The Vultures of Southern Africa – Quo Vadis?

Proceedings of a workshop on vulture research and conservation in southern Africa

2004

Editors

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McGregor Museum, Kimberley, South Africa

4-7 April 2004

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Suggested Citation

The Proceedings:
Monadjem, A., Anderson, M.D., Piper, S.E. & Boshoff, A.F. (Eds). 2004. Vultures in The Vultures of Southern Africa – Quo Vadis?. Proceedings of a workshop on vulture research and conservation in southern Africa. Birds of Prey Working Group, Johannesburg.

An article within the Proceedings:
Colahan, B.D. 2004. The status and conservation of vultures in the Free State Province of South Africa. *In*: Monadjem, A., Anderson, M.D., Piper, S.E. & Boshoff, A.F. (Eds). Vultures in The Vultures of Southern Africa – Quo Vadis?. Proceedings of a workshop on vulture research and conservation in southern Africa. Birds of Prey Working Group, Johannesburg.

Published by: Birds of Prey Working Group
Endangered Wildlife Trust
Johannesburg
South Africa

December 2004

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INTRODUCTION

In October 1997 a seminal workshop was held in Kimberley entitled "Vultures in the 21st Century". The aims of that workshop were to address two key questions: 1) Are vulture conservation activities appropriately planned, coordinated and executed? 2) Have the data collected on vultures been properly collated, analyzed, interpreted and published? As such, the workshop was viewed as providing a benchmark against which future efforts could be compared. A further outcome of that workshop was the drafting of a list of priority research and conservation activities.

Seven years have passed since that workshop. The big question now is what has been achieved since then? How many of the priority actions have been implemented? Has the conservation status of any species improved during this time? Are there any new initiatives on the go? Basically, how successful have we been in studying and conserving vultures in the past seven years?

To address these questions, a "follow-up" workshop was held in Kimberley in April 2004. These proceedings are the outcome of that workshop and have been divided into four sections. Section A deals with the current conservation status of vultures in southern Africa. Eight of the nine species occurring in this region are presented here. Unfortunately a species account for the Hooded Vulture could not be compiled. However, a bibliography of all the known material published on this species since 1997 has been presented instead. Species names follow Mundy *et al.* (1992), except that the African White-backed Vulture is retained in the genus *Gyps*; and *Gyps coprotheres* is referred to as either the Cape Vulture or Cape Griffon (depending on the preference of the individual author).

Section B presents reports from eighteen regions, summarizing research and conservation activities undertaken in the past seven years. Regions are not necessarily political entities, for example several accounts deal with single vulture colonies (such as Blouberg and Kransberg) or conservation areas (e.g. Kruger National Park).

Section C presents the key threats to vultures and vulture conservation in southern Africa. Included here are papers dealing with electrocution, poisons, changes in land use, traditional medicine and non-steroid anti-inflammatory drugs; as well as a paper on vulture restaurants (which ideally should have been placed in a conservation section). Finally, Section D is dedicated to reviewing the progress made since 1997. In some ways, this is the most important contribution of these proceedings. Have we met the objectives laid out in the 1997 workshop? If not, how far have we come? What still remains to be done? This critical assessment is vital for the setting of research and conservation priorities in the future. However, at the end of the day, our effectiveness in conserving southern African vultures can only be gauged by reference to how vulture populations are responding.

With few exceptions, the papers presented in these proceedings have not been peer-reviewed, and the views and opinions expressed are those of the

authors. Furthermore, editorial changes have been kept to the minimum so as to retain the style of individual authors.

This workshop was held from the 4 to 7 April 2004 in the McGregor Museum, Kimberley. The workshop was officially opened by Mrs Vytjie Mentor, Member of Parliament. These proceedings deal with presentations made on the 5 April and the morning of 6 April. The remaining time was spent on a strategic planning workshop facilitated by the Conservation Breeding Specialist Group. The report from the latter workshop forms a sister document to the current one.

The workshop was organized by Kerri Wolter, Vulture Study Group, and Mark Anderson, Northern Cape Department of Tourism, Environment & Conservation. Financial support was provided by the Lomas Wildlife Protection Trust and Sasol. Inputs into the organization of the workshop were made by the VSG committee, with Steven Piper, Ara Monadjem and Mark Anderson being responsible for the scientific programme. Yolan Friedmann gave up her time to facilitate the strategic planning workshop. The assistance of the McGregor Museum's Felicity Msuthu, Colin Fortune and Tania Anderson was appreciated. De Beers and Angus and Sue Anthony are thanked for the sponsorship of the braai and the use of facilities at Benfontein Game Farm.

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Ara Monadjem, Mark Anderson, Steven Piper & André Boshoff

December 2004

Section A

Status of vulture species in southern Africa

Cape Griffon *Gyps coprotheres*

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Distribution

Historical distribution

Formerly more widespread, especially in Namibia and the former Cape Province. In Namibia the Cape Griffon is no longer to found as extensively as it was prior to the second world war. All its known breeding colonies and roosts were abandoned, except for a handful of individuals by the 1990s (Mundy & Ledger 1977; Collar *et al.* 1994; Simmons & Bridgeford 1997; Simmons 2002). Current intensive observations near the Waterberg indicate that there are about a dozen individuals left (M. Diekmann personal communication). Prior to 1905 there were likely two core breeding populations of the Cape Griffon in the south and west of South Africa. In the south-western Cape and the former Transkei but they could be found anywhere within the former Cape Province, though less frequently in the north (Boshoff & Vernon 1980). There was a great decline in numbers and range from about 1900 due to rinderpest (1886-1903), The Anglo-Boer War, destruction of game herds, replacement by domestic stock and conversion of grazing to cultivation and poisoning (Boshoff & Vernon 1980). From 1950 to 1975 there was a range expansion from the former Transkei and Eastern Cape into the Karoo but there was little change in south-west Cape; the greatest concentration was in eastern Cape grasslands (Boshoff & Vernon 1980). However, from 1975 the range contracted again as a result of overgrazing and declining livestock carrying capacity (Boshoff & Vernon 1980).

Current distribution

Two core populations are centred on the former Transvaal Province and Botswana and around the Drakensberg Massive (i.e. Lesotho, north Eastern Cape, KwaZulu-Natal and Free State Provinces). There is an isolated deme in the southern Western Cape, a relic population around the Waterberg in Namibia, probably non-breeding and various nursery areas around the sub-continent, e.g. Wabai Hills, Zimbabwe. This species is confined entirely to southern Africa (Anderson 2000; Borello & Borello 2002; Mundy *et al.* 1992; Piper 1994).

Reasons for change

Declines in the quantity and quality of food, electrocution, collision, poisoning, drowning and disturbance etc. (Anderson 2000), see Current threats, below.

Population size

Current population size, southern Africa - breeding: 3000+ pairs with about 60+% in the former Transvaal Province and neighbouring Botswana and about 30+% along the KwaZulu-Natal-Lesotho Drakensberg escarpment and the north-east Eastern Cape (Anderson 2000; Mundy *et al.* 1992; Piper 1994,

Piper *et al.* in prep). There is an isolated and small breeding population in the Western Cape (Shaw & Scott 2003).

Current population size, southern Africa - non-breeding: possibly upwards of 3000 individuals to give a total population size of about 10,000 (Piper *et al.* in prep).

Current global population size: About 3000+ pairs and 10,000 individuals, see above as the entire population is confined to southern Africa.

Red Data Book status: world-wide "Least Concern" (BirdLife International 2004), "Vulnerable" in South Africa, Lesotho and Swaziland (Anderson 2000) and "Critically Endangered" in Namibia (Robertson *et al.* 1998) or even "Regionally Extinct" (Simmons & Bridgeford 1997).

Changes since 1997: An approximate estimate of decline in the breeding population is 0.73% p.a. and while there is a much higher apparent decline in the total population this is not credible because it is based on the number of non-breeding individuals seen at breeding colonies and roosts (Piper *et al.* in prep). However, it is the common experience of most observers that one more and more frequently sees Cape Griffons roosting overnight on high voltage electricity power-pylons, i.e. Cape Griffons are abandoning traditional roost sites in favour of these new structures. Hence, counts at colonies and roosts probably no longer yield an exhaustive enumeration of the population.

Current threats

The well-documented threats are poison, electrocution and collisions with power-lines, persecution, harvesting for use in traditional medicine and drowning in farm reservoirs (Anderson 2000). Less well-known but potentially more important are loss of habitat and decrease in food supply. However, there has been no quantification of any of these threats (Anderson 2000).

Current research, monitoring and conservation initiatives

Research

A project to estimate the physical and chemical properties of streamers produced by Cape Griffons on power-lines has just been completed (van Rooyen 2004). An exciting project in KwaZulu-Natal was to develop for Eskom a geographic information system that allows them to predict where there will be serious vulture-power-line interactions (van Rooyen 2004). An earlier model of survival in non-adult Cape Griffons (Piper *et al.* 1999) is currently being extended to estimate survival rates in adults. A number of monitoring projects (e.g. Piper & Neethling 2002; Shaw & Scott 2003 etc.) are collecting breeding productivity data that will eventually lead to an analysis of the spatial and temporal variations in fecundity. The current use of satellite-based devices on Cape Griffons in Namibia is already yielding excellent data on home range, foraging etc. that will lead to a number of important research projects (M. Diekmann personal communication). Similarly the current vulture restaurant monitoring programme will lead to a number of new research initiatives, see below.

Monitoring

The few remaining Cape Griffons in Namibia are regularly sighted at the vulture restaurant near the Waterberg (M. Diekmann personal communication). The current status of Cape Griffons in Zimbabwe is poorly known due to the constraints placed on local travel as a result of internal political strife (P.J. Mundy personal communication). There is a well co-ordinated and thorough monitoring programme in Botswana where the results are published regularly two or three times every decade (Borello & Borello 1992; Borello & Borello 1993; Borello & Borello 2002). The small population in Swaziland and southern Mozambique has been monitored from time to time (Monadjem 2003; Monadjem *et al.* 2003; Parker 1994; Parker 1995; Parker 1994). *Ad hoc* observations have been made at colonies in Lesotho in recent times, however, there is no co-ordinated programme of monitoring (Anderson 2002; Maphisa 1997; Maphisa 2001). A few sites are regularly monitored in the Eastern Cape though there are many more that could be (Vernon 2003; S.E. Piper unpublished data) while the Potberg colony in the Western Cape is extremely well monitored (Shaw 2003; Shaw & Scott 2003). There are no breeding colonies or roosts to monitor in the Northern Cape (Anderson 2000; Anderson 2003). There are no recent published reports of a monitoring programme for Cape Griffons in the Free State though there are probably still active roosts there (Colahan & Esterhuizen 1997). In KwaZulu-Natal, monitoring of some colonies (e.g. Umtamvuna, Mzimkulu, Kranskop – S.E. Piper unpublished data) was undertaken in the 1990's. However, a renewed programme of monitoring was initiated in 2000 for the many sites along the Drakensberg by staff of Ezemvelo KZN Wildlife (S. Krüger, I. Rushworth & D. van Zyl unpublished data). There are no monitoring programmes for Cape Griffons in Mpumalanga and Limpopo Provinces for which published results are available. In North West Province (Verdoorn 2000; Verdoorn 2002; Verdoorn 2003; Verdoorn 2003).

Conservation initiatives

Both in southern Africa and around the world vulture restaurants are favoured as a pro-active conservation tool to provide poison-free and good-quality meat and bone fragments to vultures (Anderson 2001; Bahat 2001; Ben-noon *et al.* 2003; Bögel & Slotta-Bachmayr 2003; Camiña 2003; Cunningham 2002; Diekmann 2003; Piper 2004; Sarrazin *et al.* 2003, Shaw & Scott 2003). Monitoring programmes are in place to detect the impacts of poisons (N. van Zyl personal communication) and electrocutions and collisions associated with power-lines (van Rooyen 2000) and appropriate mitigation action is taken by the Poison Working Group and the Eskom/Endangered Wildlife Trust Partnership, respectively. In many parts of southern Africa the relevant nature conservation authorities provide advice and guidance to landowners so that they can manage their land in a wildlife friendly manner.

Proposed future research, monitoring and conservation initiatives

Research

There is an urgent need to develop programmes that will determine the home range and foraging patterns of all vulture species in the sub-continent along the lines of M. Diekmann's project in Namibia. Little is known of the quantity and quality of food and its availability to vultures anywhere in southern Africa

and this needs to be explored urgently. There is a proposal to expand the current monitoring programme of the use of vultures in traditional medicine in KwaZulu-Natal into a full research project (S. McKean & I. Rushworth personal communication). The most urgent research projects are those that provide estimates of the impacts that each of the known mortality factors (e.g. poisons, electrocutions etc.) is having on the population.

Monitoring

A recent meeting in KwaZulu-Natal saw the setting up of an extensive vulture (all species) monitoring programme to cover both protected areas and private and communal lands (I. Rushworth personal communication). The newly formed Birds of Prey Working Group at the Endangered Wildlife Trust (which incorporates the Vulture Study Group and the Raptor Conservation Group) has as one of its aims a vulture monitoring programme for the entire sub-continent (A. Botha personal communication). This will incorporate the former Sasol Monitoring Project (Verdoorn 2001). The monitoring programmes of the Poison Working Group and the Eskom/EWT Partnership will both continue (S. Evans & C. van Rooyen personal communication).

Conservation initiatives

The current initiatives to mitigate the effects of poisons, power-lines etc. on vultures needs to be vigorously maintained while new programmes are needed to mitigate harvesting for use in traditional medicine, disturbance at roosts, breeding colonies and feeding sites.

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Rüppell's Griffon *Gyps Rueppellii*

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Introduction

Rüppell's Griffon *Gyps rueppellii* is one of the eight recognized *Gyps* species of the Old World. These include Rüppell's Griffon, Cape Griffon *Gyps coprotheres*, Eurasian Griffon *Gyps fulvus*, Himalayan Griffon *Gyps himalayensis*, Long-billed Griffon *Gyps tenuirostris*, Indian Griffon *Gyps indicus*, African White-backed Vulture *Gyps africanus* and Oriental White-backed Vulture *Gyps bengalensis*. Two sub-species of Rüppell's Griffon have been described but are contested by different authors (Mundy *et al.* 1992). Brehm described the nominate sub-species *Gyps rueppellii rueppellii* in 1852 as occurring from Senegal to the Sudan and in 1908 Salvadori described *Gyps rueppellii erlangeri* as a sub-species that occurs in the Ethiopian Highlands, Somalia and Eritrea. There is disagreement about the validity of the two sub-species and also about the distribution of the sub-species.

Distribution

The extent of occurrence of Rüppell's Griffon is from the Atlantic west coast of Africa (Senegal and the Gambia) to the Red Sea coast of northeast Africa (Ethiopia, the Sudan and Djibouti) (Mundy *et al*. 1992; Del Hoyo *et al*. 1994; Brown *et al*. 1982). This covers 23 African countries covering more than 7 million square kilometers that includes all known, inferred or projected sites of the present occurrence of the species excluding vagrants.

The area of occupancy of the species is the area defined as the area within the extent of occurrence that is occupied by Rüppell's Griffon excluding the vagrancy records. This includes all 23 African countries but is probably no more than 70% of the extent of occurrence. The population is concentrated in 11 African countries and is fragmented into 6 sub-populations. The inter-sub-population distances are not significant in terms of a species that is known to be able to cover significant distances. Breeding populations that cover roughly 10% of the area of occupancy are separated by significant distances but such breeding populations are largely linked through the extent of occurrence.

Population size

No precise data exist for the total population of Rüppell's Griffon but the estimated figure is around 30,000 individuals while a total breeding population of 22,000 individuals or 11,000 breeding pairs is given in the authoritative literature. Country figures are as follows:

West Africa	2,000 breeding pairs
Ethiopia	2,000 breeding pairs
Sudan	2,000 breeding pairs
Tanzania	3,000 breeding pairs
Kenya	2,000 breeding pairs

While these estimates agree with those of the IUCN (BirdLife International 2004) they may be too optimistic in light of the recent declines reported for West Africa (Rondeau & Thiollay 2004).

D. Houston mentioned in a film production about the Rüppell's Griffon that the total population consumes about 6 million kilograms of meat per annum.

Appearances in southern Africa during the last decade

Mundy *et al.* (1992) claimed that this species does not occur in southern Africa and no mention is made in their account of the species also occurring in Europe. However, there are several substantiated and recent sightings of Rüppell's Griffons in Europe (Camiña 2003; de Juana & Camiña 2001), the Middle East (Shobrak 2003) and southern Africa in recent times (Mundy 1997, 1998; Scott 1997; Snyman 1999; Snyman & Snyman 1997; Verdoorn 1997). The southern African records are now confirmed photographically.

In southern Africa, Mundy (1997, 1998) recorded Rüppell's Griffon twice in the Zambezi valley. Scott (1997) recorded a Griffon close to the Potberg Cape Griffon colony that appeared to be a hybrid between a Rüppell's Griffon and possibly a Cape Griffon. This individual was photographed at the feeding site. Snyman recorded and photographed a Rüppell's Griffon at the Blouberg Cape Griffon colony in 1995. According to earlier observers a Rüppell's Griffon was seen at the Blouberg Cape Griffon colony in 1991 (W. Neser personal communication). I recorded and photographed a juvenile Rüppell's Griffon at the Nooitgedacht Cape Griffon colony in May 1995 (Verdoorn 1997). The bird was photographed at the vulture restaurant in the presence of Cape Griffon. Benson (C. Van Rooyen personal communication) *allegedly* recorded a Rüppell's Griffon at the Kransberg (also known as Groothoek) Cape Griffon colony. The date of this observation is unknown.

The most significant occurrence of Rüppell's Griffon in southern Africa is that of the individual that arrived at Blouberg in 1995. Snyman (1999) recorded the interbreeding between a male Rüppell's Griffon and a female Cape Griffon as early as 1998. The pair produced and successfully fledged offspring in two breeding seasons while in between their offspring died and remains were recovered under the cliffs for genetic analysis. In 2004 Snyman (personal communication) found another male Rüppell's Griffon breeding with a female Cape Griffon at Blouberg. These records may be sufficient evidence to accept Scott's (1997) belief that the specimen photographed at Potberg was a hybrid between Rüppell's Griffon and Cape Griffon.

Conservation status

According to Jackson (Mundy *et al.* 1992) the use of strychnine against predators in the early parts of the 20th century caused a significant decline in the Rüppell's Griffon numbers in the Kenyan Highlands. Pennycuick noted that the Hell's Gate population was in the 1970s a mere remnant of its former glory due to encroaching agriculture in the foraging range of the species. The Kotorkoshi colony had also declined drastically in the 1930s. No other significant declines have been recorded and the current population appears to be stable.

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African White-backed Vulture *Gyps africanus*

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Distribution

The African White-backed Vulture (AWbV) is widespread in sub-Saharan Africa, but absent from desert and forest areas (Mundy *et al.* 1992). The AWbV enjoys a widespread distribution in southern Africa, especially Botswana, the eastern and northern areas of Namibia and parts of Zimbabwe (Borello & Borello 1997; Mundy 1997; Simmons & Bridgeford 1997; Piper 2005). It is also present in the Lowveld areas of Swaziland (Parker 1994; Mundy 1997), where there is a healthy breeding population (Monadjem 2001, 2003a; Monadjem & Garcelon in press). The AWbV is uncommon in Mozambique, probably because of the decimation of wild ungulates during the recent civil war (Parker 1997, 1999). In South Africa it is confined to the northern and eastern region of the country, being most frequently encountered in the Kruger National Park and adjacent conservation areas, northern KwaZulu-Natal, and Kalahari region of the Northern Cape and North West Provinces (Mundy 1997). It is also present as a breeding species in the Free State (Colahan & Esterhuizen 1997).

The AWbV's distribution correlates with drier woodlands and tall trees, such as *Acacia* spp, *Ficus* spp. and *Adansonia digitata*, which it uses for roosting and breeding (Mundy *et al.* 1992; Mundy 1997). The AWbV also breeds on electricity pylons, albeit rarely (Ledger & Hobbs 1985; Anderson 2001).

The species is most common in sparsely inhabited areas (such as the Kalahari of the Northern Cape Province) and large conservation areas (Kruger National Park, northern KwaZulu-Natal conservation areas and Kgalagadi Transfrontier Park, Mundy 1997).

In the former Cape Province there has been no significant change in distribution (Boshoff *et al.* 1983), while in the former Transvaal there is evidence that the range of the AWbV has decreased markedly (Tarboton & Allan 1984). Possible reasons for these changes are given below (under Current threats). During recent times it has possibly become more common on the highveld areas of Zimbabwe (Mundy 1997). The species may be increasing in numbers and range in Swaziland, partly through the establishment of a vulture restaurant at Mafutseni (Monadjem *et al.* 2003). The expansion of the protected area network in South Africa (such as the newly established Madikwe Game Reserve and Tswalu Private Nature Reserve in the North West and Northern Cape Provinces respectively) has probably benefited the AWbV (e.g. Benson 1997) and the noted increase in the range of this vulture in KwaZulu-Natal may be in response to the establishment of new game farms in this Province (Piper & Johnson 1997).

Population size

The AWbV is the most common vulture in Africa (Mundy *et al.* 1992) and the most numerous in southern Africa (Mundy 1997). The global (i.e. African) population has been estimated at 100 000 pairs or 270 000 individuals (Mundy *et al.* 1992). The total population in southern Africa has been estimated at 15 000 pairs or 40 000 individuals (Table 1) (Mundy 1997; Anderson 2000a). In South Africa it was determined that the former Transvaal Province supported a population of about 2500 pairs, 65% occurred in the lowveld conservation areas (Tarboton & Allan 1984); this probably remains unchanged today (Benson 1997). The populations in other areas of South Africa have been estimated at 350 (Piper & Johnson 1997) to 400+ (Johnson *et al.* 1998) pairs in KwaZulu-Natal, 500 pairs in the Northern Cape (Anderson 2004a) and 100 pairs in the Free State (Colahan & Esterhuizen 1997). Other population estimates are 100 breeding pairs in Mozambique and 300 breeding pairs in Swaziland (Parker 1994, 1997; Monadjem & Garcelon in press). The total population in South Africa (and Swaziland) is therefore about 3500 pairs or 9000–10 000 individuals (Table 1) (Anderson 2000a).

Although it has been suggested that the population has declined by at least 10% during the past three generations (Anderson 2000a), there are no data to suggest that there has been any significant change in the size of the population of AWbVs in southern Africa during the past 10 years. Better population estimates are however now available for some areas, such as in the Northern Cape, where recent aerial surveys have been conducted (Murn 2001; Murn *et al.* 2002; Anderson 2004). There has possibly been an increase in the size of the AWbV population in Swaziland since 1980 (Monadjem personal communication), but this could also be attributed to better knowledge of the size of the breeding population (Monadjem 2001, 2003a; Monadjem & Garcelon in press). There are conflicting reports from Namibia, with suggestions that the population has both increased (increase in numbers of birds outside protected areas in northern Namibia; T. Osborne personal communication) and decreased (M. Diekmann personal communication, R.E. Simmons personal communication). In Zimbabwe, the distribution has expanded onto the highveld areas and it has also been suggested that the population may be increasing (P.J. Mundy personal communication).

The AWbV breeds in several Important Bird Areas (IBAs), such as the Hluhluwe-Umfolozi Park (200-250 pairs), Dronfield Farm (50-60 pairs), and Ndumo Game Reserve (50-60 pairs) (Barnes 1998). The population in the Kruger National Park has been estimated at between 600-1000 (Herholdt 1997) and 1404 (Tarboton & Allan 1984) breeding pairs. The Kgalagadi Transfrontier Park population (i.e. on the South African side of the Park) comprises approximately 60 pairs (Herholdt 1995; Anderson & Maritz 1997). The total population of AWbVs in 15 South Africa and Swaziland IBAs has been estimated at 1400 pairs (3800-5900 individuals) (Barnes 1998), which is about 40-50% of the total South African population (Anderson 2000a).

Table 1. Number of breeding pairs of African White-backed Vultures in southern Africa.

Country/Province	Breeding pairs	Source of data
Swaziland	300	Monadjem & Garcelon (in press)
Mozambique	c. 50	Parker (1997)
Zimbabwe	c. 2000	Mundy (1997)
Botswana	?	
Namibia	6000+	Simmons (personal communication)
Northern Cape	c. 500	Anderson & Maritz (1997); Anderson (2004)
Free State	c. 100	Colahan & Esterhuizen (1997)
KwaZulu-Natal	400+	Piper & Johnson (1997)
"Transvaal"	c. 2500	Tarboton & Allan (1984)
South Africa	c. 3500	Anderson (2000a)
Southern Africa	c. 15 000	Mundy *et al.* (1992)

Current threats

Although not listed in the previous *South African Red Data Book – Birds* (Brooke 1984), the AWbV is now listed as "vulnerable" in *The Eskom Red Data Book of Birds of South Africa, Lesotho & Swaziland* (Anderson 2000a). It is listed as 'near-threatened' in the new *Threatened vertebrates of Swaziland* (Monadjem *et al.* 2003) and will be listed as 'near-threatened' in Namibia (Simmons & Brown in prep).

The major threats are probably loss of habitat, through a change in land-use, and declining food availability (Boshoff *et al.* 1983). There are various examples of how this is affecting vultures. In the former Transvaal (and today's Gauteng) land-use change is one of the key factors responsible for the decline in AWbV numbers (Tarboton & Allan 1984; C. Whittington-Jones personal communication). Habitat fragmentation has also resulted in the localisation of AWbV breeding colonies in a few protected areas in Swaziland (Monadjem 2003a). It has been suggested that bush encroachment in Namibia has affected the AWbV, mainly through impacts on the ability of the vultures to forage (M. Diekmann personal communication). Declining tree numbers, which may limit nesting opportunities (due to the combined effects of elephants and fire in savanna, and in the riparian zone due to floods and drought), may have had an affect on vulture numbers in the Kruger National Park (I.J. Whyte personal communication). Changing land-use practices in Zimbabwe (due to the land reform programme) may be impacting on vultures through a change in livestock numbers, disturbance and the use of poisons (P.J. Mundy personal communication). Although a large proportion of the population breeds in protected areas, in the Northern Cape, for example, *c.* 80% of the breeding pairs are located on private land (Anderson & Maritz 1997). Therefore, not all breeding colonies are adequately protected.

Improved domestic livestock management practices result in less food being available to vultures (Piper 2005). The large-scale reduction of the indigenous fauna in Mozambique, as a consequence of civil war, has caused a major decline in the food base of the AWbV (Parker 1997, 1999).

The feeding style of the AWbV makes it very vulnerable to poisoning, especially when carcasses are laced with poisons in an attempt to kill Black-backed Jackals *Canis mesomelas* and other so-called problem animals (Verdoorn 1997). There have been several incidents of poisoning of AWbVs (Van Jaarsveld 1986, 1987; Butchart 1987; Anderson 1993, 1995; Verdoorn 1997, 1999; Snyman 2000; Bridgeford 2001). The poisonings can also be deliberate, i.e. the persecution of vultures by farmers (rarely), or in order to acquire vulture parts for medicine and superstitious purposes by traditional healers (apparently increasing) (Mundy *et al.* 1992; Govender 2002). An extensive record of poisonings showed 499 AWbVs poisoned in 32 incidents (average = 15.6 per incident) in South Africa for the period 1995-2002 (=62.4 birds per year) (Poison Working Group unpublished data; Piper 2005).

Acaricides containing organochlorine and organophosphate compounds and used on livestock may also affect vultures (Mundy *et al.* 1982; Anderson 2000c; G.H. Verdoorn personal communication).

AWbVs roost (and breed) on transmission, distribution and reticulation power-line structures and this behaviour makes them vulnerable to electrocutions (Anderson & Kruger 1995; van Rooyen & Piper 1997, 2000; Kruger 1999; Kruger *et al.* 2004) and collisions (Oatley *et al.* 1998). There are currently (up to April 2004) records of 166 AWbV mortalities (155 electrocutions and 11 collisions) on the Eskom-EWT Partnership database (C.S. van Rooyen personal communication).

Vultures occasionally drown in farm reservoirs and there have been at least three mass drownings of AWbVs in these structures (Knight 1987; Anderson 1995; Anderson *et al.* 1997, 1999; Anderson 2000b; Bridgeford 2001).

There are few records of bone abnormalities of nestling AWbVs (Verdoorn & Terblanche 1995), as has been recorded in the Cape Vulture (Mundy & Ledger 1976).

The veterinary drug, diclofenac, has recently been shown to be responsible for the precipitous decline of vulture populations in the Indian subcontinent (Oaks *et al.* 2004) and, although this drug is apparently not used in South Africa (and possibly in southern Africa), other non-steroidal anti-inflammatory drugs are extensively used to treat horses and dairy cows (Anderson *et al.* in prep). It is likely that AWbVs and other vulture species may be exposed to these drugs, especially when carcasses are deposited at vulture restaurants (Anderson *et al.* in prep).

Other threats include direct persecution (Mundy *et al.* 1992; Oatley *et al.* 1998) and road casualties (Kingsley 1999; Piper 2005), but these probably have a negligible impact on the southern Africa population of AWbVs.

Current research, monitoring and conservation initiatives

Current AWbV research in southern Africa includes the following:

1. Ringing of nestlings with metal rings and/or colour rings in Northern Cape, Free State, Namibia and Swaziland (Table 2). This research has

generated some interesting resightings (Anderson unpublished data) and recoveries (Oschadleus 2002).
2. Radio tracking at Waterberg, Namibia (M. Diekmann).
3. Nesting success of a breeding population along the Siphiso River, Mlawula Nature Reserve, Swaziland (A. Monadjem) and Dronfield/Ingelwood farms, Kimberley, Northern Cape (M.D. Anderson & A. Anthony).
4. Investigation of nest site fidelity in northern Namibia, using DNA band sharing coefficients (T. Osborne).
5. Use of vultures by traditional healers in Namibia (P. Cunningham) and KwaZulu-Natal (S. Mckean)
6. Haematozoa studies of nestlings in Kimberley area (M.D. Anderson & M. Peirce) and other parasite studies in Waterberg area (M. Diekmann).
7. Study to determine the effects of lead (from lead bullets) on particularly AWbV nestlings in the Kimberley area (M.D. Anderson).
8. Determination of nest site characteristics (C. Murn) (Monadjem 2003b).
9. Possible inter-breeding with Cape Griffons in northern Namibia (M. Diekmann).
10. Methods to differentiate sexes of Cape Griffons and AWbVs (M. Diekmann).
11. Morphometrics and moult of AWbVs and Cape Griffons at the Waterberg (P.J. Mundy & M. Diekmann).
12. Study to determine appropriate capture methodologies for AWbVs and Cape Griffons at the Waterberg (M. Diekmann).
13. Telemetry-attachment methods for AWbVs and Cape Griffons (M. Diekmann, A. Scott, M. Scott).
14. Body condition parameters of Cape Griffons and AWbVs (urea, urate, calcium, total protein, albumin, AST) (M. Diekmann & I. Spitze).
15. Winter *vs* summer feeding needs of captive and wild Cape Griffons, Lappet-faced Vultures and AWbVs in the Waterberg, Namibia (M. Diekmann).
16. Effects of diclofenac and other non-steroidal anti-inflammatory drugs on AWbVs (G. Swan, RSPB and VSG) (Anderson 2003; Anderson & Benson 2003).
17. S.E. Piper maintains an extensive computerised vulture literature database.

Table 2 Localities where AWbV nestlings are currently ringed in southern Africa

Area, Province, Country	Researchers
Kimberley, Northern Cape	M.D. Anderson, A. Anthony *et al.*
VanZylsrus/Askham, Northern Cape	A.W.A. Maritz
Kimberley, Free State	E. Fuller & B. Colahan
Sandveld Nature Reserve, Free State	B. Colahan
Swaziland	A. Monadjem
Central Namibia	P. Bridgeford
Northern Namibia	T. Osborne & W. Versfeld
Waterberg NP, Northern Namibia	M. Diekmann & collaborators

Current AWbV monitoring in southern Africa includes the following:

1. Vulture counts at carcasses in Etosha National Park (T. Osborne)
2. Monitoring of ringed birds, e.g. at vulture restaurants in Swaziland (A. Monadjem).
3. *Ad hoc* road surveys, such as in the Northern Cape (M.D. Anderson).
4. Documentation of mortality events, including reservoir drowning (M.D. Anderson), electrocutions (C.S. van Rooyen) and poisonings (Poison Working Group).
5. Documentation of out of range sightings, interesting observations, and breeding information, such as in the Northern Cape (M.D. Anderson), Zimbabwe (P.J. Mundy) and Botswana (W. Borello & R. Borello, BirdLife Botswana Nest Record Card Scheme).
6. Resighting data of ringed Cape Griffons and AWbVs at the Waterberg; in order to obtain information on their use of the REST restaurant and their feeding needs (M. Diekmann).
7. The aim of the Sasol Vulture Monitoring Programme, conducted under the auspices of the Vulture Study Group, is primarily to monitor the status of Cape Griffons at their breeding sites, but it is planned to collect data on trends in breeding colony sizes and reproductive success for other vultures too (including the AWbV).

Current AWbV conservation in southern Africa includes the following:

1. Landowner extension programmes; for example, in the Northern Cape (Kalahari Raptor Project, Platberg-Karoo Raptor Project and Department of Tourism, Environment & Conservation).
2. Modifications of vulture-unfriendly electricity pylons, especially in South Africa (Eskom-EWT Partnership), and especially of the staggered vertical power-line structures (Kruger *et al.* 2004).
3. Modification of farm reservoirs (Anderson & Taljaard 1994a,b; Anderson undated).
4. Landowner extension programmes of the Endangered Wildlife Trust's Vulture Study Group, Poison Working Group and Raptor Conservation Group (now Birds of Prey Working Group).
5. Care and rehabilitation of sick, poisoned and injured vultures at several facilities in southern Africa, including the De Wildt Vulture Unit.
6. Production of resource materials about vultures (Vulture Study Group). In some areas, such as the Northern Cape, area-specific resource materials are being developed (e.g. Anderson & Kruger 2001, 2002; Anderson 2002b).
7. In the Northern Cape there are several novel conservation initiatives. These include: (a) presentation of raptor certificates to landowners who have breeding vultures on their properties (Anderson 1994, 2000c), (b) presentation of the annual Gariep Raptor Conservationist Award to an individual (or organisation) who (which) has made a significant contribution to raptor conservation in the Province (Anderson 2000c), (c) development of the Kalahari Raptor Route (Anderson & Maritz 2003, 2004) and (d) training of bird guides who will take bird-watchers to see vultures (Biggs *et al.* 2003a,b; Anderson & Biggs 2004).
8. Several documents have been produced by the Rare and Endangered Species Trust in order to promote vulture conservation issues in

northern Namibia (M. Diekmann personal communication). These include a predator ID sheet (for farmers) and a vulture activity sheet (for children).

Proposed future research, monitoring and conservation initiatives

Proposed AWbV research in southern Africa includes the following:

1. Study to determine the relative importance of the different threats, which will aid in deciding which threats need priority attention.
2. Study to determine to what extent food is limiting AWbV populations in southern Africa, and to what extent possible food shortages could be alleviated by, for example, changing farm management practices and establishing vulture restaurants.
3. Surveys of AWbV breeding colonies in Northern Cape Province (Kalahari), North West Province, Kruger National Park, Namibia and Botswana.
4. Properly designed survey at repeated intervals to establish breeding numbers, habitat preferences, and current threats in Botswana (W.D. Borello personal communication).
5. Continue the annual colour-ringing of AWbV nestlings at various localities in southern Africa.
6. Determine the role of vultures in the spread of anthrax and botulism.
7. Studies of vultures (possibly using satellite telemetry or GPS technology), especially to determine their foraging, roosting and breeding ranges in relation to different land-use practices.
8. Research to determine the impact of traditional medicine on vulture populations (as well as methods used to acquire vultures, uses of vulture parts, etc.).
9. Determine the effects of lead bullets on, in particular, AWbV nestlings.
10. Analyse recovery (and observation) data of ringed AWbV to get some information on the movement/dispersal patterns of these birds.
11. Continue with research on the affects of non-steroidal anti-inflammatory drugs on AWbVs and other vultures.

Proposed AWbV monitoring in southern Africa includes the following:

1. Continue collating information on the different mortality factors (drownings, poisonings and electrocutions, etc.) and monitor the impact of these factors on AWbV populations.
2. Continue with raptor road surveys and assist the Avian Demography Unit with the development and implementation of a RAPTOUR project.
3. Implement a resighting programme in order to generate observations of colour-ringed AWbVs.
4. It has been suggested that African *Gyps* monitoring projects (i.e. continent-wide projects) should be initiated (Anderson & Mundy 2001; Anderson *et al.* 2002).

Proposed AWbV conservation in southern Africa includes the following:

1. Continue with landowner extension programmes. The focus of the extension programme should be on promoting selective problem

animal control techniques, in order to address the problem of the inadvertent poisoning and trapping of vultures and other raptors.

