funding / Resources	**Timeframe**	**Measurable Indicators / Outputs**

Agency operational budget.	• Ongoing • Every two years after gazetting • Within one year of gazetting, ongoing. • Within one year of gazetting	• National SGH window-breaking register database established. • Revised education and awareness materials for the mitigation of responses to SGH window damage. • The number of business and industry partnerships established for providing alternate window protection materials.
Challenges: Cost of implementing effective mitigation measures.		

5.5 Objective 5: TO REDUCE AND ELIMINATE THE CONFLICT AND MORTALITY OF SGH AS A RESULT OF CURRENT AND FUTURE ENERGY INFRASTRUCTURE DEVELOPMENT.

5.5.1 Objective Target 1: To reduce and eliminate the mortalities of SGH through modification and mitigation of existing energy infrastructure, including distribution poles and power lines, within 5 years since gazetting, for zero SGH electrocutions due to unsafe distribution poles and minimise SGH collisions on power line spans.

ACTION 5.5.1.1	**Modification and marking electrical-provision infrastructure to reduce SGH mortality**	
Lead agencies: **Implementing agencies:** **Collaborators:**	DFFE DE; ECPTA; EC DEDEAT; EKZNW; MPTA; LEDET; SANParks; SANBI, DFFE MGHP, Birdlife SA, HEIs, EWT; Eskom, IPPs, BARESG	
Essential activities:	• Establish and maintain a SGH electrocution/collision register database • Develop high-incident-potential site identification model (within distribution range overlapping power distribution/ transmission lines). • Research and publish findings of incidents of electrocution/collisions and effectiveness of mitigation measures implemented. • Develop guidelines for the effective insulation of transformer boxes, live components of all new transformer boxes and marking of provisioning infrastructure for implementation by ESKOM in partnership with BirdLife SA.	
Expected Outcome in 5 yrs.:	• Decreased electrocution/collision incidents in high-incidence-potential areas. • Reduction in mortalities from baseline.	
Monitoring and Evaluation:	• Reporting on the number of modified structures. • The trend in the number of SGH electrocutions/collisions reported.	
Funding / Resources	**Timeframe**	**Measurable Indicators / Outputs**
Agency operational budget.	• Within one year of gazetting and then ongoing – annual feedback and report. • Within three years of gazetting and ongoing.	• Engagement between Eskom and EWT/BirdLife SA/Mabula Ground Hornbill Project. • Publications (popular and peer-reviewed) on the effectiveness of mitigation measures. • Adaptive management implementation of research findings.

Challenges: Knowledge gaps. Cost of mitigation and modification of electricity provisioning infrastructure.

5.5.2 Objective Target 2: To assess the potential for wind farms as an emerging threat to SGH.

ACTION 5.5.3.1	**Develop appropriate mitigation and monitoring protocols for the potential impact of wind farms/turbines on SGH**	
Lead agencies: **Implementing agencies:** **Collaborators:**	DFFE ECPTA; EC DEDEAT; EKZNW; MPTA; LDEDET; SANParks; SANBI; DFFE ; DE MGHP, Birdlife SA, HEIs, EWT, Eskom, IPPs, BARESG	
Essential activities:	• Report to ESKOM/ EWT database • Develop high-incident-potential site identification model (within distribution range overlapping distribution of wind turbines). • Research and publish findings of incidents of collisions with wind turbines. • Develop and include guidelines for the effective pre-and post-construction monitoring of SGH in existing BirdLife SA/EWT Best Practice Guidelines. • Engage national and Provincial Environmental Authorisation authorities.	
Expected Outcome in 5 yrs.:	• Environmental Authorisations for wind farms mitigate threats to SGH • Species-specific guidelines for potential threat mitigation developed and implemented.	
Monitoring and Evaluation:	• SGH mortalities trends in BirdLife SA occasional report on recorded bird fatalities at wind farms in South Africa.	
Funding / Resources	**Timeframe**	**Measurable Indicators / Outputs**
Agency operational budget.	• Within one year of gazetting • Within one year of gazetting and ongoing. • Within one year of gazetting; information made available and best practice guidelines updated within three years of gazetting. • Within 5 years of gazetting. • Within one year of gazetting.	• Updated BirdLife South Africa/EWT Best Practice guidelines for Wind Energy Facilities. • Stakeholder engagements at BARESG (Birds and Renewable Energy Specialist Group) and BAREF (Birds and Renewable Energy Forum) • Surveillance and monitoring results made available by avifaunal specialists and published by BirdLife South Africa, to update the Best Practice Guidelines accordingly. • Publications (popular and peer-reviewed) on the impacts of wind farms on SGH. • Species-specific guidelines for mitigation of impacts developed.
Challenges: Environmental Authorisations to include specialist monitoring results.		

5.6 Objective 6: TO REDUCE HABITAT LOSS, DEGRADATION/ALTERATION AND FRAGMENTATION OF CORE SGH HABITAT.

5.6.1 Objective Target 1: To reduce, halt and reverse the loss of core SGH habitat

ACTION 5.6.1.1	**Inform land use planning policies to secure core areas for SGH**	
Lead agencies:	DFFE	
Implementing agencies:	ECPTA; EC DEDEAT; EKZNW; MPTA; LDEDET; SANParks; SANBI, DFFE; DAFF: DE; Municipalities	
Collaborators:	MGHP, BirdLife SA, HEIs, EWT	
Essential activities:	• National SGH monitoring plan implemented across all provinces. • Maintain national SGH population monitoring database. • SGH data informs Bioregional Conservation Plans / Biodiversity Spatial Plans • BCPs/BSPs inform land-use planning policies, protected area expansion strategies (including stewardship), IDPs and SDFs • SGH included in BirdLife South Africa Best Practice Guidelines for EIA assessments. • Develop and mainstream best practice land-use guidelines. • Develop SGH conservation reintroduction guidelines. • Protected Area Management Plans include SGH population monitoring. • Integrate impacts of climate change on the mapping of climate change corridors in conservation planning products.	
Expected Outcome in 5 yrs.:	• SGH targets integrated into land-use planning tools and policies, • Reduction in SGH-unfriendly land management practices	
Monitoring and Evaluation:	• The trend in environmental authorisation conditions favouring SGH • Populations status and trends.	
Funding / Resources	**Timeframe**	**Measurable Indicators / Outputs**
Agency operational budget.	• Within 1 year of gazetting • Within 1 year of gazetting, revised annually. • Within 1 year of gazetting	• National SGH spatial distribution database • Provincial population monitoring databases • SANParks population monitoring databases. • National SGH population monitoring database. • Best Practice Guidelines for EIA assessments including SGH • SGH Conservation Translocation and Reintroduction Guidelines. • Best Practice Land Use guidelines for SGH (and stewardship). • Climate change corridors include SGH parameters.
Challenges: Compliance with Environmental Authorisation conditions; Conservation Plans not mainstreamed into IDPs and SDFs.		

5.7 Objective 7: To minimise the risk of infection of NCD and other infectious diseases in *in-situ* SGH populations

5.7.1 Objective Target: To maximize prevention by rapid response, containment and awareness of NCD and other infectious disease outbreaks in the distribution range of SGH.

ACTION 5.7.1.1	**To mitigate against the impacts of NCD and other infectious disease outbreaks in the distribution range of SGH.**	
Lead agencies:	DFFE	
Implementing agencies:	ECPTA; EC DEDEAT; EKZNW; MPTA; LDEDET; GDARD; SANParks; SANBI, DFFE; NDA;	
Collaborators:	MGHP, Birdlife SA, HEIs, EWT; Poultry Industry	
Essential activities:	• Assess historical NCD and other infectious disease outbreaks in the distribution range of SGH • Develop SGH Disease Risk Assessment. • Maintain national NCD outbreaks register database • Maintain/establish NCD outbreak reporting protocol • Facilitate disease outbreak notification to stakeholders. • Develop and implement an NCD/Infectious Disease Outbreak Reaction Protocol (including post-mortem and sampling).	
Expected Outcome in 5 yrs.:	• Maximised prevention of NCD outbreak impacts on SGH populations; • Rapid response and containment of NCD and other infectious disease outbreaks in the SGH distribution range.	
Monitoring and Evaluation:	• Disease outbreak trends.	
Funding / Resources	**Timeframe**	**Measurable Indicators / Outputs**
Agency operational budget.	• Within one year of gazetting.	• NCD incident reporting database and protocols for conservation agencies, small scale or subsistence-scale poultry farmers and stakeholders. • NCD Reaction Protocol including a post-mortem of SGH carcasses, and sampling of live birds. • NCD Disease risk assessment for SGH. • Revised education and awareness materials for the response to NCD outbreaks.
Challenges: National NCD reporting skewed to poultry species; Low reporting/ submission of carcasses for testing.		

ACTION 5.7.1.2	**Assess the feasibility of using the NCD vaccination protocol for the protection of wild SGHs.**
Lead agencies:	DFFE
Implementing agencies:	State Veterinary Services
Collaborators:	MGHP, Birdlife SA, HEIs, EWT; PAAZA; Poultry Industry
Essential activities:	• Maintain a database of all vaccination administration, type, frequency and resulting blood titres; • Analysis of titres to assess the efficacy of various vaccine protocols. • Finalize and implement the vaccine protocol for the NCD

Expected Outcome in 5 yrs.:	• Rapid response and containment of NCD outbreaks in the SGH distribution range.	
Monitoring and Evaluation:	• NCD outbreak and vaccination trends.	
Funding / Resources	**Timeframe**	**Measurable Indicators / Outputs**
Agency operational budget.	• Within one year of gazetting • Within one year of gazetting • Within two years of gazetting	• National SGH mortality database includes reporting relevant to NCD. • Development of vaccination protocols for *in situ* SGHs and trials of implementation.
Challenges: Risk associated with the handling of specimens.		

4. REFERENCES

Abolnik, C., Gerdes, G.H., Kitching, J., Swanepoel, S. & Romito, M. 2008. Characterization of pigeon paramyxoviruses (Newcastle disease virus) isolated in South Africa from 2001 to 2006. *Onderstepoort Journal of Veterinary Research*. 152:147–152.

Anderson, K., Garner, M.M., Reed, H.H., Cook, K., Aguilar, R., Horton, S., Case, A.L. & Wolf, K.N. 2013. Hemorrhagic diathesis in avian species following intramuscular administration of polysulfated glycosaminoglycan. *Journal of zoo and wildlife medicine*. 44(1):93–9. Available: http://www.ncbi.nlm.nih.gov/pubmed/23505708.

Anon. 1998. The Ground Hornbill. *Honeyguide*. 44(4):88.

Archibald, A.S., Bond, W.J., Stock, W.D. & Fairbanks, D.H.K. 2005. Shaping the landscape: fire-grazer interactions in an African savanna. *Ecological Applications*. 15(1):96–109.

Asah, S.T. & Blahna, D.J. 2013. Practical implications of understanding the influence of motivations on the commitment to voluntary urban conservation stewardship. *Conservation Biology*. 27(4):866–875. DOI: 10.1111/cobi.12058.

Balter, R.S. 1968. The microtopography of avian lice eggs. *Medical Biology*. 18:166–179.

Bedford, G.A.H. 1929. *Anoplura (Siphunculata and Mallophaga) from South African hosts.*

BirdLife International. 2018. *Bucorvus leadbeateri*.

BirdLife International. 2019. *Southern Ground-hornbill (Bucorvus leadbeateri) - BirdLife species factsheet*. Available: http://datazone.birdlife.org/species/factsheet/southern-ground-hornbill-bucorvus-leadbeateri [2018, July 27].

Bond, W.J. & Archibald, S. 2003. Confronting complexity: Fire policy choices in South African savanna parks. *International Journal of Wildland Fire*. 12(4):381–389. DOI: 10.1071/WF03024.

Broms, K.M., Johnson, D.S. & Altwegg, R. 2014. Spatial occupancy models applied to atlas data show Southern Ground Hornbills strongly depend on protected areas. *Ecological Applications*. 24(2):363–374.

Brunton, S. & Badenhorst, S. 2013. Ritual fauna from Ratho Kroonkop: a second millennium AD rain control site in the Shashe-Limpopo Confluence area of South Africa. *Azania: Archaeological Research in Africa*. 48(1):111–132. DOI: 10.1080/0067270X.2012.759691.

Bruyns, R.K., Williams, V.L. & Cunningham, A.B. 2013. Finely Ground-Hornbill: The sale of Bucorvus cafer in a traditional medicine market in Bulawayo, Zimbabwe. In *Animals in Traditional Folk Medicine*. R.R.N. Alves & I.L. Rosa, Eds. Berlin: Springer-Verlag Berlin Heidelberg, Germany. 475–486. DOI: 10.1007/978-3-642-29026-8.

Canaris, A.G. & Gardner, S.L. 2003. *Bibliography of Helminth Species Described from African Vertebrates 1800-1967*. Lincoln.

Carstens, K.F., Kassanjee, R., Little, R.M., Ryan, P.G. & Hockey, P.A.R. 2019a. Breeding success and population growth of Southern Ground Hornbills Bucorvus leadbeateri in an area supplemented with nest-boxes. *Bird Conservation International*. (April, 10):1–17. DOI: 10.1017/S0959270919000108.

Carstens, K.F., Kassanjee, R., Little, R.M., Ryan, P.G. & Hockey, P.A.R. 2019b. The effects of weather, group size and type of nest on the timing of egg-laying in the Southern Ground-hornbill Bucorvus leadbeateri. *Journal of Ornithology*. (March, 25):1–8. DOI: 10.1007/s10336-019-01654-x.

Chisadza, B., Tumbare, M.J. & Nhapi, I. 2013. Useful traditional knowledge indicators for drought forecasting in the Mzingwane Catchment area of Zimbabwe. *Disaster Prevention and Management*. 22(4):312–325.

Chiweshe, N. 1998. Birds and n'angas in the Matobo Hills. *Honeyguide*. 44:111–112.

Chiweshe, N. 2007. The current conservation status of the Southern Ground Hornbill Bucorvus leadbeateri in Zimbabwe. In *Proceedings of the 4th International Hornbill Conference: The Active Management of Hornbills and Habitats for Conservation*. A.C. Kemp & M.I. Kemp, Eds. Pretoria: Nomads & Naturalists. 252–266.

Cho, B.R. & Kenzy, S.G. 1975. Virologic and Serologic Studies of Zoo Birds for Marek 's Disease Virus Infection '. *Infection and Immunity*. 11(4):809–814.

Clay, T. & Rothschild, M. 1938. Ectoparasites from captive birds. *Novitates Zoologicae*.

Coetzee, H.C. & Wilkinson, M. 2007. The cultural value of Africa's two endemic ground- hornbills, genus Bucorvus. *Proceedings of the 4th International Hornbill Conference: The Active Management of Hornbills and their Habitats for Conservation*. 395.

Coetzee, H., Nell, W. & van Rensburg, L. 2014. An exploration of cultural beliefs and practices across the Southern Ground-Hornbill's range in Africa. *Journal of Ethnobiology and Ethnomedicine*. 10(1):1–7. DOI: 10.1186/1746-4269-10-28.

Coetzee, H., Nell, W. & Rensburg, L. Van. 2014. An intervention program based on plant surrogates as alternatives to the use of Southern Ground-Hornbills in cultural practices. *Ethnobotany Research and Applications*. 12:155–164.

Crutzen, P.J. 2006. The anthropocene. In *Earth System Science in the Anthropocene*. Berlin/Heidelberg: Springer-Verlag. 13–18. DOI: 10.1007/3-540-26590-2_3.

Cundill, G., Roux, D.J. & Parker, J.N. 2015. Nurturing communities of practice for transdisciplinary research. *Ecology and society*. 20(2):22.

Derwent, S. & Mander, M. 1997. Twitchers bewitched: The use of birds in traditional healing. *Africa - Birds and Birding*. 2(1):22–25.

Dickens, J. 2010. How much is enough? Calibrating satellite telemetry for Southern Ground-Hornbills. The University of Cape Town.

Elbel, R.E. 1964. THE AMBLYCERAN MALLOPHAGA (BITING LICE) FOUND ON THE BUCEROTIDAE (HORNBILLS). The University of Oklahoma.

Engelbrecht, D., Theron, N., Turner, A., van Wyk, J. & Pienaar, K. 2007. The status and conservation of Southern Ground Hornbills Bucorvus leadbeateri in the Limpopo Province, South Africa. In *Proceedings of the 4th International Hornbill Conference: The Active Management of Hornbills and their Habitats for Conservation*. M.I. Kemp, A. C. & Kemp, Ed. Pretoria, South Africa: Naturalists and Nomads. 231–239.

Fairfield, J.R. 1973. Observations on hatching north African ground hornbills at the San Diego Wild Animal Park. *Avicultural Magazine*. 27–29.

Forsberg, O. 1994. More Ground Hornbills. *Tiptol*. 32:7.

Fuhlendorf, S.D. & Engel, D.M. 2001. Restoring heterogeneity on rangelands: ecosystem management based on evolutionary grazing patterns. *BioScience*. 51(8):625–632.

Godfrey, R. 1941. *Bird-Lore of the Eastern Cape Province*. Monograph ed. Johannesburg.

Herremans, M. 1998. Conservation status of birds in Botswana in relation to land use. *Biological Conservation*. 86(2):139–160. DOI: 10.1016/S0006-3207(98)00016-0.

Hockley, M. & Archer, W.H. 1966. *The Southern Ground Hornbill or "Bromvogel"*.

Hulley, P. & Craig, A.J. 2007. The status of the Southern Ground-Hornbill in the Grahamstown region, Eastern Cape, South Africa. *Ostrich*. 78(February):89–92. DOI: 10.2989/OSTRICH.2007.78.1.13.57.

Jiri, O., Mafongoya, P.L. & Chivenge, P. 2015. Indigenous knowledge systems, seasonal 'quality'' and climate change adaptation in Zimbabwe'. *Climate Research*. 66:103–111. DOI: 10.3354/cr01334.

Jordan, M. 2011a. *Southern Ground Hornbill (Bucorvus leadbeateri) Species Recovery Plan for South Africa*. Johannesburg.

Jordan, M. (Ed). 2011b. *Southern Ground Hornbill (Bucorvus leadbeateri) Species Recovery Plan for South Africa*.

Kalimira, N. 2007. The status of the Southern Ground Hornbill Bucorvus leadbeateri in some protected areas of Malawi. In *Proceedings of the 4th International Hornbill Conference: The Active Management of Hornbills and their Habitats for Conservation*. A.C. Kemp & M.I. Kemp, Eds. Pretoria, South Africa: Naturalists and Nomads. 245–251.

Kioko, John, Delaney Smith, and C. Kffiner. 2015. Uses of birds for ethno-medicine among the Maasai people in Monduli district, northern Tanzania. *Ethnobiol. Ethnomed* 1 1-13.

Kemp, A. 1995a. Southern Ground Hornbill Bucorvus leadbeateri. In *Bird Families of the World: The Hornbills Bucerotiformes*. 1st ed. Oxford, UK: Oxford University Press. 94–99.

Kemp, A.C. 1988. The behavioural ecology of the Southern Ground Hornbill: are competitive offspring at a premium? In *Proceedings of International 100th Deutscheornitologen-Gesselschaft Meeting*. Bonn: Current topics in avian biology. 267–269.

Kemp, A.C. 1995b. The Hornbills Bucerotiformes. In *Bird Families of the World*. 94–99.

Kemp, A.C. 1996. Hammer of the Savannah. *BBC Wildlife*. (May):31–36.

Kemp, L.V. 2017. Conservation biology and molecular ecology of the Southern Ground-Hornbill (Bucorvus leadbeateri). University of the Free State.

Kemp, A. & Webster, R. 2008. *Latest analysis of Southern Ground Hornbill (SGH) distribution and population in South Africa*. Bela Bela.

Kemp, A.C. & Begg, K.S. 1996. Nest sites of the Southern Ground Hornbill Bucorvus leadbeateri in the Kruger National Park, South Africa, and conservation implications. *Ostrich*. 67:9–14.

Kemp, A.C. & Begg, K.S. 2001. Comparison of time-activity budgets and population structure for 18 large-bird species in the Kruger National Park, South Africa. *Ostrich*. 72(3):179–184.

Kemp, A.C. & Kemp, M.I. 1980a. The biology of the Southern Ground Hornbill Bucorvus leadbeateri (Vigors) (Aves: Bucerotidae). *Annals of the Transvaal Museum*. 32(4):65–100.

Kemp, A.C. & Kemp, M.I. 1980b. The Biology of the Southern Ground Hornbill Bucorvus leadbeateri (Vigors) (Aves: Bucerotidae). *Annals of the Transvaal Museum*. 32(4):65–100.