2. The concept of vulture restaurants, used to provide vultures with a source of poison-free food and to supplement the amount of available food, should be promoted (Butchart 1988; Anderson & Scott 1996a,b; Scott & Anderson undated). However, whether the artificial provisioning of food at these sites contributes significantly to the food requirements of the species remains to be determined. Also, it may be necessary to review the number and placement of vulture restaurants in southern Africa and determine, for example, whether these feeding stations need to be established at additional key sites (such as the 100,000 ha Dinokeng Game Reserve proposed for the north-east of Gauteng).
3. Awareness campaigns, especially about selective problem animal controls and the negative affects of poisons need to be undertaken throughout the range of the AWbV.
4. Continue with the reprinting and development of vulture resources materials which can be used in landowner extension programmes, environmental education, etc.
5. General public awareness and education programmes about vultures, using written media, radio, television, and talks to different target audiences.
6. Depending on the outcomes of the non-steroidal anti-inflammatory drug research being conducted by Gerry Swan (Ondersterpoort, University of Pretoria), threats to southern Africa's vultures by these veterinary drugs will need to be addressed (Anderson 2002a; Anderson *et al.* 2002).
7. Initiate an awareness programme amongst traditional healers in order to reduce the impact of harvesting of vultures on populations of AWbVs and other vulture species.
8. Encourage electricity utilities in southern Africa to construct raptor-friendly power-lines and modify hazardous power-line structures.
9. Continue to promote the modification of farm reservoirs to prevent the drowning of vultures.
10. As the majority of AWbVs breed on private farmland, encourage the protection of vulture breeding sites; for example, consider registering properties with AWbV breeding colonies as Natural Heritage Sites or Important Bird Areas.
11. Investigate the possibility of developing incentive schemes for landowners who conserve vultures and, where necessary, prosecute farmers who conduct illegal activities that impact on these birds.

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Lappet-faced Vulture *Torgos tracheliotos*

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Distribution

Historical distribution

At the turn of the 20th century, Lappet-faced Vultures *Torgos tracheliotos* were found in most of Africa. They were widespread in South Africa and almost reached Cape Town. The Lappet-faced Vulture favours semi-arid to arid areas, with scattered trees. The birds were found in the Sahara and Arabian deserts and in the Sahel zones adjoining these. Until the Second World War, it was common in the Negev desert. South of the equator, it was widespread in the Kalahari and Namib. It was however, also found in areas of higher rainfall such as northern Tanzania, Zambia, South Africa and West Africa (Mundy *et al.* 1992).

Current distribution

Now, at the turn of the 21st century, Lappet-faced Vultures have disappeared from many of their previous haunts.

In South Africa, it is no longer found south of 30° S (Anderson & Maritz 1997). The last birds in the eastern Cape were reported in 1966 (Mundy *et al.* 1992). The good news is that in the northern Cape, above 30° S, their numbers appear to be slowly increasing over the past few years (Anderson & Maritz 1997, Anderson 2001). The largest numbers in South Africa appear to be in the Kruger National Park and northern Zululand (Mundy *et al.* 1992).

In other southern African countries, Namibia seems to have the largest population, favouring the arid Namib Desert and Etosha National Park. This is in areas largely undisturbed by man, mainly conservation areas, where the rainfall is low and where there are suitable trees for nesting (Simmons & Bridgeford 1997).

In Botswana, the species is widespread and breeds in the Kgalagadi Transfrontier Conservation area, Makgadikgadi Pan and the Okavango (Borello & Borello 1997; Mundy 1997a).

In Swaziland, Parker (1997) estimated three breeding pairs, a figure confirmed by Monadjem & Garcelon (in press).

In Zimbabwe, Lappet-faced Vultures appear to be doing well, breeding in the north-west, south-west and south-east, but not in the “highveld” *i.e.* above 1 200 m. Because Zimbabwe is a country dedicated to cattle and game ranching, vultures live in an increasingly supportive environment (Mundy 1997b).

In southern Mozambique Parker (1997) estimated that there were ten breeding pairs, concentrated in the north-west of the region, bordering the

Kruger National Park and Gonarhezou. The numbers of all vultures have probably declined because of the extirpation of most larger mammals from the region during the civil war (Parker 1997).

While there is concern for the dwindling numbers of vultures in southern Africa, the Lappet-faced Vulture is extinct in Morocco, Algeria, Tunisia and only a few pairs remain in southern Egypt. It is considered common in the Sudan and breeds in small numbers in other North African countries (Mundy *et al.* 1992).

In Israel, the vulture population has declined drastically over the past century and they are now extinct in the wild (Yosef & Hatzofe 1997). In the Arabian peninsular, Lappet-faced Vultures appear to be increasing or "increasingly discovered" since the early 1990's in Saudi Arabia, Yemen, Oman and the United Arab Emirates (Mundy *et al*. 1992; Ferguson-Lees & Christie 2001). According to Newton & Shobrak (1993), there is a threefold increase in Saudi Arabia.

Reasons for change

The decrease in range of the vultures, is due to expanding human populations throughout Africa and changing land use patterns (Verdoorn 1997a; Vernon 1997). This impacts negatively on the birds in various ways e.g. disturbance at the nest (Mundy *et al.* 1992), destruction of nesting trees, as in Namibia's north-eastern rivers (Simmons & Bridgeford 1997). Even an increase in tourists and tourist vehicles negatively affects the breeding of Lappet-faced Vultures, as seen in the Tsauchab River in the Namib-Naukluft Park (NNP) (Bridgeford 2003). In 2002, no birds bred in this river, and in 2003 there were four breeding attempts, which produced one chick (personal observation). Inadvertent poisoning however, is the biggest killer in southern Africa (Brown 1986; Mundy *et al.* 1992; Simmons 1995; Simmons & Bridgeford 1997; Verdoorn 1997b; Bridgeford 2001 & 2002b).

Electrocution and collision with power lines takes its grim toll every year, although other vultures are more prone to this way of being killed than Lappet-faced Vultures (van Rooyen 2000).

Anderson & Maritz (1997) and Anderson *et al.* (1999) highlighted the problem of vultures drowning in farm reservoirs. Of the 322 drowned birds recorded by the authors, only three were Lappet-faced Vultures.

Other possible causes in the demise of vulture populations include:

- Use in traditional medicine
- Decline in food resources
- Egg collecting
- Direct persecution.

Population size

Southern Africa

The figures being used in publications on vulture populations are all over ten years old. The figure for Lappet-faced Vultures is 1 000 pairs or 3 000

individuals (Mundy *et al* 1992). BirdLife International (2004) and Ferguson-Lees & Christie (2001) all quote the above figures. If these population estimates are used, then Namibia holds approximately 50% of the southern African population (Simmons & Brown in prep).

Global

Again, there is no change in the estimates given by Mundy *et al* (1992).

8 000 birds in Africa.
500 birds in Arabia.

Red data book status

Globally the Lappet-faced Vulture is listed as "vulnerable" (BirdLife International 2004). It is believed that the species has experienced more than 25% decline within a period of ten years or three generations (BirdLife International 2004). In South Africa and Namibia, this species is also listed as "vulnerable" (Simmons & Brown in prep).

Population change since 1997

As mentioned above, population figures are estimates made over ten years ago by Mundy *et al.* (1992). No new figures are available, but from the continuous reports of poisoning, electrocution, collision with power lines, drowning and direct persecution, there must have been a population decline since 1997. It must be kept in mind that these birds only reach sexual maturity at about five or six years of age, lay only one egg and the breeding cycle lasts almost a year. In addition, the recorded mortalities are only the tip of the iceberg, as most go unreported (Bridgeford 2001).

Current threats

The threats have not changed over the past few years. The most important are:

- Inadvertent poisoning.
- Drowning in farm reservoirs.
- Electrocution.
- Collision with power lines.
- Disturbance during breeding.
- Habitat destruction i.e. nest tree removal.
- Changing land use patterns.

Current research

In South Africa, there is a ringing project in the northern Cape. The number of birds ringed varies from year to year as they move to new nest sites (Anderson 2003).

In Namibia Lappet-faced and other vulture chicks, are ringed annually in the Etosha National Park and this project is continuing. A total of 78 Lappet-faced Vultures chicks have been ringed in the past six years (W. Versveld personal communication). The ringing project in the Namib-Naukluft Park, Namibia, which started in 1991 is now in its 13th year (Bridgeford, P. & M. 2003).

Monitoring of breeding birds is undertaken in Swaziland (Monadjem 2003).

Proposed future research

One of the most important projects is to try to obtain reliable estimates of the population size. Aerial surveys of breeding birds would give the most accurate assessment of the total number of birds. Bridgeford (2002a, 2003) and Monadjem & Garcelon (in press) have successfully used aerial surveys to find breeding birds. Borello & Borello (1997) also suggest aerial surveys of nesting Lappet-faced Vultures, especially because of the size of the areas involved and their remoteness. A factor, which must be kept in mind when doing an aerial survey of breeding vultures, is rainfall. Rainfall in an arid environment like the Namib, can negatively affect breeding (Bridgeford & Bridgeford 2003), and one-off surveys need to consider this.

In Namibia, the detrimental effect of power lines on vulture populations should be investigated. Although a lot of information is available in South Africa (van Rooyen 2000), very little is known about this perceived problem in Namibia.

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White-headed Vulture *Trigonoceps occipitalis*

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Introduction

Despite its wide distributional range, little is known about the biology or ecology of the White-headed Vulture. In fact, Virani & Watson (1998) scored it as the most poorly-known vulture species in East Africa. The IUCN, which lists species according to the threat they face globally, lists it as "Least Concern" (BirdLife International 2004). However, regionally this species is listed as "Endangered" in Swaziland (Monadjem *et al.* 2003), "Vulnerable" in South Africa (Anderson 2000) and East Africa (Bennun & Njoroge 1996), suggesting that it is facing some level of threat, at least at the local scale.

Distribution

The White-headed Vulture is confined to sub-Saharan Africa where it is widely distributed in savanna habitats (Mundy *et al.* 1992). Breeding has been confirmed in 24 countries, and suspected in a further 12 (Dowsett & Forbes-Watson 1993). Due to recent atlasing initiatives, the map in Mundy *et al.* (1992) can be extended in Tanzania (Baker & Baker in prep) and southern Mozambique (Parker 1999).

Due to the nature of historical records, it is difficult to assess whether this species has undergone a range contraction. The type locality for this species is Kuruman in the Northern Cape, South Africa (Mundy *et al.* 1992), where it no longer occurs. This, however, only represents a range contraction of a few hundred kilometres at most. In fact, the type specimen may represent an individual dispersing, in which case the species may not have been breeding in the area at all. In the 1957 edition of Roberts (Maclachlan & Liversidge 1981), the distribution map for this species includes the entire former Transvaal province (South Africa) as well as southern Namibia. Neither area currently supports breeding White-headed Vultures, but supporting evidence for past breeding in these two areas is not available. Hence, regarding the issue of range contraction, we may speculate (but cannot confirm) that the species could have disappeared from the extreme southern parts of its historical range.

Comparison of the distribution of this species in the former Transvaal and KwaZulu-Natal in the 1970s and 1980s (Cyrus & Robson 1980; Tarboton *et al.* 1987) with recent times is made possible by the southern African bird atlas project conducted in the late 1980s and early 1990s (Harrison *et al.* 1997). The distribution maps of the earlier atlases are almost identical to that shown in the recent bird atlas. Thus, any range contraction that may have occurred, must have taken place before the 1970s.

Population size

The only global population estimates for this species are from Mundy *et al.* (1992) who estimated a total of 2 600–4 700 pairs and 7 000–12 500 individuals.

Based on the known range of the species and densities of breeding pairs in different habitats, it is possible to develop a theoretical estimate of the global population. Using the base map of Mundy *et al.* (1992), one can extend the range in Mozambique (Parker 1999) and Tanzania (Baker & Baker in prep). This covers a range of 8 million km^2 as calculated by GIS (A. Monadjem personal observation).

Various density estimates are available, mostly from southern Africa. At the low end of the range, 10 breeding pairs are known from Etosha National Park (M. Diekmann personal communication) which covers about 20 000 km^2 or a density of 1 pair/2000 km^2. At moderate densities (e.g. 4 pairs in 1 636 km^2 in Serengeti National Park) 1 pair occupies around 400 km^2 (Pennycuick 1976), while at high densities (e.g. 9 pairs in 960 km^2 in Mfolozi-Hluhluwe Game Reserve) 1 pair occupies 100 km^2 (Mundy *et al.* 1992). Assuming that half of the African range of this species lies in low density habitat, a quarter in moderate and a quarter in high density habitat, this gives an estimate of 27 000 pairs. It must be borne in mind that this is an estimate of the theoretical maximum number of pairs and should be treated as such. However, it is unlikely that the species breeds throughout its range, and the actual figure probably lies well below this one.

Population estimates are available for some southern Africa countries (Table 1), which place this population at less than 450 breeding pairs. Even with the inclusion of pairs breeding in Botswana and northern Namibia (outside of Etosha National Park), the southern African total is unlikely to exceed 500 pairs. Zimbabwe is the stronghold for this species in this region, supporting about 60% of the population. It should be highlighted that no realistic estimates are available for Botswana which represents an important gap in our knowledge. The estimate for Namibia only covers Etosha National Park; the numbers of breeding pairs present outside of this protected area are unknown. Finally, the Mozambique estimate is not based on enumeration of nests (Parker 2004).

Table 1. Population estimates for White-headed vultures in southern Africa. The figures represent breeding pairs.

Country/region	No. breeding pairs	Source
Zimbabwe	300	Mundy (1997)
Mozambique	50	Parker (2004)
Kruger National Park	<50	Benson (1997)
KwaZulu-Natal	15	Piper & Johnson (1997)
Etosha National Park	10	M. Diekmann (personal communication)
Swaziland	5	Monadjem & Garcelon (in press)
Botswana	Unknown	Borello (2004)
Total	430	

Current threats

There appear to be three main threats facing this species.

- Habitat disturbance
- Poisoning
- Harvesting for traditional medicine

The White-headed Vulture is strongly associated with protected areas (see below), and does not appear to occur in significant numbers beyond them in southern Africa. This is accentuated by the findings of Herremans & Herremans-Tonnoeyr (2000) that show that sightings of this species decline sharply at the boundary of protected areas. Furthermore, they show that sightings actually decline within protected areas even before the boundary has been reached. Therefore, White-headed Vultures are most abundant in core regions of conservation areas, and disappear almost entirely beyond their boundaries. The cause of this relationship is not known but may be due to poisoning or other subtle and insidious factors such as habitat degradation or disturbance.

White-headed vultures are not frequently reported as having been poisoned. However, an incident possibly involving five birds was recently reported from northern Namibia (Bridgeford 2001). Due to the small population of this species in southern Africa, any poisoning is likely to send the species spiraling into decline.

It is known that this species is used for traditional medicine (Derwent & Mander 1997), but the impact of this on vulture numbers has not been quantified. Due to the potential threat that this may pose, this threat needs to be urgently assessed.

At present, this species has not been reported to have suffered mortality due to collision with power lines or electrocution (van Rooyen 2000); nor has the species been reported to have drowned in farm reservoirs (Anderson *et al.* 1999). This species is legally protected in all southern African range states, with the possible exception of Mozambique (where the legal status of this species is unknown).

Current research, monitoring and conservation initiatives

Practically no research, monitoring or conservation action has been conducted on or for this species. As mentioned above, Herremans & Herremans-Tonnoeyr (2000) showed this species to be confined to the centres of large protected areas (at least in Botswana). They also showed that it was the least sighted vulture species in Botswana, based on extensive road counts.

Similarly, Harrison & Navarro (1998) showed that White-headed Vulture sightings are significantly correlated with the size of protected areas, with reporting rates being higher in larger protected areas. This suggests that smaller protected areas, regardless of the quality of the habitat, may not be able to adequately protect this species.

Monadjem & Garcelon (in press) surveyed vulture nests in Swaziland by air, during which they recorded five nests of White-headed Vulture. This is the first estimate for this species in Swaziland based on enumeration of nests. Mean inter-nest distance was 4.3 km.

Finally, some miscellaneous and anecdotal observations of interest have been published recently. Biggs (2001) recorded 2-5 birds at a quelea colony in Kruger National Park, suggesting that these birds may make use of this super-abundant food source when available. Oatley *et al.* (1998), summarising ringing statistics for birds of prey, mentioned that 77 White-headed Vultures had been ringed in southern Africa, of which three have been recaptured, all within 100 km of the ringing site. Twelve egg laying records are available from Botswana, all between May and July (Skinner 1997). Scholte (1998) suggests that White-headed Vultures are rarer in West Africa than suggested by Mundy *et al.* (1992), but does not provide figures. Finally, Salewski (1997) reported seeing "about 20" White-headed Vultures soaring above an elephant carcass in Ivory Coast. This last observation seems rather incredible considering that this species usually gathers at carcasses singly or in pairs.

Proposed future research, monitoring and conservation initiatives

Very little is known about this species, so almost any research or monitoring would be valuable for the conservation of this species. However, several areas require urgent attention. With regards to research, the big question to address should be why this species is so confined to protected areas (at least in southern Africa)? The answer to this question would certainly impact on its conservation status, as it might be possible to reverse some of the factors preventing it from successfully occupying areas outside of reserves.

A second research question concerns the nature of its diet. Where does this species get most of its nutritional requirements? Does it feed predominantly on small carcasses as suggested by Mundy *et al.* (1992)? How much food does it obtain from large carcasses? Does it hunt and kill its own prey? These are important questions that have yet to be answered.

A final important research question relates to movement patterns of juveniles and sub-adults. How far do these individuals range? Do they return to breed in their natal areas? Or do they disperse far?

With regards to monitoring, a baseline survey of the breeding pairs in Botswana may be critical to our understanding of the core of this species distribution in southern Africa. Baseline surveys in northern Namibia and Mozambique are also required.

Finally, a better understanding of breeding success and factors impinging on it need to be developed. This can be done through the monitoring of nests.

Conclusion

This is one of Africa's least studied vultures. Very little is known about its basic biology, and threats to its survival have yet to be determined, let alone quantified. It is suggested that this species be targeted for an in-depth study.

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Hooded Vulture *Necrosyrtes monachus*

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Introduction

At the 2004 Vulture Study Group workshop, held in Kimberley, there was no summary of the current status of the Hooded Vulture in southern Africa. Furthermore, no record can be found of anyone having undertaken any serious study of the species anywhere in Africa in the last decade. However, should someone wish to begin such an urgently needed study a bibliography of all the known material published since 1997 has been compiled and is presented below. Should an annotated bibliography of this material be required it can be supplied electronically.

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Palm-nut Vulture *Gypohierax angolensis*

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Distribution

Palm-nut vultures *Gypohierax angolensis* are breeding residents only in Mozambique and South Africa within the southern African sub-region.

This species occurs along the Mozambique coast and breeds at scattered localities along the Mozambique coast. There are no recent breeding records for southern Mozambique (Parker 1999), but it is likely to be a breeding resident there, and at scattered lowland localities from Beira through to the Zambezi delta.

South Africa

The breeding distribution of the Palm-nut Vulture during the 1970s census period was centred on the Raffia Palm groves of the Kosi Bay system and Mtunzini (Cyrus & Robson 1980). By the early 1990s this species was more widely recorded in Zululand adjacent to the coast (Mundy & Allan 1997). Currently it is regarded as a breeding resident in the eastern coastal littoral between Kosi Bay and Mtunzini in northern KwaZulu-Natal, with recent breeding records (1998, 1999) of one pair breeding at a *Raphia* palm grove at Tongaat north of Durban (29.6° S) (Davis 2000). Its distribution is linked to the presence of Raffia Palms *Raphia australis* at all permanently occupied sites, and the existence of this species at Mtunzini is entirely due the artificial cultivation of Raffia Palms, begun in the early twentieth century, the natural southern limit of this palm being Kosi Bay (Abbott 2002). During the 1970s only a single pair bred at Mtunzini but by 2001 there were four breeding pairs (Allan 2001).

The species is regularly seen in the interior of Maputaland including at Ndumo Game Reserve, Hluhluwe Game Reserve and at Nsumu Pan in Mkhuze Game Reserve (I. Rushworth personal observation, W. Matthews personal communication). There are records of a juvenile seen in the Underberg region (130 km from the coast) in late 2003 (M. Gemmell personal communication), and in the Howick area (90 km from the coast) in 2004 (W. Howells personal communication). It has been recorded as a vagrant along the eastern seaboard as far south as De Hoop Nature Reserve and at Mossel Bay (McCall 1994; Graham 1996) and inland to Mpumalanga (Tarboton *et al.* 1997). It is clear from the sizeable number of records of vagrants in the sub-continent over the last decade that this species produces a fair number of dispersive individuals that move over long distances. While there are more records of vagrants now than in times gone by, and while it is temping to think that this indicates an increased or more productive population or the start of range expansion, it is also possible that the growing bird-watching community is recognising out-of-range birds, especially juveniles which are easily confused with other species. Birds recorded in Namibia, Zimbabwe and

Kgalagadi Transfrontier Park probably reflect vagrant movement southwards from Angola and Zambia.

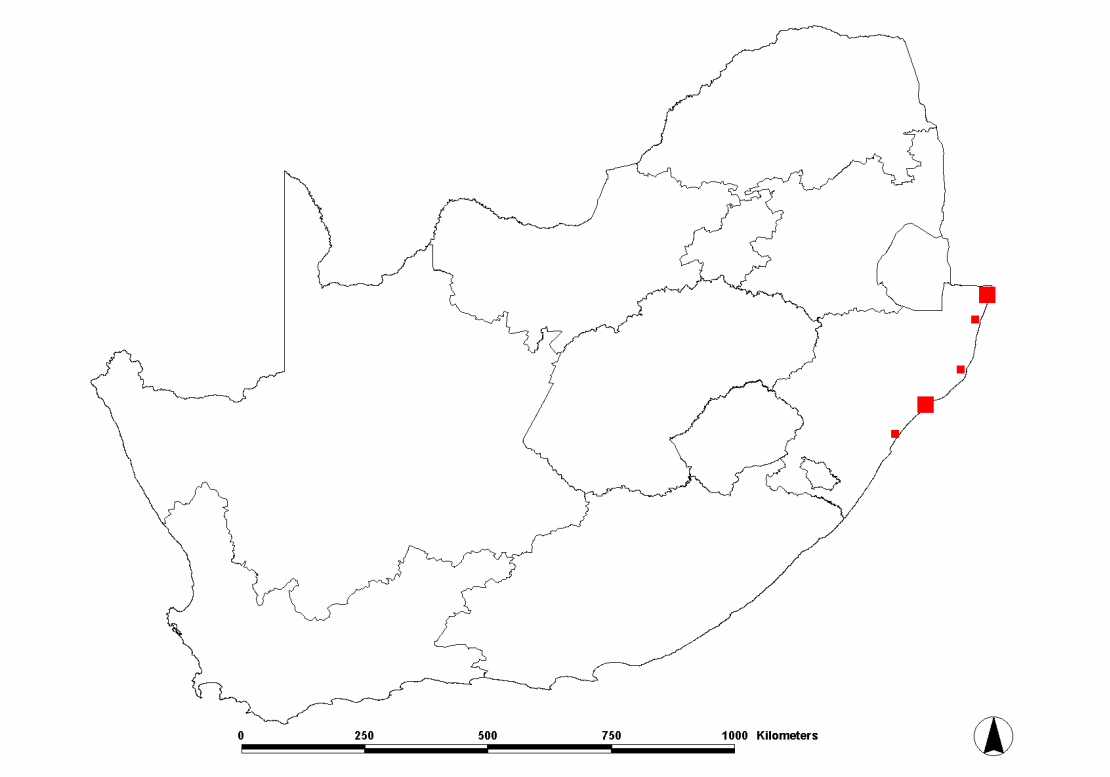

Figure 1. Breeding distribution of Palm-nut Vultures in South Africa in 2004.

Population size

Recorded as threatened with an estimated population of fewer than 20 birds in southern Mozambique (Parker 1999).

The species is uncommon and localised in South Africa, and resident south of Kosi Bay only since the introduction of *Raphia* palms in the early 1900s (Chittenden 2005). It was claimed as one of the rarest breeding raptors in the region in the late 1970s (Brooke & Cooper 1978). The breeding population was estimated to be 3-6 pairs by the late 1980s (Mundy *et al.* 1992), by the mid-1990s this estimate had increased to 8-10 pairs (Chittenden & Myburgh 1996), and in 2004 a minimum of 12 breeding pairs were recorded in northern KwaZulu-Natal (H Chittenden unpublished data). Based on the breeding population size the total South African population is estimated at approximately 40 birds.

The only known nesting sites within protected areas are the six pairs in the Greater St. Lucia Wetland Park (5 pairs, actual nesting sites unknown, at Kosi Bay and one pair west of the town of St. Lucia); the known Mtunzini nesting site occurs just outside the Umlalazi Nature Reserve.

Current threats

The South African population is not considered to be under any form of immediate threat (Chittenden 2005). That being said, the threats to this species in South Africa are not well understood.

There are no records of poisoning of this species (G. Verdoorn personal communication). The species feeds predominantly on *Raphia australis* fruits, but also on crabs (freshwater and marine), fish, small mammals, (especially rodents), tree frogs, snails, locusts, sea-lice, dung beetles, termites and flying ants (Mundy *et al.* 1992, Chittenden & Myburgh 1996). However, Palm-nut Vultures are potentially vulnerable to poisons as they also frequently feed on carrion.

As they scavenge on the beach they may be vulnerable to picking up discarded or 'lost' fish baits with hooks in them. They have been observed feeding a chick on the skeletal remains of sardine bait picked off the beach (Chittenden & Myburgh 1996).

The low population size makes the species vulnerable to stochastic events.

In Mozambique Parker (1999) observed that cutting down of coastal forest was threatening breeding habitat.

Current Research, Monitoring and Conservation Initiatives

Research

No research is currently being undertaken in South Africa on this species.

Monitoring

Bird clubs and individuals do informal monitoring, and Palm-nut Vultures are recorded when seen during the Coordinated Waterbird Counts that are conducted biannually at several wetlands in the range of the species. However, there is no formalised monitoring or data management process in place.

Conservation

There are no specific conservation initiatives in place for this species, but there is some degrees of chance protection provided in that the core breeding populations occur in or near protected areas (Greater St. Lucia Wetland Park and Umlalazi Nature Reserve). The species is benefiting from increased ornamental plantings of *Raphia australis*.

Proposed Future Research, Monitoring and Conservation Initiatives

Research

The key research question must be: What is the value of the South African satellite population in producing dispersing birds that are contributing to maintaining the Mozambique population (and hence the larger metapopulation), and, dependant on the answer to the first question, is there a need to enhance this value?

Monitoring

Monitoring must take place in a more formal manner, with annual/biennial status assessments taking place, and with data being stored in one central repository.

Conservation

The Palm-nut Vulture is the only species of vulture in South Africa with an increasing (albeit small) population size. This species is on the edge of the range of the African population, but if there is a conservation reason to increase numbers, then this could be done by increasing plantings of *Raphia australis*; this is happening to some extent anyway. Recorded as threatened with an estimated population of fewer than 20 birds in southern Mozambique (Parker 1999); it is not known to what extent the KwaZulu-Natal population is important for maintaining the Mozambique population (metapopulation) through production of dispersing birds for recolonisation and establishment of new breeding pairs.

Conclusion

The total African population is estimated to be 80 000 pairs (Mundy *et al.* 1992). The approximately 40 birds in South Africa therefore represent less than 0.05% of the continental population, and therefore this country plays a small role in the conservation of the species at a continental scale. However, as with other vulture species at the limits of their distribution this population may act as an indicator of environmental health, and more importantly may be essential for the long-term persistence of the southern Mozambique population. It is noteworthy that this is the only species in South Africa that is increasing in numbers, although, ironically, this is largely due to man-induced habitat changes.

Acknowledgements

Thanks to Prof. Steven Piper for ideas and comments on an earlier draft of this paper, and to Prof. Piper for access to his Vulture Bibliography.

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Bearded Vulture *Gypaetus barbatus*

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Introduction

Detailed research into the biology, population structure, distribution and feeding ecology of the Bearded Vulture was undertaken in the Drakensberg in the early 1980s by Brown (1988). In a later paper, Brown (1991), documented the decline in the range of the species and the number of individuals, and listed several threats responsible for this. No further research or formal monitoring was undertaken until 2000.

Results from recent surveys indicate that population numbers are still declining along the Drakensberg escarpment. Without the immediate implementation of conservation measures, this isolated population could soon become extinct in southern Africa.

Distribution

There are three main races of Bearded Vulture (Mundy *et al.* 1992). The *Gypaetus barbatus barbatus* race is found in the Atlas Mountains. The *G. b. aureus* race encompasses all Asian and European countries. The African subspecies *G. b. meridionalis,* is the southern race that occurs south of the Tropic of Cancer.

Globally, the species covers a range of between one and 10 million km^2, and is sparsely distributed over Africa, Eastern Europe, the Mediterranean and the Himalayas (BirdLife International 2004).

The race *meridionalis* has an isolated population in southern Africa whose breeding range is confined to about 35 000 km^2 in the Drakensberg and Maloti mountains of the KwaZulu-Natal Province and Lesotho (Barnes 2000). This race also occurs peripherally in the Eastern Cape and the Free State Provinces. The foraging range of the Bearded Vulture in southern Africa is about three times larger than its breeding range, some 100 000 km^2 (Brown 1992).

Historically, the distribution of the Bearded Vulture in southern Africa was far more widespread (Brown 1991). The species has lost 38% of its former breeding range, approximately 21 000 km^2, mainly in the Eastern and Western Cape.

The Bearded Vulture is currently extinct in Western Cape (c. 1940) and it has declined dramatically in the Eastern Cape (Vernon & Boshoff 1997), where only a few nesting sites still remain post 1970. The species no longer breeds in the Free State (Colahan & Esterhuizen 1997) and in Lesotho sightings in the lowlands are rare and some nesting sites are no longer used (Maphisa 1997). Piper & Johnson (1997) reported that the Bearded Vulture showed a

possible range expansion in KwaZulu-Natal where its range had expanded northwards from the Drakensberg along the Free State border. However, Colahan & Esterhuizen (1997) have reported that there have been no active nest sites in the Free State since 1997.

Although the reasons for this large range contraction are not well understood, it is thought that displacement by humans and livestock at lower altitudes and the degeneration of many of its habitats were the main causes (Mundy *et al*. 1992).

Population size

Globally the bird is classified as a species of least concern and is not considered to be under any form of threat (BirdLife International 2004). In southern Africa on the other hand, the Bearded Vulture is listed as endangered (Barnes 2000). It has been classified as endangered based on its small and declining population size, restricted range, range contraction, and susceptibility to several threats in Lesotho and South Africa.

BirdLife International (2004) estimate the entire Bearded Vulture population to consist of between 10 000 and 100 000 individuals. Although the range in global numbers is large, the numbers of individuals in high-density areas (such as Africa), suggest that the global numbers are probably closer to the lower end of the scale (i.e. 10 000). Mundy *et al.* (1992) estimated the total numbers in Africa to be between 4600 and 7000 individuals with the race *meridionalis* having its stronghold in Ethiopia, approximately1400 pairs. Brown (1992) estimated the southern African population to consist of 204 pairs and 630 individuals.

Apart from the aerial and ground surveys undertaken by Ezemvelo KZN Wildlife staff from 2001 to 2003, no formal surveys have been undertaken to determine the population status of the Bearded Vulture in southern Africa. The Free State conservation staff undertake infrequent monitoring and informal monitoring is done by interested birders.

Krüger and van Zyl's (2004) minimum estimate of the current southern African population is approximately 71 pairs, a third of Brown's (1992) estimates. It must be noted that these estimates are based on the results of the surveys undertaken in KwaZulu-Natal only. Brown (1992) recorded a total of 42 nest sites in KwaZulu-Natal. Krüger and van Zyl (2004) recorded a total of 11 positively identified nest sites plus an additional four possible nest sites which have been included in the total number of sites for the Province. In calculating the overall numbers of Bearded Vultures for southern Africa, the assumption has been made that i) the estimate obtained for KwaZulu-Natal is a good indication of the number of pairs nesting in the Province and, ii) populations in Lesotho and the Eastern Cape are following a similar trend to those in KwaZulu-Natal.

Although an attempt was made at a minimum total count of the population during 2003, results of a Vulture Count Day at vulture restaurants met with limited success. The total number of individuals in the population was

therefore calculated using Brown's (1997) age ratios (young 37% : sub adults 3.5% : 60% adults) with the estimated number of adult birds in the population obtained from nesting pairs. Krüger and van Zyl (2004) estimate the total number of Bearded Vulture individuals in southern Africa to be 238 (88 young : 8 sub-adults : 142 adults). If the number of individuals is calculated by comparing previous and current estimates of pairs and individuals, a slightly lower estimate (219) is obtained.

The above estimates indicate an overall decline of between 61% and 65% in Bearded Vulture numbers in southern Africa. Although the number of individuals is a minimum estimate, the indication is that there has been a dramatic decline in Bearded Vulture numbers since 1997.

A number of threats (listed below) are assumed to have negatively affected the breeding success and increased the mortality of the population. These include human disturbance and persecution, deliberate and unintentional poisoning coupled with limited conservation efforts/initiatives.

Current threats

Brown (1991, 1997) found that nest site availability and food shortage were not limiting factors, since the Bearded Vulture in southern Africa had a comparatively high breeding success rate (0.89 young/pair/year). Poisoning on the other hand accounted for a high percentage (68%) of known deaths, as well as certain animal population control methods (Brown 1991). Because Bearded Vulture are solitary birds, which locate and feed from small scraps of carrion as well as carcasses, they are exposed to small blocks of poisoned bait which are in wide-scale use (Brown & Plug 1990; Brown 1991). Brown (1991) suggests that the injudicious use of poison by farmers was the driving force in the species becoming extinct from areas in which they used to occur.

Brown (1991) also reported disturbance during the breeding season where eggs were stolen and young birds attacked by vandals. Maphisa (1997) reported similar trends in Lesotho, namely the direct persecution of adults and robbing nests of chicks and eggs. The deliberate shooting of vultures, for traditional medicine, food and ceremonial purposes, is a serious and increasing threat in Lesotho (Maphisa 1997; Mundy *et al*.1992). Allan *et al*. (1996) and Maphisa (1997) indicate that the Lesotho Highlands Development Project poses a long term threat to the species by increasing accessibility into Lesotho and making the birds more susceptible to human induced threats. In the Eastern Cape (Vernon & Boshoff 1997) found stock farming to negatively impact the birds by disturbance at the nest

Young birds of up to four years have an 86.8% mortality (Brown 1997). These individuals are particularly vulnerable to threat because they inhabit areas avoided by adults, usually those areas where human population density is higher and subsequent threats are more severe. Conservation efforts should concentrate on addressing the threats to young birds.

Although none of the above mentioned threats are recent reports (post 1997), they have not been adequately addressed over the past few years and there

is no reason to suggest that they no longer pose a threat to the current population.

Deliberate poisoning appears to be an ongoing threat in Lesotho (Rushworth personal communication). In South Africa, unintentional poisonings may pose a threat to Bearded Vulture feeding at vulture restaurants. The latter poisonings refer to the carcasses of stock that have been treated with certain veterinary drugs, such as non-steroidal anti-inflammatory drugs that have been shown to be lethal to certain species of vultures (Oaks *et al.* 2004).

Disturbance by climbers and air traffic (in particular helicopters) has been known to cause nest site desertion and/or increased egg and chick predation by ravens and/or crows in Europe (Margalida & Garcia 1999). Although the impact of the above has not been quantified for the Drakensberg Escarpment, it does cause concern because these impacts may displace birds and force them to move into areas of unfavourable environmental conditions and higher human population densities which in turn may affect their breeding and the conservation of the species. Power-line collisions also account for a few deaths (e.g. van Rooyen 2003).

Current Research, Monitoring and Conservation Initiatives

Research

No research projects are currently being undertaken on Bearded Vulture in southern Africa.

Monitoring Initiatives

Ongoing infrequent monitoring is undertaken by the Free State Department of Tourism, Environment and Economic Affairs, particularly with reference to the number of birds at vulture restaurants (Colahan, personal communication).

Ezemvelo KZN Wildlife staff have undertaken several aerial and ground surveys during 2001 to 2003 (Krüger & van Zyl 2004). An annual Vulture Count Day was initiated in 2003.

No formal monitoring is being undertaken in the Eastern Cape.

The Quthing Wildlife Development Trust is undertaking some monitoring in the Quthing District of Lesotho (W. Vogeley personal communication).

Conservation Initiatives

Various data-gathering initiatives are underway which include Ezemvelo KZN Wildlife staff as well as landowners, vulture restaurant owners, visitors to the uKhahlamba Drakensberg Park World Heritage Site (UDP WHS) as well as the general public. These initiatives provide data on the number of birds seen, their location as well as any other valuable observations.

The South African Police Service staff who operate within the Bearded Vulture's range have been given an identification sheet which will assist them

in identifying any dead birds that they may encounter during the course of their duties.

The District Officers of Ezemvelo KZN Wildlife are currently updating all the vulture restaurant site forms that form part of the Vulture Study Group's database. The site visits also provide them with an opportunity to address any vulture restaurant management issues such as fencing, types of carcasses placed at the restaurant and types of drugs used on the property.

Ezemvelo KZN Wildlife is assessing the type of food that is placed at the restaurants that they manage within in their protected areas, in particular the Giant's Castle vulture restaurant.

Ezemvelo KZN Wildlife are currently developing an airspace use policy which aims to restrict the use of airspace over the UDP WHS, both spatially and temporally, particularly in terms of flights along the escarpment and landings on top of the escarpment.

Apart from the above mentioned Ezemvelo KZN Wildlife initiatives, Mr. W. Vogeley of the Quthing Wildlife Development Trust is active in addressing vulture conservation issues in Lesotho. Mr. Vogeley would like to establish a vulture restaurant in the Quthing District where he has worked on an awareness programme with the local community. Both Bearded Vultures and Cape Griffons nest in the area and are threatened with death by the locals who are under the impression that the vultures kill their stock.