Kemp, A.C. & Kemp, M.I. 2007. What proportion of Southern Ground Hornbill nesting attempts fledge more than one chick? Data from the Kruger National Park. In *Proceedings of the 4th International Hornbill Conference: The Active Management of Hornbills and their Habitats for Conservation*. A.C. Kemp & M.I. Kemp, Eds. Pretoria, South Africa: Naturalists and Nomads. 267–286.

Kemp, L. V. & Bruford, M.W. 2018. *Southern Ground-Hornbill Habitat Viability Assessment Workshop Final Report.*

Kemp, A.C., Joubert, S.G.J. & Kemp, M. 1989. Distribution of southern ground hornbills in the Kruger National Park in relation to some environmental features. *South African Journal of Wildlife Research*. 19(3):93–98.

Kemp, A.C., Kemp, M.I. & Turner, A. 2007. What has become of eggs and chicks of Southern Ground Hornbills harvested from the Kruger National Park? In *Proceedings of the 4th International Hornbill Conference: The Active Management of Hornbills and their Habitats for Conservation*. A.C. Kemp & M.I. Kemp, Eds. Pretoria, South Africa: Naturalists and Nomads. 288–297.

Kemp, L.V., Kotze, A., Jansen, R., Dalton, D.L., Grobler, P.J. & Little, R.G. n.d. Review of trial reintroductions of the long-lived, cooperative breeding Southern Ground-Hornbill Bucorvus leadbeateri. *Bird Conservation International*.

Kiondo, M.R. & Clamsen, T. 2002. *Initial assessment on sustainability of the live bird trade in Tanzania: Vulnerable species.*

Knight, G.M. 1990. A preliminary investigation into the status, distribution and some aspects of the foraging ecology of the Southern Ground-Hornbill (Bucorvus cafer) in Natal. University of Natal.

Koeppel, K.N. & Kemp, L. V. 2015. Lead toxicosis in Southern Ground-Hornbills Bucorvus leadbeateri: a case from South Africa. *Journal of Avian Medicine and Surgery*.

Komar, N. 2003. *West Nile Virus: Epidemiology and Ecology in North America*. DOI: 10.1016/S0065-3527(03)61005-5.

Koopman, A. 2011. Lightning birds and thunder trees. *Natalia*. 41:40–60.

Kuckertz, H. 1983. Symbol and authority in Mpondo ancestor religion. *African Studies*. 42(2):113–133. DOI: 10.1080/00020188308707599.

Lack, D. 1933. Habitat selection in birds - with special reference to the effects of afforestation on the Breckland avifauna. *Journal of Animal Ecology*. 2(2):239–262.

Leader-Williams, N. & Tibanyenda, R.K. 1996. The Live Bird Trade in Tanzania. In *The Live Bird Trade in Tanzania*. N. Leader-Williams & R.K. Tibanyenda, Eds. Dar es Salaam. 31.

Loftie-Eaton, M. 2014. Geographic Range Dynamics of South Africa's Bird Species. University of Cape Town.

Maasdorp, L. 2007. A campaign to highlight the plight of the Southern Ground Hornbill in Zimbabwe. In *Proceedings of the 4th International Hornbill Conference: The Active Management of Hornbills and their Habitats for Conservation*. A.C. Kemp & M.I. Kemp, Eds. Pretoria, South Africa: Naturalists and Nomads. 225–230.

Macarthur, R.H. 1965. Patterns of species diversity. *Biological Review*. 40:510–533.

MAFF. 1990. *Importation of birds, mortality statistics from quarantine returns*. Surbiton, UK.

Mander, M., Ntuli, L., Diederichs, N. & Mavundla, K. 2007. Economics of the Traditional Medicine Trade in South Africa. In *South African Health Review*. 2007th ed. Durban: Health Systems Trust. 189–200.

Mander, M., Diederichs, N., Ntuli, L., Mavundla, K., Williams, V. & Mckean, S. 2007. *Survey of the trade in vultures for the traditional health industry in South Africa*. Everton, South Africa.

Mills, M.S.L. 2004. Bird community responses to savanna fires: should managers be concerned ? *South African Journal of Wildlife Research*. 34(December 2003):1–11.

Morrison, K., Daly, B., Burden, D., Engelbrecht, D., Jordan, M., Kemp, A. & Potgieter, C. 2005. *Southern Ground Hornbill (Bucorvus leadbeateri) PHVA*.

Morrison, K., Daly, B., Burden, D., Engelbrecht, D., Jordan, M., Kemp, A., Kemp, M., Potgieter, C., *et al.* 2005. *PHVA Southern Ground Hornbill (Bucorvus leadbeateri) Population and Habitat Viability Assessment workshop report*. Johannesburg, South Africa. DOI: 10.1080/10807030500278610.

Msimanga, A. 2000. The role of birds in the culture of the Ndebele people of Zimbabwe. *Ostrich*. 71(1–2):22–24. DOI: 10.1080/00306525.2000.9639858.

Muiruri, M.N. & Maunda, P. 2010. Birds, People and Conservation in Kenya. In *Ethno-Ornithology: Birds and Indigenous Peoples, Culture and Society*. S. Tidemann & A. Gosler, Eds. London, England: Earthscan.

Mullen, P. & Pohland, G. 2007. Studies on UV reflection in feathers of some 1000 bird species: are UV peaks in feathers correlated with violet-sensitive and ultraviolet-sensitive cones? *Ibis*. 150(1):59–68. DOI: 10.1111/j.1474-919X.2007.00736.x.

Mundy, P.J. 2003. Bird Strikes on Aeroplanes in Zimbabwe and Remedial Action. 326–331.

Musila, S.N. 2007. The conservation status of hornbill species in Kenya. In *Proceedings of the 4th International Hornbill Conference: The Active Management of Hornbills and their Habitats for Conservation*. A.C. Kemp & M.I. Kemp, Eds. Pretoria, South Africa: Naturalists and Nomads. 135–142.

Nevill, H. 1984. Some birds in Xhosa folklore. *Bokmakierie*. 36(2):29–31.

Newton, I. 2003. *Population limitation in birds*. San Diego, California: Academic Press.

Ngwenya, M.P. 2001. *Implications of the medicinal animal trade for nature conservation in KwaZulu-Natal*. Unpublished EKZN Report No. NA/125/04.

Nilsson, G. 1985. *Importation of birds into the United States 1980 - 1984*. Washington.

Oatley, T. 1967. Ground Hornbill's seige of Ixopo. *Albatross*.

Ocholi, R.A. & Kalejaiye, J.O. 1990. Pet Bird Medicine: Case Report Aeromonas hydrophila as Cause of Hemorrhagic Septicemia in a Ground-Hornbill (Bucorvus abyssinicus). *Avian Diseases*. 34(2):495–496.

Odull, M.O. & Byaruhanga, A. 2009. *Ecological baseline surveys of: Lake Bisina-Opeta wetland system, Lake Mburo-Nakivali wetlands system*. Kampala.

Okonya, J.S. & Kroschel, J. 2013. Indigenous knowledge of seasonal weather forecasting: A case study in six regions of Uganda. *Agricultural Sciences*. 04(12):641–648. DOI: 10.4236/as.2013.412086.

Orlove, B., Roncoli, C., Kabugo, M. & Majugu, A. 2010. Indigenous climate knowledge in southern Uganda: the multiple components of a dynamic regional system. *Climatic Change*. 100(2):243–265. DOI: 10.1007/s10584-009-9586-2.

Paolilo, K. 1993. Birds on the Turgwe River, Humani Ranch. *Honeyguide*. (January 1988):1988.

Purvis, A., Gittleman, J.L., Cowlishaw, G. & Mace, G.M. 2000. Predicting extinction risk in declining species. *Proceedings. Biological sciences / The Royal Society*. 267(1456):1947–52. DOI: 10.1098/rspb.2000.1234.

Ranger, G. 1928. The Birds of Blythswood. *The Blythswood Review*. 11:39–40.

Runo, M. 2001. Ground hornbills feeding on burnt leopard tortoise. *Honeyguide*. 47(2):184.

Rusinga, O., Chapungu, L., Moyo, P. & Stigter, K. 2014. Perceptions of climate change and adaptation to microclimate change and variability among smallholder farmers in Mhakwe communal area, Manicaland Province, Zimbabwe. *Ethiopian Journal of Environmental Studies and Management*. 7(3):310–318.

Sanft, K., Wermuth, H., Mertens, R., Hennig, W. 1849. No Title.

Scott, M. 1999. Interesting bird observations at Londolozi. *Ecological Journal*.

Seddon, P.J. 2011. Habitat restoration and management in avian reintroductions. *Reintroduction*. 1:5–14.

Short, A. & Rushworth, I. 2004. Using cattle to achieve conservation objectives. *Newsletter of the Grassland Society of Southern Africa*. 4(1):15–16.

Simelane, T.S. 2011. Are traditionally used resources within conservation areas a function of their sizes? *Natural Resources*. 02:130–139. DOI: 10.4236/nr.2011.22018.

Simmons, R.E., Brown, C.J. & Kemper, J. 2015. Southern Ground Hornbill. In *Birds to watch in Namibia: red, rare and endemic species.* Windhoek, Namibia: Ministry of Environment and Tourism, Namibia Nature Foundation. 38–39.

Smith, D.A. 2003. Part IV Avian Group. In *Fowler's Zoo and Wild Animal Medicine*. 93–276. DOI: 10.1201/9781420027952.pt4.

Smith, A.M., Ismail, H., Henton, M.M., Keddy, K.H. & Surveillance, G. 2014. Similarities between Salmonella Enteritidis isolated from humans and captive wild animals in South Africa. *Journal of Infections in Developing Countries*. 8(12):1615–1619. DOI: 10.3855/jidc.5393.

Snow, D.S. 1978. Bucerotidae. In *An Atlas of speciation in African non-passerine birds*. D.S. Snow, Ed. London: British Museum of Natural History. 323.

Squires, B., Lowry, R. & Banks, C. 2016. Utilizing Zoos Victoria's Connect-Understand-Act model to enable social and biological gains in northern Kenya. *International Zoo Yearbook*. 50(1):96–111. DOI: 10.1111/izy.12128.

Staver, A.C., Bond, W.J., Stock, W.D., Van Rensburg, S.J., Waldram, M.S. & Carla, A. 2013. Browsing and fire interact to suppress tree density in an African savanna. *Ecological Applications*. 19(7):1909–1919.

Taylor, M.R. & Kemp, L. V. 2015. Southern Ground-Hornbill. In *The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland.* M.R. (ed). Taylor, Ed. Johannesburg, South Africa: BirdLife South Africa.