Proposed Future Research, Monitoring and Conservation Initiatives

Species Biology

The biology of the species has been well researched and documented (Brown 1988; Mundy *et al.* 1992). Additional research on species biology is not considered a current priority.

However, a study on the foraging range of young birds would provide useful information that can be used to address the threats to this age class in an attempt to reduce the high mortality experienced by them.

Monitoring

- A site-specific base line survey will be undertaken during 2004 in the UDP WHS (Ezemvelo KZN Wildlife).
- Future monitoring will consist of a sub-set of nest sites (Ezemvelo KZN Wildlife in South Africa & Quthing Wildlife Development Trust in Lesotho).
- Future monitoring will include limited aerial surveys and will maximize ground surveys and road counts in KwaZulu-Natal. The latter two survey techniques pose fewer disturbances to the birds and are also more cost effective.
- Future monitoring must include road counts in Lesotho.

An attempt will be made by Ezemvelo KZN Wildlife to collate historical written and verbal reports into a central database, as well as collating and updating the information received from various information sources such as field ranger reports and the mountain rescue register.

Conservation Initiatives

Indiscriminate poisonings and nest disturbance must be addressed both within Lesotho and South Africa. The threats to the birds in terms of their use in traditional medicine need to be addressed as a matter of priority.

Restaurant management must be monitored continually and the establishment of new restaurants should be encouraged. It is however critical that the correct type of food is placed at these sites.

An assessment of the potential threat of disease should be undertaken.

The Maloti Drakensberg Transfrontier Project (MDTP) should be used as a vehicle to encourage conservation areas in Lesotho, suggested by Brown (1989), which will protect the entire range of a few pairs. In addition, the project could facilitate future monitoring efforts such as road counts and nest site surveys, as well as initiatives aimed at addressing the threats to Bearded Vulture in Lesotho.

The southern African Bearded Vulture population is a small and isolated one that is habitat-bound and therefore can be seriously affected by episodic events. To reduce the possibility of such events affecting the entire population, the possibility of establishing pairs in the areas of former occupation should be considered. However, re-introductions should only be considered if the original factors resulting in the bird's extinction from the areas have been addressed.

Conclusion

Although the latest estimates of the Bearded Vulture population show a drastic decline, these are extrapolations from conservative data and represent a minimum number. Nevertheless, it is realistic to assume that there is still a decline in numbers, and that several threats to the population have not been adequately addressed.

The Bearded Vulture is a specialised species in terms of its habitat requirements and food choice, and conservation areas cannot adequately contain a pair of Bearded Vulture nor provide sufficient food throughout the year (Brown & Plug 1990). Management and conservation of the population must therefore rely on partnerships between conservation organisations and landowners. These partnerships together with education and awareness programmes and a concerted effort to address the threats to the species will go a long way to ensuring their long-term survival.

Acknowledgements

We gratefully acknowledge the Wildlands Trust and the MDTP for financial assistance with the monitoring programme. We thank Ezemvelo KZN Wildlife

for their assistance and support, in particular Peter Chadwick, Ian Rushworth, Athol Marchant and Steve McKean. We thank Prof. S.E. Piper for access to the Vulture Study Group's vulture restaurant database.

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Egyptian Vulture *Neophron percnopterus*

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Distribution

Historical distribution

Formerly widespread but never common in the drier parts of southern Africa (Anderson 2000), though recorded from the wetter east as well (Clancey 1964: 72).

Current distribution

probably now regionally extinct as a breeding and resident species in the sub-continent (Anderson 2000). The last breeding record in South Africa was in the Eastern Cape in 1923 (Roberts 1924) though there is a suggestion that they could possibly have bred during 1990 in the Kaokoveld Mountains west of Etosha National Park (NP), Namibia (C.J. Brown unpublished data). However, this later claim was not confirmed by subsequent fieldwork (R. Simmons, unpublished data). There were 15 reliable sightings between 1945 and 1978 and at least another 27 documented sightings of at least 29 individuals between 1978 and 1999 (Jenkins 1997; Brown, Forbes & Symes 2000). These latter sightings may be placed in three groups: a) Namibia, especially Etosha NP and the area to its west, b) the Limpopo, North West and Mpumalanga Provinces and c) the Transkei region of the Eastern Cape. There is a reasonable possibility that the individuals seen about Etosha NP come from a small, resident breeding population from northern Namibia or even Angola, though breeding has never been established in Angola (Dean 2000: 52-53); adults have been seen throughout the year. On the other hand the individuals seen in Mpumalanga, North West and Limpopo Provinces, and Botswana, Swaziland and Zimbabwe have been recorded, in the main, in summer and it is possible that they are Palaearctic migrants having come further south than most. The third group in the Transkei may indeed represent a small breeding population (Brown *et al.* 2000). In their collation of recent southern African records (Brown *et al.* 2000) overlooked at least three older records from Botswana (Simic 2001).

Since 1999 there have been further reports of sightings of Egyptian Vultures in southern Africa. Six Egyptian Vultures were seen at Mabuasehube Pan, Kgalagadi Transfrontier Park, Botswana on 2 October 2001 (Anonymous 2002). A 2nd year Egyptian Vulture was observed at the Rietfontein waterhole, Etosha National Park, Namibia on Sunday 4 November 2001 (Hansson 2002). On 1 May 2002 a juvenile Egyptian Vulture was spotted soaring above the Ysterberg between Polokwane (formerly Pietersburg) and Potgietersrus, Limpopo Province (Archer 2002). On 4 October 1998 an adult Egyptian Vulture was seen in at Tshukudu Dam, Madikwe Game Reserve, North West Province (Hofmeyer 1998). An Egyptian Vulture was seen while travelling in a car from the Bakubung gate to the Manyane gate on the Mankwe drive in the

south east of Pilanesberg on 27 November 2001 (Stumpf 2002). An immature bird was seen at Vanzylsrus, Northern Cape in March and April 2001 (Anonymous 2001). There have been two sightings of single Egyptian Vultures (one adult and one juvenile) on the Pungwe flats near Beira (Parker 2001). These post-1999 sightings are similar in spatial distribution and temporal location to the patterns previously elucidated (Brown *et al.* 2000). However, the sightings in Mozambique are exceptional, this species was not even mentioned as a vagrant in the recent bird atlas of the southern third of Mozambique (Parker 1999) though it was once reported from Beira, nearly 60 years ago (Haagner 1945).

Reasons for change: there is no consensus as to why this species went extinct in the region. A number of reasons have been advanced: food shortages resulting from the extirpation of the herds of indigenous antelope, the decimation of cattle herds by Rinderpest at the end of the 19th century, a decrease in small terrestrial fauna consequent on overgrazing, improvement in general hygiene around human settlements and towns, deliberate persecution by Ostrich farmers, incidental poisoning as a result of problem animal control (Anderson 2000; Jenkins 1997; Mundy *et al.* 1992: 200-201) and competition from introduced omnivores and scavengers, e.g. domestic pigs *Sus scrofa* (S.E. Piper in Ledger 1985).

Population size

Current population size, southern Africa - breeding: possibly in the Eastern Cape and north-west Namibia, see above.

Current population size, southern Africa - non-breeding: a handful, perhaps, five vagrants arriving in southern Africa down the eastern seaboard each year, probably Palaearctic migrants, usually in the summer, a mixture of birds in both adult and non-adult plumage (Brown *et al.* 2000, and references therein). A few in Etosha NP and vicinity in northern Namibia from a small local breeding population, possibly augmented from the Angolan deme (Dean 2000: 52-53).

Current global population size, N. p. percnopterus: abundant in East Africa, Ethiopia and the Island of Socotra with a total resident African population of about 20,000 individuals augment by Palaearctic migrants during the Boreal winter (Mundy *et al.* 1992: 200-201), Palaeartic population, excluding Africa was about 2750 pairs in the mid-1970's (Cramp & Simmons 1980: 65).

Current global population size, N. p. ginginianus: abundant in south Asia, especially India. Global population of both races is in the range 10,000 – 100,000 pairs and occupies an area of about 10,000,000 km^2 (BirdLife International 2000).

Red Data Book status: world-wide both races are of *Least Concern* BirdLife International 2004) but *Regionally Extinct* in South Africa, Lesotho and Swaziland (Anderson 2000) and *Critically Endangered* in Namibia (Robertson *et al.* 1998) or even *Regionally Extinct* (Simmons 2002).

Changes since 1997: other than for possible breeding in the Eastern Cape and for two sight records in central Mozambique, the frequency and distribution of sightings has remained unchanged.

Current threats
None known, but poisons remain a concern.

Current research, monitoring and conservation initiatives
In my opinion, until such time as a satisfactory explanation of the causes of decline of this species has been hypothesised there will be no justification for a re-introduction programme. Raising funds for a captive-breeding programme, prior to re-introduction, is not currently justified in the light of the need to conserve existing regional populations of other vulture species in the subcontinent.

Both the central Transkei and Etosha NP and its environs would repay an extensive search for breeding sites.

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Section B

Status of vutures in different regions

Status of vultures in the Western Cape

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Introduction

The Potberg breeding and roosting site of the Cape Vulture is in a narrow ravine (± 400 m wide at the top) in the Potberg Mountain within the De Hoop Nature Reserve (34° 22' 55"S, 20° 33' 38"E). The ravine is ± 1.3 km long and is ± 220m deep. The colony has probably the best historical record as it has been under intermittent observation between 1951 and 1976 and regularly between 1977 till the present. Only minimum nest numbers are available for the period 1951-1971 (Jarvis *et al.* 1974), but more detailed observations (population size, breeding pairs, etc) have been recorded since (Boshoff 1981, 1987; Boshoff & Scott 1990; Scott 1997 and Shaw & Scott 2003). Population numbers and breeding records are available for the little Karoo colonies from 1978 up until 1990 when these sites were abandoned (Boshoff 1981, 1987; Boshoff & Scott 1990).

The majority of the Cape Vulture research in the Western Cape was carried out between the mid 1970's to the mid 1980's. Since then very little research has been done with work been focused on monitoring and conservation initiatives. In 1995 these efforts were formalised into a conservation programme for the Cape Vultures in the Western Cape (Scott 1997). The programme has nine objectives (Table 1) and because of it simplicity and relevance the programme is still applicable and is still in use.

Table 1: Objectives of the conservation programme for the Cape Vulture in the Western Cape (from Scott 1997).

1.	Protect the breeding colonies
2.	Manage the food supply
3.	Reduce the effects of agrochemicals
4.	Treat sick, injured and poisoned birds
5.	Monitor numbers and breeding success
6.	Increase the public awareness campaign
7.	Promote nature education
8.	Promote effective liaison
9.	Obtain funding for projects

Species

The Cape Vulture (*Gyps coprotheres*) is the only vulture species resident in the Western Cape. Two other species, the Palm-nut Vulture (*Gypohierax angolensis*) and the Lappet-faced Vulture (*Torgos tracheliotos*), have been recorded as vagrants. The latest population estimate for the Cape Vulture in the Western Cape (Potberg colony) is 131 free-flying individuals (102 adults and 29 juveniles), which was recorded in November 2003. During the 2003/2004 breeding season 44 breeding attempts (breeding pairs) were recorded (Shaw personal observation).

Threats

The Cape Vulture in the Western Cape relies entirely on small stock agriculture (mainly sheep) for food. A major threat to the species is the shortage of food especially between lambing seasons. A supplementary feeding scheme is operated at a vulture restaurant near the Potberg colony during periods when food is not readily available. The colony is situated ±20 km from the Overberg Test Range and ±50 km from the South African Airforce Test Flight and Development Centre. Disturbance from aircraft carrying out experimental flights is a continuous threat even though a "no fly zone" of a 5km radius and a height of 2km above the Potberg ravine exists.

Other threats include collisions with powerlines, electrocutions, persecution, and agrochemicals. As the vultures are mostly foraging over the agricultural landscape, conflict situations do arise and persecution is a possibility. Furthermore the birds are more readily exposed to agrochemicals, which could have severe consequences for the species. Organophosphates for example are used in the small stock sector to prevent tick and blow fly infestation. Table 2 indicates the causes of Cape Vulture mortalities since1997.

Table 2. Causes of mortality of Cape Vultures since 1997. Weak refers to those incidences where vultures are found unable to fly and the cause for the condition cannot be determined. In most cases the birds recover very quickly with a steady supply of food and water, and are released within a month.

Year	Cause	Number of birds
1999	Powerline	1
2000	Weak	2
	Unknown causes	2
	Drowned	2
	Powerline collision	2
2001	Drowned	1
2003	Weak	1

Current research, monitoring and conservation initiatives

Very little if any research has been done on the Cape Vultures in the Western Cape since the mid 1980's. However, the monitoring programme initiated in the early 1970's has been maintained. A programme to count the vultures at the Potberg colony at least once a month was initiated in 2000 and barring one or two months this has been sustained.

The ringing of vulture chicks was reinstated in 1999. The ringing of vulture chicks was carried out at the Potberg and Little Karoo colonies in the past, but was stopped in 1984. Unfortunately due to inexperience no chicks were ringed in 1999, but chicks were ringed in 2000 (6), 2001 (5), 2002 (11) and 2003 (14).

Conservation initiatives have been focused on dealing with conflict, treating injured/sick/poisoned/birds, liaison with the local community and public awareness either through media releases and/or talks.

Proposed research, monitoring and conservation initiatives

Currently there are no research projects that are a priority. Monitoring of the Cape Vultures at the Potberg colony will be continued. Should the Little Karoo colonies be utilized on a more permanent basis then they will be monitored on a more regular basis and in the same way as the Potberg Colony.

Since 1951, 268 Cape Vultures have been ringed in the Western Cape. In order to make maximum use of this resource a continuous active ring re-sighting programme is required. While fairly rigorous and intensive ring re-sighting has been carried out in the past, it has not been maintained due to the huge effort that was put into the initiative. A less intensive, but continuous programme needs to be formalised and implemented.

In an attempt to address conservation issues of communities, Western Cape Nature Conservation Board (conservation authority of the Western Cape Province) has employed a number of Community Conservation Officers. These officers are the link between the conservation authority and the community and they can play an important role in the conservation of the species. In order to do so they need to be trained and provided with information regarding Cape Vultures. An informal/formal training programme, which should include information packages, is required to provide these officers with the necessary knowledge.

An initiative of the Cape Action Plan for the People and the Environment (CAPE) is the establishment of Mega Parks. While the Outeniqua Mega Park, is not part of the CAPE Project, it is to be initiated and managed along the same lines. If this park becomes a reality it would include all the Little Karoo sites not already included in formal conservation areas. The Mega Park concept is a conglomerate of areas with different conservation categories and would provide a safe environment for Cape Vultures in the Little Karoo area.

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Research, monitoring and conservation of vultures in the Northern Cape Province, South Africa

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The Northern Cape's vultures

Fifty-three species of raptors have been recorded in the Northern Cape including several species of vultures (Anderson 2000a; Anderson & Maritz 2003, 2004). Six vulture species historically occurred in the Northern Cape, of which the Egyptian Vulture is now extinct (Mundy 1978) (Table 1). Of these vultures, the African White-backed and Lappet-faced Vulture are fairly common and widespread in the Kalahari thornveld areas north of the Orange River. The Nama and Succulent Karoo areas of the Province (south of the Orange River), previously the domain of the Egyptian, Cape Griffon and Lappet-faced Vultures, are now devoid of these scavenging birds. The Palm-nut Vulture is a vagrant to the Kgalagadi Transfrontier Park (KTP). These vultures, excluding the Palm-nut Vulture are listed in *The Eskom Red Data Book of Birds of South Africa, Lesotho & Swaziland* (Anderson 2000b).

History of vulture research, monitoring and conservation

The focus of vulture research and monitoring in the Northern Cape has been in the Kalahari and in the Kimberley area (see below for details of work on individual vulture species). Since the 1960s several studies have been conducted on the African White-backed Vultures that breed on Dronfield Farm (Forrester 1967; Mundy 1982, Anderson & Maritz 1997; Murn *et al.* 2002). The Kalahari's vultures have been the focus of research conducted by Knight (Knight 1987; Anon 1990), Herholdt (1995) and Maritz (Anderson & Maritz 1997). These studies have mainly focused on monitoring of breeding performance, other reproductive studies and the ringing of nestlings.

Species accounts: distribution and population sizes

Egyptian Vulture *Neophron percnopterus*

The Egyptian Vulture formerly occurred throughout the Northern Cape, but disappeared in the 1950s (Mundy *et al.* 1992). Although Anderson & Maritz (1997) and Jenkins (1997) reported that there were no recent records in the Northern Cape, the species has been subsequently been observed: e.g. at Pearson's Hunt in April 1998 (Anon. 1998), Vanzylsrus area in March and April 2001 (Anon. 2001a), KTP in 2003 (Redfern 2003) and at the nearby Molopo Nature Reserve in the North West Province in June 1999 (Dell 1999).

Palm-nut Vulture *Gypohierax angolensis*

The Palm-nut Vulture is a vagrant to the KTP (Brooke 1984) and there have been three recent records, one bird in the KTP in April 2000 (Steyn 2000), one in Kathu in November 2000 (Anon. 2001b) and one in the KTP in May 2002 (Mattinson 2002)

Hooded Vulture *Necrosyrtes monachus*

The Hooded Vulture has always been a non-breeding vagrant in the Northern Cape, with very occasional observations of individual birds (Boshoff *et al.* 1983; Anderson & Maritz 1997). There was one record from the KTP during the Atlas period (Mundy 1997a), but none subsequently.

White-headed Vulture *Trigonoceps occipitalis*

The White-headed Vulture has always been rare in the Northern Cape, as this area is at the periphery of its range, and the Province does not provide the species' preferred habitat (Boshoff *et al.* 1983; Mundy 1997b). Although breeding has previously been reported for the KTP (Broekhuysen *et al.* 1968; Brooke 1984; Mundy *et al.* 1992), White-headed Vultures are scarce in the Park (Knight 1987; Herholdt 1989) with breeding (maybe just two pairs) confined to the Botswana side of the KTP (Anderson & Maritz 1997). There was a possible sighting of a White-headed Vulture at Tswalu Kalahari Reserve in September 2002 (Stainthorpe 2003), the first record of this species in the Northern Cape, outside the KTP, in several decades.

Cape Griffon *Gyps coprotheres*

The Cape Griffon is extinct as a breeding species in the Northern Cape, and the locations of previous breeding/roosting colonies have been mapped by Boshoff & Vernon (1980), with additional information provided in Anderson & Maritz (1997). The Cape Griffon is a vagrant to the KTP (Liversidge 1984; Knight 1987; Herholdt 1989; 1995; Mundy *et al*. 1992; Maritz unpublished data). Cape Griffons, especially immature birds, are occasionally seen foraging/roosting with the African White-backed Vultures in the greater Kimberley area, a supposed 'nursery area' for this cliff-nesting species (Ledger & Mundy 1976; Mundy 1982; Mundy *et al.* 1992). There is a marked absence of Cape Griffons from the central and western areas of the Northern Cape (Mundy *et al*. 1992).

Lappet-faced Vulture *Torgos tracheliotos*

Once more widespread in the Northern Cape (Brooke 1984; Boshoff *et al.* 1983), the Lappet-faced Vulture is now mainly confined (especially as a breeding species) to the Kalahari region of the Province (Knight 1987; Herholdt 1995; Anderson & Maritz 1997; Mundy 1997c). The increase in numbers of Lappet-faced Vultures on farmland in the Northern Cape from one known pair in the early 1990s (Mundy 1997c) to 33 pairs in 1997 (Anderson & Maritz 1997) to *c.* 40 pairs today (A.W.A. Maritz personal communication) is testimony to the success of Abrie Maritz's Kalahari Raptor Project. It is unlikely that the breeding population of Lappet-faced Vultures in the Northern Cape (i.e. including the birds in the KTP) exceeds 50 pairs (Anderson & Maritz 1997; A.W.A. Maritz personal communication). Although only two breeding pairs have been located in the South African side of the KTP, with a possible maximum of eight pairs (Anderson & Maritz 1997), there are possibly another 40 breeding pairs in the Botswana side of the KTP (J.J. Herholdt personal communication; Anderson & Maritz 1997).

African White-backed Vulture *Gyps africanus*

The historical and present distribution of the African White-backed Vulture in the Northern Cape is probably fairly similar (Anderson & Maritz 1997). Its distribution is confined to the areas north of the Orange River (Mundy 1997d) and it is the most common vulture in the Northern Cape (Anderson & Maritz 1997). Breeding is confined to four main areas: greater Kimberley area, Askham, VanZylsrus and the KTP. The Vanzylsrus colony became established in 1999 and there has been a gradual increase in numbers to *c.* 100 pairs in 2003. There are approximately 60 breeding pairs in the KTP (Anderson & Maritz 1997; J.J. Herholdt, personal communication). The African White-backed Vulture population size was estimated at 300 pairs in 1997, but is now thought to number more than 500 pairs (Anderson in litt.; Murn *et al.* 2002). The increase in numbers can be attributed to (1) the newly established breeding colony at Vanzylsrus, with the birds possibly originating from Botswana (A.W.A. Maritz, personal communication) and (2) better knowledge of the size of the population in the greater Kimberley area (Murn *et al.* 2002). African White-backed Vulture typically nest on Acacia trees (Mundy *et al.* 1992), *Acacia erioloba* trees in the Northern Cape (Murn 2001), but in the Kimberley area a few birds nest on electricity pylons (Ledger & Hobbs 1995; Anderson 2001a). Although the species is apparently resident, some movements have been recorded (Liversidge 1984; Anderson & Maritz 1997), including a long-distance movement of a Kimberley-ringed bird to northern Namibia (Oschadleus 2002) (1426 km).

Table 1. Estimated size of breeding population and status of vultures in the Northern Cape (for source of data, see references in text)

Species	Number of pairs (2003)	Status in Northern Cape
African White-backed Vulture	>500	Fairly common to common
Lappet-faced Vulture	<50	Uncommon to fairly common
White-headed Vulture	0	Possibly two pairs in Botswana side of Kgalagadi Transfrontier Park
Cape Griffon	0	Extinct as a breeding species; birds occasionally observed in greater Kimberley area; vagrant to Kalahari
Hooded Vulture	0	Vagrant; No recent observations
Palm-nut Vulture	0	Vagrant
Egyptian Vulture	0	Vagrant

Threats

Vulture numbers in the Northern Cape have been affected by a large number of factors, including the disappearance of the herds of large migratory mammals (Boshoff & Vernon 1980), changes in farm management practices that reduced carcass availability (Boshoff & Vernon 1980), poisoning (Allan 1989; Anderson 1994a; 1995; Brown 1986, 1988), direct persecution (Boshoff & Vernon 1980), electrocution (Ledger & Annegarn 1981; Anderson & Kruger 1995), collision with the cables of powerlines (Anderson unpublished data), and drowning in farm reservoirs (Ledger 1979; Herholdt 1995; Knight 1987; Anderson 1995, 2000c; Anderson *et al.* 1997; Anderson *et al.* 1999). An overview of vulture electrocutions in South Africa was provided by Van Rooyen (2000). Kruger *et al.* (2004) provided the details of vulture mortalities

on staggered vertical powerlines in the Northern Cape. Anderson *et al.* (1997) and Anderson *et al.* (1999) provide a summary of known vulture drownings in reservoirs in southern Africa (a significant number of birds drown in the arid parts of southern Africa). There has been only one recent (post-1997) known poisoning of vultures in the Northern Cape. During February 1999, 20 African White-backed Vultures and two Lappet-faced Vultures were poisoned near Postmasburg after consuming carbofuran poison on a sheep that was killed by a jackal (Verdoorn 1999). A possible new threat is non-steroidal anti-inflammatory drugs (NSAIDs), with vultures becoming exposed to these veterinary drugs when the carcasses of horse and dairy cows are disposed of at vulture restaurants (Anderson 2002a, 2003, 2004; Anderson & Mundy 2001; Anderson *et al.* 2002; Anderson & Benson 2003). Various recommendations have been made about priority research and conservation projects (S. Shultz in litt.), including in South Africa (Anderson 2001b; Anderson & Mundy 2001), and a research project is currently underway to test the vulnerability of African White-backed Vultures to diclofenac and other NSAIDs (G. Swan in litt.).

Current research, monitoring and conservation initiatives

Past vulture research and monitoring in the Northern Cape has included the following:

Research and monitoring prior to 1997

- Studies of the breeding biology of African White-backed Vultures on Dronfield Farm during 1965 (Forrester 1967) and the mid-1970s (Mundy 1982)
- Collection of African White-backed Vulture eggs from Dronfield farm for DDE residue analysis (Mundy *et al.* 1992).
- Toxicology of African White-backed Vulture nestlings at Dronfield (van Wyk *et al.* 2001).
- Breeding of African White-backed Vultures in the KTP (Maclean 1970, Herholdt 1995).
- Study of African White-backed Vulture morphometrics (Herholdt 1993).
- Raptor surveys inside the KTP (Liversidge 1984; Knight 1987) and outside the KTP (Anderson & Maritz unpublished data).
- Documentation of mortality events (e.g. Anderson 1994a, 1995; Anderson & Kruger 1995; Anderson *et al.* 1999).
- Study on vulture (and other raptor) drowning in farm reservoirs (Anderson *et al.* 1999).
- Radio-tracking of six African White-backed Vultures and two Lappet-faced Vultures from mid-1989 to late-1990 in the KTP (Anon. 1990)

Conservation prior to 1997

- Landowner extension programmes of the Kalahari Raptor Project, Platberg-Karoo Raptor Project and Department of Tourism, Environment & Conservation.
- Raptor certificates are presented to landowners who have breeding vultures on their properties (Anderson 1994a,b,c, 2000a).
- The annual Gariep Raptor Conservationist Award is presented annually to an individual who makes a significant contribution to raptor conservation in the Province (Anderson 2000a).

Current research and monitoring (1997-2004)

- Two vulture nestling ringing projects, one in the Kimberley area (by Anderson, Anthony and co-workers), which started in 1993, and the other in the Kalahari (by Abrie Maritz). Since the early 1990s, 987 vultures (91.1% = African White-backed Vultures, 8.6% = Lappet-faced Vultures) have been ringed (789 with colour rings) in the Northern Cape (Anderson in litt.).
- Study to determine the effects of lead (from lead bullets) on particularly African White-backed Vulture nestlings.
- In collaboration with Dr Mike Peirce (MP International Consultancy, UK), a study on African White-backed Vulture haematozoa is being undertaken.
- Rudi Kruger (1999) conducted a study on raptor electrocutions, with much of the data collected in the Northern Cape.
- Raptor road count project.

Current conservation (1997-2004)

- There are three important farmer extension projects in the Northern Cape: Kalahari Raptor Project, Platberg-Karoo Raptor Project, and Department of Tourism, Environment & Conservation extension programme.
- Various projects are currently underway to promote bird-watching in the Northern Cape, which will not only create employment, but also contribute to the economy of the Province. If the residents of the Province see that birds can derive economic benefit, they will ensure that they are conserved. The initiatives include the development of the Kalahari Raptor Route (Anderson & Maritz 2003, 2004) and the training of bird guides in the Kimberley area (Biggs *et al.* 2003 a,b; Anderson & Biggs 2004).
- The media has been used to create an awareness of vultures in the greater Kimberley area (Anderson 2002b, 2003b).

Proposed research, monitoring and conservation initiatives

The research, monitoring and conservation initiatives which should be undertaken in the Northern Cape include the following:

Research

- Using satellite-telemetry conduct a study to determine the moment patterns of African White-backed Vultures, especially adult, breeding birds.
- Continue with research to determine the breeding, foraging and roosting distribution of African White-backed Vultures relative to different land-use practices in the greater-Kimberley area.
- Determine the effects of lead bullets on, in particular, African White-backed Vulture nestlings.
- Analyze recovery (and observation) data of ringed African White-backed Vultures to get some information on the movement/dispersal patterns of these birds.

Monitoring

- Aerial survey of African White-backed Vultures nesting at Askham and Vanzylsrus in order to obtain a better indication of the size of the two breeding populations.
- Follow up aerial survey of the African White-backed Vulture breeding population in the Kimberley area, perhaps in 2006 (five years after the first aerial survey; Murn *et al.* 2002).
- Continue the annual colour-ringing of the African White-backed Vulture nestlings in the Kimberley area, and at Askham and Vanzylsrus.
- Implement a resighting programme in order to generate observations of colour-ringed African White-backed Vultures.
- Continue with raptor road surveys and assist the Avian Demography Unit with the development and implementation of a RAPTOUR project.

Conservation

- Modify existing staggered vertical powerline structures, especially in the areas where vultures are common.
- Modify other hazardous pylon structures.
- Continue to promote the modification of farm reservoirs to prevent drownings (Anderson & Taljaard 1994a,b,c,d; Anderson undated).
- Continue with landowner extension programmes, especially those conducted by the Kalahari Raptor Project and the Department of Tourism, Environment & Conservation. The focus of the extension programme should be on promoting selective problem animal control techniques, in order to address the problem of the inadvertent poisoning and trapping of vultures and other raptors.
- Reprint and distribute the 'Raptors drowning in farm reservoirs' pamphlet (Anderson undated).
- Reprint and distribute the 'Raptor conservation in the Northern Cape Province' booklet (Anderson & Kruger 2001, 2002).
- Where necessary, and where feasible, encourage the establishment of vulture restaurants (Anderson & Scott 1996a,b; Scott & Anderson undated).
- As the majority of vultures breed on private farmland, encourage the protection of vulture breeding sites; for example, consider registering properties with African White-backed breeding colonies as Natural Heritage Sites. Some of the breeding sites are recognized Important Bird Areas (Barnes & Anderson 1998).

Acknowledgements

Abrie Maritz, Angus Anthony and Campbell Murn are thanked for information that is provided in this report as well for the contribution they have made to research and conservation of the Northern Cape's vultures. Many other people have assisted with me during my vulture research and conservation work in the Northern Cape, especially Eddie MacFarlane, Tania, Ryan and Stephanie Anderson, Steven Piper, Julius Koen, Werner Sinclair, Enrico Oosthuysen, Ronelle Visagie, Francois Taljaard, Corné Anderson and Beryl Wilson. The financial and logistic contributions from the Northern Cape Department of Tourism, Environment & Conservation and De Beers are much appreciated.

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The Eastern Cape's vultures

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Cape Vulture

A study of the Cape Vulture (*Gyps coprotheres*) in the Eastern Cape started in 1977 and has continued until 2003 with the intention to continue indefinitely. The last report on the subject is in an article in *Vulture News* 49 (Vernon 2004). Apart from an annual visit to Colleywobbles to count the number of breeding pairs, no fieldwork has been done on vultures since 1999.

The situation outlined in the report presented at the last vulture workshop in Kimberley (Vernon & Boshoff 1997) pertains and no new information is available that radically alters the views expressed there.

Observations gathered from various sources suggest that there are still vultures in the Eastern Cape in both the Transkei and the area between the Great Kei and the Great Fish Rivers where there are commercial stock farms, formerly known as the Border region. No records are available for the area formerly known as the Ciskei and none for the Albany district around Grahamstown, south of the Great Fish River.

The vultures in the Border Region are known mainly from the roost on the farm Longfield (32°21', 27°16') on the Thomas River but there is no evidence that they breed there. The vultures used to gather at a bone factory nearby, at 32°24', 27°18', where the carcasses and the debris from the factory was laid out in the veld. This practice was discontinued in 2000. A new vulture restaurant was open by Reid Wardle, a farmer adjacent to the factory on the farm Rexfield (32°24, 27°19'), which he hopes will be a tourist attraction. Up to 50 Cape Vultures have been seen at his restaurant, but there are disturbing snippets which indicate that there are still farmers around who are prejudiced against the vultures. One farmer claims to have watched hoards of vultures killing ewes while they were lambing (Reid Wardle, personal communication). There may have been a recent poisoning episode, killing "half" the birds, but the facts have not been investigated.

Vultures have been sighted at Martha and Mary (32°06', 26°21') and at Thaba Themba (Tsolwana) (32°07, 26°31'), both near Tarkastad, but there is still no evidence that they breed there.

In the Transkei vultures continue to be sighted in small numbers throughout the region. The greatest numbers still occur in the Idutywa district and emanate from Colleywobbles. The are reports of vultures breeding at Gulandoda (31°36', 28°06) west of Umtata en route to Engcobo but I think that it is only a roost. I have long wanted to check that cliff - for certainly the last time I went there in the mid 1980s there was no evidence of breeding.

I found a new colony (31°25, 29°18') along the Mzimvubu River west of Lusikisiki which I reported to Steven Piper. I was there in February 2004 and looked at the immense cliffs from a great distance. The nature of the white-washed cliffs and the to-ing and fro-ing of the vultures suggested to me that it was a breeding colony.

There are reports that the breeding colony in the Mkambati Nature Reserve (30°13' 29°59') in Pondoland continues to flourish. It seems to me that these birds which bred along the Mtentu in the 1980s and along the Msikaba river in the 1990s are linked to those birds that used to breed along the Mtamvuma River, KwaZulu-Natal. The site is being monitored by Steven Piper. It is my contention that these vultures are dependent upon the carcasses of eland in the Mkambati Nature Reserve. It is also my observation that these eland do untold damage to the floral heritage of Pondoland – i.e. its diversity of rare plants found only on the Pondoland Sandstone. It is my contention that the conservationists there are neglecting their responsibility to the endangered flora by promoting the eland as a game to be view by tourists. It is a classic case of doing the wrong thing for the wrong reasons. The eland should be culled or translocated and with their demise would lead to the emigration of the dependent vultures.

A new roost (31°50, 28°21') was found on the Mbashe River near Clarkebury, which was reported to Steven Piper who continues to maintain a register of all vulture breeding sites.

Bearded Vulture

There are occasional sightings of Bearded Vultures (*Gypaetus barbatus*) in the Winterberg between Adelaide and Tarkastad. The breeding sites in the north-eastern Eastern Cape Drakensberg continue to be used. I managed to visit the one at Bottelnek (3127 BB) and saw the birds there. In our 1975 Raptor Survey of the Cape, done with Cape Nature Conservation, with Andre Boshoff as project leader, I had a report of a Bearded Vulture eyrie by a Mr Moore of Maclear which I did not follow up. Last year I tracked down his descendants and visited the site. We did not find an eyrie but saw birds, and after we had staggered out of the mountains were told we went to the wrong spot. Such is the life of intrepid vulturephiles.

Egyptian Vulture

In the 1990s I found an eyrie in a cave which I consider belongs to a pair of Egyptian Vultures (*Neophron percnopterus*)– however, they were not seen on the nest and I now lack the energy and resources to venture over the rugged terrain to the site. The locality of this site will only be revealed to those who would care to take me there. I did see an Egyptian Vulture at Halcyon Drift (30°58', 28°26') on 25 November 2001 and am happy that their presence in the Transkei is not a myth.

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The status and conservation of vultures in the Free State Province of South Africa

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Introduction

The Cape Vulture was the first of the four vulture species occurring in the Free State to receive any attention when O'Connor (1980) visited some cliff sites from 1974-1976; this species has received varying amounts of attention since then (Stoltz 1981; Colahan 1988, 1989, 1990, 1991, 1993; Colahan & Esterhuizen 1997). In the course of my work on this species I also made observations on the Bearded Vulture (B. Colahan unpublished data), as did T.G. O'Connor (Vulture Study Group unpublished data). The monitoring of the breeding activity (with the ringing of nestlings) of African White-backed Vultures in and around Sandveld Nature Reserve in the Hoopstad District of the northwestern Free State, started in 1985 and has continued, with some breaks, until now (B. Colahan unpublished data); the ringing of chicks in the "Susanna colony" (Murn *et al.* 2002) in the western Free State started more recently (1997), and has continued to varying degrees since then (J.R. Esterhuizen unpublished data; A. Fuller unpublished data; B. Colahan unpublished data). (The ringing of these nestlings in the western Free State may have started earlier, with part of the "Dronfield colony", which has been intensively monitored since 1993, extending into the Free State (Murn *et al.* 2002).)

A vulture restaurant was started at Sterkfontein Dam Nature Reserve in 1990 by the Free State Department of Tourism, Environment & Economic Affairs, and, after initial funding problems, has been operating successfully since 1992 (but only because of outside sponsorship, mainly from the Mazda Wildlife Fund, and Dries Auto of Harrismith) (C. Erasmus personal communication); other feeding stations in the Province, such as at Zastron, and in Golden Gate National Park, have been less successful.

The rehabilitation of vultures has been efficiently carried out near Bloemfontein by Ms Alma Fuller since 1994.

Species

The limited data available on the present (or recent) status of the four vulture species that have been recorded in the Free State (since 1983) are summarised in Table 1.

Bearded Vulture *Gypaetus barbatus*

There may still be a nest in Golden Gate National Park, on Generaalskop, the highest peak in the Park and not readily accessible (P.G.J. Koornhof personal communication).

Table 1. Free State vulture populations.

Species	Breeding pairs (year)	Total population	Source
Bearded Vulture	1? (2003)	2-3?	P.G.J. Koornhof (pers. Comm..); F.P. Fihlo (pers. Comm.)
Cape Vulture	?	100+?	B. Colahan (unpublished data)
White-backed Vulture	97+ (2001)	262+ (300-400?)	Murn *et al.* (2002), S.J. Els (unpublished data)
Lappet-faced Vulture	0 (2003)	?	