Taylor, M.R., Peacock, D.S. & Wanless, R.M. 2015. *The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland*. BirdLife South Africa.

Theron, N., Jansen, R., Grobler, P. & Kotze, A. 2013. The home range of a recently established group of Southern ground-hornbill (Bucorvus leadbeateri) in the Limpopo Valley, South Africa. *Koedoe*. 55(1):1–8. DOI: 10.4102/koedoe.v55i1.1135.

Theron, N., Dalton, D., Grobler, J.P., Jansen, R. & Kotze, A. 2013. Molecular insights on the re-colonization of the Limpopo Valley, South Africa, by Southern Ground-Hornbills. *Journal of Ornithology*. 154(3):727–737. DOI: 10.1007/s10336-013-0937-4.

Trail, P.W. 2007. African hornbills : keystone species threatened by habitat loss, hunting and international trade. *Ostrich*.

78(3):37–41. DOI: 10.2989/OSTRICH.2007.78.3.7.318.

Underhill, L.G. 2014. Why are some species doing badly? *African BirdLife*. 38.

Valeix, M., Fritz, H., Sabatier, R., Murindagomo, F., Cumming, D. & Duncan, P. 2011. Elephant-induced structural changes in the vegetation and habitat selection by large herbivores in an African savanna. *Biological Conservation*. 144(2):902–912. DOI: 10.1016/j.biocon.2010.10.029.

Janse van Vuuren, Andries; Kemp, Lucy; McKechnie, A. The beak and unfeathered skin as heat radiators in the Southern Ground-hornbill. *J. Avian Biol.* 51, (2020).

Vernon, C. 1974. Ground-Hornbills and the drought. *The Bee-eater*. 35(3):32.

Vernon, C.J. 1982. *Notes from the border 9*.

Vernon, C.J. 1986a. The ground-hornbill at the southern extremity of its range. *Ostrich*. 57:16–24.

Vernon, C.J. 1986b. THE GROUND HORNBILL AT THE SOUTHERN EXTREMITY OF ITS RANGE. *Ostrich*. 57:16–24.

Whiting, M.J., Williams, V.L. & Hibbitts, T.J. 2011. Animals traded for traditional medicine at the Faraday market in South Africa: species diversity and conservation implications. *Journal of Zoology*. 284(2):84–96. DOI: 10.1111/j.1469-7998.2010.00784.x.

Wilfred, P. 2007. Habitat viability for the Southern Ground Hornbill in Tanzania: the case for the Malagarasi – Moyovozi Ramsar Site. In *Proceedings of the 4th International Hornbill Conference: The Active Management of Hornbills and their Habitats for Conservation*. A.C. Kemp & M.I. Kemp, Eds. Pretoria, South Africa: Naturalists and Nomads. 240–244.

Williams, V.L., Cunningham, A.B., Bruyns, R.K. & Kemp, A.C. 2013. Birds of a Feather: Quantitative Assessments of the Diversity and Levels of Threat to Birds Used in African Traditional Medicine. In *Animals in Traditional Folk Medicine*. R. Alves & I. Rosa, Eds. Berlin, Heidelberg, Germany: Springer-Verlag. 383–420. DOI: 10.1007/978-3-642-29026-8.

Wilson, G. 2010. What causes variation in the reproductive performance of groups of Southern Ground-Hornbills Bucorvus leadbeateri? University of Cape Town.

Wilson, G. & Hockey, P.A.R. 2013. Causes of variable reproductive performance by Southern Ground-hornbill Bucorvus leadbeateri and implications for management. *Ibis*. 155:476–484.

Witteveen, M., Parry, E., Norris-Rogers, M. & Brown, M. 2013. Breeding density of the Southern Ground Hornbill, Bucorvus leadbeateri, in the communal areas surrounding the Matobo National Park, Zimbabwe. *African Zoology*. 48(2):274–278.

Wyness, W. 2011. Home range use by Southern Ground-Hornbills (Bucorvus leadbeateri) - quantifying seasonal habitat selection and vegetation characteristics. University of Cape Town.

Zoghby, B. 2015. Fine-scale movements and habitat use of the Southern Ground-hornbill Bucorvus leadbeateri. University of Cape Town.

Zoghby, B. A., Little, R. M., Ryan, P. G. & Hockey, P. A. R. Patterns of roost site selection and use by Southern Ground-Hornbills in north-eastern South Africa. *Ostrich* 1–6 (2016). doi:10.2989/00306525.2016.1156180

Zoghby, B. A., Ryan, P. G., Little, R. M., Reid, T. & Hockey, P. A. R. Seasonal changes in movement and habitat use by Southern Ground-Hornbills in the South African Lowveld. *Ostrich* **86**, 1–9 (2015).

5. APPENDICES

Appendix A: Invitation to workshop participants

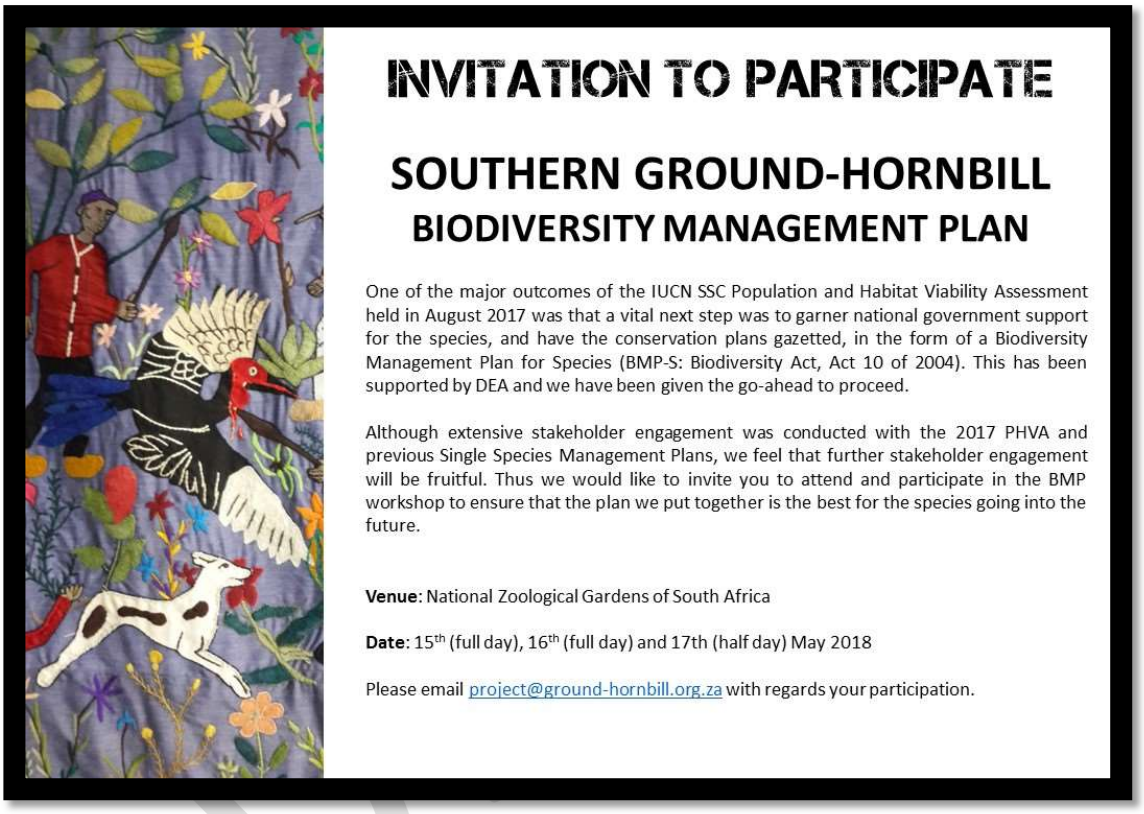


*Image from one of six tapestries depicting the cultural value of the species to the Xhosa people by these Keiskamma Arts Trust, a collaborative artwork led by Cebo Mvubu.

Appendix B: Contributors to compiling the first draft

PRIMARY WORKSHOP: 15TH – 17TH MAY 2018

i) Attendance register

Name	Email Address	15th May 2018	16th May 2018	17th May 2018
Alf Rewin	alf@ground-hornbill.org.za			
Antoinette Kotze	antoinette@nzg.ac.za			
Coral Birss	cbirss@capenature.co.za			
Craig Whittington-Jones	Craig.Whittington-Jones@gauteng.gov.za		apologies	apologies
Delecia Gunn	delecia@loskopnaturereserve.co.za			
Elaine Reeve	Curator@montebg.co.za			
Evans Mabisa	evannmabiza@yahoo.com			
Gareth Tate	garetht@ewt.org.za			
Grace Nkgweng	gnkgweng@jhbcityparks.com			
Hanneline Smith-Robinson	conservation@birdlife.org.za			
Joanne Meyer	joannefshr@yahoo.com			
Kara Heynis	kara@lorypark.co.za			
Lizanne Nel	lizanne@sahunt.co.za		apologies	
Lucy Kemp	project@ground-hornbill.org.za			
Lucy Young	lucyyoung861@gmail.com			
Megan Murison	meganm@ewt.org.za			apologies
Melissa whitcross	melissa.whitecross@birdlife.org.za			
Merlyn Nomsa Nkomo	mesynomsa@gmail.com			
Mike Harman	mikehornbill@gmail.com	apologies	apologies	apologies
Nomusa Mkhungo	gnomusam@gmail.com			
Nthabiseng Monama	education@ground-hornbill.org.za			
Patience Shito	patience@ground-hornbill.org.za			
Rob Little	rob.little@uct.ac.za			
Sharon Thompson	sharon.thompson@sanparks.org	apologies		
Shaun Wilkinson	shaun@montebg.co.za	apologies		
Tim de Jongh	Tbone.DeJongh@~~deaet.ecape~~.gov.za			
Tracy Rehse	~~tracy@nzg.ac.za~~ t.rehse@sanbi.org.za			
Humbu Mafumo	hmafumo@environment.gov.za			
Yvette Ehlers-Smith	EhlersSmithY@ukzn.ac.za			
David Ehlers-Smith	SMITHD1@UKZN.AC.ZA			
MR MNCEDISI CINDI	mcindi@environment.gov.za Mncedisi.Cindi@gmail.com			
Tebogo Mashua	tmashua@environment.gov.za			
Stanley Tshitwamulomani	StanleyT@environment.gov.za			