Bearded Vultures still use the Sterkfontein Dam Nature Reserve feeding station (2-3 birds, F.P. Fihlo personal communication), but are rarely seen elsewhere in the Province; any birds in the Free State are probably just visitors from Lesotho and KwaZulu-Natal.

Cape Vulture *Gyps coprotheres*

There are no regularly used Cape Vulture cliff roosts left in the Free State, and occasional roosts seem to be used irregularly and by small numbers of birds (B. Colahan unpublished data); the small breeding colony found on the Free State section of the High Drakensberg (in the former QwaQwa), during an aerial survey in 1983 (C.J. Brown in litt.) does not appear to have been checked since, so may still exist. The Cape Vulture also makes use of electricity pylons to roost on in this Province, usually together with African White-backed Vultures; with very limited information on these I have no idea how many Cape Vultures there may be in this Province at any time, but would guess at 100+, with this varying seasonally.

Cape Vultures make good use of the vulture restaurant at Sterkfontein Dam Nature Reserve (most probably from the breeding colony just over the escarpment, at the northern end of the reserve) - c.340 birds was the highest count in 2003 (F.P. Fihlo personal communication).

African White-backed Vulture *Gyps africanus*

The African White-backed Vulture could be the only species still breeding in the Free State, and there were probably over 100 pairs nesting in this Province in 2001 (with the figure used for the Boshof District including active nests in only the Susanna colony, and apparently excluding those on electricity pylons (Murn *et al.* 2002), and the search for birds nesting on farms around Sandveld Nature Reserve only cursory (S.J. Els personal communication)). Using the figure of 0.35 immatures and non-breeding adults per breeding adult (Mundy *et al.* 1992), there were an estimated 262 birds in the Free State colonies in 2001; with the surveys of the colonies not complete, and the presence of birds at electricity pylon roosts elsewhere in the Province, there could have been as many as 300-400 African White-backed Vultures here.

The population in Sandveld Nature Reserve and on adjacent farmland seems to have declined over the past 10 years, with those on private land particularly affected. However, it will require a properly conducted survey, preferably from the air, to confirm this.

For the period 1985-1996 106 chicks were ringed at the colonies in and around Sandveld Nature reserve; a greater proportion of the chicks produced in the Free State was ringed from 1997, with the commencement of ringing in the Boshof District, and 224 were ringed in the Province for the years 1997-2003. (The figures for both periods include the occasional rehabilitated bird that was ringed when released.)

Lappet-faced Vulture *Torgos tracheliotos*

It is over 100 years since this species was last recorded breeding in the Free State (Colahan & Esterhuizen 1997), so it is unlikely that there are any pairs nesting undetected in the northwestern quarter of the Free State. One Lappet-faced Vulture was apparently sighted at the pylon roost south of Dealesville c.4 years ago (A. Fuller personal communication), and Van Zijl *et al.* (2003) list this species among those in "proven and suspected" poisoning incidents in this Province for the period 1995-2002. The coordinates for a ring recovery from a juvenile in 2001, "near the Orange R[iver], Free State", at "2919S 2234E" (Oschadleus 2002), actually lie in the Northern Cape, northwest of Prieska.

Major threats

With hundreds of wooden T-structure 11/22 kV electricity poles, some of the newer staggered vertical poles, and other lethal structures scattered throughout the Free State, the electrocution of vultures must be continuing unabated. Similarly, it is likely that very few farm reservoirs in the Free State have been made safe for birds, and vultures continue to drown here; e.g. Anderson (2001) and Oschadleus (2002).

Van Zijl *et al.* (2003) list all four species for the Free State in their table showing "Regional distribution of vulture mortality due to poisoning" for the period 1995-2002; they were killed in problem animal control attempts, and for "consumption", using carbamates, strychnine and 1080 (sodium monofluoroacetate). In the table "Number of specimens per incident", the Free State appears under the "1 only", "2 to 5", "6 to 10" and "26 to 50" columns. In 2003, at least three Cape Vultures were poisoned in the Harrismith District by a farmer who is reputed to take orders for dead vultures, presumably for the *muthi* trade.

An African White-backed Vulture nestling from Sandveld Nature Reserve in the 2000 breeding season, estimated to be c.55 days old, exhibited bowing of both legs, a symptom of metabolic bone disease (Benson 1997); an attempt to raise it in captivity failed.

The Department of Water Affairs & Forestry continues to issue permits for the felling of Camel Thorn woodland in the Hoopstad District (so that the land can be cultivated); a particularly fine stand of this woodland was felled in 2003 (S.J. Els personal communication).

Current research, monitoring and conservation initiatives

Dr Pieter Koornhof of Bethlehem runs the "Hoogland Raptor Project" of the Raptor Conservation Group (Endangered Wildlife Trust); his activities involving raptors in the northeastern Free State includes the monitoring of vultures at Golden Gate National Park and environs.

The ringing of African White-backed Vulture chicks at colonies in Sandveld Nature Reserve and environs, and in the Boshof District, has continued annually since 1997, but the proportion of the chicks ringed varies from one year to the next, according to resources.

The aerial survey of African White-backed Vulture colonies in the Kimberley area in 2001 (Murn *et al.* 2002) included those in the adjacent Boshof District of the Free State, within c.40 km of Kimberley.

The vulture restaurant at Sterkfontein Dam Nature Reserve continues to operate successfully (F.P. Fihlo personal communication), while that at Golden Gate National Park has been restarted, but is unfortunately not well supported at this stage (P.G.J. Koornhof personal communication).

Ms Alma Fuller's raptor rehabilitation facility is still running, though she has not had many vultures to attend to these past few years.

Proposed research, monitoring and conservation initiatives

Cape Vulture

- The apparent increase in demand for vulture heads in the *muthi* trade, to be used in predicting the winning numbers in National Lottery draws (Khan 2003), is cause for concern in the Harrismith District; it is essential that the VSG make a concerted effort to persuade the Traditional Healers' Association to stop the use of vultures for divination.
- It is essential that existing vulture restaurants be supported, and the initiation of new ones be encouraged, so as to keep vultures from carcasses poisoned by stock farmers for problem animal control, or by people wanting specimens for the *muthi* trade.
- The proposed expansion and amalgamation of Tussen-die-Riviere and Gariep Nature Reserves in the southern Free State, together with the adjacent Oviston Nature Reserve in the Eastern Cape, and the subsequent re-introduction of large predators, could benefit the few remaining Cape Vultures in that part of the country. It is possible that the cliffs on the Aasvoëlkop at the eastern end on Tussen-die-Riviere, and those on another Aasvoëlkop adjacent to the northern side of Gariep Nature Reserve, could be recolonised if there is a regular supply of food from predator kills; this must be monitored.

African White-backed Vulture

- An aerial survey is required of the stands of *Acacia erioloba* and *A. tortilis* in the northwestern Free State to determine whether there are any as yet undocumented colonies between those in the Hoopstad and Boshof districts, and whether colonies that have disappeared from

some Hoopstad farms have just shifted to nearby farms. It would probably be useful to precede this with a postal survey among all landowners in these two districts.

- All landowners in the Hoopstad and Boshof districts with African White-backed Vultures nesting on their land should to be given some sort of recognition for "their" vultures, and some guidance on looking after them.
- The Department of Water Affairs & Forestry needs to be confronted by the VSG over the apparently uncontrolled issuing of permits to clear acacia woodland.
- Arrangements must be made to monitor the vultures using the feeding station at the Beefmaster feedlot at Christiana, where colour-ringed birds have been sighted (C. Pretorius personal communication). It would be desirable to have a vulture restaurant closer to the Hoopstad District breeding colonies, in either Sandveld, or Bloemhof Nature Reserve, or on one of the nearby game farms.

Acknowledgements

I am grateful to the people mentioned above for the additional information they supplied.

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Status and conservation of vultures in KwaZulu-Natal, South Africa

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Introduction

KwaZulu-Natal vulture populations, with the exception of the Palm-nut Vulture, are continuing to decline. This document presents the best current estimates of population status and trend, and provides a brief overview of the history of vulture monitoring, research and conservation activities in KwaZulu-Natal, as well as of current and proposed activities.

History of vulture monitoring, research and conservation in KwaZulu-Natal

Monitoring

There has never been a coordinated vulture monitoring programme operational in KwaZulu-Natal (KZN). Most existing data collection programmes are uncoordinated, undocumented, lack adequate data management and, importantly, are not linked to formal conservation targets or programmes. There are no good 'baseline' estimates of population sizes, other than for Bearded Vultures (BVs) and Cape Vultures (CVs) which were conducted by Brown (1988) and Brown & Piper (1988) respectively.

The CV Site Register was set up two decades ago as a repository of everything that is known of breeding and roosting sites for this species (Piper *et al*., In prep). No other co-ordinated scheme exists for any other vulture species in the Province. The extensive ground and aerial survey of CVs and BVs undertaken in the early 1980's along the Drakensberg escarpment and into Lesotho was followed by less extensive surveys in 1994 and 2001-2003 (Brown 1988; Brown & Piper 1988; Krüger & van Zyl 2004; Maphisa 1997; Maphisa 2001). Intensive monitoring of the CV colonies in Umtamvuna Nature Reserve (NR) and Oribi Gorge has been undertaken for many years (Piper 1982; Piper 1985; Piper & Neethling 2002).

Under the auspices of the former Natal Parks Board surveys of breeding vultures were carried out in Hluhluwe-Imfolozi Park in the early 1970's (Hitchins 1980), early 1980's (Whateley 1986) and late 1980's by Bill Howells (personal communication) though these latter data have yet to be published. From the mid-1970's to the early-1990's records were kept of vulture nests in Mkhuze Game Reserve (GR) (KZN Wildlife unpublished records). An aerial survey of Palm-nut Vultures was conducted in 1977 (Brooke & Cooper 1978), and incidental records of Palm-nut Vultures have been made during the Coordinated Waterbird Counts. KZN Wildlife maintains a 'Sensitive Site Register' where breeding records of raptors and other important species are recorded, but there are only limited records of vulture nesting sites in this database.

The best current estimate of distribution is provided in the Atlas of southern African Birds (Harrison *et. al*. 1997), but it needs to be recognised that the breeding range of all vulture species is significantly smaller than the foraging range. Due to the lack of formal monitoring programmes the population sizes of vultures will always be open to speculation, but best current estimates are presented in Table 1.

Research

Almost all of the pioneering research on the Bearded Vulture was undertaken in KZN and Lesotho, while other species have been little researched. Key publications on Bearded Vultures include a monumental Ph.D. thesis (Brown 1988) and 25 papers and popular articles emanating from that and subsequent work.

Cunningham (1990) reported on the use of vultures in the medicinal trade. The most recent research on the medicinal use of vultures was conducted by Ngwenya (Ngwenya 2001), and although relatively superficial, indicated that of all bird species, vultures are most sought after. More recent informal assessments by KZN Wildlife staff indicate that the value in 2004 of a vulture's head may be in the region of R650 (Steve McKean, personal communication).

An analysis of the literature indicates that the numbers of scientific publications pertaining to vultures in KZN grew steadily over time, peaked in the late 1980's, and has been declining ever since; a large number of popular and other articles have been published since the early 1980's (Figure 1).

There are no research projects currently underway on any species of vulture, other than the 'Streamer Project' and 'Proactive Marking' projects being funded by Eskom and being undertaken by one of us (S.E. Piper unpublished data). The former is a national project aimed at gaining an understanding the size (length), frequency and conductivity of vulture excrement ('streamers') thereby providing information for better design of electricity pylons. The latter involves the development of a risk model for CV-transmission line interactions, thereby proactively highlighting lines requiring marking or structures requiring modification.

Conservation

No focussed or coordinated conservation strategy for vultures has ever been developed in KZN. Conservation efforts that exist are uncoordinated and hence, in hindsight, have been rather ineffective - testimony to this being the continuing decline in vulture numbers (Table 1).

In our opinion, the official conservation agency for the province (KZN Wildlife) has failed to either coordinate or lead vulture conservation initiatives, and has demonstrated a lack of appreciation of the plight of vultures and the need for conservation intervention. The organisation extirpated the Ornithologist post in 2000 during re-structuring, and all species-conservation initiatives are now left to generalist ecologists who work within management regions. Thus the organisation is seemingly not able to easily initiate any Province-wide single species conservation strategies. This is also apparent for other bird species (cranes, Blue Swallow, Cape Parrot, Ground Hornbill, etc.) for which non-governmental organisations (NGOs) have taken the lead in developing

conservation strategies and action plans. In the case of vultures, the Vulture Study Group (VSG) (as the appropriate NGO) has failed thus far to step in and provide appropriate leadership and direction for vulture conservation initiatives.

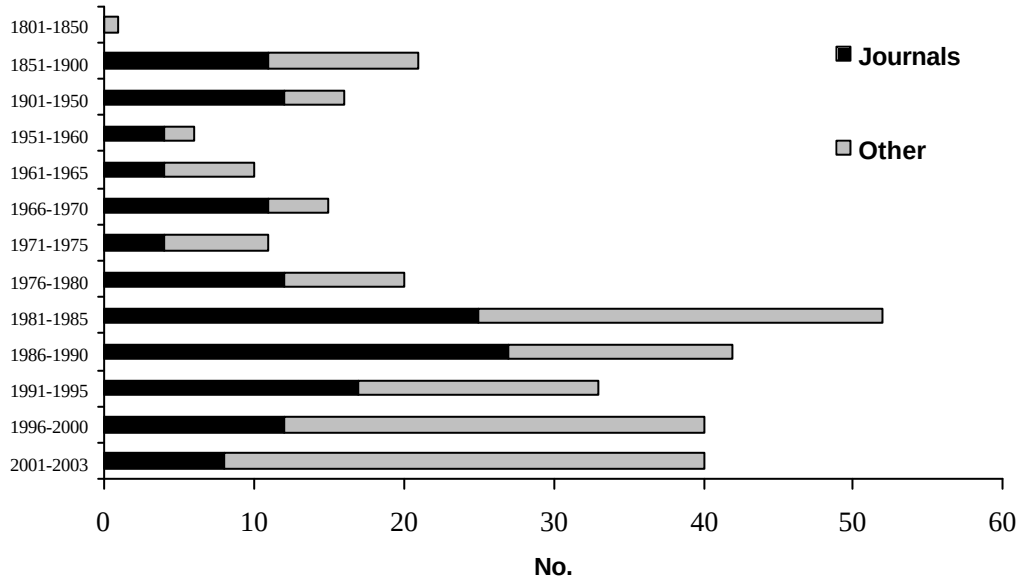

Figure 1 Number of published accounts of vultures in KZN since written history of the province started (S.E. Piper unpublished data)

Table 1. Estimates of population size and trend of all vulture species in KwaZulu-Natal in 2004. Numbers of breeding pairs in protected areas indicated in parentheses.

Species	Population size (2004)	Breeding pairs (2004)	Population trend	Sources
White-backed Vulture *Gyps africanus*	800-1000	300-350 (150-250)	Probably declining	Rushworth (unpubl. data) guesstimate (no reliable recent data)
Cape Vulture *Gyps coprotheres*	910	196 (158)	Declining	Piper, Mundy & Vernon (In prep)
Bearded Vulture	46-51	15 (15)	Declining	Krüger & van Zyl (2004)
Lappet-faced Vulture *Torgos tracheliotos*	60	= 20 (=20)	Probably declining	Rushworth (unpubl. data); population size based on estimate of breeding population size based on ratio of 2:3 breeding:total (Piper & Johnson 1997)
White-headed Vulture *Trigonoceps occipitalis*	36-45	12-15 (=12)	Declining	Ditto
Palm-nut Vulture *Gypohierax angolensis*	40	12 (5)	Slowly increasing	Rushworth & Chittenden (2004)
Hooded Vulture *Necrosyrtes monachus*	Rare vagrant	0 (0)	Unknown, but frequency of visits probably declining	Harrison *et al*. (1997)
Egyptian Vulture *Neophron percnopterus*	Effectively locally extinct	0 (0)	Effectively locally extinct	Brown *et al*. (2000)

The VSG must also be condemned for deliberately ignoring the plight of the Bearded Vulture and initially refusing to heed warnings raised by KZN Wildlife about suspected dramatic declines or to support the call for a monitoring programme. This small deme, consisting of considerably less than 200 breeding pairs (Krüger & van Zyl 2004) based entirely on the Drakensberg-Maloti Massive, is completely isolated, both demographically and genetically, from the nearest sub-population in East Africa (Mundy *et al*. 1992). Hence it is more (regionally) threatened than the Cape Vulture that has thus far received considerably more publicity and resources.

On a positive note a Memorandum of Understanding was signed between the Endangered Wildlife Trust and KZN Wildlife in 2004 which will go a long way towards coordinating vulture conservation and research efforts, maximising funding opportunities, ensuring access to data and facilitating resources for vulture conservation.

Vulture restaurants have been particularly successful in KZN, with approximately 90 proposed or established and at least 57 currently in operation as at March 2004 (S. E. Piper, unpublished data). Most of these are on private land; KZN Wildlife operates four vulture restaurants, these being in the uKhahlamba Drakensberg Park (Giant's Castle GR), Spioenkop NR, Weenen GR and Ithala GR. Other than at Giant's Castle GR only wild game, specially shot for this purpose, has been utilised since 1998 so as to minimise the risk to vultures of veterinary drugs, other agrochemicals and diseases. In

hindsight and with the experience of the 'Asian Vulture Crisis' (Oaks *et al.* 2004) this cautious strategy appears to have been justified. In the case of Ithala GR game is deliberately shot and left in the veld in order to benefit vultures and other scavengers and specifically to get vultures to return as breeding residents to an area from which they previously disappeared (Marchant *et al*. 1998). The amount of carrion left for vultures is based on an estimate of what predators would have left prior to recent human settlement (I. Rushworth unpublished data.). As at March 2004 no nests have yet been recorded in Ithala GR, but four species of vulture have been recorded, three of which are regularly present. The VSG has developed and maintains in conjunction with KZN Wildlife a register of all known vulture restaurants (S.E. Piper unpublished data.) (Figure 2).

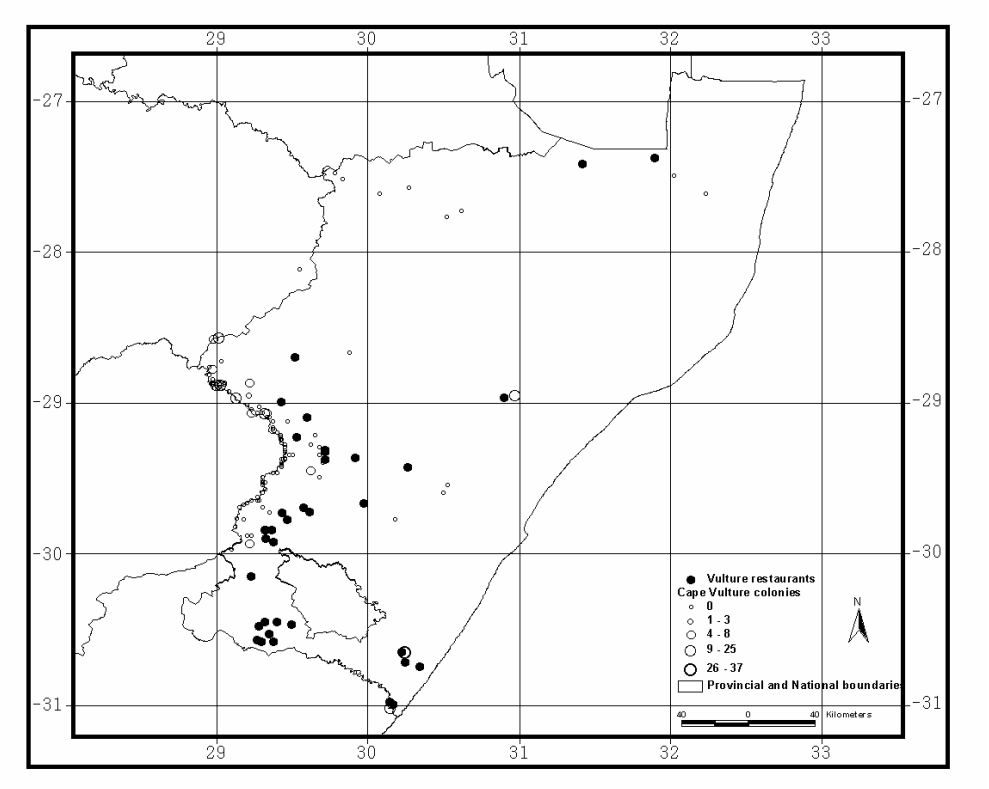

Figure 2. Location of known vulture restaurants in KZN in 2004 (S.E. Piper unpublished data) in relation to Cape Vulture colonies (breeding and roosting, past and present) (Piper *et al.* in prep.).

Good news for CV and BV conservation is the World Bank-funded Maloti-Drakensberg Transfrontier Project (MDTP) that will assist in focussing attention on these two species, improve capacity of conservation agencies to undertake vulture conservation, and improve trans-boundary co-operation between South Africa and Lesotho.

Several of the Elephant Management Plans for Zululand protected areas explicitly take vulture conservation into account, with a 'limits of acceptable change' approach in terms of elephant impacts on breeding sites and population sizes of vultures being adopted (e.g. Rushworth & Blok 2001).

However, there is little evidence that the monitoring requirements of these plans are being implemented.

Proposed monitoring, research and conservation

Proposed Monitoring

It is proposed that KZN Wildlife undertake a complete aerial survey of vulture nests in Zululand and Maputaland protected areas in 2004. This will provide a useful time series analysis of vulture numbers in Hluhluwe-Imfolozi Park, and provide a baseline for Mkhuze GR and other protected areas against which future changes can be measured. It is envisaged that a more formal vulture monitoring programme will be developed for the entire Zululand and Maputaland area.

KZN Wildlife and the VSG are in the process of developing a province-wide monitoring protocol for BVs and CVs. This will, of necessity, be expanded to a bioregional monitoring programme to encompass the full range of BVs and CVs in eastern South Africa and Lesotho.

Building on the Zululand/Maputaland survey and the CV and BV monitoring protocols, it is planned that a monitoring programme for all vulture species in KZN will be developed, resourced and implemented.

Proposed Research

In our opinion the following are the top research requirements:

Survey into the use of vultures in traditional medicine

Problem statement: It is known that vultures are sought after in the medicinal trade (Cunningham 1990; Ngwenya 2001), but there is little detailed understanding of the religious and belief systems that drive this use, what vulture parts are used for, the magnitude of the demand, the volumes currently being traded, and whether there are viable alternatives. There is also no ongoing monitoring in place to record volumes traded/used. Consequently, it is difficult to design and implement conservation actions.

Product: Better understanding of demand and traditional reasons for use, with consequent insights for appropriate conservation actions.

Population-level effects of disturbance to BV and CV nesting and roosting sites by climbers, ramblers, helicopters etc.

Problem statement: In Europe nest site desertion and/or increased predation at vulture nests as a result of disturbance caused by aircraft and climbers has been documented, and Brown (1988) recorded nest abandonment by BVs in response to the installation of a video camera; it is also known that visitor numbers and demand for helicopter flights in the uKhahlamba Drakensberg Park will continue to increase, especially following the World Heritage Site designation in 2000. It is suspected that it will be necessary to develop appropriate spatial and temporal zonation of use in order to mitigate disturbance.

Product: Quantitative information on the extent of disturbance by different types of use and the population-level impacts that this may be having, and

guidelines for appropriate spatial and temporal zonation of land- and aerial-based activities.

Loss of foraging habitat and change in food supply

Problem statement: Significant areas are now inaccessible as foraging habitat for vultures due to land transformation, and the density of livestock on remaining natural veld is declining due to declining grassland productivity, stock theft and economic factors. It is suspected that this may be resulting in a reduction in food availability for vultures (Piper & Johnson 1997). However, the move from livestock to game farming in savanna areas may be benefiting vultures but there may be an increased use of poisons for problem animal control to eliminate jackals that are suspected of preying on valuable game (T. Snow, personal communication).

Product: Quantification of the population-level impacts (positive or negative) of land use change, thereby providing information to guide land use change decisions.

Landowner attitudes and use of poisons

Problem Statement: It has been more than a decade since a systematic survey of attitudes of landowners and use of poisons has been conducted (last survey conducted by Brown 1991). It is important to understand in both KZN and Lesotho (a) the current attitudes of commercial and communal landowners to vultures, and (b) to better understand the current use of poisons and other potentially harmful agrochemicals/veterinary drugs e.g. non-steroidal anti-inflammatory drugs.

Product: Better information about attitudes and use of poisons/agrochemicals/veterinary drugs leading to better conservation strategies being developed.

Proposed Conservation

Vulture restaurants that provide a reliable and safe source of food to vultures are seen as a key conservation tool for all species in KZN. There are plans to develop at least two more restaurants in the UDP and to review the operation of those in Weenen GR and Spioenkop NR.

It is hoped that the MDTP will provide an essential catalyst in the period 2004-2007 to improve communication and collaboration between SA and Lesotho, especially in terms of vulture monitoring and conservation. The future of BV and CV conservation in this region is dependant on improving collaboration, as the populations in each country are dependant on what is happening in the other.

Options for better protection from disturbance by aircraft and rock climbing of breeding and roosting sites of BVs and CVs in the Drakensberg are being evaluated.

With the possible exception of CVs, it is clear that there are not viable breeding populations contained within existing protected areas (PAs) (Table 1), and in any event given the relatively small sizes of PAs in KZN the majority of the foraging range of these birds will extend beyond the PA boundaries.

Breeding of some species such as Lappet-faced and White-headed Vultures appears to be restricted to PAs. Without major interventions the continued presence of most species of vultures in KZN cannot be assured.

The key direct threats to vultures in KZN, in rough order of importance, are: Poisoning (deliberate persecution, harvesting for traditional medicine, accidental poisoning); electrocutions and collisions with power lines; direct persecution; food shortage (quantity and quality); and disturbance.

Acknowledgements

The financial support of The Wildlands Trust and Maloti Drakensberg Transfrontier Project for vulture monitoring in the uKhahlamba Drakensberg Park World Heritage Site is gratefully acknowledged. We thank the Vulture Study Group for access to the Cape Griffon Site Register, Vulture Restaurants Database and Vulture Bibliography. We thank Sonja Krüger and Doug van Zyl for help, data and useful comments.

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The status of vultures in Gauteng, South Africa

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Introduction

Four vulture species are listed for Gauteng (Tarboton 1997) although of these, only the Cape Griffon *Gyps coprotheres* occurs as a breeding resident in the province. The status of Gauteng's only Cape Griffon breeding colony at Nooitgedacht in the Magaliesberg remains largely unchanged from that reported in Verdoorn (1997). The number of pairs peaked at 74 in 2002 (Verdoorn 2003) and it would appear that the breeding population has stabilized at a level similar to that recorded prior to the abandonment of the colony in 1967 when construction of micro-wave transmission towers was initiated at Nooitgedacht.

The African White-backed Vulture *Gyps africanus* is known to have bred within the provincial boundaries (i.e. at Zoutpan and Hammanskraal) up until at least 1925 (Tarboton & Allan 1984), but it is now only an erratic, non-breeding visitor to the province (Tarboton 1997; P. Irons personal communication). The highest reporting rate for this species in Gauteng during the southern African bird atlas project coincided with those quarter degree squares in the vicinity of the Magaliesberg that contain vulture restaurants (Mundy 1997). While this may reflect food shortages in other areas of suitable habitat, it could also be attributable to observer bias.

The remaining two species, the Bearded Vulture *Gypaetus barbatus* and the Lappet-faced Vulture *Torgos tracheliotos* are both listed as vagrants to Gauteng by Tarboton (1997), though Verdoorn (1997) reports the latter to be a regular visitor to the vulture restaurant at the Rhino and Lion Nature Reserve, Kromdraai. In contrast, records for the Bearded Vulture are very limited with possibly as few as two unconfirmed sightings over the past 40 years (Tarboton *et al.* 1987; J. Ceronio personal communication), both for the Heidelberg area.

Species

Table 1 Most recent estimate of size and status of vulture populations in Gauteng.

Species name	Breeding pairs	Individuals	Source of data
African White-backed Vulture	Non-breeding	Erratic visitor	Tarboton 1997; P. Irons personal communication
Cape Griffon	64 (2003)	240 (2003)	Verdoorn 2003
Bearded Vulture	Non-breeding	Vagrant	Tarboton 1997
Lappet-faced Vulture	Non-breeding	Vagrant	Tarboton 1997

Threats

Habitat loss and transformation

The breeding habitat of the Cape Griffon in Gauteng portion of the Magaliesberg falls within the Nooitgedacht Game Ranch and Magaliesberg Protected Natural Environment and is therefore protected, but the extent and quality of suitable foraging habitat for this species has undoubtedly diminished. By 2000, less than 30% of the original extent of natural habitat in Gauteng remained untransformed and this was fragmented (M. Pfab personal communication). Habitat loss and transformation are therefore considered to be the most significant threats to vultures in this province.

Collision and electrocution

Mitigation measures introduced by the Eskom-EWT partnership appear to have addressed the collision and electrocution risk posed by powerlines at Nooitgedacht (C. van Rooyen personal communication). More recent collision related mortality of vultures in the vicinity of the Rhino and Lion Nature Reserve are currently being addressed.

Other

The traditional use of vulture parts is a cause for concern, but no attempt has yet been made to quantify the extent of trade in the province or assess the origin of the carcasses that are being utilized. The absence of any records of recent vulture poisoning incidents in Gauteng does, however, suggest that the carcasses are imported from other provinces. No other unnatural causes of mortality (e.g. drowning) have been reported.

Current research, monitoring and conservation initiatives

Research

No vulture-related research projects are being conducted in the province at present, though there is a definite need for additional information on the foraging range and movement patterns of the Magaliesberg Cape Griffons. A sound understanding of the basic requirements of this species is essential if the conservation plan being developed for Gauteng is to be effective.

Monitoring

The Vulture Study Group has been monitoring breeding success at the Nooitgedacht colony annually since 1991. The results of the last three seasons monitoring are summarized in Verdoorn (2003) and encouragingly suggest that the breeding population is stabilizing. Monitoring of vulture restaurants appears to occur on a more *ad hoc* basis and the extent to which supplementary feeding at the remaining three active restaurants in Gauteng contributes to the food requirements of vultures in the province is another topic for future research.

Conservation

Provision of supplementary food at vulture restaurants on the Nooitgedacht Game Ranch, the Rhino and Lion Nature Reserve and at Mohale's Gate, together with the education and awareness work conducted by the Poison Working Group, the Raptor Conservation Group and the Vulture Study Group

are conservation initiatives with the potential for immediate and direct benefit to vultures.
The conservation plan being developed for Gauteng by the Directorate of Nature Conservation is a more strategic approach intended to deliver long-term benefits to vulture (and broader biodiversity) conservation in a province characterized by high development pressure. For this approach to be successful however, the conservation targets set for this species (in terms of both desired population and spatial requirements) need to provide adequately for the long-term conservation of a viable local population, but still remain realistic and achievable.

The provisional target proposed for the Cape Griffon colony at Nooitgedacht was protection of the farm Nooitgedacht 471 JQ and a 1000m buffer zone. Various reviewers justifiably criticized this target as being too vague and for failing to provide a mechanism for the attainment of the target, though this latter requirement was beyond the brief of the initial target setting process. As a revised target, I therefore propose a minimum population target of 74 breeding pairs of Cape Griffons at Nooitgedacht. This is equivalent to the maximum number of pairs recorded at this colony since 1967 and is clearly feasible in terms of the available nest sites.

In order to achieve this target, at least the following supporting objectives need to be met:

1. Ensure the long-term protection of the breeding cliffs on Nooitgedacht and a 1000m buffer zone. This could involve a conservation partnership between landowners, the Vulture Study Group, provincial and local governments and any other relevant parties to develop and implement a management plan for the area that would remove or at least mitigate threats to vultures.
2. Retain the potential for movement (immigration and emigration) of vultures between Nooitgedacht and other breeding colonies on the Magaliesberg at Scheerpoort and Robert's Farm (e.g. for genetic exchange and temporary refuge should conditions at one site deteriorate). This would necessitate close cooperation between provincial and local governments in Gauteng and the North West Province to ensure that the requirements of vultures are integrated into strategic development plans for the area.
3. Critically assess the role of vulture restaurants in maintaining the viability of the vulture breeding colonies in the Magaliesberg. If supplementary feeding is found to be necessary, every effort should be made to ensure that the three remaining active vulture restaurants in Gauteng are appropriately managed and at least adequately provisioned during the main "bottleneck" periods i.e. when chicks are fledging and when the juveniles are becoming independent. Strengthening partnerships between restaurant managers and surrounding agricultural and business communities could facilitate this.

Proposed research, monitoring and conservation initiatives

The need for further vulture related research and conservation initiatives is Gauteng is clear. However, rather than focussing on the significant gaps in our knowledge, only those proposed initiatives that I believe have a good probability of being achieved in the next five years are discussed below.

Research and monitoring

The Gauteng Directorate of Nature Conservation will shortly be advertising a post for a scientist to undertake work with traditional healers and traders. One of the responsibilities of this individual must be to investigate and monitor the extent to which animal parts are traded and utilised for traditional purposes. This will contribute to a better understanding of the extent to which vultures are impacted by trade.

Conservation

The Gauteng Provincial Government has identified the potential of the northeast of the province as a tourism destination and has already spent a number of years working with landowners in the area to develop and promote the Dinokeng concept. This area is proposed to include a 100 000 ha game reserve which could potentially see the African White-backed Vulture breeding in the province for the first time in
decades. The potential for establishing a vulture restaurant on an existing provincial reserve in Dinokeng is currently being investigated.

Acknowledgements

I would like to thank Mark Anderson, Pete Irons, Christine Koenig, Peter Mundy, Michéle Pfab, Steven Piper, Chris van Rooyen, Gerhard Verdoorn and Kerri Wolter for generously making their data and ideas available to me.

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Vultures in the Northwest Province of South Africa

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Introduction

The Northwest Province is one of South Africa's nine provinces and covers a surface area of approximately 116,000 square kilometers. Two biomes are represented in the province with the savanna biome covering 71% of the surface and the grassland biome covering the remainder 29%. Ten vegetation types are recognized in the province. Thornveld, bushveld and savannah grassland are the most representative vegetation types in the province with Kalahari thornveld the most dominant in the arid western regions of the province. There are 3,025 identified plant species in the Northwest Province, 95 reptiles, 25 amphibians, 395 bird species and 138 mammals. Invertebrates have not yet been thoroughly documented. Geophysical features of the province are highly varied between alluvial plains in the central south to volcanic outcrops of the Pilanesberg and sedimentary outcrops of the Magaliesberg (www.nwpg.gov.za/soer).

Eight of the Old World Vulture species occur in the Northwest Province of South Africa. The Cape Griffon (*Gyps coprotheres*) inhabits the Magaliesberg cliffs and is one of the most common vultures in the province. African White-backed Vultures (*Gyps africanus*) are found in most regions of the province with the largest part of the population in the arid Kalahari thornveld and southern thornveld regions. Lappet-faced Vultures (*Torgos tracheliotos*) occur in the Kalahari thornveld, bushveld and southern thornveld regions. White-headed Vultures (*Trigonoceps occipitalis*) are vagrants to the Kalahari thornveld close to the Botswana border. Single records of the Egyptian Vulture (*Neophron percnopterus percnopterus*), Palm-nut Vulture (*Gypohierax angolensis*), Hooded Vulture (*Necrosyrtes monachus*) and Rüppell's Griffon (*Gyps rueppellii*) have been recorded in the province over the past decade (Verdoorn personal observation).

Status of vulture species in the Northwest Province

Cape Griffon *Gyps coprotheres*

The Cape Griffon is an abundant resident of the Magaliesberg Mountains. Historically three colonies existed at Scheerpoort (25°45'S 27°45'E), Olifantsnek or Robert's Farm (25°50'S 27°17'E) and Nooitgedacht (25°51'S 27°33'E) (Tarboton & Allan, 1984). The Nooitgedacht colony was abandoned by the vultures in 1964 when construction activities on the micro-wave towers took place and possibly caused too much disturbance for the vultures (J.C. Sanders personal communication). Repatriation occurred during 1989 when the landowners started a vulture restaurant on the montane plateau and the first successful breeding was recorded in 1991 (Verdoorn & Becker 1992). The Scheerpoort colony has remained a major breeding colony since the early 1980s although the numbers have declined since the days of the first Cape Griffon ringing in the 1950s. The Robert's Farm colony has declined

alarmingly in the late 1980s and early 1990s to very low numbers (Verdoorn, personal observation). Some of the vultures that recolonised the Nooitgedacht colony are believed to be Robert's Farm birds but the mass electrocution of Cape Griffons on an 88 kV kite structure powerline west of Ventersdorp in the Northwest Province (Verdoorn personal observation) is also believed to have contributed to the drastic decline of the colony in the mid 1990s.

The current breeding population and nestling production status of the Magaliesberg Cape Griffons is listed in table 1. There was a decline of 9.5% in the total number of breeding pairs in the Magaliesberg from 2001 to 2003 and a decline of 13.3% in nestling production during the same period. The decline in the breeding pairs and nestlings at Scheerpoort was not as significant as the declines recorded for the Robert's Farm colony. The Robert's Farm colony showed a drastic decline in 2002 and that was attributed to a mass poisoning incident at Derby west of the Magaliesberg on 6 December 2001 when between 38 and 58 Cape Griffons died of carbofuran poisoning (Verdoorn personal observation). A small improvement in numbers was recorded for the Nooitgedacht colony although significant fluctuations occurred between different years.