ii) List of participants and contact details

Participants			
Alf	Rewin	Mabula Ground Hornbill Project	alf@ground-hornbill.org.za
Antoinette	Kotze	SANBI-NZG	A.kotze@sanbi.org.za
Cindi	Mncedisi	Department of Environmental Affairs	MCindi@environment.gov.za
Craig	Whittington-Jones	GDARD	Craig.Whittington-Jones@gauteng.gov.za
David	Ehlers-Smith	Univ. of KwaZulu-Natal	smithd1@ukzn.ac.za
Elaine	Reeve	Montecasino Bird Gardens	curator@montebg.co.za
Evans	Mabisa	Children and Nature Conservation Trust	evannmabiza@yahoo.com
Gareth	Tate	Endangered Wildlife Trust	garetht@ewt.org.za
Hanneline	Smit-Robinson	BirdLife South Africa	hanneline.smit-robinson@birdlife.org.za
Humbu	Mafumo	Department of Environmental Affairs	HMafumo@environment.gov.za
Joanne	Meyer	Sabbatical	joannefshr@yahoo.com
Kara	Heynis	Lory Park	kara@lorypark.co.za
Lizanne	Nel	SA Hunters and Game Conservation Association	lizanne@sahunt.co.za
Lucy	Kemp	Mabula Ground Hornbill Project/ IUCN Hornbill Specialist Group	project@ground-hornbill.org.za
Megan	Murison	Endangered Wildlife Trust	meganm@ewt.org.za
Melissa	Whitecross	Birdlife South Africa	melissa.whitecross@birdlife.org.za
Merlyn	Nkomo	Children and Nature Conservation Trust Zimbabwe	merynomsa@gmail.com
Nomusa	Mkhungo	Women's Leadership and Training Programme	gnomusam@gmail.com
Nthabiseng	Monama	Mabula Ground Hornbill Project	education@ground-hornbill.org.za
Patience	Shito	Mabula Ground Hornbill Project	patience@ground-hornbill.org.za
Rob	Little	FitzPatrick Institute of African Ornithology	rob.little@uct.ac.za
Stanley	Tshitwamulomoni	Department of Environmental Affairs	StanleyT@environment.gov.za
Tebogo	Mashua	Department of Environmental Affairs	TMashua@environment.gov.za
Tim	de Jongh	Eastern Cape Nature Conservation	Tbone.DeJongh@deaet.ecape.gov.za
Tracy	Rehse	National Zoological Gardens of South Africa	tracy@nzg.ac.za
Yvette	Ehlers-Smith	Univ. of KwaZulu-Natal	yvetteehlers@hotmail.com
Apologies			
Alan	Kemp	Retired (ex- Ditsong Museum of Nat. History)	leadbeateri@gmail.com
Andre	Botha	Endangered Wildlife Trust	andreb@ewt.org.za
Arnaud	Le Roux	Wildlife Ranching South Africa	arnaudleroux109@gmail.com

Brent	Coverdale	Ezemvelo Kwazulu-Natal Wildlife	Brent.Coverdale@kznwildlife.com
Candice	Pierce	Sabisand Wildtuin	ecoofficer@sspt.co.za
Coleen	Downs	Univ. of KwaZulu-Natal	Downs@ukzn.ac.za
Craig	Mulqueeny	Ezemvelo Kwazulu-Natal Wildlife	Craig.Mulqueeny@kznwildlife.com
Damin	Dallas	Sabisand Wildtuin	conservation@sabisand.co.za
Dane	Antrobus	Manyoni Reserve	wildlife@manyoni.co.za
Dean	Pienke	Eastern Cape Parks and Tourism Agency	dean.peinke@ecpta.co.za
Deon	Cornelius	Ubhetyan O Africa	corneliusdeon49@gmail.com
Delecia	Gunn	Mpumalanga Tourism and Parks Agency	delecia@loskopnaturereserve.co.za
Derek	Englebrecht	University of Limpopo	fauna.pburg@mindsmail.co.za
Don	Leitch	Retired (ex-sugar cane, citrus and pecan farming)	dongilly@iafrica.com
Ed	Hurn	Lory Park	eha@icon.co.za
Erika	Albers	Wildlife Ranching South Africa	erika@mlpmedia.co.za
Ertjies	Rohm	Mpumalanga Tourism and Parks Agency	ernst@mtpa.co.za
Eugene	Marais	Retired (ex-National Zoological Gardens)	eugenemarais6@yahoo.com
Grace	Nkgweng	Johannesburg Zoo	gnkgweng@jhbcityparks.com
Ian	Rushworth	Ezemvelo Kwazulu-Natal Wildlife	Ian.Rushworth@kznwildlife.com
Jannie	Coetzee	Mpumalanga Tourism and Parks Agency	jannie@loskopnaturereserve.co.za
Joanne	Marias	Mitchell's Park Zoo	joanne.marias@durban.gov.za
John	Werth	Pan-African Association of Zoos and Aquaria	johnw@zoosafrica.com
Joseph	Heymans	LEDET	HeymansJA@ledet.gov.za
Kabelo	Senyatso	BirdLife Botswana	blb@birdlifebotswana.org.bw
Kate	Carstens	Wild Bird Trust	kfcarstens@gmail.com
Katja	Koeppel	Onderstepoort Veterinary Institute	katja_koeppel@gmx.net
Kobus	Pienaar	LEDET	PienaarAJ@ledet.gov.za
Kobus	Havemann	Mabula Private Game Reserve	rm@mabulatimeshare.co.za
Kyle	Middleton	Percy FitzPatrick Institute of African Ornithology	nghututu@gmail.com
Lente	Roode	Hoedspruit Endangered Species Centre	lentelidiaroode@icloud.com
Lucy	Young	Univ. of Johannesburg	lucyyoung861@gmail.com
Malcolm	Cumming	Mabula Ground Hornbill Project	mal@ibi.co.za
Matthew	Hutchinson	Princeton University	mcch@princeton.edu
Megan	Loftie-Eaton	African Demography Unit, UCT	meg.loftie.eaton@gmail.com
Mike	Harman	Retired (ex- Johannesburg Zoo)	mikehornbill@gmail.com
Nokulinda	Mkhize	Sangoma	nokulinda@ithonga.co.za
Nollie	Cilliers	Boscia Birds	nollie@plantae.co.za
Raymond	Jansen	Tshwane Univ. of Technology	JansenR@tut.ac.za
Sarah	Chabangu	National Zoological Gardens of South Africa	sarah@nzg.ac.za

Sharon	Louw	Ezemvelo Kwazulu-Natal Wildlife	louws@kznwildlife.com
Sharon	Thompson	SANParks	sharon.thompson@sanparks.org
Shaun	Wilkinson	Montecasino Bird Gardens	shaun@montebg.co.za
Sophie	Vrard	Pan-African Association of Zoos and Aquaria	sophie@zooafrica.com
Tarryn	Bristow	Umgeni River Bird Park	tarryn@urbp.co.za
Werner	Marais	Umgeni River Bird Park	werner@urbp.co.za

Appendix C: Attendance register and invitee list for the actions and relevant agreements workshop for implementation

a) **LEDET (Modimolle)**

Purpose of Workshop

The aim of this workshop is to ensure all relevant stakeholders are engaged in the drafting of the biodiversity management plan for the Southern Ground-Hornbill in South Africa.

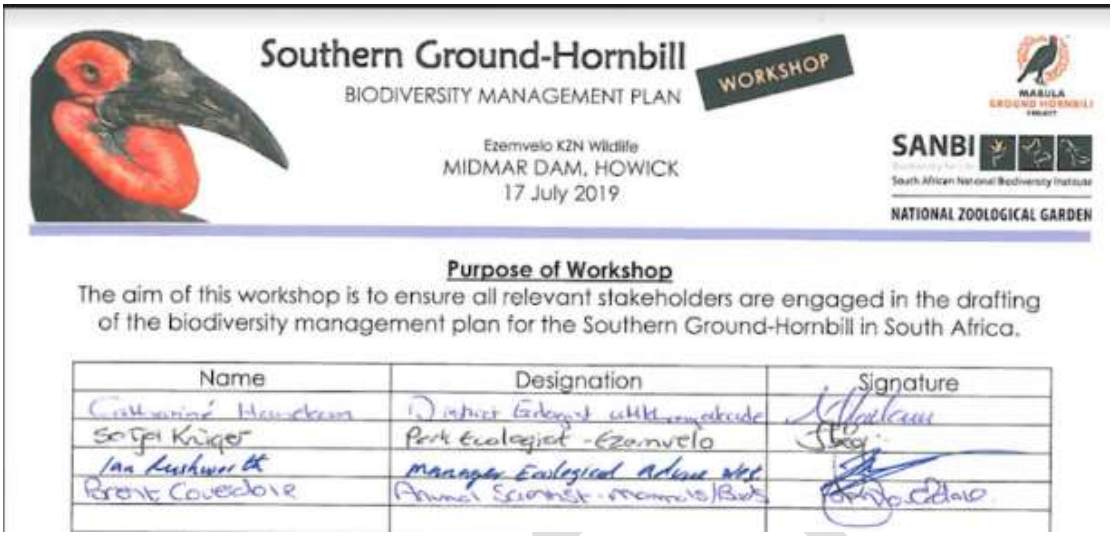
Name	Designation	Signature
JA Heymans	Environmental Officer	
K Steenkamp	Deputy director	

Participants			
Joseph	Heymans	Environmental Officer	HeymansJA@ledet.gov.za
Karin	Steenkamp	Deputy Director	Steenkampk@ledet.gov.za
Apologies			
Kobus	Pienaar	Permit officer	PienaarAJ@ledet.gov.za

b) MTPA (Loskop Nature Reserve)

Participants			
Klaas	Modau	Loskop Dam Nature Reserve Manager	gwetshiwe@telkomsa.net
Ertjies	Rhom	Game capture manager	ernst@mtpa.co.za
Hannes	Botha	Herpetofauna Scientist	nilecrocs@gmail.com
Jannie	Coetzee	Ecologist	jannie@loskopnaturereserve.co.za
Delecia	Gunn	Principal nature conservator	delecia@loskopnaturereserve.co.za
Gait Jan	Sterk	Senior Conservator	
Apologies			
Johan	Eksteen	Manager Ecological Services	Johan.Eksteen@mtpa.co.za

c) EKZN (Howick)


Southern Ground-Hornbill
BIODIVERSITY MANAGEMENT PLAN
WORKSHOP
Ezemvelo KZN Wildlife
MIDMAR DAM, HOWICK
17 July 2019
MARULA GROUND HORNBILL PROJECT
SANBI
South African National Biodiversity Institute
NATIONAL ZOOLOGICAL GARDEN

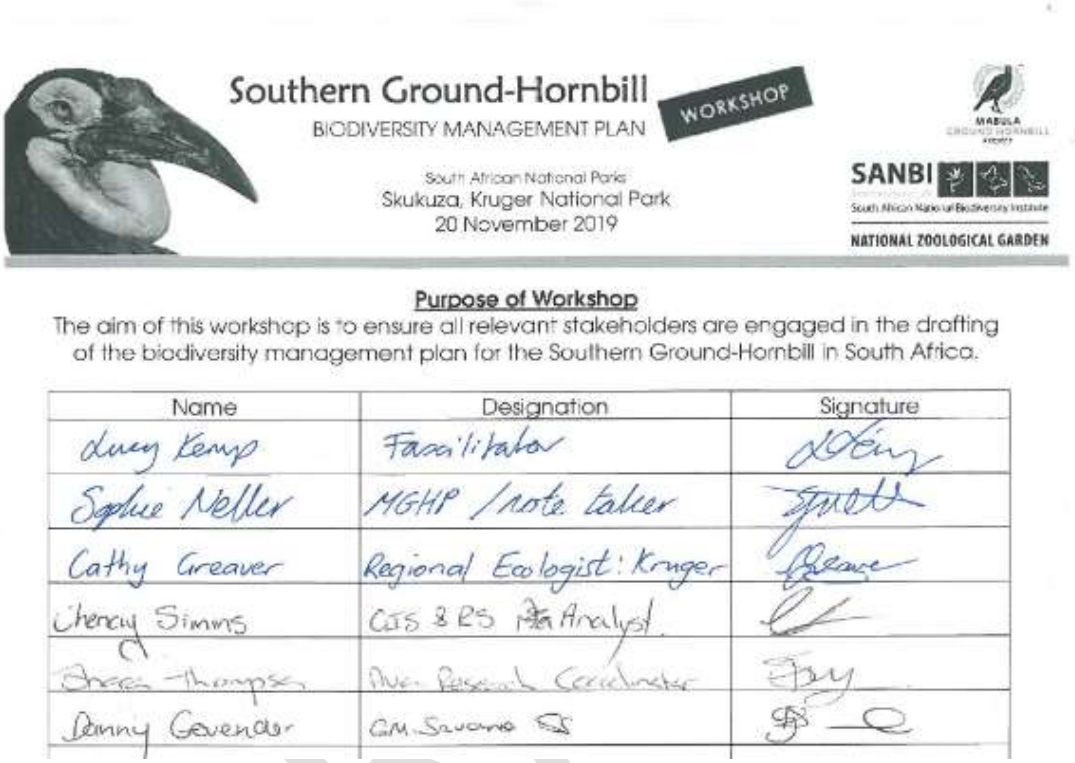
Purpose of Workshop

The aim of this workshop is to ensure all relevant stakeholders are engaged in the drafting of the biodiversity management plan for the Southern Ground-Hornbill in South Africa.

Name	Designation	Signature
Cathering Hanekom	District Ecologist uMkhanyakude	
Sonja Kruger	Park Ecologist - Ezemvelo	
Ian Rushworth	Manager Ecological Advice WKZ	
Brent Coverdale	Animal Scientist - Mammals/Birds	

Participants			
Cathy	Hanekom	District ecologist	
Sonja	Kruger	Park Ecologist	
Ian	Rushworth	Manager: Ecological Advice West	
Brent	Coverdale	Animal Scientists (Mammals and birds)	
Apologies			
Craig	Mulqueeny	Manager: Ecological Advice East	

d) South African National Parks (Skukuza)


Southern Ground-Hornbill
BIODIVERSITY MANAGEMENT PLAN
WORKSHOP
South African National Parks
Skukuza, Kruger National Park
20 November 2019
SANBI
NATIONAL ZOOLOGICAL GARDEN

Purpose of Workshop

The aim of this workshop is to ensure all relevant stakeholders are engaged in the drafting of the biodiversity management plan for the Southern Ground-Hornbill in South Africa.

Name	Designation	Signature
Lucy Kemp	Facilitator	
Sophie Neller	MGHP / note taker	
Cathy Greaver	Regional Ecologist: Kruger	
Chenay Simms	GIS & RS Analyst	
Sharon Thompson	Avian Research Coordinator	
Danny Govender	GM Savanna	

Participants			
Cathy	Greaver	Regional ecologist	Cathy.Greaver@sanparks.org
Danny	Govender	Disease Ecologist and Veterinarian	danny.govender@sanparks.org
Chenay	Sims	GIS & Remote Sensing Analyst	Chenay.Simms@sanparks.org
Sharon	Thompson	Avian Research and logistics coordinator	sharon.thompson@sanparks.org
Sophie	Neller	Minutes	sophie@ground-hornbill.org.za
Apologies			
Conrad	Strauss	Park Manager at Mapungubwe	conrad.strauss@sanparks.org
Navashni	Govender	Senior Manager: Conservation Management	navashni.govender@sanparks.org
Mphadeni	Nthangeni	Marakele Park Manager	mphadeni.nthangeni@sanparks.org
Marisa	Coetzee	Senior Manager: Park Planning and Conservation Management	Marisa.Coetzee@sanparks.org
Letsie	Coetzee		letsie.coetzee@sanparks.org
Sam	Ferreira	Scientist: Large Mammal Ecology	sam.ferreira@sanparks.org
Peter	Buss	Veterinary senior manager	peter.buss@sanparks.org

Appendix D: Research needs

As a BMP-S is not a research strategy and focusses on adaptive management implementation research requirements are not fixed and changes with implementation but research strategies should support the BMP-S implementation. The following list of research was identified as important at the BMP-S workshop and also includes the research requirements identified during the PHVA that are yet to be completed. It was emphasised that research needs to speak to desired outcomes and achievable outcomes. This is in addition to ensuring all existing data is analysed and published, and that no data lies dormant with agencies, but is used to continue to grow the evidence-base for conservation planning and action.

Veterinary Health

- Investigate the suitability, dosages and pathways of veterinary drugs.
- Initiate toxicology studies.
- Compile risk assessments of NCD in captive and wild populations.

Agri-Science

- Identification and dissemination of information of the agrochemicals (herbicides, pesticides) that will impact SGH health and survival.
- Model current potential impacts of agrochemicals on SGH.
- Investigate drugs used in agriculture (herbicides, pesticides) that can impact on the health and survival of SGH.
- Identify areas of different uses and availability including rural areas.

Social Sciences

- Study to investigate shared anthropogenic threats of culturally important species that include SGH and species e.g. Secretary birds.
- Continue to investigate activities and monitor use in traditional medicine markets.
- Investigate current local illegal use of SGH by communities.

Indigenous Knowledge Systems

- Investigate and quantify levels and trends in knowledge, attitudes, perceptions, beliefs and behaviour of all stakeholder groups that share their land with SGH (MGHP/ UKZN underway)

Breeding / Biology

- Investigate and monitor the survivability of 2nd egg hatchlings during the entire growth period. Develop a technique to accurately confirm the sexes of birds.
- Investigate group dynamics in different areas.
- Investigate skewed mortality in females.

- Develop more effective techniques for an accurate census to include citizen science reporting and new methods (apps) for monitoring.

Modelling energy developments

- Model high-risk areas (identified for renewable energy and provision) concerning occupied SGH distribution.
- Determine the overlap of wind farms or wind resource (potential wind farms) and SGH distribution.
- Model impact of wind turbines – the effect of potential collisions. Look at Transkei area with new developments of proposed wind farms. Only vulture information available thus far.
- Identify emerging threats posed by energy providers.
- Conduct post-construction monitoring at existing wind farms aimed to better understand avoidance behaviour and how birds interact with infrastructure.

Transformer boxes – further research required to qualify the threat

- Model overlap of transformer boxes with species distribution range.
- Determine the number of transformer boxes over distribution range.
- Assess how many cases to qualify scope.
- Investigate more suitable infrastructure.
- Conduct behavioural studies as to why birds use the infrastructure.
- Conduct a study to investigate alternative mitigation measures eg detracting the birds from using transformers (noise, height).
- Investigate and develop alternative monitoring and evaluation technologies.

Habitat

- Scale the risk of a potentially emerging threat: invasive alien plant species, including indigenous plant species e.g. *Pteridium aquilinum*.
- Conduct risk assessments for climate change.
- Monitor and manage the impacts of surrounding land.
- Understand what burning regime would best support both SGH and optimal grassland species richness. To support the development of habitat management guidelines and thus address burning and grazing intensity to take quantify difference between short/well-grazed grass and overgrazing.
- Investigate the feasibility by applying bioregional plans for data deficient areas within the distribution range.
- Secure and safeguard stronghold/core areas for SGH breeding and foraging sites both within and outside protected areas - monitoring and research required.
- Investigate the impact of human infrastructure on mortalities.
- Use of telemetry (GPS or satellite transmitters) in areas of potential conflict to track birds (core and home range) and do fine-scale innovative modelling.
- Track birds to determine flight height.
- Identify possible corridors to allow for gene flow in populations/groups in Zululand, southern KNP.
- Investigate the distribution and home-range use within mixed landscapes.
- Identify areas suitable for release through bioregional plans.

- Describe forage areas in more detail with regards to bush encroachment; under grazing, loss of nests, disturbances.
- Investigate the degree of increasing habitat fragmentation on the genetic health of SGH populations.
- Investigate the effectiveness of disposal of biological waste, chicken litter and carcasses by farms, including facilities feeding animals.

Appendix E: Detailed national monitoring plan

Contact project@ground-hornbill.org.za for a full copy of the National Monitoring Plan.