Table 1. Status of the Cape Griffon breeding pairs and nestling production in the Magaliesberg.

Colony	Breeding pairs 2001	Nestlings 2001	Breeding pairs 2002	Nestlings 2002	Breeding pairs 2003	Nestlings 2003	% Variance br. pairs	% Variance nestlings
Scheerpoort	200	181	194	176	188	157	-6.0	-13.3
Nooitgedacht	59	51	74	73	64	60	+8.5	+17.6
Robert's Farm	35	32	15	9	14	12	-40.0	-37.5
Total	294	264	283	258	266	229	-9.5	-13.3

Air traffic disturbance of the Magaliesberg Cape Griffons has always been of concern both for the SASOL Vulture Monitoring Project and landowners on whose land the Cape Griffons reside. The author approached the South African Air Force with a request to restrict military flights at all major Cape Griffon colonies in South Africa after two incidents of military helicopter disturbance at Nooitgedacht and Scheerpoort in 2001. A list of the main colonies and a report on military air traffic disturbance of Cape Griffons was forwarded to the SA Air Force for their consideration in 2001. In March 2004 a directive was issued by the SA Air Force to limit all military air traffic at the 22 main Cape Griffon colonies in South Africa. No military flights may henceforth be conducted within 2,500 feet of Cape Griffon colonies unless in cases of natural disaster or serious national security breaches.

Presentations were also made to hang glider clubs and civil aviation clubs to limit civilian air traffic at Cape Griffon colonies in South Africa.

African White-backed Vulture *Gyps africanus*

Although no population estimates for the African White-backed Vulture exist in the Northwest Province the species may be considered to an abundant resident in most parts of the province. Breeding populations exist in the Molopo, Vryburg, Stella, Zeerust, Madikwe and Wolmaransstad regions of the

Northwest Province. Large aggregations of African White-backed Vultures are regularly recorded at vulture restaurants in the province (Verdoorn personal observation). The largest number recorded by the author was at the Lichtenburg Game Breeding Centre's vulture restaurant in January 2001. There were more than 450 African White-backed Vultures within the immediate area of the vulture restaurant. Good numbers are also recorded on cattle farms at animal carcasses north of Vryburg (B. De Klerk personal communication; E. Graupner personal communication).

African White-backed Vultures are also often observed in the Magaliesberg. No breeding has been recorded for the greater Magaliesberg region but up to 40 individuals are regularly seen at vulture restaurants at Nooitgedacht, De Wildt Cheetah Centre and Hurland feedlot. During the winter of 1999 five juvenile African White-backed Vultures were found very early in the morning emerging from the cliffs of the Scheerpoort Cape Griffon colony. The white defecation on the birds' back indicated that they had roosted in the colony that previous night.

Lappet-faced Vulture *Torgos tracheliotos*

This large vulture species is found mostly in the western regions of the province and is a fairly common resident in the Northwest Province. Breeding has been recorded in the Lichtenburg Game Breeding Centre (U. Oberprieler personal communication), Pilanesberg Game Reserve (S. Dell personal communication), Molopo Nature Reserve (S. Dell personal communication) and Madikwe Game Reserve (S. Dell personal communication). They visit vulture restaurants often and have been recorded at Lichtenburg (44 individuals observed by author in January 1999), Nooitgedacht (J.C. & C. Sanders personal communication; personal observation), De Wildt Cheetah Centre (personal observation), Mareetsane (B. De Klerk personal communication), Ventersdorp (D. Kotze personal communication), Bloemhof Dam Nature Reserve (personal observation), Geysdorp (personal observation), Molopo Nature Reserve (S. Dell personal communication), Pilanesberg Game Reserve (personal observation) and Klerksdorp (P. Orford personal communication).

Lappet-faced Vultures appear to have increased over the last 15 years in the Northwest Province. More sightings are recorded now than in 1987 and 1988 at the Lichtenburg Game Breeding Centre and the Magaliesberg region (Verdoorn personal observation).

Hooded Vulture *Necrosyrtes monachus*

Very few records exist for the Hooded Vulture in the Northwest Province and at best it can be described as a rare vagrant to the province. One specimen was recorded by J.C. Sanders in May 1994 at the Nooitgedacht vulture restaurant. A. Matthee photographed a juvenile at the Lichtenburg Game Breeding Centre's vulture restaurant in 1999. No other substantiated sighting records exist for the province and no breeding has been recorded.

White-headed Vulture *Trigonoceps occipitalis*

The White-headed Vulture is a very rare vagrant to the Northwest Province but due to scant observations the species may be a very rare resident in the north-western outskirts of the province on the Botswana border. No breeding records exist for the province but it cannot be ruled out that there may be some breeding in the sparsely population Kalahari regions of Northwest Province.

Egyptian Vulture *Neophron percnopterus percnopterus*

Only one recent confirmed record of an Egyptian Vulture exists for the Northwest Province. B. Ryan and G. McIlleron (personal communication) observed a juvenile at the Lichtenburg Game Breeding Centre's vulture restaurant on 31 December 1998. It was also photographed by the first observers and the author. The vulture remained at the restaurant for four days before it disappeared. Sighting of Egyptian Vultures in southern Africa are very rare and the species can therefore be considered to be a very rare vagrant to the Northwest Province.

Another observation of an Egyptian Vulture was tendered by W. Stumpf in the Pilanesberg Game Reserve on 27 November 2001. Although the bird was not photographed by the recorder the description was such that there is no reason to doubt the authenticity of this observation.

Palm-nut Vulture *Gypohierax angolensis*

A juvenile Palmnut Vulture was first reported to the author by A. Matthee of the Lichtenburg Game Breeding Centre in 1999. The vulture was seen at the vulture restaurant and subsequently photographed by the author and W.D. Borello. Although the habitat is unlikely to support the species Palmnut Vultures are known to be located in very dry areas such as the Kgalagadi Transfrontier Park. It is considered to be a very rare vagrant to the Northwest Province.

Rüppell's Griffon *Gyps rueppellii*

The author photographed a juvenile Rüppell's Griffon in the company of Cape Griffons in May 1995 at the Nooitgedacht vulture restaurant. It shares the status of a very rare vagrant to the Northwest Province with the previously mentioned four species.

Threats to vultures in the Northwest Province

Vultures face many challenges in the modern world and the Northwest Province is no different to any other province in South Africa in this regard. The main threats that have transpired during the author's 18 years of vulture conservation and studies in the province are:

Pesticide misuse

Pesticides and poisons are often misused by stock and game farmers to kill problem animals such as Black-backed Jackal *Canis mesomelas*, Caracal *Felis caracal*, Feral Dog *Canis vulgaris*, Leopard *Panthera pardus*, Brown Hyaena *Hyaena brunnea* and Spotted Hyaena *Crocuta crocuta*. Large animal carcasses that are laced with pesticides or poisons may attract vultures and

destroy large numbers of birds. Incidents of vulture poisoning have been recorded in the Northwest Province in recent years. The most recent incident occurred west of the town Derby on 6 December 2001 when between 38 and 58 Cape Griffons were poisoned and killed by carbofuran in a cattle carcass. In October of the same year a Lappet-faced Vulture and an African White-backed Vulture were found poisoned in the Lichtenburg Game Breeding Centre after scavenging off a Black-backed Jackal that died of carbofuran in the reserve (A. Matthee personal communication; Verdoorn personal observation). The animal was most possibly poisoned on a neighbouring farm.

Powerline impacts

Unsafe electricity utility structures pose a constant threat to vultures in the Northwest Province. The discovery of a mass electrocution event by a 88 kV kite structure west of Ventersdorp in 1996 highlighted the significance of electrical powerline impacts on vultures and other large raptors. Lower voltage powerlines such as 11 and 22 kV with cross arms also electrocute vultures and several incidents have been recorded in the province. All such incidents are reported to the EWT-ESKOM partnership and are investigated for the implementation of mitigation measures (Van Rooyen 2000).

Collision with powerlines also cause losses of African White-backed, Lappet-faced and Cape Griffons in the Northwest Province. Such incidents mostly occur with high voltage lines such as the 400 kV lines of the Lichtenburg area (Verdoorn personal observation).

Habitat modification

Habitat modification may be detrimental to vultures as breeding areas are disturbed or lost, and food resources may change or disappear completely. Bush encroachment clearing often necessitates the use of extreme measures to eradicate invaders such a *Dicrostachys cinerea* and the herbicides used for such eradication programmes may also kill large trees that are used by tree nesting vultures such as the African White-backed Vulture and Lappet-faced Vulture. There are areas in the Kalahari thornveld of Northwest Province where soil sterilant herbicides have been applied and killed off vast numbers of *Acacia erioloba* trees (Verdoorn personal observation). Landowners mentioned that the vultures have since disappeared from the land.

Changing from livestock farming to crop farming also eliminates natural ecosystems that support not only vultures but other biota as well.

Game farming that should normally benefit vultures is not always conducted in an ecological sustainable fashion. Some individuals within the game farming arena do not tolerate predators on their land and resort to the poisoning of predators. This poses a serious threat to vulture populations.

Food shortage

Due to the changes in land use patterns vultures may be deprived of sufficient food supplies. The large number of vulture restaurants in the province mitigate the problem to a certain extent but it may not be sufficient throughout the province.

Aviation disturbance

Aviation disturbance at vulture colonies has been mentioned earlier on in this paper. It is a threat to vultures especially during the breeding season when incubating or brooding birds may abandon nests due to aircraft disturbance. The SA Air Force has committed themselves to restrictions for operations around Cape Griffon colonies and the author hopes to convince the civil aviation authorities to impose the same sanction on civilian air traffic.

Drowning in water reservoirs

Vultures drink water on a regular basis and bathe often as well. Round farm reservoirs often result in the drowning of vultures as they fall into the reservoirs and are unable to get out of the dams again (Anderson, 1995). This is a significant threat to vultures in the arid regions of the Northwest Province. Despite publicity and awareness of the problem very few farm reservoirs have been fitted with appropriate structures to prevent the drowning of vultures.

Acknowledgements

The author wishes to thank the Mazda Wildlife Fund, SASOL (Pty) Ltd, the Tony and Lisette Lewis Foundation, the South African Air Force, and 14 Squadron, the Sanders family of Nooitgedacht Game Ranch, Malcolm McKee of Leopard Lodge, Hugh Roberts of Roberts Farm, Danie Terblanche, Gerhard van Deventer, Andre Matthee of Lichtenburg Game Breeding Centre, Willem Prinsloo of Standard Bank and Raymond Bobbert of Hurland Feedlot for their support of vulture conservation in the Northwest Province.

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The status and conservation of vultures in the Limpopo Province of South Africa

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Introduction

Limpopo is home to six of the nine vulture species that are found within South Africa. This includes the following species: Cape Vulture (*Gyps coprotheres)*, African White-backed Vulture (*Gyps africanus),* Lappet-faced Vulture (*Torgos tracheliotos),* White-headed Vulture (*Trigonoceps occipitalis)*, and Hooded Vulture (*Necrosyrtes monachus)* that are all breeding in the Province. The Egyptian Vulture (*Neophron percnopterus)* is often seen at Langjan Nature Reserve (Departmental records) and one vagrant specimen of Ruppell's Griffon (*Gyps rueppellii*) has now been cross-breeding with a Cape Vulture at Blouberg Nature Reserve for the last three seasons. There is also one recorded sighting of a Palm-nut Vulture (*Gypohierax angolensis*)(P le S. Milstein, personal communication)

The establishment of vulture restaurants are very popular in the Limpopo Province and the current figure stands at 33 sites with more landowners interested. These are situated on private and government land though a survey is needed to establish which are still active.

The rehabilitation of vultures has been efficiently carried out at Blouberg Nature Reserve by Peter and Janine Snyman of the Blouberg Vulture Project since 1993. This mainly entails rewarding the rural community for handing in fledglings found on the ground and not being able to take off again as well as poisoned or injured birds. Rehabilitation is also carried out at Moholoholo Rehabilitation Centre near Hoedspruit.

Species and Distribution

Limited data are available on the present (or recent) status of the vulture species that have been recorded in the Limpopo.

Cape Vulture

This seems to be the best studied species with monitoring projects at the three biggest colonies in the Province, those at Blouberg, Kransberg and Manutsa. There are also small colonies of Cape Vulture at Moletje Nature Reserve near Polokwane (Pietersburg) and along some of the cliffs of the Waterberg. The species has also been recorded on most of the nature reserves of the province.

African White-backed Vulture

The African White-backed Vulture is the second most common species in the Limpopo and reserve records shows that it is fairly widely distributed and is appearing on records for the most eastern and western reserves. Breeding colonies are mainly situated on privately owned land.

Lappet-faced Vulture
Very little is known about this species numbers and breeding activities. It has been recorded on most nature reserves in the Limpopo.

Egyptian Vulture
Although this species is listed as Regionally Extinct (Barnes 2000) it is frequently sighted and recorded for Langjan Nature reserve near Vivo – close to Blouberg.

Hooded Vulture
An uncommon species recorded for dry northern reserves and adjacent to Kruger National Park. Very little is known about its numbers and breeding activities.

White-headed Vulture
Although also recorded from Atherstone Nature Reserve in the dry west to reserves adjacent to Kruger National Park in the east, very little is known about its numbers or breeding activities in the Limpopo Province.

Major threats
With hundreds of wooden T-structure 11/22 kV electricity poles, some of the newer staggered vertical poles, and other lethal structures scattered throughout the Limpopo, the electrocution of vultures is a continuous threat. Apart from that, poisoning occurs very often and with lots of predators causing damage to stock and game, landowners still resolve their problems by putting poison in carcasses. Added to this, the killing of vultures for "Muti" purposes has also been reported. Habitat destruction seems to be a threat as deforestation for crop farming is also reported.

Current research, monitoring and conservation initiatives
Apart from Pat Benson's research projects and the Blouberg Vulture Project, no information on other projects are available.

The Mohololo rehabilitation centre is contributing to conservation through the rehabilitation of poisoned or injured vultures.

The list of vulture restaurants for the Limpopo currently stands at 33 sites but it is unknown how many are actually active.

Proposed research, monitoring and conservation initiatives
Vulture conservation as a separate issue has not received specific attention in the past from Limpopo Environmental Affairs - but recently some processes were put in place that will address this. Contributing to this will be the Biodiversity Bill which will force formal conservation agencies to look at more than the "big and hairies".

The Limpopo also has a new Act in place, (Limpopo Environmental Management Act.) Act no 7 of 2003. This act provides for the registration of "Sites of ecological importance"; a tool that can be used in the protection of, for example, breeding sites.

For the first time raptors are included on the list of specially protected wild animals**,**and this includes all six vulture species found in the province. We will also give attention to the important bird areas (IBA's) as identified by BirdLife SA.

The Department is in the process of drafting a new policy, regulations, standards and guidelines for rehabilitation in the province.

Cape Vulture

Apart from a few sites in the Waterberg, the breeding colonies of this species are all situated within protected areas and those areas not yet having such status need to be included. Data on the numbers for each colony are needed and might be available from the current research projects.

Other Species

Surveys are required in suitable habitats over the entire province to establish actual distribution and breeding sites of vultures.

Vulture restaurants

The information on these needs to be updated.

Acknowledgements

I am grateful to the relevant people for the information they supplied.

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The status of the Kransberg and Manutsa Cape Vulture colonies *Gyps coprotheres* in 2003: causes of mortality, reasons for concern, research needs and recommendations

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Introduction

The Cape Vulture *Gyps coprotheres*, a southern African endemic, is classified as "vulnerable" (Anderson 2000). As other *Gyps* species, Cape Vultures are specialist feeders, having evolved with migratory ungulate herds (Houston 1983). With the disappearance of these herds vultures have become dependent on domestic livestock as their main food source (Vernon 1999, Gilbert *et al*. 2002, Benson *et al.* in press). Once breeding over much of South Africa, Cape Vultures are presently confined mainly within or near communal livestock grazing areas. The strongholds of the Cape Vulture are located in the northern provinces of South Africa (Transvaal Region), KwaZulu-Natal and the Eastern Cape Provinces (these areas are represented by the former "homelands" (e.g. Lebowa, Bophuthatswana, KwaZulu, Transkei - Brown & Piper (1988), Benson, Tarboton *et al.* (1990), Vernon (1999) instituted by the South African *Nationalist* Government in the 1950's) and adjacent national states (e.g. Botswana, Lesotho, Mozambique - Donnay 1989, Parker 1998, Borello & Borello 2002). In these areas, grazing intensity is high resulting in poor veldt conditions and high livestock mortality rates (Huntley *et al.*1989). Away from these areas, mainly commercial farming districts, livestock is intensively managed and little food is available to vultures and therefore little breeding occurs. Poisons for mammalian predator control, are also used more extensively in these commercial farming areas (Allan 1989). As the total number of breeding birds becomes lower the potential that a higher proportion of individuals in the population can be impacted by a catastrophic event (e.g. poisoning) increases (Benson 2000). It is important that basic biological information is collected concerning: 1) total numbers, 2) breeding success, 3) feeding areas and 4) causes and rates of mortality of birds. It is necessary to monitor these factors to provide reasonable information for the management of any species. This project is the most extensive long-term project on Cape Vultures and concentrates on monitoring the above factors mainly at the Kransberg colony, but also other colonies in the Transvaal Region (i.e. Manutsa, Blouberg, etc.) on a long-term basis to provide information for management of the species.

The purpose of this paper is to: 1) report on the number of breeding pairs at two of the largest Cape Vulture colonies, Kransberg and Manutsa and changes which have occurred at these sites, 2) report on factors negatively affecting these colonies and 3) consider possible actions which can be taken to mitigate against these negative factors.

Study sites

The Kransberg and Manutsa Cape Vulture colonies are located in Limpopo Province, South Africa. Both colonies are in the savanna biome (Rutherford & Westfall 1994).

The Kransberg colony (2428S, 2736E) is situated on a 200 m high south facing cliff on the southwest corner of the Waterberg Mountain Range, 20 km northeast of the community of Thabazimbi. The western portion of the nesting cliff is located in the Marakele National Park, administered by South African National Parks (SANP). The eastern portion of the cliff is on private farms. Land-use in the region is mainly cattle and game farming. The Botswana border is 60 km to the west and the former homeland of Bophuthatswana is 65 km to the southwest of the colony. Birds from this colony forage mainly in these communal grazing areas (Benson 1996).

The Manutsa colony (2426S, 3041E) is positioned on a 350 metre high, north-facing cliff on the farm Manutsa, 31 km southwest of Hoetspruit. The Kruger National Park is 80 km to the east of the colony. The top of the nesting cliff is the boundary with the former homeland of Lebowa. Other portions of this homeland, where communal grazing of livestock occurs, are found to the north of the colony. There is extensive commercial cattle and game farming in the area as well as crop farming activities (e.g. citrus, mangos, avocados, vegetables).

Methods

A series of aerial photos taken during photo surveys conducted at these colonies (Tarboton & Benson 1988, Benson *et al.* 1990) are used to map the nest sites (over 3000 and 1400 respectively at Kransberg and Manutsa) on the nesting cliffs. Using a tape recorder, telescope, binoculars and pre-prepared data sheets, observations are made of each nest site, during ground surveys, noting the presence or absence of birds, their behavioural and reproductive activities. Such observations are made repeatedly over a series of days on each visit to a colony. Monitoring of the Kransberg cliff began in 1981 and has continued on a monthly basis, through the main nesting season, ever since. The Manutsa colony was first monitored in 1985 during a once off visit while surveying the nesting activities of Cape Vultures in the then Transvaal Province (Benson, *et al*. 1990). A once off visit was made in 2000, when repeating the above survey exercise. More extensive monitoring of this colony began in 2001, with multiple visits made during the breeding season. The methods and terminology of Postupalsky (1974) are followed, requiring at least two visits to a nest site per season to determine nesting success.

The base of the nesting cliff is searched to discover vulture carcasses, to document the incidence of poisoning events. The area surrounding the Sentech (South African Broadcasting Corporation) Tower (Kransberg) is searched to find carcasses of birds which have collided with the guywire supports.

Results

Figures 1 & 2 show the trends in the numbers of nesting pairs at Kransberg and Manutsa Cape Vulture colonies from the mid-1980's to 2003. The number of breeding pairs (561) observed at the Kransberg colony (Figure 1) in the 2003/2004 breeding season is 58.4% of what was observed in the 1984/1985 season (961 - Benson, *et al.* 1990).

The number of breeding pairs observed during ground surveys of the Manutsa colony (Figure 2) and the "best estimates" (see Benson *et al.* 1990 for calculations of "best estimates") of the number of breeding pairs for the season, calculated from those surveys (1985 & 2000), indicate a decline of 36.3%, between 1985 and 2003. Regular subsequent visits to the Manutsa colony suggest the estimation technique is quite accurate, though perhaps a bit conservative, if the cliff is not well known to the observer. The higher value for the 2003 season over the 2000 value (Figure 2) is probably due to an improved knowledge of this large nesting cliff and an increase in the number of visits/year to the colony, rather than an actual increase in the number of birds breeding.

One incident of poisoning is known to have occurred at the Kransberg colony in 1998. Carcasses of four fledgling vultures have been collected from under the Sentech (South African Broadcasting Corporation) tower, having collided with the guywire supports.

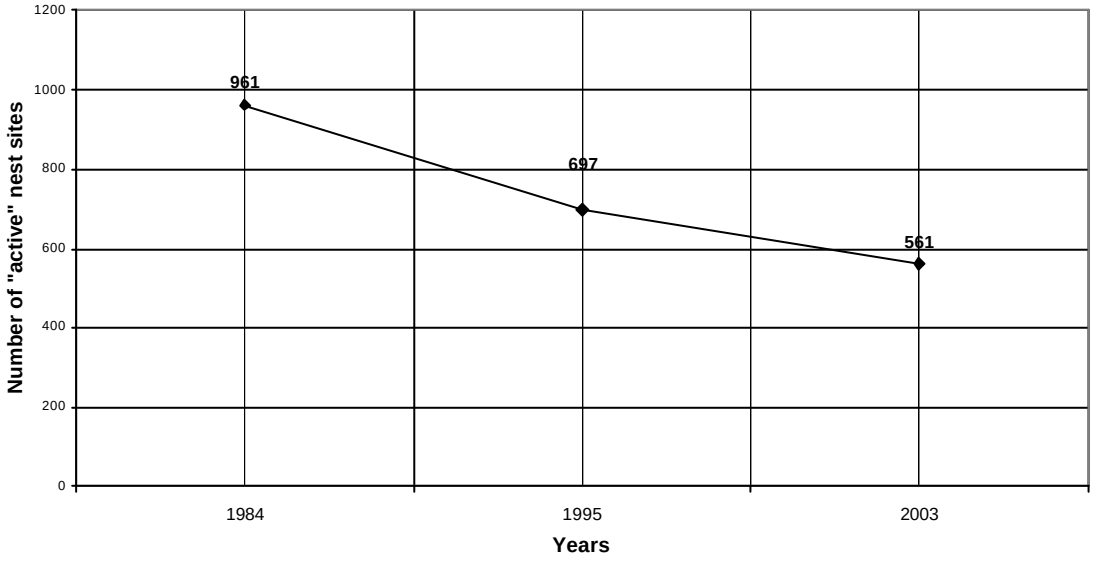

Figure 1. Trend of the number of known "active" nests at the Kransberg Cape Vulture colony from 1984 to 2003.

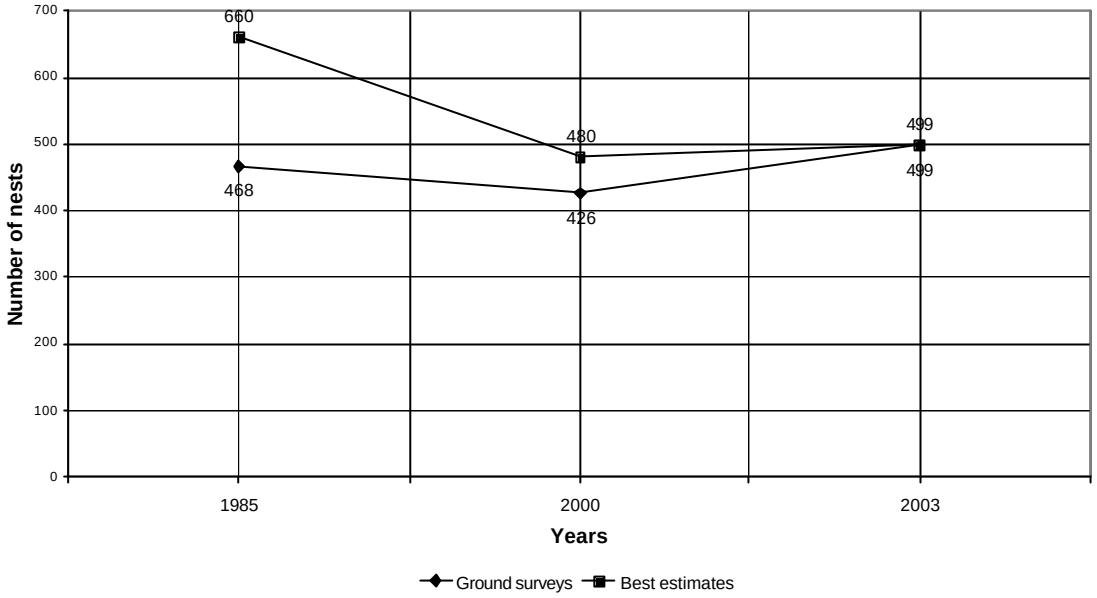

Figure 2. Results of ground surveys and "best estimates" of the numbers of breeding pairs at the Manutsa Cape Vulture colony 1985, 2000 and 2003.

Discussion

Food availability

"The ultimate factor controlling the number of breeding vultures presumably is the amount of food available" (Vernon 1999). Benson (2000) found the highest mortality rate in nestling Cape Vultures at the Kransberg colony occurred during the period of fastest growth rate and highest food requirements, suggesting food was limiting reproductive success at that colony. Benson *et al.* (in press) suggest one reason Cape Vultures eat non-food items (e.g. glass, plastic, ceramic, etc.) are because food, generally, is limited in farming areas.

Most Cape Vulture breeding colonies are located in, adjacent to or very near the former homelands of South Africa, where communal domestic livestock grazing is the main land-use. Of those remaining, the majority are found in areas where communal grazing of livestock is also the primary land-use (Donnay 1989, Parker 1998, Borello & Borello 2002). High stocking rates in such areas result in poor veldt conditions and higher livestock mortality rates than in commercial farming areas (Huntley *et al.* 1989). Vernon (1999) attributes the decline in the number of breeding pairs of Cape Vultures in the Transkei, between the early 1980's and mid-1990's, to a reduction in the amount of food available due to changing human social patterns (movement of humans to the cities and a reduction of livestock numbers present in the vulture's foraging area).

Similar conditions in the former homelands of Bophuthatswana and Lebowa, surrounding Kransberg and Manutsa respectively, probably account for the decline in the number of breeding pairs, at those colonies, between the early 1980's and 2003 (Figures 1 & 2). The higher rate of decline at the Kransberg

colony may be attributable to Bophuthatswana's proximity to the Johannesburg-Midrand-Pretoria conurbation, (Gauteng), which draws many people to the perceived higher number of employment opportunities, compared to those in the smaller centres near other colonies (e.g. Manutsa, Blouberg).

Other factors may account for a reduction of food in an area. In the early 1980's extensive drought conditions occurred in South Africa (Huntley *et al.* 1989). Livestock and wild ungulate numbers suffered the effects of these conditions resulting in more food for vultures. The number of breeding pairs was the highest ever recorded at Kransberg during this period (Benson *et al.* 1990). In subsequent years the amount of precipitation increased and the numbers of breeding pairs declined. During the drought of 1991/1992 the number of fledged young/active nest site increased from previous years (unpublished data), presumably due to increased food in the area during the drought.

Food availability is affected not only by ungulate mortality rates and weather patterns. Cultural practices of the local human populations affect the amount of food available to vultures. In south Asia, where religious taboos forbid the use of ungulate carcasses, that die of natural causes (i.e. Muslim), or cattle at all (i.e. Hindu), large quantities of food are available to scavengers (Gilbert *et al.* 2002; Virani *et al.* 2004) and have resulted in the highest numbers of *Gyps* vultures in the world. In Africa, human populations compete with wild avian and mammalian scavenger populations for this carcass resource (P. Benson, personal observation; Blumenschine 1986), reducing the amount of food available to the birds.

When natural systems have broken down (e.g. disappearance of ungulate herds, increase in intense agricultural areas) supplemental feeding programmes can result in an increase in vulture numbers (Piper *et al.* 1999; Camiña In press). This however requires a dedicated team and an enlightened public to provide carcasses on a regular and continuous basis for this management tool to be successful (Mendelssohn & Leshem 1983). Though some groups (e.g. Vulture Study Group) have advocated the use of "vulture restaurants" to supplement food for vultures (Friedman & Mundy 1983, Butchart 1988) other than a small colony in the Western Cape (Potberg, < 90 individuals Piper *et al*. 1999), there is no evidence that this technique has had any major impact on Cape Vulture numbers, certainly not at large colonies of the Transvaal Region. If such a management tool is to be effective there must be a concerted effort for its implementation, without which, a single individual can sabotage an entire programme. The vulture restaurant at Thabazimbi's *Iscor* (Kumba) mine, which was successfully run for over a decade is such a case as it is in danger of being closed due to the lack of interest of the new personnel given the task of its maintenance (A. Schutte, personal communication). Unfortunately, there seems to be little interest, in maintaining a feeding programme, in South Africa, on the scale which has been successfully implemented elsewhere (e.g. Spain -Camiña In press), because "it is a time consuming and costly exercise" (Verdoorn 1997:121).

Van Rooyen & Vernon (1997) suggest that evaluation of the impacts of restaurants on vultures should be undertaken.
The development of Marakele National Park was initiated in 1988 and officially proclaimed in 1994. Initially none of the vulture nesting cliff was included in the park. Presently, the majority of nests are included, though only about 1/3 of the nesting cliff is contained within Marakele. Radio-marked Cape Vultures from the Kransberg foraged to the west of Marakele National Park mainly in the former homeland of Bophuthatswana and Botswana (Benson 1995). The marked birds were never observed foraging within or east of Marakele National Park, though some other birds have occasionally been observed foraging in those areas (M. Roussouw, personal communication; P. Benson, personal observation). Though the majority of birds breed within the park, the main foraging areas of the Kransberg Cape Vultures are well outside of the Marakele (Benson 1995). There is a public perception that the food needs of the Kransberg Cape Vultures will be fulfilled with the development of Marakele National Park. Part of this perception is that the vultures will be maintained from the leavings of large mammalian carnivores (i.e. lions *Panthera leo*, spotted hyeana *Crocuta crocuta*) found in the park. In the Serengeti, Houston (1983) found that less than 5% of the food available to *Gyps* vultures was from predator kills and that these carnivores were actually competitors, often displacing the birds from carcasses which they had discovered. Because Marakele's Cape Vultures rarely forage within the park, it is likely that the Kransberg birds will obtain even less of their food from mammalian carnivore kills.

Since 1996 a movement to establish the "Waterberg Biosphere Reserve" has been active in the region (Walker 1998). Though the Kransberg vultures have been cited as a reason for the establishment of this biosphere reserve, only the nesting cliff is included in the reserve which is east of Thabazimbi, its western boundary. The main foraging areas of this colony are well to the west of Thabazimbi and are therefore excluded from the biosphere reserve. Unfortunately, to reach these foraging areas the birds must cross extensive commercial farming areas where they are exposed to poisoned carcasses, potential drowning in farm dams and electrocution on an extensive powerline grid. The biosphere reserve affords no additional protection to the vultures over that which the national park already provided, though they were cited as an important reason for the biosphere's establishment.

Benson (submitted manuscript) suggests conservation areas should be designed based on the habits of wide-ranging avian species rather than the more sedentary movements of terrestrial mammals. Even the movements of migratory ungulates do not come close to the extensive peregrinations of avian scavengers (Kemp *et al.* 2003). Conservation areas designed on the movements and habitat needs of selected bird species could include the requirements necessary for the maintenance of a greater diversity of plant and animal species than any based on the most wide ranging terrestrial mammal (Benson submitted manuscript).

Other mortality factors

Benson (2000) cites several additional mortality factors impacting the birds at the Kransberg. Subsequent to 1998 a single poisoning incident was known to affect the Kransberg birds. Additional collisions have occurred on the Sentech radio and television mast, at the top of the mountain where nesting occurs, even though a third technique, "flappers" was applied to four new guywires placed on the tower in 2000, in addition to the previously placed orange coloured metal balls and "diverters".

Conclusions

Threats

Threats to the Cape Vultures at the Kransberg colony remain the same as those discussed by Benson (2000).

Food

The continual decline in numbers of breeding pairs at the Kransberg colony and the high nestling mortality observed during the period of highest food requirements suggest that food is limiting reproduction at the colony. This is similar to the observations made at the Collywobbles colony in the Eastern Cape, South Africa by Vernon (1999). Stopping and/or reversing the decline in the number of Cape Vulture breeding pairs should be the highest conservation priority. To do this there must be a better understanding of the food resources available to the birds and how best to exploit and augment it.

Poisoning

Poisoning remains a threat to the birds at all of the colonies in the Transvaal Region. This is a particularly serious threat because: 1) it removes reproductively active individuals from the population, 2) it removes sub-adult birds that are potentially new breeders and 3) its potential impact on the Cape Vulture population increases as the total numbers decline (which appears to be the case, at present).

Collisions

Collisions with the guywires of the Sentech tower continue to occur even though three different techniques have been applied to the offending supports. This factor affects a small cohort, though it is a fraction that has survived the nestling and fledging periods and thus passed through a critical stage of development and therefore potentially more valuable to the population than unfledged nestlings.

Recommendations

1) Research at, and monitoring of the Kransberg and Manutsa colonies should and will continue.
2) A critical evaluation of the food resources in the area surrounding these colonies should be undertaken as a means of understanding the foraging dynamic of these colonies.
3) The Waterberg Biosphere Reserve should be extended to the west of Thabazimbi, to include, at least, the former homeland of Bophuthatswana. Ideally, the project should become a Transfrontier

Biosphere Reserve, including Cape Vulture foraging areas in Botswana, taking note and advantage of the economic, social and educational factors considered in such a project.

4) A major educational and extension programme should be implemented to enlighten farmers on the problems of poisoning to vultures.

Acknowledgements

The author would like to thank the following organisations and individuals for providing financial and/or logistical support for this project: American Philosophical Society, Anglo American and De Beers Chairman's Fund, Bayer Animal Health Division, Billiton Development Trust, BirdLife South Africa, Caltex Oil, Colour Presentations, Council for Scientific and Industrial Research, De Beers Educational Trust, Die Kwêvoël, Edison Electric Institute, Great Pacific Iron Works, Griffis Foundation, Manutsa Ranch, Mining Stress Systems, National Geographic Society, New York Zoological Society, Optimus-Princess, Inc., Pentel of America, Pretoria Bird Club, Rennies Travel, Raptor Research Foundation, Recreational Equipment Inc., Rembrandt Tobacco Co., School of Animal, Plant and Environmental Sciences University of the Witwatersrand, Sierra West, South African Broadcasting Corporation, South African Department of Development Aid, South African Department of Environment Affairs, South African National Parks, South African Nature Foundation, The Peregrine Fund, Transvaal Directorate of Environmental & Nature Conservation, Transvaal Museum Archaeozoology and Bird Departments, Tundra/Echo Films, Velcro USA, Waterberg Country Lodge, Western Foundation of Vertebrate Zoology, WITS Foundation, Witwatersrand Bird Club, World Wide Fund for Nature – South Africa, M. Abramson, M. H. Anderson, B. Freimond, A. Groenewald, J. Harris, T. Harris, E. Joseph, D. Solomon, W. Tarboton, R. Thorsell, and an anonymous donor.

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Introduction

The earliest recorded data with regard to the status, breeding success and population trend in the Cape Griffon *(Gyps coprotheres)* at the Blouberg Colony appears to be that of P.C. Benson conducted during the 1984/85 and 1985/86 breeding seasons (Benson 1986). Subsequently Blouberg Vulture Project has conducted monitoring and conservation activities at this breeding colony and in the surrounding areas since the 1993/94 breeding season until present. There must however, also be some records and information available from the Limpopo Province Department of Finance, Economic Affairs and Tourism as the larger sub-colony of this breeding colony falls within the confines of the Blouberg Nature Reserve. W.R. Tarboton of the then Transvaal Nature Conservation Division took photographs from a helicopter that were analysed after the fact and these results were published in Birds of the Transvaal (Tarboton *et al.* 1987). Two other research projects were conducted in which the author participated by providing data and conducting the annual census together with the students for their Higher Diploma at the Pretoria Technicon. The managers of Blouberg Nature Reserve undertook these projects in 1995 and 1999, namely D. de Klerk and J. S. van Wyk respectively.

Species

Table 1. Vulture species recorded in the Blouberg area.