Appendix F: SGH BMP-S Monitoring and Reporting Framework

SECTION BMP-S ACTIONS & ACTIVITIES	TIMEFRAME	FUNDING / RESOURCES	IMPLEMENTING AGENCIES / COLLABORATORS	RESPONSIBLE AGENCY (REPORTING)	MEASURABLE OUTCOMES	PROGRESS	CHALLENGES / CORRECTIVE MEASURES	IMPLEMENTATION IMPLICATIONS
OBJECTIVE 1	**TO ESTABLISH AND MAINTAIN EFFECTIVE COMMUNICATION AND AWARENESS BETWEEN AND AMONG STAKEHOLDERS AND THE PUBLIC**							
OBJECTIVE TARGET 1.1	**Objective Target: Establish and maintain productive partnerships for SGH conservation**							
ACTION 1.1.1	**Formalise inter-agency collaboration to coordinate and review the implementation of the SGH BMP-S**			**DFFE**				
Establish a Steering Committee	Within year one	Each agency to commit budget for and fund their commitment	ECPTA, EC DEDEAT, EKZNW, MPTA, LDEDET, GDARD, SANParks, SANBI, DFFE; MGHP, BirdLife SA		Steering Committee meetings with minutes		Continuity and continued participation	
Develop Terms of Reference (ToR) for SGH BMP-S Working Groups					SGH WG Terms of Reference		Cost of participation/create an improved mechanism for virtual communication e.g. video conferencing	
Inter-agency agreements identified and initiated					Annual M&E report			
ACTION 1.1.2	**Develop productive partnerships with stakeholders for SGH conservation**			**DFFE**				

SECTION BMP-S ACTIONS & ACTIVITIES	TIMEFRAME	FUNDING / RESOURCES	IMPLEMENTING AGENCIES / COLLABORATORS	RESPONSIBLE AGENCY (REPORTING)	MEASURABLE OUTCOMES	PROGRESS	CHALLENGES / CORRECTIVE MEASURES	IMPLEMENTATION IMPLICATIONS
Stakeholder matrix with existing programmes and required critical interventions developed								
Stakeholder engagement strategy with clear targets and responsibilities developed	Within one year of gazetting	Each agency to fund its commitment	ECPTA, ED DEDEAT, EKZNW, MPTA, LDEDET, GDARD, SANParks, SANBI, DFFE; MGHP, BirdLife SA		Awareness and educational campaigns		Funding	
Develop and package stakeholder-specific resource content and tools as approved by SC	Then ongoing				Distribution of awareness tools/brochures			
Investigate and guide the development of appropriate incentives for participation in SGH conservation					Voluntary stewardship/custodianship sites identified and established			
Facilitate safe spaces for SGH in core habitat					Best practice guidelines for land management in SGH habitat developed			
Develop and implement								

SECTION BMP-S ACTIONS & ACTIVITIES	TIMEFRAME	FUNDING / RESOURCES	IMPLEMENTING AGENCIES / COLLABORATORS	RESPONSIBLE AGENCY (REPORTING)	MEASURABLE OUTCOMES	PROGRESS	CHALLENGES / CORRECTIVE MEASURES	IMPLEMENTATION IMPLICATIONS
management guidelines for elephant damage to nests, bush encroachment and invasive species control, land-use practices and disturbance of nesting and roosting sites								
OBJECTIVE 2	**TO SIGNIFICANTLY IMPROVE THE HEALTH AND BREEDING POTENTIAL OF THE WILD SGH POPULATION**							
OBJECTIVE TARGET 2.1	**To reduce poisoning of SGH in South Africa by improved reporting and monitoring network for all SGH poisoning events in South Africa with a measurable reduction in agrochemical poisoning events relating to SGH in South Africa.**							
ACTION 2.1.1	**Improve reporting of all SGH mortalities to the national mortality database**			**DFFE**				
Centralise population monitoring and mortality database established	Annually	Agency optional budget	ECPTA, EC DEDEAT, EKZNW, MPTA, LDEDET, GDARD, SANParks, SANBI, DFFE; MGHP, BirdLife SA		National mortality database established		Standardised reporting	
Data sharing agreements: MGHP custodians of the national database								
ACTION 2.1.2	**Collection of data on the prevalence of lead in SGH**			**DFFE**				

SECTION BMP-S ACTIONS & ACTIVITIES	TIMEFRAME	FUNDING / RESOURCES	IMPLEMENTING AGENCIES / COLLABORATORS	RESPONSIBLE AGENCY (REPORTING)	MEASURABLE OUTCOMES	PROGRESS	CHALLENGES / CORRECTIVE MEASURES	IMPLEMENTATION IMPLICATIONS
An opportunistic sampling of blood (from living birds) or, liver, bone, eggshells collected from nests	Ongoing	Agency optional budget	ECPTA, EC DEDEAT, EKZNW, MPTA, LDEDET, GDARD, SANParks, SANBI, DFFE; MGHP, BirdLife SA, EWT, SAHGCA, WRSA		Biobank samples			
SOP for sample/specimen collections developed (including chain-of-custody and post mortems)					Sample collection SOP developed			
Monitoring protocol and programme implemented					National lead prevalence database established			
Develop and implement non-lead ammunition campaigns								
ACTION 2.1.3	**Report on SGH poisoning and collaborate with the National Wildlife Poison Prevention Working Group (NWPPWG)**			**DFFE**				
Develop and implement training modules for dealing	Annually and ongoing	Agency optional budget	ECPTA, EC DEDEAT, EKZNW, MPTA, LDEDET,		Training modules developed		Available capacity	

SECTION BMP-S ACTIONS & ACTIVITIES	TIMEFRAME	FUNDING / RESOURCES	IMPLEMENTING AGENCIES / COLLABORATORS	RESPONSIBLE AGENCY (REPORTING)	MEASURABLE OUTCOMES	PROGRESS	CHALLENGES / CORRECTIVE MEASURES	IMPLEMENTATION IMPLICATIONS
with poisoned/injured SGH			GDARD, SANParks, SANBI, DFFE; MGHP, BirdLife SA, EWT					
Report SGH poisoning to NWPPWG					SOP for veterinary care and rehabilitation developed			
Conduct poison response and site training (all birds-of-prey), including management of carcass retrieval and disposal					Number of stakeholders trained			
SOP for veterinary care and rehabilitation of affected individuals developed					Annual poisoning report			
ACTION 2.1.4	**Raise awareness relating to impacts of agrochemicals (illegal/off-label) and lead ammunition on SGH**			**DFFE**				
Develop and distribute awareness material relating to the impacts of agrochemicals (illegal/off-label) and	Within two years of gazetting	Agency optional budget	ECPTA, EC DEDEAT, EKZNW, MPTA, LDEDET, GDARD, SANParks,		Awareness material and training modules developed and distributed to SGH Custodian		Sourcing funding to ensure Custodian Programme can be fully implemented and maintained	

SECTION BMP-S ACTIONS & ACTIVITIES	TIMEFRAME	FUNDING / RESOURCES	IMPLEMENTING AGENCIES / COLLABORATORS	RESPONSIBLE AGENCY (REPORTING)	MEASURABLE OUTCOMES	PROGRESS	CHALLENGES / CORRECTIVE MEASURES	IMPLEMENTATION IMPLICATIONS
lead ammunition on SGH			SANBI, DFFE; MGHP, BirdLife SA					
Engage and assign SGH Custodians	Custodianship training annually				SGH Custodianship engagements and agreements in place			
Update and review SGH Custodianship Programme material and training modules					Publications (popular and peer-reviewed) on the prevalence and impacts of agrochemicals and lead ammunition			
Research and publish articles on the prevalence and impacts of agrochemicals and lead ammunition								
OBJECTIVE 3	**TO REDUCE SGH OFFTAKE FOR BELIEF-BASED USES**							
OBJECTIVE TARGET 3.1	**SGH is culturally revered throughout their range, however, these cultural belief systems rely on some offtake from the SGH population and so we seek a measurable reduction in illegal off-take in SGH and co-management of off-takes by traditional leaders to reduce illegal offtake of SGH.**							
ACTION 3.1.1	**Expand cultural protection in South Africa, through engagements with indigenous knowledge systems and traditional leaders**			**DFFE**				
Research and publish findings on cultural perceptions and values	Within one year of gazetting	Agency optional budget	ECPTA, EC DEDEAT, EKZNW, MPTA, LDEDET, GDARD, SANParks,		Publications (popular and peer-reviewed) on cultural		The sensitive approach required to	

SECTION BMP-S ACTIONS & ACTIVITIES	TIMEFRAME	FUNDING / RESOURCES	IMPLEMENTING AGENCIES / COLLABORATORS	RESPONSIBLE AGENCY (REPORTING)	MEASURABLE OUTCOMES	PROGRESS	CHALLENGES / CORRECTIVE MEASURES	IMPLEMENTATION IMPLICATIONS
			SANBI, DFFE; MGHP, BirdLife SA, HEIs, Traditional Leadership Councils, WLTP, Traditional Healers Council, DoTA, All relevant language group community leaders.		perceptions and values of SGH		prevent any perverse outcome	
Stakeholder and community engagement					Off-take assessments			
Co-management conservation plans developed and implemented	Within one year of gazetting and ongoing				Sustainable off-take simulators			
Community engagement strategy developed and implemented					Community engagement			
Capacity assessment of community leadership structures	Within three years of gazetting and ongoing							

SECTION BMP-S ACTIONS & ACTIVITIES	TIMEFRAME	FUNDING / RESOURCES	IMPLEMENTING AGENCIES / COLLABORATORS	RESPONSIBLE AGENCY (REPORTING)	MEASURABLE OUTCOMES	PROGRESS	CHALLENGES / CORRECTIVE MEASURES	IMPLEMENTATION IMPLICATIONS
Capacity development of community leadership structures for sustainable management and off-takes of SGH	Within five years of gazetting and ongoing				Facilitate co-management agreements			
OBJECTIVE 4	**TO REDUCE SGH MORTALITIES DUE TO PERSECUTION IN RESPONSE TO WINDOW DAMAGE**							
OBJECTIVE TARGET 4.1	**To enhance communities and landowner awareness concerning SGH window damage, and change attitudes of affected parties away from lethal or injurious actions against SGH.**							
ACTION 4.1.1	**Improve mitigation measures against impacts of breaking windows by SGH and implemented protocols on how to protect windows from being broken by the birds**			**DFFE**				
Establish and maintain an SGH window-breaking register database	Ongoing		ECPTA, EC DEDEAT, EKZNW, MPTA, LDEDET, GDARD, SANParks, SANBI, DFFE; MGHP, BirdLife SA, HEIs, Traditional Leadership Councils, WLTP, Traditional Healers Council, DoTA		National SGH window-breaking register database established			
Research and publish findings on cost-effective mitigation	Every two years after gazetting	Agency optional budget			Revised education and awareness materials for the mitigation of			

SECTION BMP-S ACTIONS & ACTIVITIES	TIMEFRAME	FUNDING / RESOURCES	IMPLEMENTING AGENCIES / COLLABORATORS	RESPONSIBLE AGENCY (REPORTING)	MEASURABLE OUTCOMES	PROGRESS	CHALLENGES / CORRECTIVE MEASURES	IMPLEMENTATION IMPLICATIONS
measures against the impacts of breaking windows by SGH					responses to SGH window damage			
Develop and distribute awareness material relating to breaking of windows by SGH in areas of risk, such as schools, with affected communities, private landowners and Custodians	Within one year of gazetting, ongoing				Number of business and industry partnerships established for providing alternate window protection material			
Develop and implement Immediate Response and Mitigation Protocols	Within one year of gazetting							
Foster relationships with industrial suppliers of mitigation materials and facilitate provisioning to high-risk areas								
OBJECTIVE 5	**TO REDUCE AND ELIMINATE THE CONFLICT AND MORTALITY OF SGH AS A RESULT OF CURRENT AND FUTURE ENERGY INFRASTRUCTURE DEVELOPMENT**							
OBJECTIVE TARGET 5.1	**To reduce and eliminate the mortalities of SGH through modification and mitigation of existing energy infrastructure, including distribution poles and power lines, within 5 years since gazetting, for zero SGH electrocutions due to unsafe distribution poles and minimise SGH collisions on power line spans.**							

SECTION BMP-S ACTIONS & ACTIVITIES	TIMEFRAME	FUNDING / RESOURCES	IMPLEMENTING AGENCIES / COLLABORATORS	RESPONSIBLE AGENCY (REPORTING)	MEASURABLE OUTCOMES	PROGRESS	CHALLENGES / CORRECTIVE MEASURES	IMPLEMENTATION IMPLICATIONS
ACTION 5.1.1	**Modification and marking electrical-provision infrastructure to reduce SGH mortality**			**DFFE**				
Establish and maintain an SGH electrocution/collision register database	Within one year of gazetting and then ongoing - annual feedback reports	Agency optional budget	DE, ECPTA, EC DEDEAT, EKZNW, MPTA, LDEDET, GDARD, SANParks, SANBI, DFFE; MGHP, BirdLife SA, HEIs, EWT, ESKOM		Engagement between ESKOM and EWT/BirdLife SA/MGHP		Knowledge gaps	
Develop high-incident-potential site identification model (within distribution range overlapping power distribution lines)					Publications (popular and peer-reviewed) on the effectiveness of mitigation measures		Cost of mitigation and modification of electricity provisioning infrastructure	
Research and publish findings of incidents of electrocution/collisions and effectiveness of mitigation measures implemented	Within three years of gazetting and ongoing				Adaptive management implementation of research findings			
Develop guidelines for the effective insulation of transformer boxes, live components of all new transformer boxes and marking of								

SECTION BMP-S ACTIONS & ACTIVITIES	TIMEFRAME	FUNDING / RESOURCES	IMPLEMENTING AGENCIES / COLLABORATORS	RESPONSIBLE AGENCY (REPORTING)	MEASURABLE OUTCOMES	PROGRESS	CHALLENGES / CORRECTIVE MEASURES	IMPLEMENTATION IMPLICATIONS
provisioning infrastructure for implementation by ESKOM in partnership with BirdLife SA								
OBJECTIVE TARGET 5.2	**To assess the potential for wind farms as an emerging threat to SGH.**							
ACTION 5.2.1	**Develop appropriate mitigation and monitoring protocols for potential impacts of wind farms/turbines on SGH**			**DFFE**				
Establish and maintain SGH wind turbine collisions register	Within one year of gazetting	Agency optional budget	ECPTA, EC DEDEAT, EKZNW, MPTA, LDEDET, GDARD, SANParks, SANBI, DFFE, DE; MGHP, BirdLife SA, HEIs, EWT		Update BirdLife SA/EWT Best Practice Guidelines for Wind Energy Facilities		Environmental Authorisations to include specialist monitoring results	
Develop high-incident-protocol site identification model (within distribution range overlapping distribution of wind turbines)	Within one year of gazetting and ongoing				Stakeholder engagements and BARESG (Birds and Renewable Energy Specialist Group) and BAREF (Birds and Renewable Energy Forum)			
Research and publish findings of incidents of collisions with wind turbines	Within one year of gazetting; information made available				Surveillance and monitoring results made available by avifaunal specialists and published			

SECTION BMP-S ACTIONS & ACTIVITIES	TIMEFRAME	FUNDING / RESOURCES	IMPLEMENTING AGENCIES / COLLABORATORS	RESPONSIBLE AGENCY (REPORTING)	MEASURABLE OUTCOMES	PROGRESS	CHALLENGES / CORRECTIVE MEASURES	IMPLEMENTATION IMPLICATIONS
	and best practice guidelines updated within three years of gazetting				by BirdLife SA, to update the Best Practice Guidelines accordingly			
Develop and include guidelines for effective pre-and post-construction monitoring of SGH in existing BirdLife SA/EWT Best Practice Guidelines	Within five years of gazetting				Publications (popular and peer-reviewed) on the impacts of wind farms on SGH			
Engage national and Provincial Environmental Authorisation authorities	Within one year of gazetting				Species-specific guidelines for mitigation on impacts developed			
OBJECTIVE 6	**TO REDUCE HABITAT LOSS, DEGRADATION/ALTERATION AND FRAGMENTATION OF CORE SGH HABITAT**							
OBJECTIVE TARGET 6.1	**To reduce, halt and reverse the loss of core SGH habitat**							
ACTION 6.1.1	**Inform land-use planning policies to secure core areas for SGH**			**DFFE**				
Maintain national SGH spatial distribution database	Within one year of gazetting	Agency optional budget	ECPTA, EC DEDEAT, EKZNW, MPTA, LDEDET, GDARD, SANParks, SANBI, DFFE, DE,		National SGH spatial distribution database		Compliance with Environmental Authorisation conditions; Conservation Plans	

SECTION BMP-S ACTIONS & ACTIVITIES	TIMEFRAME	FUNDING / RESOURCES	IMPLEMENTING AGENCIES / COLLABORATORS	RESPONSIBLE AGENCY (REPORTING)	MEASURABLE OUTCOMES	PROGRESS	CHALLENGES / CORRECTIVE MEASURES	IMPLEMENTATION IMPLICATIONS
			Municipalities; MGHO, BirdLife SA, HEIs, EWT				not mainstreamed into IDPs and SDFs	
Maintain national SGH population monitoring database					Provincial population monitoring database			
SGH data informs Bioregional Conservation Plans/Biodiversity Spatial Plans	Within one year of gazetting, revised annually				SANParks population monitoring database			
BCPs/BSPs inform land-use planning policies, protected area expansion strategies (including stewardship), IDPs and SDFs					National SGH population monitoring database			
SGH included in BirdLife SA Best Practice Guidelines for EIA assessments	Within one year of gazetting				Best Practice Guidelines for EIA assessments including SGH			
Develop mainstream best practice land-use guidelines					SGH Conservation Translocation and Reintroduction Guidelines			

SECTION BMP-S ACTIONS & ACTIVITIES	TIMEFRAME	FUNDING / RESOURCES	IMPLEMENTING AGENCIES / COLLABORATORS	RESPONSIBLE AGENCY (REPORTING)	MEASURABLE OUTCOMES	PROGRESS	CHALLENGES / CORRECTIVE MEASURES	IMPLEMENTATION IMPLICATIONS
Develop SGH conservation translocation and reintroduction guidelines					Best Practice Land-use Guidelines for SGH (and stewardships)			
Protected Area Management Plans included SGH population monitoring					Climate change corridors include SGH parameters			
Integrate impacts of climate change on the mapping of climate change corridors in conservation planning products								
OBJECTIVE 7	**TO MINIMISE THE RISK OF INFECTION OF NCD AND OTHER INFECTIOUS DISEASE IN IN-SITU SGH POPULATIONS**							
OBJECTIVE TARGET 7.1	**To maximize prevention by rapid response, containment and awareness of NCD and other infectious disease outbreaks in the distribution range of SGH.**							
ACTION 7.1.1	**To mitigate against impacts of NCD and other infectious disease outbreaks in the distribution range of SGH**			**DFFE**				
Assess historical NCD and other infectious disease outbreaks in the distribution range of SGH	Within one year of gazetting	Agency optional budget	ECPTA, EC DEDEAT, EKZNW, MPTA, LDEDET, GDARD, SANParks, SANBI, DFFE, NDA; MGHP, BirdLife SA,		NCD incident reporting database and protocols for conservation agencies, small-scale or subsistence-scale poultry farmers and stakeholders		National NCD reporting skewed to poultry species	

SECTION BMP-S ACTIONS & ACTIVITIES	TIMEFRAME	FUNDING / RESOURCES	IMPLEMENTING AGENCIES / COLLABORATORS	RESPONSIBLE AGENCY (REPORTING)	MEASURABLE OUTCOMES	PROGRESS	CHALLENGES / CORRECTIVE MEASURES	IMPLEMENTATION IMPLICATIONS
			HEIs, EWT, Poultry Industry					
Develop SGH Disease Risk Assessment					NCD Reaction Protocol including a post-mortem of SGH carcasses, and sampling of live birds		Low reporting/submission of carcasses for testing	
Maintain National NCD outbreaks register database					NCD Disease risk assessment for SGH			
Maintain/establish NCD outbreak reporting protocol					Revised education and awareness materials for a response to NCD outbreaks			
Facilitate disease outbreak notification to stakeholders								
Develop and implement NCD/Infectious Disease Outbreak Reaction Protocol (including post-mortem and sampling)								
ACTION 7.1.2	**Assess the feasibility of using the NCD vaccination protocol for the protection of wild SGH**			**DFFE**				

SECTION BMP-S ACTIONS & ACTIVITIES	TIMEFRAME	FUNDING / RESOURCES	IMPLEMENTING AGENCIES / COLLABORATORS	RESPONSIBLE AGENCY (REPORTING)	MEASURABLE OUTCOMES	PROGRESS	CHALLENGES / CORRECTIVE MEASURES	IMPLEMENTATION IMPLICATIONS
Maintain a database of all vaccination administration, type, frequency and resulting blood titres	Within one year of gazetting	Agency optional budget	ECPTA, EC DEDEAT, EKZNW, MPTA, LDEDET, GDARD, SANParks, SANBI, DFFE, NDA, State Veterinary Services; MGHP, BirdLife SA, HEIs, EWT, PAAZA, Poultry Industry		National SGH mortality database includes reporting relevant to NCD		The risk associated with handling specimens	
Analysis of titres to assess the efficacy of various vaccine protocols	Within one year of gazetting				Development of vaccination protocols for *in situ* SGH and trails of implementation			
Finalise and implement the vaccine protocol for the NCD	Within two years of gazetting							