Name	Breeding pairs	Individuals	Source of data
Cape Griffon *(Gyps coprotheres)*	736	2000*	Census conducted by author in the 2003 breeding season
African White-backed Vulture *(Gyps africanus)*	Does not breed	Vagrant**	Personal observation
Lappet-faced Vulture *(Torgos tracheliotos)*	Does not breed	Vagrant***	Personal observation
White-headed Vulture *(Trigonoceps occipitalis)*	Does not breed	Rare vagrant****	Personal observation
Hooded Vulture *(Necrosyrtes monachus)*	Does not breed	Rare vagrant*****	Personal observation

* Given that over the years of monitoring and counting at this colony it has been ascertained that not all of the pairs breed every breeding season (section counts vary substantially from breeding season to breeding season, however, the total overall number of breeding pairs remains more or less stable) this figure is estimated at more than merely double the number of breeding pairs. There are also a considerable number of "hidden" nest sites that are not included in the census figures.

** These vagrants are for the most part fledglings and juveniles and their numbers fluctuate dramatically from season to season. There are however, always one or two present and as many as 10 to 15 at a carcass, wherever the Cape Griffons congregate.

*** The number of vagrants of this species fluctuates dramatically from season to season and usually they are juvenile and immature birds. Their occurrence is not as common as that of the African White-backed Vulture.

**** Only two individuals have been observed at a carcass at the vulture restaurant on Blouberg Nature Reserve since June 1993 on two separate occasions. The one was a juvenile and the other an immature.

***** One observation of a juvenile at a carcass at the vulture restaurant on Blouberg Nature Reserve since June 1993.

Threats

The major threat to all vulture species in this region is poisoning given their nature of feeding en masse. The birds in this area forage for the most part over rural farmlands, wild areas over the Botswana border and therefore this threat is not as prominent as in other areas where vultures only forage over more developed farmlands. Nevertheless, they do also feed on available carcasses on the more developed farms in the region and this puts them at risk. Over the past 10 years the Blouberg Vulture Project has endeavoured to raise the awareness of vultures amongst the farming communities in the area and during this period of time 2 mass poisonings have been recorded. In May 1999, 25 African White-backed Vultures and one Hooded Vulture were poisoned on the farm "Lubbeslust" in the Brombeek area. In April 2000, 26 Cape Griffons, four African White-backed Vultures and one Lappet-faced Vulture were poisoned on the farm "Josland" in the Vivo area. It was ascertained that the latter was as a result of a grudge held against the farmer by a disgruntled employee who poisoned one of his employer's cows as well as his dogs. There have been a few isolated incidences of individual birds having been found suffering from what appeared to be symptoms of poisoning and therefore one must presume that there have been other incidences of mass poisoning that are not on record. However, the majority of farmers in this region are very co-operative and eager to assist in the conservation and monitoring of the vultures that occur in this area.

A further threat is the electrocution of vultures on secondary power lines that traverse farmlands in the area. The only mass electrocution that has been reported and recorded for this region is that of 19 January 2004 where six fledgling Cape Griffons were electrocuted after attempting to perch on a 11/22 kV Wishbone structure on the farm "Fraaifontein" near the breeding colony after having fed on a dead waterbuck. This is considered to be an isolated incident as a result of inexperienced birds attempting to perch on the nearest available structure as there were no adult birds involved in this incident. However, this type of situation can arise again and must therefore be considered a threat as well as the fact that other electrocutions may have taken place and not come to the project's notice or discovered by the landowners.

Drowning in reservoirs may also be considered a threat although only one incident has been recorded in the past 10 years. This occurred on Blouberg Nature Reserve and was as a result of a culmination of circumstances. These being the borehole running dry at the vulture restaurant, the tractor breaking-down that transported the water to this waterhole since the borehole was not longer providing water, the level of the offending reservoir being allowed to drop to bellow half, the vultures being forced to find an alternative bathing spot and choosing this particular reservoir. This all resulted in six Cape Griffons drowning in this reservoir in May 2003. This is also considered to be an isolated incident, has been rectified thanks to a generous donation from Sasol but nevertheless proves that this must be considered as a threat to the vultures in this region.

This breeding colony being surrounded by rural communities has both advantages and disadvantages. The advantages are the low incidence of mass poisoning and the high mortality of stock resulting in a plentiful supply of food. The disadvantage is that the people that populate these communities historically have had strong traditional beliefs and therefore have made use of vulture parts in their traditional medicines. This has been an important aspect of Blouberg Vulture Project's activities since 1993 and due to the implementation of a community vulture conservation programme has gone a long way to minimising this threat in this region. However, one must never be so naive as to believe that though this has been a very successful project and almost 300 Cape Griffons have been "rescued" from the "muthi trade" and given a second chance, that this practice does not still continue. It is inevitable that there will still be some mortality of vultures due to this practice but the impact on this particular population of vultures has been reduced and it is clear that the number of vultures ending up in the "muthi trade" has been significantly minimised.

Current research, monitoring and conservation initiatives

The Blouberg Vulture Project has two main conservation initiatives, both of them involving the dissemination of information resulting in an increased awareness of vulture biology that should and does contribute considerably towards reducing the man made threats to these avian scavengers. The first and major conservation initiative involves the rural communities in this region of which there are many. These are, for the most part, under-developed and impoverished communities that do not have the luxury of being able to be concerned about an endangered species as they are taken up with the daily struggle for survival. Involving such a sector of the population in caring and protecting the vultures that share their space means providing them with some tangible benefit for doing so. This therefore was one of the major motivations behind the "reward" programme amongst these communities for handing over grounded fledglings to Blouberg Vulture Project for rehabilitation. Since the inception of this programme during the 1993/94 breeding season these people have been responsible for "rescuing" 293 fledgling Cape Griffons that have been given a second chance. Initially it was all about the reward money however, over the years with more and more involvement on the part of community members themselves in the project, the forming of a community steering committee to run this project in Indermark (the community in the shadow of the breeding colony) and a better understanding of why it is necessary to conserve these birds, not merely for the reward but for their contribution to the ecosystem, these communities have become the "champions of the Cape Griffon". They have named their soccer league team after these birds; their resident poet has composed a poem (Mahaba 2002) that has been published in Vulture News in honour of their vultures, at every opportunity on occasions when journalists, TV crews and the media in general have interviewed these local residents they have come out strongly in support of protecting their vultures. The community of Indermark in particular has taken on the responsibility of protecting this vulture colony, they have taken ownership of this project and in so doing this has had an empowering effect on them. For the past 2 years this community has taken it upon themselves to arrange the "vulture reward" ceremony, provide the entertainment in the form

of traditional dancers and drummers to celebrate the occasion, issued the invitations to the members of the community to attend this event, made the speeches themselves encouraging each other to continue with this most important activity and responsibility of caring for their vulture colony, issuing warnings as to the repercussions should residents not co-operate in that it is an illegal act to kill a vulture and the necessity of conserving these birds. The level of commitment to the conservation of the Cape Griffons in this region by these local communities has increased dramatically since the commencement of this project and in terms of vulture conservation in this area this is extremely positive.

The second and equally as important conservation initiative is the involvement of the farming community. More and more farmers in this region are turning to game farming as a result of the drought conditions and basic unsuitability of this area for cattle farming. This is good news for vultures, as this type of farming does not make much use of agro-chemicals. Over the years the farmers in this region have been very co-operative and eager to participate in any vulture related activities of this project. A number of the cattle farmers that are in close proximity to Blouberg Nature Reserve donate their stock mortalities on a regular basis to the vulture restaurant on the reserve. There have also been a number of farmers prepared to establish feeding sites on their farms as a result of increased awareness about the vultures in this region due to the project's awareness campaign. There are currently six well-established vulture restaurants in this region with all of these landowners committed to providing carcasses on a regular basis as well as bone fragments during the breeding season. Recently the game farmers in this area established the "Bo-Brak River Game Study Group" that involves all the game farmers in this region and the author has been requested to serve as the secretary on this committee. This is an excellent opportunity to be involved with this sector of the population in this area that undoubtedly have vultures foraging on their farms. All of these farmers, after having given a talk at their first meeting, are in favour of becoming involved in the monitoring aspect of this project as well as providing food for the vultures on their farms. This may not necessarily be by establishing a formal feeding site, however, they are all prepared to leave carcasses in the "veld" for the vultures to feed on. Over the years this sector of the community has supported this project in terms of passing on information pertaining to vultures – be it the number of vultures at a carcass observed on their farm or an injured bird that they have called in – contributing to the overall conservation of the vultures in this region.

Since the Kimberley workshop in 1997 only two further recoveries of ringed fledgling Cape Griffons from this colony have been reported. These are: 1) the recovery of a bird on 21 March 2001 in the Tuli Block farms district that was ringed and released on Blouberg Nature Reserve on 19 December 1995; and 2) the recovery of a bird in August 2001 at Snymansdrift – Polokwane (Pietersburg) district that was ringed and released also on Blouberg Nature Reserve on 22 January 1996. These two recoveries are interesting in that both of these birds were either approaching or had reached sexual maturity and were recovered not far from their natal colony.

The resident Rüppell's Griffon *(Gyps rueppellii)* has been observed to exhibit breeding behaviour since the 1999/2000 breeding season raising a chick with its mate, a Cape Griffon, every year since this time. During the 2001/2002 breeding season the nestling had a deformed wing and was not able to fledge. The carcass was subsequently recovered and samples sent to the University in Heidelberg – Germany for DNA analysis. Thus far a report has been received from Professor M Wink stating that he is 95% certain that this material is from a hybrid between these two species however, in order to make certain he is conducting further analysis used in forensic science as the samples were considerably desiccated.

The overall status of the Blouberg Cape Griffon breeding colony appears to be stable as indicated by the census figures for the years indicated below.

Table 2. Number of pairs of Cape Griffons breeding at Blouberg 1995-2003.

Breeding season	Number of breeding pairs
1995/1996	716
1997/1998	619*
1999/2000	704
2000/2001	691**
2001/2002	720
2002/2003	736

*Census conducted by volunteers; they were unable to reach a satisfactory observation point for sub-colony A resulting in limited visibility. This must therefore be considered an inaccurate count.
**Census conducted by P.C. Benson

Proposed research, monitoring and conservation initiatives

The proposed initiatives for this project are to continue much along the same lines as in the past, involving all sectors of the communities that make up the population in this region. With regard to the rural community of Indermark and those other communities in the vicinity the proposed initiative for the future is to assist in the establishment of an eco-tourism enterprise involving the Cape Griffon breeding colony as the focal point. The Blouberg Vulture Project has already been requested by the Blouberg Municipality for assistance and involvement in this project and every effort will be made to secure funding and support for this endeavour as utilising this colony as a tourist attraction from which these people can derive a further benefit will ensure an even greater level of protection for these birds.

With the newly formed game study group in the area and the project's involvement in this initiative it is proposed that a more thorough monitoring programme amongst the farming community will be established. Also it will be easier to keep abreast of problems, activities, *etc* within the farming community that concern vultures by attending these meetings on a regular basis.

The key to the survival of the Blouberg Cape Griffon breeding colony lies with the communities that share their environment. On the whole these communities, both rural and farming alike, are to be commended for their dedication, support and enthusiasm in their attempt to conserve their vultures. Even the local farmers refer to these birds as "ons aasvoëls" (our vultures).

Involving people, the local communities, is of paramount importance in the conservation of any species in these present times and it is the intention of Blouberg Vulture Project to continue relying on the participation and commitment of the people in this region to address the conservation of the vulture species of this area.

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The status and conservation of vultures in the Kruger National Park

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No special or additional emphasis has been placed on vulture conservation, research or monitoring in the Kruger National Park (KNP) since 1997. Although it is recognized that poisoning of vultures in the areas adjacent to Kruger does occur, little has changed in Kruger regarding policy or management that could have had any adverse effects on vulture ecology. Culling of elephant and buffaloes was discontinued in 1994 and that additional unnatural supply of protein is now no longer available to the vultures. The perceived negative effects that the increase in elephant numbers and human-induced fires might have on large nesting trees are being monitored.

Subjective estimates of population size, biomass and status of vultures are the only quantitative ecological data available. Kemp *et al* (2001) gave estimates of the population sizes in the KNP by making use of the Southern African Bird Atlas Project (SABAP) results and most recent publications. The results on the estimated numbers of the different vulture species in the Park will be incorporated in the species account section that follows.

Between 1982 and 1994 active vulture nests or breeding vultures were recorded during the annual herbivore census in the KNP. These surveys were done with a fixed wing aircraft during the dry season. Parallel strips 800m apart (extending 400m on either side of the aircraft) are flown to achieve total coverage of the area. The counting of vultures was discontinued after 1994 to allow observers to concentrate on the main purpose of the census – the large herbivores. The numbers of the active vulture nests recorded during the census are given in Appendix 1 and the averages incorporated into the species account. Since the counting of active vulture nests was a by-product of the large herbivore census, it can be assumed that a large percentage of nests were overlooked. In some years fewer nests were attributed to specific vulture species (recorded only as "vulture nest"), but the average total numbers of active nests per count were never too far from the average of 265 nests. The low total count during 1994 was due to the fact that the census was not completed.

The Scientific Services at Skukuza have implemented a Cyber Tracking program (http://www.cybertracker.co.za) with KNP Conservation Services. The game rangers, who use the system, record a wide range of field observations that include vulture sightings, active nests and birds at carcasses. The program still has certain logistical difficulties but it might prove to be a very useful tool in the future.

African White-backed Vulture (*Gyps africanus*)

By far the most abundant vulture in the Park and always present at carcasses (Sinclair & Whyte 1991). This vulture is a breeding resident with an estimated population size of 2 048 individual birds (nearest threshold: 2^{11}) (Kemp *et al.* 2001). The distribution map of this vulture in southern Africa (Harrison *et al.*

1997) indicates the highest reporting rates in the sparsely inhabited and conserved areas, especially in the KNP.

African White-backed Vultures nest over a wide range in the KNP, on top of a variety of tree species. They often nest along rivers, especially when the surrounding vegetation supports few large trees, but with many nests away from watercourses if the nesting habitat is available (Kemp *et al.* 2003). Knobthorns *(Acacia nigrescens)* are a favoured species and declines in this species induced by elephants may be a cause for concern. An average of 112 nests was counted during the annual aerial census between 1982 and 1994, with the highest number of 205 during 1993 (Appendix 1).

Cape Vulture (*Gyps coprotheres*)
The Cape Vulture is a rare non-breeding visitor to the Park. Although Kemp *et al.* (2001) estimated that 128 birds may be present in the KNP, this number most probably represents the birds scavenging in the KNP from their cliff roosting sites outside the Park.

Hooded Vulture (*Necrosyrtes monachus*)
Although the Hooded Vulture is largely restricted to the northern and eastern tropical lowveld regions, it is a common vulture throughout the Park with an estimated population size of 64 individual birds (nearest threshold: 2^6)(Kemp e*t al.* 2001). Tarboton & Allan (1984) estimates 50 breeding pairs for the old Transvaal province and breeding is restricted to the lowveld conservation areas, especially the KNP where they are attendant at almost all carcasses. The nests of Hooded Vultures are difficult to locate and the number of breeding pairs may therefore be higher than this. They nest below the canopy, often in evergreen riparian trees (Kemp *et al*. 2003), and that may be why they were not accounted for during the KNP annual aerial censuses. During the period of elephant and buffalo culling in the Park, the availability of large amounts of offal favored the survival of young birds in the area. Culling is no longer conducted in the KNP, and the impact of this on juvenile survival is unknown.

White-headed Vulture (*Trigonoceps occipitalis*)
This is a fairly common breeding species throughout the Park with an estimated population size of 64 individual birds (nearest threshold: 2^6)(Kemp e*t al*. 2001). Tarboton & Allan (1984) estimated that the KNP and neighboring conservation areas support about 100 breeding pairs. An average of 23 nests was counted during the annual aerial census between 1982 and 1994, with the highest number of 30 during 1993 (Appendix 1). The high number recorded during 1988 is most probably a data input error.

Egyptian Vulture (*Neophron percnopterus*)
A rare vagrant to the northern sector of the Park with an estimated population size of 2 (nearest threshold: 2^1) individual birds (Kemp e*t al*. 2001).

Lappet-faced Vulture (*Trogos tracheliotos*)
The Lappet-faced Vulture is a fairly common breeding resident throughout the Park and is seen at most kills. It has an estimated population size of 64

individual birds (nearest threshold: 2^6)(Kemp e*t al.* 2001) in the Park. Lappet-faced Vultures nest mainly in open bushveld on the basalt plains of eastern KNP (Kemp *et al.* 1998), on the flat crown of low thorny trees. An average of 22 active nests was counted during the annual aerial census between 1982 and 1994, with the highest number of 49 during 1990 (Appendix 1). Mundy (1997) estimated a higher breeding density of 40-50 pairs of these vultures in the KNP.

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Appendix 1: Active vulture nests or breeding vultures that were counted during the annual herbivore census between 1982 and 1994.

Year	White-backed	White-headed	Lappet-faced	Unidentified vulture	Total
1982	110	10	18	74	212
1983	67	12	18	225	322
1984	73	19	16	234	342
1985	154	14	25	118	311
1986	67	14	24	163	268
1987	62	25	9	265	361
1988	63	91*	19	63	236
1989	83	11	7	121	222
1990	145	17	49	19	230
1991	165	29	35	32	261
1992	181	14	32	46	273
1993	205	30	20	8	263
1994	87	12	14	40	153
Average	112	23	22	108	265

*probably a data input error.

Status of vultures in Quthing District, southern Lesotho

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Introduction

Several papers have been published on vultures in Lesotho. Donnay (1990) conducted an extensive survey of Cape Griffon (*Gyps coprotheres*) distribution in Lesotho in 1985/86. He found a total of 47 suspected and confirmed Griffon colonies, supporting 552 breeding pairs with a population of about 1500 individuals. For the Quthing District he gives a figure of 52 breeding pairs at the Quthing Valley colonies. Research on the population dynamics of Bearded Vulture (*Gypaetus barbatus*) in southern Africa was conducted by Brown (1997). More recently, Maphisa (2001) conducted a one-month vulture count in 1998 in southern and central Lesotho.

The Quthing District with a size of about 70 X 50 km is located in the south of Lesotho, bordering the former Transkei. Like most parts of Lesotho, Quthing is a mountainous with altitudes ranging from 1200m in the Senqu (Orange) River valley to up to 3000m a.s.l.. Major parts of the district being above 2000m in altitudes. Steep, grass covered mountainsides, cliffs and deeply carved river valleys characterize the region. Due to poor infrastructure the accessibility of most the area is quite difficult.

The Quthing Wildlife Development Trust (QWDT), a local NGO, started vulture conservation in the Quthing District in 1988. Mainly through information in villages and discussions with villagers QWDT has achieved a change of mindset and a positive attitude towards vultures in most of the rural areas of the district.

A detailed survey on vulture populations in the Quthing District has started recently (September 2003), conducted by myself in co-operation with QWDT and will be continued until 2006.

Species

Cape Griffon and Bearded Vulture are the only vulture species recorded in the Quthing District (Ambrose 2002).

Table 1. Showing numbers of vultures recorded in the Quthing District of Lesotho.

Species	Confirmed & suspected (+) Breeding/roosting sites	Pairs in 2003	Individuals in 2003	Source
Bearded Vulture	2 (+3)	2	10	This study
Cape Griffon	3 (+1)	-*	±200	This study

*no research during breeding season

Threats

Threats for both species appear to be shortage of food due to close control of livestock by herd boys. Veld fires close to colony sites during the winter

months might have a negative effect on the breeding quality and success of Cape Griffons. Power lines (absent in areas inhabited by vultures), poisoning and traditional medicine use seem to play no role as threats yet.

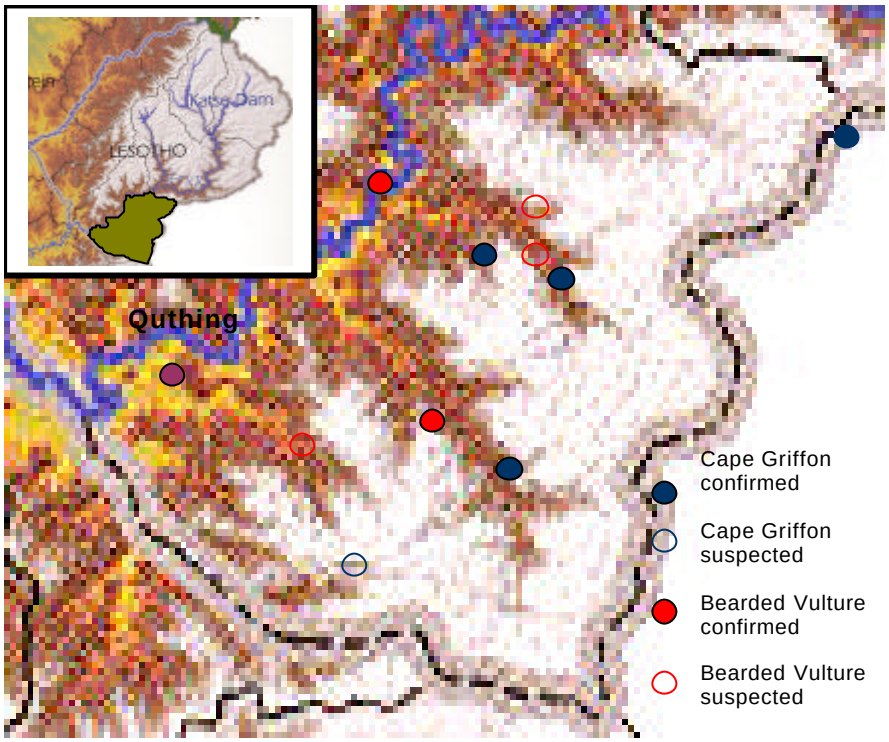

Figure 1. Distribution of breeding colonies of Cape Griffon (blue) and Bearded Vulture (red) in the Quthing District / Lesotho. Note the colony indicated on the territory of the former Transkei (north east).

Current research, monitoring and conservation initiatives

- A comprehensive survey on Bearded Vulture and Cape Griffon populations in the Quthing District has started as well as monitoring of breeding success for both species.
- There will be ongoing information dissemination to villagers about vultures and their potential value as tourist attractions.
- Two locations for proposed vulture restaurants have been identified. The villagers in these locations have expressed their support for this project.

Proposed research, monitoring and conservation initiatives

- Proposed conservation activities: Information about vultures, establishment of two vulture restaurants in the area (major problem: carcasses).
- Proposed research comprises monitoring of populations, research at vulture restaurants (publishing of results).
- A research on the foraging area of the local Bearded Vulture population via radio/satellite would be a long-term aim. The realization of such a project however appears to be impossible at the moment due to financial constraints.

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Conservation status of vultures in Swaziland

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Introduction

The first person to study Swaziland's birds in any detail was Parker (1994a) who produced a national bird atlas based on intensive field work. This atlas provided distribution maps for five species of vulture: African White-backed Vulture (*Gyps africanus)*, Lappet-faced Vulture (*Torgos tracheliotos)*, White-headed Vulture (*Trigonoceps occipitalis)*, Cape Vulture (*Gyps coprotheres)* and Hooded Vulture (*Necrosyrtes monachus)*. Of these, only the first three breed in the country. The Cape Vulture is a regular visitor, but the closest breeding colony is in Mozambique (Goba) on the Swaziland border (Parker 1994b), while there have been less than 10 sightings of Hooded Vulture in the past 18 years (Parker 1994a; A. Monadjem unpublished data).

Prior to 1997, which marked the occasion of the seminal workshop held in Kimberley (Boshoff *et al.* 1997), knowledge of Swaziland's vultures was limited to Parker's (1994a) atlas, i.e. there was information on which species are present and their distributions based on sight records. Parker (1997) did provide some population estimates for breeding vultures, but these were not based on enumeration of nests or nesting pairs. Thus, accurate information on the number of breeding pairs and nesting distributions was lacking.

The aim of this paper is to present vulture work conducted in Swaziland since 1997.

Activities since 1997

A number of research initiatives have been initiated since 1997 which can be broadly grouped into the following four areas:

- Baseline surveys of total breeding pairs of vultures in Swaziland.
- Monitoring the inter-annual nesting success of African White-backed Vultures at a single site.
- Ringing of chicks.
- Survey of active vulture restaurants in the country.

<u>Baseline surveys</u>

Baseline surveys of breeding vultures in Swaziland have focused on enumerating active nests and have been conducted both from the ground and from the air. Ground surveys were carried out in the winters of 2000 and 2001 (Monadjem 2003a), while an intensive 7-day aerial survey was conducted in July 2002 (Monadjem & Garcelon in press). These baseline studies provided valuable information for the Red Data Book on Swaziland's vertebrates in which the Cape Vulture was listed as "Regionally Extinct", the White-headed and Lappet-faced Vultures as "Endangered" and the African White-backed Vulture as "Near Threatened" (Monadjem *et al.* 2003).

Table 1 presents the results of the aerial survey (Monadjem & Garcelon in press). A total of 240 active nests of African White-backed Vultures were counted during that survey, with a total estimate of 300 breeding pairs present in the country. In contrast, based on the ground surveys, only 170 breeding pairs were estimated to be present (Monadjem 2003a). It would, therefore, appear that ground surveys vastly under-estimate the number of breeding pairs. This observation needs to be taken into account when accurate breeding numbers are required.

Table 1. Vulture numbers breeding in Swaziland, based on aerial surveys conducted in July 2002 (Monadjem & Garcelon in press). Numbers in parentheses indicate the total numbers estimated based on the assumption that 20% of pairs may not attempt to breed in any particular season.

Species	Breeding pairs	Total population
African White-backed Vulture	240 (300)	638 (798)
White-headed Vulture	5	13
Lappet-faced Vulture	3	8

Land use and land tenure have been shown to have significant effects on breeding vultures in Swaziland. All three species breed in protected areas, but only the African White-backed Vulture breeds outside these areas. Furthermore, nesting density also varies considerably depending on the level of protection provided. Nesting densities are very high in protected areas, moderate in commercial cattle ranches which protect wildlife resources on their properties, and marginal on government-owned ranches which generally provide minimal or no such protection (Figure 1).

All eight pairs of White-headed and Lappet-faced vultures breed exclusively in the Hlane-Mlawula reserve complex in the north-east of the country.

Information on nest site selection for the African White-backed Vulture in Swaziland has also been published (Monadjem 2003b). It would appear that, at least along drainage lines, broad-leaved trees are used in proportion to their availability, while spiny *Acacia* trees are used in lower proportions than their availability.

Monitoring breeding success

The monitoring of breeding success was initiated in 2000 for a small population of African White-backed Vultures in Mlawula Nature Reserve (Monadjem 2001). About 18-24 pairs breed along the Siphiso River annually. Breeding success was around 60% in two of the years, but dropped to below 40% in 2002 (Figure 2). Although the cause of this drop is still being debated, it is highly likely to be linked to the major road works that were under way at the time. To support this view, two nests showed clear signs of having been visited (with both chicks disappearing), and all the nests that failed were within sight of the roads being upgraded. I would suggest that these nests failed, not because of disturbance from the road works, but because of harvesting of the chicks.

Ringing

Ringing of vulture chicks was initiated in 2002. A total of four African White-backed Vulture chicks were ringed during that year, and a further nine chicks were ringed in 2003. A single White-headed Vulture chick was ringed in 2003. All chicks were fitted with metal rings and a combination of five colour rings.

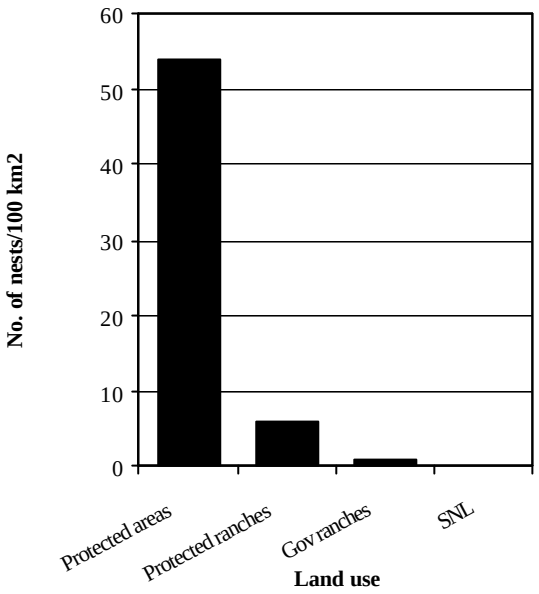

Figure 1. Vulture nesting density in relation to land use.

Vulture restaurants

A survey of all active vulture restaurants in Swaziland was conducted in 1999-2000. A total of seven operational restaurants was recorded which laid out in the region of 25-30 tons of meat per annum (Monadjem 2003a). This was thought to contribute about 40% of the requirements of Swaziland's vultures in 2001. However, since the 2001 estimate (170 pairs) is far lower than the real total, this figure has to be revised. Depending on which total is used (the 240 pairs that were recorded in 2002, or the 300 pairs estimated to be present in Swaziland), this figure lies between 23–28% of the food requirements of Swaziland's vultures.

Threats to Swaziland's vultures

The threats to Swaziland's vultures have not yet been quantified, so this section must necessarily involve speculation. I speculate that the three most important threats to Swaziland's vultures (in order of importance) are as follows:

- Massive loss of habitat due to land transformation, mostly for irrigation agriculture such as sugar cane with concomitant decline in food supply.
- Harvesting of chicks for traditional medicine.
- Disturbance of breeding pairs at the nest.

Large-scale or deliberate poisoning of vultures by Swazi farmers has not yet been reported, although five poisoned vultures were reported in the north-

eastern part of the country in 1994 (Monadjem *et al.* 2003). These birds were found within 20 km of the South African border and, therefore, the site of the poisoning could have been in either country.

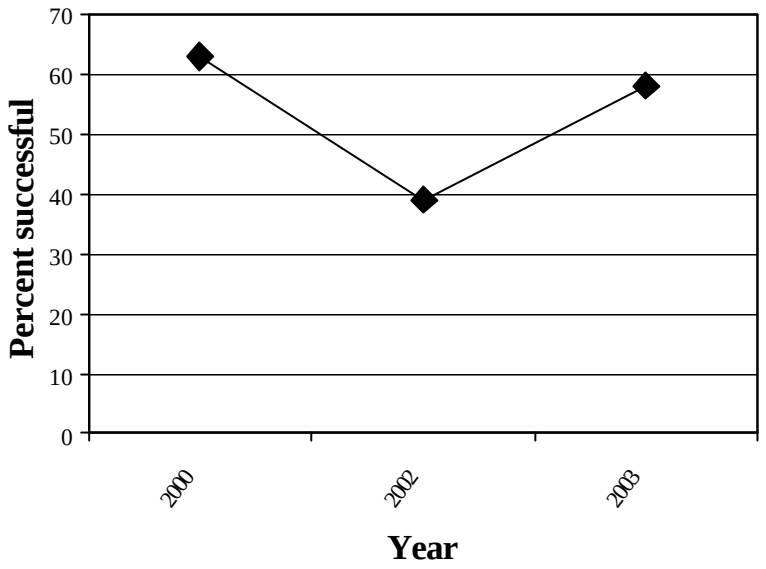

Figure 2. Breeding success of African White-backed Vultures nesting at Mlawula Nature Reserve. Note that breeding success was not recorded in 2001.

Proposed research, monitoring and conservation initiatives

A number of initiatives are suggested for Swaziland that would, hopefully, result in the improved conservation status of the country's vultures. These are in addition to the on-going initiatives mentioned above.

Research

The demand for vulture parts by traditional healers needs to be quantified. Understanding the demand for vulture parts is critical for the development of an appropriate plan of action to deal with this threat.

The survival of vultures from chicks to adults is currently unknown. It is thought that this is the period when proportionately the highest death rate occurs. Therefore, measuring this juvenile survival rate will be important. This should be possible by ringing chicks and searching for colour-marked individuals over an extended period of time.

Linked to the above study, I suggest that nest site fidelity be examined in (particularly in the African White-backed Vulture). Do the chicks return to nest in the area in which they were born? Or do they disperse over large distances? These questions need answers, as they have an important bearing in small populations.

Monitoring

A small number of White-headed and Lappet-faced Vultures breed in Swaziland. It is important to record the breeding success of these species in Swaziland. To this end, their nests need to be monitored over several breeding seasons.

Conservation

A few pairs of African White-backed Vultures breed on a single government ranch, yet suitable habitat occurs across several such farms. Why are these farms devoid of breeding vultures? And how can they be encouraged to breed on these farms? I suggest that they main reason why vultures have all but disappeared from these farms is that the illegal harvesting of wildlife resources (including vulture chicks) is not prevented or even controlled here. Should the managers of these farms put in place mechanisms for the protection of vultures at the nest, I predict that the birds will eventually return to breed on these farms (many of which adjoin areas currently harbouring nesting vultures). Working with these government ranches in general and their farm managers in particular, may be the most important short-term activity possible in Swaziland.

Another important conservation activity in Swaziland is the publication of articles for the lay-person e.g. newspapers, local magazines, etc.

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The status of vultures in Mozambique

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Introduction

The status of vultures throughout Mozambique is being investigated by the Mozambique Bird Atlas Project of the Endangered Wildlife Trust / Forum Natureza em Perigo. No other initiatives relating specifically to monitoring or conservation of vultures in the country, past or present, are known.

Species information

Table 1. Estimates of population size of vultures in Mozambique and major threats, based on Parker (1999; in press; in prep).

Species	Breeding pairs (total individuals)	Major threats
Hooded Vulture *Necrosyrtes monachus*	50 (150)	Bush meat trade
Cape Vulture *Gyps coprotheres*	12 (40)	Small population
White-backed Vulture *Gyps africanus*	500 (1500)	Bush meat trade
Lappet-faced Vulture *Torgos tracheliotos*	25 (80)	Bush meat trade
White-headed Vulture *Trigonoceps occipitalis*	160 (500)	Bush meat trade
Palm-nut Vulture *Gypohierax angolensis*	110 (350)	Deforestation

Major threats

Low numbers of large mammals and the bush-meat trade

Populations of four vulture species (Hooded, White-backed, Lappet-faced and to a lesser extent White-headed) are limited within Mozambique by the scarcity of the large mammals which form their food base. Populations of the larger mammals in the rural areas of Mozambique were already under pressure from unsustainable levels of hunting during the colonial era (Smithers & Tello 1976). These populations were exterminated from most of the country during the civil war of 1976-1991. Subsequently, the populations have been allowed to recover only in limited areas in the designated hunting concessions and some conservation areas (e.g. the Gorongosa National Park). In most of Mozambique, unsustainable levels of illegal hunting by the bush-meat industry continues to prevent the recovery of wildlife populations, despite tough anti-poaching legislation.

Education of the rural population about the benefits of non-consumptive or sustainable uses of wildlife may be a long term solution to the problem. For the present, however, lack of infrastructure renders the development of such uses impracticable.

The development of the recently proclaimed Limpopo transfrontier conservation area (publicized as forming part of the largest game reserve in the world) is not likely to support a significant increase in vulture numbers in the foreseeable future. Much of the designated area is unsuitable for

restocking with game because of the scarcity of water or the presence of large human settlements.

Palm-nut Vulture – deforestation

The Palm-nut Vulture is declining in Mozambique due to human population pressure leading to the destruction of its coastal woodland habitat. Much of its potential range was lost to habitat modification during the colonial era. Habitat is being lost at a lesser rate currently, because the remaining habitat is largely in inaccessible areas.

Cape Vulture – Small population

The Cape Vulture population, which consists of a single colony in the Lubombo Mountains at Goba, is vulnerable because of the small size of the population. It is believed that this population was never significantly larger because of the lack of suitable breeding sites. The food base for this population (which lies partly in Swaziland) is stable. The breeding site enjoys some protection from human disturbance because it is recognized by local developers as a potential tourist attraction.

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Conservation status of vultures in Botswana

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Introduction

From October 23 to 25 October 1997 a workshop took place in Kimberley to bring together people interested in or actively involved with vulture research, and among other aims, determine the current situation, to identify gaps and identify short-to medium term priorities (Boshoff *et al.* 1997). Available data on vultures in Botswana, particularly with respect to breeding numbers, habitat and nesting substrates, were published in the workshop Proceedings. It was shown that there was a serious paucity of information to estimate vulture populations and to identify threats in Botswana. We concluded that immediate priorities should be to establish numbers and localities of breeding Hooded Vultures *Necrosyrtes monachus*, African White-backed Vultures *Gyps africanus*, Lappet-faced Vultures *Torgos tracheliotos* and White-headed Vultures *Trigonoceps occipitalis* (Borello & Borello 1997).

In April 2004 a second workshop with similar aims took place in Kimberley. For this workshop the present Botswana situation was reviewed and found to be virtually unchanged from October 1997. This paper serves to highlight a continuing paucity of data.

Locality and data sources

The Republic of Botswana, a landlocked semi arid country, is situated on the Southern African Plateau at a mean altitude of 1,000 m a.s.l. Largely a sand-filled basin with gentle undulating plains, it covers over half a million square kilometres, about seventeen percent of which are protected areas (e.g., game reserves, national parks). There are seven main urban centres, with numerous scattered rural settlements. There are three distinct ecological zones a) the eastern hardveld, b) the sandveld, c) the Okavango/Chobe northern wetlands. Precipitation occurs during the summer months October – March/April, and is low, erratic and unevenly distributed, ranging from 650mm in the northeast to less than 250 mm in the extreme southwest. Temperatures can reach 40º C in summer and fall below 0ºC in winter.

The nesting records documented in Table 1 are those submitted to the national Nest Record Card scheme (NRCS) of BirdLife Botswana (formerly the Botswana Bird Club), coordinated from its inception by Dr N.J. Skinner until he stood down in 2000, personal records and records requested by the authors from other sources, including safari company personnel.

Vulture breeding information from 1997 to 2003

All vultures are protected by law in Botswana (Ministry of Commerce and Industry 1992). Conservation aspects are noted in Borello & Borello (1997, 2002). Vulture distributions are mapped in Penry (1994), Harrison *et al.* (1997), and are noted in Borello & Borello (1997).

Hooded Vulture *Necrosyrtes monachus*

No Hooded Vulture breeding records have been reported during the 1997 to 2003 period despite this species being plentiful in northern Botswana. A sum total of five nests have been documented in Botswana. One nest was reported in 1985 and three nests were reported in 1986. The only other Hooded Vulture nesting record submitted to the NRCS was in 1994

Cape Vulture *Gyps coprotheres*

The Tswapong area (22° 40'S, 27° 30'E) and Otse (25° 03'S, 25° 45'E) in the eastern hardveld are the Cape Vulture strongholds and it is the only vulture species in Botswana with sufficient data to estimate the breeding population. Descriptions of the Botswana Cape Vulture colonies, data on the status and demographic trends from 1984 until mid 1999, and known conservation aspects are documented in Borello (1985, 1986, 1987), Borello and Borello (1987, 1992,1993 and references therein, 1997, 2002). Cape Vulture studies by the authors are ongoing.

Table 1. Available recent data on vulture nests in Botswana. Records that include those from the national Nest Record Card scheme of BirdLife Botswana (formerly the Botswana Bird Club) are shown in bold type. The remaining records come from various individual sources

	Hooded Vulture	**Cape Vulture**	**White-backed Vulture**	**Lappet-faced Vulture**	**White-headed Vulture**
1998	no data	416*	**6**	no data	no data
1999	no data	333*	**7**	2	2
2000	no data	in prep	1	no data	**1**
2001	no data	in prep	5	no data	**1**
2002	no data	in prep	no data	2	no data
2003	no data	in prep	9	2	no data

* Borello & Borello 2002

African White-Backed Vulture *Gyps africanus*

White-backed Vultures are widespread and common in Botswana, yet breeding pairs are under-recorded (Table 1). Sites where several pairs traditionally breed are not monitored and since 1997 no records have even been submitted for those localities, e.g. along the Motloutse River near Selebi Phikwe (21º 59'S, 27º 50'E), Orapa (21º 16'S, 25º 19'E). The highest number of nest records submitted for any year since the inception of the NRCS in 1981 was 30, mainly around Orapa.

Lappet-faced Vulture *Torgos tracheliotos*

Lappet-faced Vulture is on the list of threatened birds of the world (BirdLife International 2002), yet over the six-year period only six nesting pairs of Lappet-faced Vulture have been recorded (Table 1). Prior to 1997, only 17 pairs had been recorded breeding. The maximum number of nest records submitted for a single year was five, which happened on two occasions. Localities where Lappet-faced Vultures were known to breed, e.g. Jwaneng Game Reserve (*c.* 24º 32'S, 24º41'E) (Soroczynski 1993) are no longer visited.

White-headed Vulture *Trigonoceps occipitalis*

Only four nesting pairs of White-headed Vultures have been documented (Table1). As in the Lappet-faced and White-backed Vultures, the few records submitted are mostly from popular tourist areas and contain only perfunctory data. This species also needs attention.

Discussion and conclusions.

There is very little that can reliably be said since the data are too few to draw any conclusions. Vultures, particularly nesting birds, are under-recorded. As previously reported by Borello & Borello (1997), only a handful of people may report vulture nests and this is clearly evident in Table 1.

There is a general disinterest in vultures in Botswana. A few records came from safari companies and other interested individuals (at the author's behest), but wider publicity campaigns, particularly by Botswana ornithological, wildlife and conservation groups, are necessary to reach a wider audience. Even taking into consideration that inaccessibility to many areas are a constraint to data-gathering, notwithstanding a lack of observers, it also appears that very few nesting records (for any bird species, not just vultures) are being submitted to BirdLife Botswana, perhaps indicating that birders and researchers are unaware that Botswana has a national nest record scheme. A situation that should perhaps be redressed.

Despite being listed as "Vulnerable", there is a lot of work needed before the Lappet-faced Vulture breeding population in Botswana can be estimated. There is a dismal lack of any baseline data as to its status, population dynamics and particular threats (if any) to its survival in Botswana. Two Botswana Vulture Study Group members in conjunction with BirdLife Botswana are trying to set up a country-wide network to report on Lappet-faced Vultures, with an emphasis on breeding data collection, combining it with education activities to devise a basic "blueprint" for information gathering strategies and public awareness campaigns. It is hoped that the species, now being of global concern, will provide an impetus for good baseline data collection, particularly among Botswana's university students.

There have been major environmental changes due to population and livestock pressures (Vanderpost *et al.* 1998), compounded by prolonged cyclical droughts. The intensification of human activities will continue to impact upon the Kalahari ecosystem (e.g. Moleele & Mainah 2003). With the possible exception of Cape Vultures, there are no data on habitat requirements and related research on breeding birds. Consequently threats and conservation priorities are difficult to identify. Kenward (2002) has shown that the most visible cause of mortality is not necessarily that which affects the population dynamics. There is no point in using guesswork; guesses become established in the literature and any retractions and errata are always ignored. A few years ago we had no idea what was about to happen to the Indian White-backed Vulture *Gyps bengalensis* population (see Prakash *et al*. 2003, Oakes *et al.* 2004). We could never have guessed if asked.

We need to know where vultures in Botswana breed and in what numbers and we need to use a capable methodology in order to get some scientifically useful answers.

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Status of vultures in Namibia

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Introduction

Vulture research in the desert started in the 1960's in the Namib Desert Park, now part of the Namib-Naukluft Park (NNP). Several researchers have worked on vultures in the same area over the years. The present project in the NNP, the ringing of Lappet-faced Vultures (*Torgos tracheliotos*), started in 1991 (Bridgeford & Bridgeford 2003). In 2003 a project to ring African White-backed Vultures (*Gyps africanus*) on commercial farms east of Windhoek, commenced. The research and ringing in Etosha National Park (ENP) is an ongoing project. Research in the Waterberg area by REST will be discussed elsewhere. Since 1997, after the Kimberley Workshop, the Vulture Study Group has been active in Namibia. The focus has been the conservation of vultures, through extension work with Farmers Unions, Conservancies and the public.

Species numbers

Lappet-faced Vulture *Torgos tracheliotos*

Lappet-faced Vultures are found over most of Namibia, but no reliable figures are available on the number of breeding pairs or individuals in the country. The only reliable figures are for breeding birds in the NNP, 78 pairs, (Simmons & Brown in prep.) in a population of approximately 500 pairs Mundy *et al.* (1992) in Simmons & Bridgeford (1997). In the Namib, 369 chicks have been ringed since 1991. In the ENP, 78 chicks were ringed since 1998, but only part of the population is ringed annually (W. Versfeld personal communication).

African White-backed Vulture *Gyps africanus*

The most common vulture in Namibia, even found in small numbers in the Namib, although they do not breed there as a rule. However, there is one record of a breeding bird in the Tsondab area of the NNP (Vinjevold 1987). These birds breed mainly in the eastern half of the country and in ENP. There are no reliable figures on the population size, but Simmons & Bridgeford (1997) state that the population is secure for the present. Since 1998, in the ENP, 139 chicks have been ringed and there were three recoveries, all of dead birds (W. Versfeld personal communication). The new ringing project on commercial farms east of Windhoek, managed to ring 28 chicks on seven properties, in 2003.

White-headed Vulture *Trigonoceps occipitalis*

This species occurs in the ENP, Waterberg Plateau Park, Mahango and Kaudom Game Reserves and Caprivi (Mundy 1997). It breeds in the ENP, where one chick has been ringed annually since 1999, except in 2001. The maximum breeding pairs found was two in 2002, but a predator took the second before it was ringed. Only single birds were seen at carcasses (W. Versfeld personal communication). Versfeld states that there may be more breeding birds, but finding the nests is not easy and some areas are so dense

and thorny, that a vehicle cannot get there It is seen seasonally, during the rainy months, in Kaudom, Mahango and Waterberg (M. Paxton personal communication). Paxton has found breeding birds in the east, in Bushmanland.

Hooded Vulture *Necrosyrtes monachus*
Not much is known about this species in Namibia. It occurs in the Caprivi, Bushmanland and ENP (Simmons & Bridgeford 1997). One of the reasons it is seldom reported may be because, it is small and easily overlooked at carcasses (Mundy 1997). It has been seen and photographed in Waterberg (M. Paxton pers. comm.), although it is not shown to occur there in the Atlas of southern African Birds. A single bird was seen in November 2003 at the vulture restaurant of the Rare and Endangered Species Trust on the farm Uitsig, just north of the Waterberg. Paxton reports that single birds are usually seen in the rainy season in Mahango and Kaudom Game Reserves.

Egyptian Vulture *Neophron percnopterus*
In the opinion of Simmons (Simmons & Bridgeford 1997), this rare vulture is not extinct in Namibia. Although there are no new sightings on record, Versveld (pers. comm.) states that tourists have reported seeing Egyptian Vultures in ENP, but no dates are available.

Palmnut Vulture *Gypohierax angolensis*
No more information about these vultures, than reported by Simmons & Bridgeford (1997), is available. In Angola, south of Luanda on the coast, Steve Braine (pers. comm.), reports that Palmnut Vultures are common and they are breeding there in 2003 in large numbers. This vagrant to Namibia has been reported in ENP (Mundy & Allan 1997) and one record from the Namib, at 25° S on NamibRand Nature Reserve in May 2000 (Bridgeford & Harley 2000).

Mortalities
Poisoning remains the biggest killer of vultures in the country. Mortalities from 1995 to August 2000 have been published (Bridgeford 2001). Since then, 36 KNOWN cases of poisoning have been recorded, usually as a result of poison put out for problem animals such as lions *Panthera leo*, spotted hyaena *Crocuta crocuta* and Black-backed jackals *Canis mesomelas* (Bridgeford 2002).

In 2001, six Lappet-faced Vultures and 18 African White-backed Vultures were poisoned on a farm bordering the ENP. In Karasburg, 14 African White-backed Vultures drowned in a reservoir and another in the ENP.

In the Maltahöhe district, four Lappet-faced Vultures were poisoned in 2002.

In 2003, six African White-backed Vultures and two Lappet-faced Vultures were poisoned on the eastern boundary of the ENP. Another Lappet-faced Vulture was poisoned in the Maltahöhe area and one drowned in a reservoir.

The collection of data on vulture mortalities continues, but as always, the information we receive is only the tip of the iceberg.

Current research and conservation initiatives

To date, 365 Lappet-faced Vulture chicks have been ringed in the N-NP and another four Lappet-faced Vultures were ringed on NamibRand Nature Reserve. Of the 27 recoveries/resightings, 22 were of dead birds, four resightings at a vulture restaurant and one caught in a gin trap and released.

The African White-backed Vulture ringing project started in 2003. This is a co-operative project between the VSG and farm owners, through conservancies and farmers' unions. The farmers know exactly where the vultures breed on their properties, and they, their families and farm workers help with the ringing process and manhandling the long extension ladder. In this way, they are all involved in the project. For most of them, it is the first contact with a live vulture and the feedback is very positive. Each farmer involved received an attractive certificate from the VSG Namibia. The response has been phenomenal and we have received more information from other farmers who want to be involved.

In ENP, Versveld and Osborne have ringed 139 African White-backed Vulture chicks since 1998.

Proposed research and conservation initiatives

One of the big question marks that remain is the effect of power lines on Namibian vulture populations. We have very little information on this perceived problem, and as we know, it is a big killer of vultures in South Africa, and many of our conditions are similar (van Rooyen 2000).

- Poison is still the biggest killer in Namibia, and extension work among the farmers remains a priority.
- Continue our ringing of Lappet-faced vultures in the NNP.
- Expand our African White-backed Vulture ringing project to cover a larger area and use two ringing teams if possible.
- Do extension work south of Keetmanshoop through the various Farmers Unions.

Publicity

Vultures and their plight have received good coverage in the English, German and Afrikaans newspapers during the past year. In conjunction with the Commercial Bank of Namibia, we took the press out for a day to ring Lappet-faced Vulture chicks. It was very successful and generated a lot of publicity.

The African White-backed Vulture project was well publicised by Dirk Heinrich, who was one of the organisers and ringers.

There have been articles on vulture conservation, and the activities of the VSG in AgriForum, the official magazine of the Namibia Agricultural Union.

The annual Conservation magazine had a two page spread with colour photos and activities of the VSG.

The annual VSG workshop held at Aandstêr on NamibRand Nature Reserve also received good coverage from the press.

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Status of vultures in the Waterberg region of Namibia

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Introduction

The Rare & Endangered Species Trust (REST) was founded in September 2000 in the northern section of Namibia. It is located on the private farm of Maria & Jorg Diekmann and was founded by Maria Diekmann. REST has begun many educational and research projects focusing mainly on the Cape Griffon *Gyps coprotheres.* In January 2004 REST initiated the first ever fitting of satellite transmitters on Cape Griffons. The data that we have received to date has been very interesting and vital to the survival plan of the Cape Griffon in Namibia. See below for more details on the project. We hope to expand this project to African White-backed Vultures *Gyps africanus* and Lappet-faced Vultures *Torgos tracheliotos.* In addition the year 2004 will begin our major vulture and poison awareness campaign focusing on farmers, but also distributing information to the general public. This programme will lead to the eventual release of translocated Cape Griffons from South Africa into Namibia.

Note: P. Bridgeford (in these proceedings) reported on the efforts of L. Komen in Windhoek and T. Osborne and W. Versfeld in Etosha.

Species numbers

Cape Griffon *Gyps coprotheres*

REST is currently focusing on the Cape Griffon, as it is the most endangered species in Namibia. After doing a photographic passport for each bird, we determined that the population stands at 11 individual birds consisting of eight adults (believed two females and six males), one juvenile and two immatures (believed to be a two and three years old; Mundy & Diekmann, personal observation). These birds do not regularly visit the REST restaurant together. Often 2-5 adults will come in, but more regularly no more than two adults and one or two of the younger birds. We have a feeding scheme set up with the local abattoir that we put food out about once a week here at REST for research, educational and monitoring purposes.

Lappet-faced Vulture *Torgos tracheliotos*

The most Lappet-faced vultures that we have seen at the REST restaurant at one place at one time were 56 individuals. To date we have not ringed any Lappet-faced Vultures as they usually eat a day after the Cape Griffons and African White-backed Vultures and our captures have focused on Cape Griffons out of necessity. Once we have telemetry and rings on all of our Cape Griffons we will begin more ringing of Lappet-faced Vultures. In July 2004 we will begin a programme in conjunction with Oxford University in the UK to establish minimum populations in the area.

African White-backed Vulture *Gyps africanus*

The African White-backed Vultures are without a doubt the most populous of all of the vultures in the region. At the REST restaurant we have recorded a

maximum of ±450 individuals at one place at one time. In January 2004 we ringed 91 White-backed Vultures and in March 2004 we ringed 30 individuals. We expected to see many of the ringed individuals returning at the same time for feeding. To date we have had a maximum of 15 individuals returning at any one place and time.

White-headed Vulture *Trigonoceps occipitalis*
None sited in the area.

Hooded Vulture *Necrosyrtes monachus*
There is one adult individual Hooded Vulture that visits the REST restaurant regularly especially from May until December every year. It is believed that this is the same individual that was seen and photographed on the Waterberg Plateau Park by Maria Diekmann previously to REST setting up their own restaurant.

Egyptian Vulture *Neophron percnopterus*
Chris Brown reports that he does believe that there is a small population of Egyptian vultures in the northern regions of Namibia. REST observers have not seen any individuals in the Waterberg area, but there are reliable reports every year from keen birders visiting Etosha.

Palm-nut Vulture *Gypohierax angolensis*
None sited in the area.

Re-releases and Mortalities
Releases in 2004:

- Two African White-backed Vultures were re-released both for dehydration – both in good condition otherwise.

Mortalities in 2004:

- One African White-backed Vulture was found on nearby farm road by neighbour. Too late to test for contaminates.
- One African White-backed Vulture nestling was found in tree – predation.
- One African White-backed Vulture 1st year bird – positive for strychnine – was found near REST and believed to have been poisoned within a 50-km radius.

Current research and conservation initiatives
Continuation of 'vulture culture' days with captive live CGV – Nelson
We have taken Nelson out to two live events in 2003. REST's stand and Nelson won a gold metal at the Otjiwarongo Agriculture show and we received wonderful feedback from the Okamatapati Agricultural show in Hereroland of Namibia.

Education with Vulture Activity Sheet for children
This sheet has almost been completed and will be handed out to children and teachers for projects and information on the vultures of Namibia with a focus on the Cape Griffon.

Working with Poly Technic of Namibia

The Poly Technic of Namibia has brought third year conservation students to REST headquarters for two years now for an information day on vultures and conservation. We hope to formalise this partnership and help the students with research projects.

Providing material for high school science projects

Three students requested to participate in the 21 March 2004 capture of vultures at REST after reading media reports on the January 2004 capture. All three of the students are participating in a special scientific fair held yearly in the capital. Two from Windhoek will work together on a project that focuses on the history, basic biology and behaviour and current plight of the Cape Griffon. The third student – from Otjiwarongo – will present some basic information on the Cape Griffon, but will focus on the various capture techniques possible historically and look at the current technique used by REST and all advantages of this latest method.

Nampower – working with Chris van Rooyan and Nampower

Maria met with the head of the Otjiwarongo Nampower division and a representative from Windhoek on the development of new power lines in the Otjizonjupa region. We had a formal meeting in Otjiwarongo looking at maps and pictures that Chris van Rooyan had provided months before, and then all drove out to REST headquarters to look at the specific needs of the area in relation to vultures and raptors. There had been plans to build power lines very near the current and proposed new vulture feedings sites of REST. Nampower was very grateful that we were being proactive and understood the situation perfectly. They promised full co-operation and expect to confer further with Chris van Rooyan and REST.

Reintroduction – currently holding 10 CGV from SA in Namibia

Eight Cape Griffons were brought up to Namibia to join the two already being held for reintroduction into the Namibian population. This is necessary for the gene bank of the Namibian birds. Although they are able to physically fly from SA to Namibia, the Waterberg population seems to be sufficiently cut off from any new blood due to distance and hazards along the way. The VSG had been holding these birds at the De Wildt Cheetah Research Centre. REST approached the Bateleurs, an organisation consisting of private pilots that donate time for conservation, and they in turn managed to get Air Namibia to join as a corporate member and fly the birds up to Namibia free of charge including all taxes and handling operations. A short film was made of this operation and given to Air Namibia for future use in publicity.

Marketing division

REST has expanded its marketing division from original artwork and vulture items like hats and T-shirts. Inventor Seth Fortmeyer is designing original vulture skulls, and skeletons for purchase by individuals and educational institutions. A donor from the UK has sponsored Christmas cards with a picture of one of our captive birds in order to celebrate REST's 2004 achievements with the people around the world.

Captures and fitting of satellite PTT's

January 16, 2004. REST initiated its first large-scale capture of vultures. The aim of the project was to fit the first three Platform Transmitter Terminals (PTT) or satellite transponders on to Cape Griffons. This technique consists of a large walk in trap with a second aviary adjoining the trap with captive releasable birds in it. These releasable birds are held at REST in a semi permanent status for a year as part of our reintroduction programme. These birds are held at this location in order to:

- get use to the environment of Namibia;
- to be away from major human interaction;
- to become familiar with the wild birds of the area (feeding once a week at this location);
- to view the cliffs of the Waterberg Plateau – the last natural roosting site of Cape Griffons in Namibia.

In the process captured the Cape Griffon, CA104, later named Sky Banker as he is sponsored by the Commercial Bank of Namibia. We also caught 91 African White-backed Vultures. There were approximately 380 vultures on site at the time including many Lappet-faced Vultures and Marabou Storks (*Leptoptilos crumeniferus*). We had a team consisting of various vulture experts around southern Africa and our qualified vet and her assistants. It was decided near sunset that we would keep the remaining birds overnight in the aviary as they did not appear to be overly stressed. In fact the next morning they had eaten again and were much stronger than the day before. We had no fatalities or injuries of birds. Blood was collected for in depth analysis and sexing, parasites were collected and a very large sample of birds were fully measured.

March 21, 2004. With the same capture technique REST was able to catch one adult Cape Griffon, one suspected hybrid (Cape vs African White-backed) and 32 African White-backed Vultures. The new Cape Griffon, CA204, was named Emperor by his sponsors – Steve Martin's Natural Encounters and released. Then blood and measurements were taken from 20 African White-backed Vultures and due to the lateness of the actual capture, the remaining 12 African White-backed Vultures were released without rings or samples taken. The suspected hybrid was taken overnight to the house base and the next morning full measurements, blood and photographs were taken of the bird. After much discussion with the sponsor – Ned and Diana Twining – and some members of REST's scientific board, the vulture, named TEABAG, was fitted with a PTT and released. It has been interesting to note that the two adult Cape Griffons have shown very different flight patterns from each other. Sky Banker sits most nights in a specific tree near REST headquarters. Emperor also roosts in trees and does have a favourite spot, but not as consistently as Sky Banker. Emperor also flies much further daily distances. TEABAG sleeps many nights in the exact same tree as Sky Banker. It has been decided that after the fledging period of 2004, REST will recapture TEABAG and fit his PTT on to a pure Cape Griffon if we have not secured further funding for the existing Cape Griffons of Namibia. They must remain our focus of work, but we will gather as much information on TEABAG as

possible. Permits are currently being organised to test his blood for DNA analysis of ancestry.

Studies:

- Crop capacity discrepancies between male and female in Cape Griffons.
- Feeding needs – summer vs. winter in Cape Griffons.
- Passports of individual Cape Griffons in Namibia – REST and Middlebury.
- GIS/Movements of Cape Griffons – REST and Mendelsohn.

Proposed research and conservation initiatives

- Expansion of the vultures and poison awareness campaign (Agra Registration; Farmer signs).
- Development of new research centre.
- Development & training of young Namibian researchers.
- Flight for the Plight of the Cape Griffon – 2004. This worldwide hangliding and paragliding event will take place again in November 2004. The first fund raising/public awareness event attracted 22 pilots from 7 different countries around the world.
- Continuing work with Raleigh International to expand REST aviaries etc. Raleigh International is an UK based youth group organisation that offers young people from around the world a chance to live and work for communities and conservation around the world. REST has a very strong relationship with Raleigh.

Studies:

- Namibian population density studies – REST and Oxford.
- Anthrax and Botulism – Denmark.
- Expansion of traditional healing research.

Publications: papers & reports being worked on

- A poster on Cape Griffons in Namibia and the first capture and fitting of a PTT by REST
- Diekmann, Scott, Scott & Diekmann – capture technique and harnesses for PTTs
- Verdoorn, Diekmann – physical sexing of African White-backed Vultures and Cape Griffons
- Mundy, Diekmann – external analysis of free flying African White-backed Vultures
- Others – internal analysis of free flying African White-backed Vultures (parasites etc)
- Evans, Diekmann – minimum viable population study of Cape Griffons in Namibia
- Diekmann – report on colony in Ethiopia
- Diekmann – report on resighting of ringed vultures at REST feeding site
- Diekmann – report on time and frequency of returning vultures to REST feeding site after capture

- Mendelsohn, Diekmann - analysis of Cape Griffon movement in Namibia.

Publicity

- There is good local and regional coverage of REST. All of the local papers and tourism publications have had numerous articles on various REST events. REST has featured many times on the local news and a large interview was done for Good Morning Namibia television.
- Conservation displays at information shows for Otjiwarongo and Namibia.
- International publicity – Jack Hanna/USA, BBC, Germany.
- The full nature documentary on REST is continuing to be filmed with Oracle Films and Pierre van Heerden. Pierre films most major events and provides our local broadcaster with footage for local publicity.

The status of vultures in Zimbabwe

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Introduction

Unfortunately no field work was done in 2003 due to the awful and criminal political situation pertaining; for the 4th year now.

Personally I stopped making routine sightings of vultures when I retired from the Department of National Parks at end-May 2004. But the files of data from my time of 19 years in the DNP are still in that office and accessible to me.

One probable poisoning incident, near to the Tuli Circle, was reported. At least several skeletons of African White-backed Vultures (*Gyps africanus*) were found.

An adult Egyptian Vulture (*Neophron percnopterus*) was sighted in September 2003 gliding over the Rusitu forest, at approximately 20ºS; 33ºE. This record is before the rarities committee.

Section C

Key threats to vultures in southern Africa

Historical changes in stocking rates: possible effects on scavenging birds

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Introduction

Heavy grazing by domestic livestock in the arid and semi-arid rangelands in southern Africa has almost certainly led to irreversible dryland degradation (Downing 1978). Some areas have lost a major part of their ability to support livestock, to the extent that they now only carry about 40% of the biomass of domestic livestock that was present in the early 1900s (Dean & Macdonald 1994). These changes not only indicate the loss of palatable primary production, but also suggest that patterns and processes in the arid and semi-arid rangelands have been disrupted (Talbot 1961), with important consequences for native herbivorous animals, as well as large predators and scavengers.

Grazing induced damage to soil and vegetation or to declining secondary productivity in drylands in South Africa has been reported and discussed by a number of authors over the last 50 years (Tidmarsh 1948; Acocks 1953, 1979; Downing 1978; Roux & Vorster 1983; Bruwer & Aucamp 1991; Dean & Macdonald 1994; Milton *et al.* 1994). The earliest settlers of European origin apparently over-estimated the productivity of the semi-arid rangelands, and the relatively heavy stocking rates that they imposed (Talbot 1961) may have left a legacy of change that is apparent in the present state of the rangelands (Hoffman & Ashwell 2001). Acocks (1953) was convinced that, by the early 1950s, there had been major shifts in the species composition of the rangelands of the Karoo caused by mismanagement of domestic livestock. Earlier opinions (Shaw 1875) similarly suggested that the vegetation was being heavily grazed and damaged by sheep and that there had been changes in cover and composition, and even earlier travellers, such as Burchell (1822) and others (reported in Skead 1980), had reported signs of heavy grazing and reduced plant cover.

Vegetation changes have been accompanied by major changes in the species richness and abundance of large wild herbivores and their predators (Skead 1980, 1987; Boshoff & Vernon 1980a). The indigenous large herbivores no longer occur in the drylands. It is uncertain whether habitat degradation caused by ranching contributed to the demise of the large herbivores. Nomadic movements of these herbivores between traditional, seasonal foraging areas is precluded by fencing, and the control of predatory animals (Macdonald 1992), disruption of waterways, towns and highway construction have led to changes in the original fauna and the disruption of processes in the drylands (Talbot 1961).

Here, I summarise the results of an earlier study (Dean & Macdonald 1994) that showed that there has been a marked reduction in stocking rates of domestic livestock in the drylands of western South Africa (the former “Cape

Province"). The assumption is that a reduction in stocking rate implies a reduction in carrying capacity, and a reduction in carrying capacity implies that there have been losses in that component of the primary production that can be utilised by domestic livestock. Information presented by Dean & Macdonald (1994) covers the period 1865 to 1980.

Methods

Numbers of livestock were extracted from agricultural censuses (the "Blue Books") covering the period 1840 to 1981 for all dryland administrative (magisterial) districts of the former Cape Province. Drylands are those in which the average annual rainfall is less than about 500 mm, and conditions are generally too dry to grow crops without irrigation. Blue Books from which livestock numbers were extracted were: 1840, 1845, 1855, 1865, 1875, 1891, 1904, 1911, 1921, 1930, 1939, 1945, 1955, 1960, 1971 and 1981. The numbers of each species of domestic livestock given in the censuses were converted to Large Stock Units (LSU's) (1 LSU = 1 bovid weighing 420 kg, - see Dean & Macdonald 1994). To determine carrying capacities of native rangelands, the numbers of livestock were first corrected by deducting the livestock units supported by crops, using a complicated set of conversions (see Dean & Macdonald 1994). Corrected livestock units were then converted to numbers of livestock on 100 ha of rangeland using the area of farmland in each magisterial district as recorded in the censuses. From these data we calculated average stocking rates for two different periods, 1911-1930 and 1971-1980.

Results

For all dryland districts in the Karoo and in some districts in arid savanna in western South Africa there has been a mean 44.4±14.6% (S.D.) reduction in stocking rate from the initial (1911-1930) to the final (1971-1981) period (Table 1). The trend over time for decreases in stocking rates is shown in Figure 1. For five savanna districts (Gordonia, Kuruman, Mafeking, Taung and Vryburg), there has been a mean 36.8±8.5% increase in stocking rates (Table 1), although current stocking rates are still below the peak reached in 1940-1960 (Figure 2). For all districts, the mean stocking rate was 13.04±9.1 LSU/100ha during the period 1911-1930, and 8.4±7.7 LSU/100ha in 1971-1981 (Table 1). Changes in stocking rates are inversely related to rainfall, and the change in the more arid districts has been relatively higher (Figure 3).

Table 1. Mean annual rainfall (mm), past (1911-1930) and present (1971-1981) stocking rates (SR) (LSU/100 ha) and percentage change in stocking rate for magisterial districts of the former Cape Province.

Magisterial district	Rainfall	Past SR	Present SR	% change
Savanna districts				
Barkly West	388	11.94	11.05	-7
Gordonia	188	3.60	4.73	+31
Hay	271	9.58	7.46	-22
Herbert	319	11.11	9.2	-17
Kimberley	352	15.31	9.82	-36
Kuruman	335	8.10	10.68	+32
Mafeking	434	12.12	17.07	+41
Postmasburg	308	12.15	8.72	-28
Taung	523	35.40	46.11	+30
Vryburg	394	10.27	15.42	+50
Warrenton	405	12.92	12.47	-3
Eastern Karoo districts				
Adelaide	555	35.41	21.08	-40
Albert + Venterstad	408	20.92	11.83	-43
Aliwal + Ladygrey	474	27.66	14.41	-48
Bedford	486	22.65	13.35	-41
Elliot	586	37.46	27.7	-26
Molteno	481	26.99	10.84	-60
Somerset + Pearston	401	16.75	7.54	-55
Sterkstroom	495	26.97	13.17	-51
Steynsburg	387	16.13	6.52	-60
Wodehouse	577	34.43	15.89	-54
Central Karoo districts				
Aberdeen	256	8.65	4.2	-51
Beaufort West	194	5.93	3.17	-47
Britstown	245	6.43	4.29	-33
Carnarvon	174	5.54	3.44	-38
Colesburg	326	12.35	6.12	-50
Cradock	363	15.40	7.28	-53
De Aar	295	7.82	5.32	-32
Fraserburg + Williston	161	4.46	2.74	-39
Graaff Reinet	336	11.08	5.46	-51
Hanover + Noupoort	306	8.32	4.9	-41
Hofmeyr (Maraisburg)	338	13.97	7.1	-49
Hopetown	274	8.40	5.41	-36
Jansenville	241	14.66	6.17	-58
Kenhardt	144	3.92	2.5	-36
Middelburg	325	11.69	5.12	-56
Murraysburg	268	7.69	4.38	-43
Philipstown	341	10.05	5.72	-43
Prieska	215	7.30	3.82	-48
Richmond	282	7.06	4.0	-43
Tarka	460	22.82	13.56	-41
Victoria West	225	6.38	3.76	-41
Succulent Karoo districts				
Calvinia	190	4.33	2.1	-52
Laingsburg	208	4.44	2.19	-51
Namaqualand	123	4.27	1.41	-67
Prince Albert	187	4.52	1.8	-60
Steytlerville	250	11.86	4.25	-64
Sutherland	255	4.57	2.48	-46
Vanrhynsdorp + Vredendal	162	3.80	1.07	-72
Willowmore	267	6.84	2.28	-67

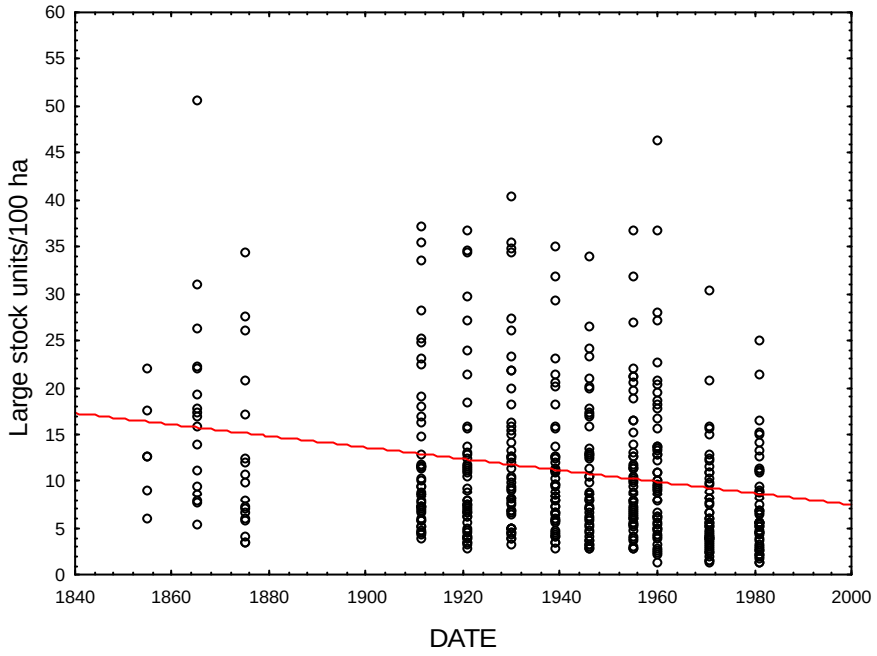

Figure 1. Trends in stocking rates over time for all arid and semi-arid Karoo and savanna magisterial districts in South Africa

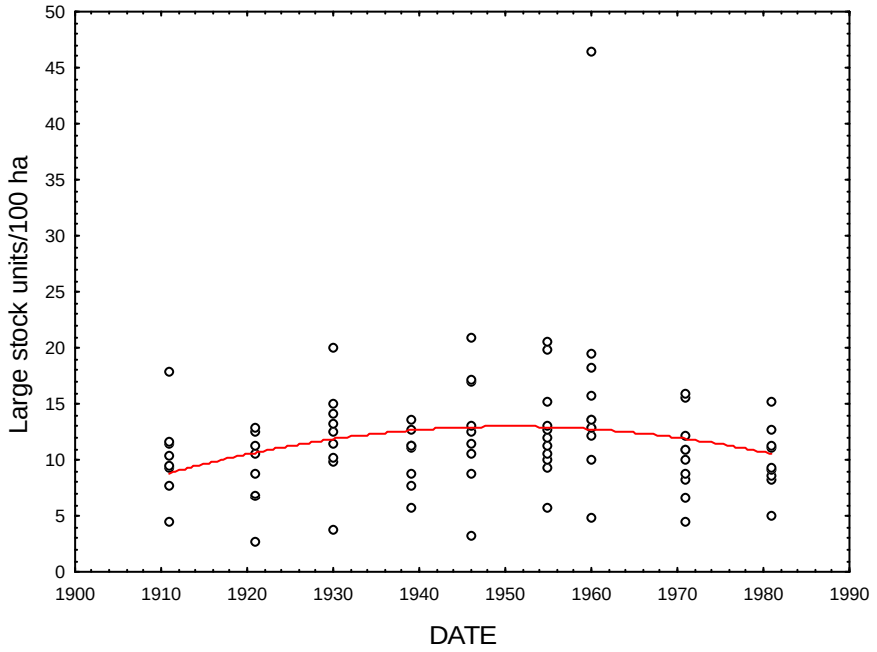

Figure 2. Trends in stocking rates in arid savanna in western South Africa.

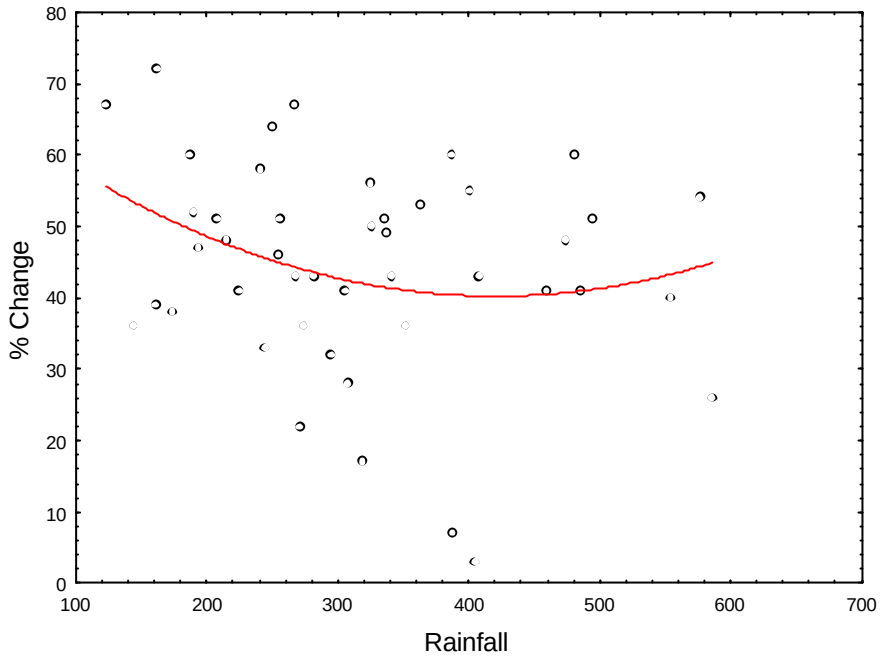

Figure 3. Trends in changes in stocking rates related to rainfall amount in western South Africa.

Discussion

Changes in stocking rates

An important point to note is that there is no legislation in South Africa that limits the number of livestock that a rancher can have on his land (Talbot 1961) so the number of livestock kept on rangelands is the result of decisions made by individual land managers. If stocking rates have been reduced it almost certainly indicates reduced carrying capacity, and this in turn indicates a reduction in the ability of dryland rangelands to support large numbers of herbivorous mammals. It may be argued that stocking rates may have been reduced for a number of other reasons, not necessarily ecological, including state-aided stock reduction schemes and economics. However, the available evidence suggests that the current livestock stocking rate in drylands in western South Africa is unrelated to market forces or government policy but is determined by rangeland productivity (Dean & Macdonald 1994).

The rural economy in the early settlement years in South Africa was almost entirely pastoral, with very little crop farming (Christopher 1982). The early immigrant settlers in the dryland areas of South Africa encountered a land that was unlike anything in their European experience. The land was dry, the vegetation was sparse, but nevertheless supported a surprising diversity of large herbivorous mammals, and the seasons were much less clear-cut, with a high co-efficient of variation in rainfall. The perception was that the land could carry large numbers of domestic livestock, and given the good market for provisioning ships at the Cape, the settlers stocked their rangelands with as many sheep or cattle that they thought the land could carry. The settled areas were, initially, close to Cape Town, and as stocking rates increased in these areas, so there was a concomitant decrease in the number of wild

animals. As the eastern frontier advanced (Christopher 1982), large herbivores were shot for food, or perhaps removed because they were strong competitors for resources (Acocks 1979). Large predators were removed to minimise losses of domestic livestock.

The management of the rangelands and domestic livestock by the early settlers was not based on any prescribed grazing system, but was simply *ad hoc* – the number of livestock on the land was always high, and set by a (usually) over estimated carrying capacity based on what land could carry in the higher rainfall years (Talbot 1961). There were other mismanagement practices – no fodder was reserved for times of drought, and the usual practice was to keep livestock on the land in the hope of rain. This repeated punishment of drought-stricken pastures led inevitably to impoverished plant cover and reduced primary and secondary production (Talbot 1961). The nomadic pastoralists also had a major impact on the vegetation in certain areas. The early settlers perceived drought years as unusual, whereas the reality is that they are equally as frequent as the wet years (Kokot 1948).

Is there a link between changes in stocking rates and changes in populations of scavenging birds?

We really have no idea of the big picture of how high stocking rates may have affected most ecological processes in the drylands. The effects of these changes in stocking rates or disruptions to processes on large scavenging birds are not at all clear. Populations of these birds were reduced through a combination of factors, of which changes in stocking rates were probably only a small part. The late 1800s-early 1900s appear to be a threshold period after which vulture populations started to decrease south of the Orange River. By the early 1900s game had virtually been eliminated from most of the dryland areas south of the Orange river, and indeed one species, the Quagga *Equus quagga* had already gone extinct (Skead 1980). But vultures, by all accounts (with the exception of two species), were still present in reasonable numbers at the turn of the 19th century.

We know, for example, that populations of vultures were still common in the late 1800s, and that there was a colony of Cape Vultures *Gyps coprotheres* with “hundreds of birds” in the 1860s (Layard 1867) and 1870s (eggs in The Natural History Museum, Tring) at Nelspoort, in the central Karoo that “had nested there for time immemorial” (Layard 1867). There was at least another colony in the central eastern Karoo in the Sneeuberg (egg in the National Museum of Scotland, Edinburgh, colony not shown on the map in Boshoff & Vernon 1980b). Layard (1867) also notes that Cape Vultures were still present around Cape Town in the 1850s. This implies that some vultures still occurred in the Karoo during the time when stocking rates were highest, although the concentrations of domestic livestock may have been on a smaller geographical scale than later on. This further implies that, for a time, there was a measure of co-existence between the stock farmers and large scavenging birds. The decrease in numbers of Cape Vultures really only began in the early 1900s, a point already made by Boshoff *et al.* (1983). Lappet-faced Vultures *Torgos tracheliotos* were also widespread in the Karoo in the 1870s, but much less is known about the point at which their

populations started to decline although it appears to have also been around the late 1800s.

The question arises of what factors, together with changes in stocking rates and the virtual elimination of game, there were around 1890-1910, that affected vultures. Firstly, the discovery of diamonds in the 1860s and the development of gold mining in the 1890s led to the development of a huge market among the miners for meat, and this encouraged commercialised hunting of wild animals (Talbot 1961). But domestic livestock are much easier to harvest than wild animals, and when the game was substantially reduced in numbers, the ready market on the mines encouraged over stocking of rangelands with domestic livestock.

Secondly, until the late 1800s, some pastoralists in Namaqualand and other parts of the western Karoo were nomadic, moving along ill defined routes with their stock, having the right to graze their animals up to 400 yards on either side of the “trek path” (Talbot 1961). Livestock were often driven hard along the trails, and subsequent losses, either deaths through heat exhaustion or livestock simply wandering away from the main flock and getting lost, provided easy prey for predators and meals for scavengers. Nomadic graziers would have hunted for the pot along the way, leaving the remains to be cleaned up by scavengers. Also, under a nomadic grazing system, there was no real need to systematically control large predators, and the remains of livestock that were taken by predators were effectively cleaned up by scavenging birds.

Other pastoralists in the drylands used a system of allowing their stock to graze over large areas, and then to round them up at night in stockpens for protection from large predators. However, crowding of livestock into small areas spread contagious diseases with some losses of livestock as a result. There were also losses of livestock through droughts and this would also have provided some food for scavengers. So in summary, livestock farming in dryland areas of South Africa in the late 1800s, regardless of whether the rangelands were lightly or heavily stocked, was not likely to have heavily impacted vultures.

However, a major change was imminent, the introduction of fencing. In 1897 pastoralists were being encouraged, through government concessions, to fence their properties to restrict the movement of livestock, and by 1912, the Fencing Act made fencing compulsory (Talbot 1961). This had a marked effect on the spread of stock diseases so that there were fewer deaths among livestock and probably less food available for scavengers. Confining livestock to fenced camps also tended to increase stocking rates per unit area, and this allowed areas to be even more overgrazed. It also encouraged pastoralists to control problem animals, so the large predators were almost completely eliminated from some areas. It also allowed game that had been confined to fenced areas to be shot out.

The third important happening at about this time was the introduction of windmills in about 1890. This, together with newly developed deep-drilling technology, allowed settlers to move in to waterless areas such as

Bushmanland, the last stronghold of large herds of game, large predators and vultures. As stocking rates increased in these areas, there was a concomitant decrease in large predatory mammals, and thus a decrease in the amount of carrion available. Also, there was concern at this time about cattle and sheep eating carrion, and it is likely that efforts were made to bury or destroy carcasses. Water points may also have been drivers of direct persecution of vultures, the perception being that vultures, because they drink and bathe frequently, foul and contaminate the water. Ironically, many of these early livestock ranching enterprises in the savannas failed, so having destroyed almost all the game and disrupted ecological processes, the settlers moved on to other enterprises (Talbot 1961).

During the late 1800s and early 1900s, rinderpest swept south from North Africa, causing devastating losses to cattle and game (Stevenson-Hamilton 1957). Although rinderpest "ravaged the continent from Abyssinia [Ethiopia] to the Cape" (Stevenson-Hamilton 1957), the impact seems to have been much higher in savanna areas in eastern and north-eastern South Africa, and it is uncertain what effect rinderpest might have had on the herbivore populations in the Karoo and arid savanna. Certain species, particularly African Buffalo *Syncerus caffer*, were all but exterminated through the disease (Skinner & Smithers 1990).

Conclusions

Changes in dryland primary production and reduced stocking rates are indicators of major ecosystem changes that have consequences for many organisms. Stock farming in the drylands has affected a large array of native animals, of which vultures are only one component. The tragedy is of course that we cannot go back; many of the changes that have happened in the dryland areas are irreversible, and even if we attempt to rehabilitate some areas, we cannot duplicate, except at high cost and over very large areas, the tightly-coupled herbivore-carnivore-scavenger system that formerly existed.

Acknowledgements

Data on stocking rates were initially extracted by Jessica Hughes and compiled and analysed by Ian Macdonald, and I thank them for their very large contribution to the database. Data on eggs in the Natural History Museum, Tring, and National Museum of Scotland, Edinburgh, were obtained while holding a grant from The Leverhulme Trust. I am grateful to Sue Milton for comments on a draft of this manuscript.

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Changing land-use patterns in southern Africa with emphasis on bush encroachment and tree removal in savanna

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Introduction

Of the 122 mil ha land in South Africa, approximately 106 mil ha is used for agriculture and forestry, 2 mil. ha for urban areas, 3 mil. ha for nature conservation and 11 mil. ha for other purposes (mining, industry, military, etc). Of the 106 mil. ha land used for agriculture and forestry, 71.3% is native rangeland, 10% is under cultivation (cash crops), 1.1% plantations, 0.9% planted pastures, 0.8% permanent crops and 3.6% used for other purposes. Also important is the fact that South Africa is a water poor country with more than 65% of the country receiving less than 500 mm of rainfall annually.

This paper will mainly focus on the 106 mil. ha used for agriculture and more specifically rangeland in the savanna biome. One of the most prominent land-use changes of agricultural land in southern Africa is the increasing change from stock farming to game ranching. Current and previous land use practices had a major influence on vegetation changes that were brought about, directly or indirectly, by human activities. The shift from stock farming to game ranching will invariably have an influence on the way that landowners (farmers) will view environmental problems and their solutions.

In southern Africa the phenomenon of increasing woody plant abundance is commonly referred to as bush encroachment. It involves indigenous woody species occurring in their natural environment and is thus mainly associated with the savanna biome. The savanna biome extends from north of 22°S into Namibia, Botswana, South Africa, Mozambique and Swaziland. The biome is the largest, comprising about 959 000 km^2 or 46.2% of southern Africa (one third of South Africa) (Rutherford & Westfall 1994).

Many savanna areas are water-limited ecosystems and bush encroachment is considered a major factor contributing towards the low occurrence or even total absence of herbaceous plants in severe cases (Smit *et al*. 1999). The grazing capacity of large areas of the southern African savanna is reported to have declined due to bush encroachment, often to such an extent that many previously economic livestock properties are now no longer economically viable. Removal of some or all of the woody plants will normally result in an increase of grass production and thus also in the grazing capacity. However, the results of woody plant removal may differ between vegetation types, with the outcome determined by both negative and positive responses to tree removal.

In southern Africa it is conceived that in the long-term very few attempts at solving the bush encroachment problem can be considered as successful (Smit 1998). This is either because the cost is too high or the wrong approach

was followed, resulting in the loss of beneficial woody plants and re-encroachment. Finding long-term solutions necessitates the need to critically evaluate the role of woody plants in savanna ecosystems as well as incorporating ecological processes into control measures. This paper is an attempt to summarize the importance of woody plants in savanna and to explore measures, based on ecosystem dynamics, which can be utilized to manage the bush encroachment problem more successfully in the long-term.

Though the impact of bush encroachment and the various attempts at solving the problem on vultures is largely unknown, it is perceived that the approach at solving the problem as described in this paper will also benefit vultures and the rest of the ecosystem for that matter.

Importance of woody plants in savanna

Direct uses of woody plants

Woody plants in South African savannas are used for firewood, rough construction timber, the production of charcoal and wood carvings. For many rural communities, wood is still the only source of fuel for cooking and heating. The wood of several savanna woody species is known for its excellent fuel properties, especially species with dense heartwood. These species also yield excellent charcoal (Smit 1999). For this reason certain desirable woody species like *Acacia erioloba* (Camel Thorn) were exploited over a long period, resulting in the degradation of ecologically important areas.

Woody plants are an important source of food for browser herbivore species, which include both domestic stock and game. With the expansion of the game ranching industry in southern Africa, the latter aspect is of increasing importance. The presence of woody plants creates unique habitats that can thus support a greater diversity of herbivore game species than ecosystems without woody plants.

Soil enrichment

Nutrients, such as nitrates, phosphorus, a series of anions and cations and various trace elements, are essential to the nutrition of plants (Bell 1982), and act as determinants of the composition, structure and productivity of vegetation. While the base-richness of the parent material is initially important in determining soil fertility, biological activities are important in the creation and maintenance of localised areas of enhanced soil fertility, often on base-poor substrates (Scholes 1991). Trees may act as such a biological agent, creating islands that differ from those in the open. Ample evidence in support of soil enrichment under tree canopies exists (Bosch & Van Wyk 1970; Kennard & Walker 1973; Bernhard-Reversat 1982; Belsky *et al*. 1989; Smit 1994; Smit & Swart 1994; Hagos 2001).

Soil enrichment can differ between tree species that grow in the same environment. Smit & Swart (1994) demonstrated that soil under both leguminous trees (mainly *Acacia erubescens*) and non-leguminous trees (mainly *Combretum apiculatum*) was richer in % total N, % organic C, Ca and Mg, while nutrients like K and Mg differed in soil from under the two tree species. Soil enrichment under tree canopies is a slow process as

demonstrated by correlations between total C and N in soil under tree canopies and tree girth, an index of age (Bernhard-Reversat 1982; Hagos 2001).

Positive influences of trees on the herbaceous layer

Trees may have positive effects on grass growth and Stuart-Hill *et al*. (1987) have argued that the net result of the negative and positive interactions on grass production is dependent on tree density.

In Kenya, Belsky *et al*. (1989) recorded significantly higher production of herbaceous plants under the canopies of both *Acacia tortilis* and *Adansonia digitata* than outside their canopies. In Mixed Bushveld of the Limpopo Province of South Africa, higher DM yields have been recorded under the canopies of leguminous trees (*Acacia erubescens*) in comparison with yields under non-leguminous trees (*Combretum apiculatum*) (Smit & Swart 1994). In contrast, Grossman *et al*. (1980) measured significantly greater biomass in open veld than under *Burkea africana* and *Ochna pulchra* trees, but the canopied habitats did yield forage of better quality.

A possible contributory factor to the higher production of forage from under-canopy subhabitats in many southern African savannas is the well documented association between *Panicum maximum,* a palatable and potentially very productive species (Smit & Rethman 1992) and the under-canopy subhabitat of larger trees in particular (Bosch & Van Wyk 1970; Kennard & Walker 1973; Belsky *et al*. 1989; Smit & Rethman 1992; Smit & Van Romburg 1993; Smit & Swart 1994).

Negative influences of trees on the herbaceous layer

The botanical composition and productivity of any mature stand of vegetation is largely determined by competition. The roots of woody plants are fundamental in their competitive interactions with herbaceous plants and other woody plants. Roots determine the spatial distribution of water and nutrient uptake and can cause an increase or a decrease in resource availability (Wu *et al.* 1985).

The roots of savanna woody plants extend well beyond their projected crown radius (Wu *et al*. 1985). In *Burkea savanna*, for example, the lateral roots of some species commonly extend linearly up to seven times the extent of the canopy (Rutherford 1980). In addition, a large proportion of the roots are concentrated at a shallow depth (Rutherford 1983; Knoop & Walker 1985; Smit & Rethman 1998b), where they would actively compete with the shallowly rooted herbaceous plants.

In a subsequent study, Smit & Rethman (2000) presented evidence that the roots of the *Colophospermum mopane* are able to utilise soil water at a matric potential lower than that of grasses (ψ < -1 500 kPa). This enables the *C. mopane* trees to compete successfully with herbaceous plants and to prevent their establishment at high tree densities.

Differences in the response to tree thinning or clearing may be ascribed to differences in soil type and soil fertility, both of which are important determinants of the magnitude of the response to tree thinning (Dye & Spear 1982). In years of high rainfall, higher yield responses have been attained in thornveld on relatively fertile clay soils than on nutrient poor sandveld. Different components of the herbaceous layer may also react differently to tree thinning. It was demonstrated by Smit (1994), for example, that in Mopane savanna the DM yield of the grass component reacted positively to thinning but that the yield of forbs declined.

Contrary to common belief that bush encroachment is detrimental to grazers, but not browsers, there are indications that bush encroachment may also be detrimental to some browsers. In mopane savanna a study by Smit (2001) showed that tree thinning reduced the available browse at peak biomass, but that trees from the low tree density plots displayed a better distribution of browse, having leaves in comparatively younger phenological states over an extended period.

Causes of bush encroachment

An increase in woody plant abundance is primarily brought about by two processes. The first is by an increase in the biomass of already established plants (vegetative growth) and the second is by an increase in tree density, mainly from the establishment of seedlings (reproduction).

The reasons for an increase in the abundance of woody plants in any vegetation type are diverse and complex. In most situations the determinants of savanna systems were modified by man, either directly or indirectly. These determinants may either be primary (such as climate and soil) or secondary (such as fire and the impact of herbivores) (Teague & Smit 1992). The latter are of particular interest since, although they act within the constraints imposed by the primary determinants, they can often be directly modified by management. Examples are the exclusion of occasional hot fires, the replacement of most of the indigenous browsers and grazers by domestic (largely grazing) livestock often at extremely high stocking rates, the restriction of movement of herbivores by the erection of fences, poor grazing management practice, and the provision of artificial watering points (Smit *et al.* 1999).

It is generally conceded that high grazing pressure reduces the growth rate and reproductive potential of individual plants and in so doing influences the competitive relationships among the different species. Grasses are fast-growing plants with roots in the upper layer of the soil and it is conceded that they can outcompete woody plants for water and nutrients (Walter 1939). With overgrazing the grasses are removed, freeing up water and soil resources for the woody plants to exploit.

Van Vegten (1983) also identified overgrazing of grasses as the main cause of the increased woody plant density in the eastern areas of Botswana. Skarpe (1990) showed that in non-grazed and moderately grazed areas, shrub densities showed no consistent trend, but increased where grazing was

heavy. The tree species which increased in abundance were shallow rooted (*Acacia mellifera* and *Grewia flava*) which, according to Skarpe (1990), suggests that they were favoured by an increase in water availability in the surface soil as a result of overgrazing of the grass layer. It is generally conceded, however, that trees rather than grasses are able to use deep water more effectively (Walker & Noy-Meir 1979; Stuart-Hill *et al.* 1987) so that any management actions which increase water penetration to depth in the soil profile should stimulate growth in already established trees.

According to Ward (2000) the conventional model of bush encroachment that heavy grazing removes dominant grasses from competing with woody plants in the upper soil layer (Walter 1936) has been found to be inappropriate or even wrong in many situations. However, Smit & Rethman (1992) have reported that while woody plants increased in Sourish Mixed Bushveld, which had been leniently grazed over a period of 52 years, they increased much more rapidly in areas which had been severely grazed during the growing season.

It has been suggested that rainfall amount and frequency may play a key role in the occurrence of bush encroachment because trees require more rain to germinate than grasses do and therefore in rare, high rainfall years may germinate in large numbers with or without grazing (Ward & Rohner 1997).

The role of fire as a determinant of woody plant density has received considerable attention in the literature (Rutherford 1981; Belsky 1984; Trollope & Tainton 1986; Sabiiti & Wein 1988). Fire is widely used, ostensibly to control woody plants, in spite of many reports that fire alone is not effective in killing woody components of the savannas of southern Africa (Rutherford 1981; Belsky 1984; Trollope & Tainton 1986). This is not surprising since the vegetation of Africa has for long been subjected to regular fires and the woody species, which now occupy these regions, are well able to survive in its presence. However, fire may be used to modify the structure of the woody layer and for this purpose fire is most useful.

Finding long-term solutions to the bush encroachment problem

The importance of tree-on-tree competition and savanna structure

Where tree densities are very high the first operation which may be required will be the thinning of trees to some predetermined density (Smit 1994). Tree thinning or clearing by means of mechanical or chemical methods will result in immediate changes in competition between woody and herbaceous plants. The resulting gaps will lead to either increased growth of neighbouring individuals or the establishment of new individuals (Teague & Smit 1992).

Tree-on-tree competition appears to be species specific (Smith & Goodman 1986) or related to the shade tolerance of the seedlings (Smith & Shackleton 1988; O'Connor 1995). In some, seedling establishment is unaffected by a tree canopy while, in others, establishment is limited to between-canopy environments (Smith & Goodman 1986; Grundy *et al.* 1994). Significant positive correlations between the size of a tree and the distance to its nearest neighbour were reported for large individuals of *Brachystegia spiciformis* and

Julbernardia globiflora in Zimbabwe (Grundy *et al.* 1994). However, the same regular dispersion pattern in stands of immature trees was not observed. This was ascribed to the fact that young plants often grow in under-canopy environments and that positive correlations between tree size and distance to nearest neighbour only develop through a thinning process as the trees mature.

Stability, resilience and a system's domain of attraction

Walker (1980) defined three concepts that have to do with system dynamics, viz. stability, resilience and a system's domain of attraction. He described a stable system as one which when subjected to outside stress (e.g. drought or grazing) changes little in composition and production. A resilient system may or may not be stable, but remains attracted towards its equilibrium. A domain of attraction is described as that region of a system's state-space within which the system is attracted towards an equilibrium. According to Walker (1980), in a resilient system the domain of attraction is usually large. If a stable system changes to such an extent that it falls outside the domain of attraction, the amounts of the variables will then either change to a different equilibrium, or they will go to zero (extinction). This concept follows the state-and-transition approach described by Westoby *et al.* (1989).

The terms eqilibrium and non-eqilibrium as used in rangelands, are points of strong debate among scientists. The central aspect of this debate is the definition of the degree to which climate or consumers influence vegetation. One view is that consumers reach densities that degrade environments from a previous condition of equilibrium (Lamprey 1983) and the other view is that the dynamics of pastoral systems are non-equilibrium and primarily dictated by variability in rainfall (Ellis & Swift 1988).

From the literature it would appear if ecosystems can display both equilibrial and non-equilibrial trends. In this regard the degree of aridity is important, with arid ecosystems that are less stable (non-equilibrial), while mesic ecosystems are often more stable (equilibrial).

Bush control measures usually attempt to restore the ecosystem to its former productive level. However, if for example, it is done in such a way that large trees are lost (loss of structure), the resultant state may be more productive due to an increased herbaceous yield, but will be unstable and may return to an encroached state very quickly. This inherent instability is due to the ecosystem's small domain of attraction. Preferably tree thinning should be conducted in such a way that larger trees are retained or encouraged to develop (structured), which will result in a more stable ecosystem with a large domain of attraction that is less prone to re-encroachment.

Maintaining or restoring savanna structure

From the former discussion it is apparent that the presence of large trees, representing a structured savanna, may result in a more stable ecosystem. Such a structured ecosystem can be considered the most productive since all the benefits of woody plants are represented: soil enrichment, which is a slow process and thus mainly associated with larger (and thus older) trees;

favourable subhabitats for the maintenance of positive grass-tree associations (e.g. *Panicum maximum*) and increased stability as large trees may suppress the establishment and development of woody seedlings under their canopies or in their close proximity.

It is perceived that the loss of large trees from savanna ecosystems through indiscriminate, non-selective bush control measures is one of the major reasons why long-term solutions to the bush encroachment problem are not achieved. Restoring savanna structure in cases where it is lost is a slow process. This will entail a highly selective approach where woody plants are thinned in such a way that the remaining trees will benefit from the reduced competition from other woody plants, resulting in increased growth and thus an increasing sphere of influence on newly established seedlings.

Due to environmental and ecological limitations the development of a highly structured woody vegetation may differ between different environments. In some ecosystems the limitations may be such that a structured savanna will never develop. In any ecosystem the element which is present in most critical quantities will determine the growth of the plants, regardless of the quantities of other essential elements that are present. This is known as Liebig's law of the minimum.

The first important determinant is soil. For example, a shallow soil with a low soil nutrient status, will limit the size and species of woody plants that can be supported. An increase in rainfall on such soils will not significantly improve the development potential of a structured savanna vegetation. As the soil potential improves, the potential to support larger woody plants will also improve. Over such a soil potential gradient the available soil water will play an increasingly important role. On a deep, fertile soil, rainfall will invariably become the next element that will determine the growth and size development of woody plants. Areas with deep, fertile soil and a high soil water potential will be able to support a savanna vegetation that can develop to a highly structured state.

In some savanna vegetation types the woody vegetation may change through the process of succession from the dominance of pioneer like woody species (usually spinescent species such as *Acacia* species) to more climax species (usually broad-leaved species). This is facilitated by the ability of these climax species to germinate and develop under the canopies of the pioneer species. In time the pioneer species may succumb due to natural causes, whereafter the climax species predominate. Such a state, in combination with a high soil nutrient and soil water potential, represents the most stable condition with the highest structure potential.

Conclusions

It is clear that the presence of woody plants in savanna is associated with both positive and negative aspects, which are closely related to tree density or tree abundance. In view of this it can be concluded that any bush control program (chemical, mechanical or biological) should focus on tree thinning rather than on clearing of all woody plants.

The rapid establishment of tree seedlings after the removal of some or all of the mature woody plants may reduce the effective time span of bush control measures. In many cases the resultant re-establishment of new seedlings may in time develop into a state that is worse than the original state. It is hypothesized that a more stable environment can be created, which is less prone to the rapid regeneration of new woody plants, by making use of system dynamics. Here the natural functioning of the savanna system is allowed to stimulate the development of an open savanna comprised mainly of large trees. It is based on the principle that the distance between a tree and its nearest neighbour of the same species is not determined purely by chance, but that tree spacing is normally distributed. The larger the individual, the greater is the distance between it and the nearest individual of the same species. This is particularly noticeable with *Acacia* species.

It has been shown that if a tree is killed, the reduced competition afforded to the remaining individuals results in an increase in their growth rate. Competition between individuals in a community can result in the stagnation of growth in a tree population. If, in such a community, low intensity thinning is applied, the growth rate of individuals adjacent to the thinned individuals will increase and this will lead to a suppression of the growth of other woody species within the area thinned. The key here is low intensity thinning. If thinning is too intensive, the remaining trees will provide insufficient competition to prevent woody plants from regenerating in the cleared area. In time this approach can assist in the creation of a more stable and structured savanna that is more resistant to bush encroachment.

It is important for any land manager to realize that there is no quick solution to the problem of bush encroachment. Effective management of bush encroachment should not be considered a once-off event, but rather a long-term commitment. This may involve alternative approaches that are not necessarily the simplest, fastest or cheapest. It has been proven that the least expensive method of killing trees may not be the most economical approach in the long-term. Once the established matured trees are lost from the ecosystem, land owners may discover that they now have to manage a much more unstable system that requires frequent and repeated efforts in dealing with a high rate of re-encroachment, often from other, more threatening woody species. It is also important to avoid or minimize other direct or indirect causes of bush encroachment. Sound grazing management practices, especially during wet seasons, which will ensure a vigorous and competitive herbaceous layer, are of critical importance.

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Changing farming practices in the Northern Cape Province, South Africa

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Introduction

One of the major changes in agricultural land use in the Northern Cape has been the change from domestic stock farming to farming with wildlife. This trend appears to be continuing and is in line with what is happening elsewhere in other agricultural districts in South Africa. Although difficult to quantify, negative attitudes towards wildlife in general appears to be decreasing. Vultures in general appear to be regarded in a positive light and very little, if any, direct persecution has recently been observed.

Problems common to all types of farming practices

Some of the problems, common to all types of farming practices, that may adversely affect the conservation of vultures are poverty on farms, lack of biodiversity, predator intolerance, disposal of carcasses and political uncertainty.

Poverty

Poverty of the majority of our people in South Africa remains one of the fundamental threats to wildlife in South Africa. Poor hunger-stricken people are in direct competition with free-ranging animals, inclusive of vultures, for food and conservation may be perceived as an elitist activity planned by the rich, for the rich. The extent of poverty in South Africa should not be underestimated and statistics for a communal rural area in 2002 reveal that 40 to 80% of the people were unemployed, that the average annual income per household of six was approximately R8500.00 and that approximately 30% of this income was derived from old age pensions.

Shockingly, statistics revealed that in 1998 only 5 cents in every R3.00 of taxpayer's money reached grass roots level in those provinces in which homelands were situated. It is also alarming that it appears as if human population growth control seems to feature very low on the agenda of statesmen and politicians. This trend also appears to apply to the much-neglected control of elephants in South African National Parks

Lack of biodiversity

A common complaint from farmers is that they simply do not see vultures. Absence of vultures may just be one symptom of a species-poor environment brought about by decades of environmental-unfriendly farming practices. Quantifying and monitoring the problem of a lack of species-diversity on land, whether it is land used for agriculture or conservation should be attempted by the compilation of a resource inventory. The latter document should reflect the scope of all phenomena, natural and human components, processes, management goals and policies, strategies, staff composition, losses, profits and potential of a given land area. It should be an ongoing working document available to all staff on a property and should form the basis for all decision-

making processes. The concept of the compilation of a detailed resource inventory for farmers, conservancies, etc., may well pose a considerable challenge which may necessitate the incorporation of a information from a number of specialists. This presents a job-creating opportunity for biologists which may well become more of a reality if farms in future are, amongst others, evaluated on a biodiversity rating

Predator intolerance

Predator control, essentially of black-backed jackals and caracals in the Northern Cape, has had an extremely negative impact on wildlife, inclusive of birds of prey and vultures. The concept of wanton destruction of predators has been in operation for a considerable period of time and does not appear to have yielded major beneficial results. A major shortfall of most methods of predator control is that they are neither species specific nor selective for the specific problem animal. Chemicals (used as poisons) are unfortunately relatively easily obtainable and can be obtained and used with minimal legal constraints.

Disposal of carcasses

Most carcasses of animals are probably either consumed by humans or buried. Whether these carcasses would be fit for vulture consumption is not known. The establishment of regional controlled dumping sites for carcasses should be investigated and may well go a long way towards providing a regular food supply for vultures.

Political uncertainty

Issues of land reform may well create uncertainty and instability which may adversely affect implementation of long-term conservation policies on agricultural land.

How is the farming scenario (stock farming) changing in the Northern Cape?

Five categories of farming practices are briefly discussed. These practices are not necessarily mutually exclusive and a farmer controlling a small unit may well be an eco-friendly and efficient stock farmer.

Game ranching

One of the major and most dramatic changes in farming practice in South Africa is the conversion from cattle to wildlife ranching. The estimated conversion rate from cattle to wildlife ranching for the whole of South Africa is approximately 500 000 hectares per year. There are an estimated 9000 wildlife ranches (not all with exemption, i.e. ‘adequately fenced’), which excludes cattle ranches that carry enough wildlife to allow their commercial exploitation. State conservation land covers approximately 5.6% of South Africa and is well below the IUCN-recommended 10%. State conservation land in combination with privately owned game ranches, however, covers approximately 20% of South Africa. It is generally accepted that there are more wildlife (probably medium and larger herbivores) today in South Africa than at any time in the past 110 years. 19.5% of all exempted game ranches are in the Northern Cape and together with Limpopo and the Eastern Cape

contain 4090 (80.8%) of all South Africa's exempted ranches with a mean size of 2072 ha for South Africa and a mean size of 4921 ha for the Northern Cape.

Trophy hunting is still the major driving force behind the game industry. Despite the fact that tourism is now believed to be the fourth largest industry in SA, ecotourism only contributed R40 million (4.7%) to the gross income of the wildlife ranching industry in 2000. The most economically viable wildlife production enterprises focus on producing the so-called rarer forms of wildlife. The following Table 1 gives an indication of mean prices (in Rands) obtained for the so-called rarer species of game animals sold at wildlife auctions.

Table 1. Price of game animals sold at wildlife auctions (in Rands).

Animal	1992	1995	2001	2003
Disease-free buffalo	16 391	47 163	82 495	120 586
Black rhinoceros	460 000	140 000	550 000	450 000*
White rhinoceros	29 375	46 629	168 431	146 477
Roan antelope	29 000	38 500	106 714	178 571
Sable antelope	18 281	13 480	66 513	91 081

*catalogue price; no buyers

Game ranches and potential problems:

- Practice predator control. Some game farms even use poisons to prevent or control game losses.
- Practice carcass removal. Fear of diseases like botulism appears to be the main reason for such practice.
- Create the potential for disastrous domestic stock diseases like tuberculosis, brucellosis, bovine malignant catharr, lumpy skin disease, botulism and negative attitudes towards wildlife. Vaccination against some of these diseases are performed in the more expensive species.
- Uncontrolled trade in animal and animal parts for medicinal purposes: vultures sell for up to R1 000; hyaenas for R1 500; leopard skins for R3 000, weasels, pythons, green mamba and Nile crocodile are in high demand
- The industry is often approached in a remarkably amateurish way which is totally unacceptable for an estimated R 16.6 billion investment (2002)
- Personal pleasure is still one of the major reasons for owning a wildlife ranch. Such a motivation may not be tolerated in a land-hungry poverty-stricken community.

Feedlots

Feedlots of varying sizes occur in the Northern Cape and surrounding areas. These feedlots are a huge potential source of food for vultures. The carcasses from feedlots are however more likely to contain a number of drug residues and an investigation into the presence, concentrations, and possible side-effects of these drug residues on vultures should be undertaken before this source of food for vultures should be exploited. Very few, if any, carcasses from feedlots are presently made available to vultures.

Larger farming units

There is in general a tendency for farmers to own/control more land: hence fewer farmers, larger units, less farm workers. This appears to result in less disturbance (less people, less frequent patrols, more tolerant towards predators) with positive spin-offs for wildlife.

Smaller farming units

It is likely that political demands may result in the establishment of smaller farming units in the Northern Cape. These are likely to have exactly the opposite effects on wildlife as mentioned for larger farming units.

Eco-friendly, efficient stock farmers

Eco-friendly, efficient stock farmers can be defined as farmers aware of practices harmful to wildlife, eager to promote existence of as many species as possible on their properties and that are profiting out of stock and or game farming. It is impossible to quantify the number of farmers belonging to this group but continued education of farmers by all possible means would ensure growth and development of these landowners. These farmers strive to the following:

- Sound soil and plant management systems
- Promotion of biodiversity
- Incorporate preventive veterinary medicine (emphasis on preventive vaccination; diagnostic procedures: fertility testing and autopsies; minimal use of chemotherapeutic agents; record-keeping to assist in identification of problems)
- Minimize control of internal and external parasites
- Do not practice predator control or practice it minimally. Practices incorporated to relieve predator pressure include changing stock (e.g. goats instead of Merino sheep), restricted grazing, guard dogs and herding. Incentives for taking up herding as a career include co-ownership of the flock/herd and upgrading of status of “herders” (the ideal position if for these persons to become actively involved in the biological part of the resource inventory).

The use of poisons and especially monofluoroacetate in strongly discouraged. I do not advocate or support the use of sodium monofluoroacetate for the following reasons:

- The introduction of this substance into the environment constitutes chemical pollution as it may remain viable in nature for considerable periods of time
- Despite the variation in the average oral lethal dosage, it is extremely toxic to a wide variety of animals, including birds
- Carcasses from animals that died of the intoxication remain contaminated which may result in secondary intoxication
- Different classes of clinical signs occur in different animals but canids develop severe convulsions which results in progressive asphyxiation and death. Vomition, disorientation, vocalization, and grand mal convulsions eventually result in the death of these animals. Death occurs in a cruel and most inhumane way. The vomitus may contain toxic amounts of the substance.

- Death occurs after a considerable period of time, hours to days, depending on the species poisoned and the amount of toxin ingested. Carcass retrieval becomes very difficult and secondary poisoning becomes more likely
- Most attempts to treat poisoned animals are unsuccessful. Human and animal poisoning cases therefore carry a very grave prognosis.

The killing of unwanted animals with poisons is archaic and unacceptable to most modern societies (the effect on our relatively small but growing eco-tourism industry may be disastrous) and even less so if the proposed poison is not one hundred per cent target specific. If poisoning was such a successful way of dealing with the predator problem in South Africa, it would have been embraced and practiced by the majority of farmers in the country. On the contrary it appears as if the majority of farmers are shying away from poisons and are employing a host of other methods to cope with the predator problem. To legalise monofluoroacetate to kill black-backed jackals in the believe that it will be to the benefit of one group of free-ranging animals, namely birds of prey, in short-sighted and not in the best interest of South African wildlife.

Conclusion

Vulture conservation is about humans! The ideal scenario for conservation is large areas of farmland without fences with a rich biodiversity of micro- and macro-species. Education/continued education for landowners and farm workers would be a positive step in the promotion of sustainable use of land and the creation of stability.

Report on vulture interactions with powerlines in southern Africa: 1996 to 2003

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Background

Prior to the establishment of the Eskom-Endangered Wildlife Trust Strategic Partnership, the South African experience with regard to wildlife interactions and electricity structures was generally characterized by an *ad hoc* approach, fragmented documentation, inconsistency of data and few "before and after" studies. The vast distances, poor coordination and integration of mitigation efforts, as well as discontinuity and duplication further exacerbated the problem. In view of the complexity, scope and persistence of the problem of interactions between wildlife and powerlines, Eskom, the South African national utility, and the Endangered Wildlife Trust (EWT) formalized a long-standing relationship by entering into a partnership in 1996 to address these problems in a systematic manner on a national basis. The goal of the partnership was the establishment of an integrated management system (van Rooyen & Ledger 1999).

Since 1996, a lot of effort has gone into the monitoring and mitigation of powerlines responsible for vulture mortality, through the mechanism of the partnership. This contribution aims to give an overview of vulture interactions with electricity infrastructure in southern Africa since the inception of the partnership, as well as completed and planned mitigation efforts. The discussion is mainly centred around the work done in the seven Eskom regions in South Africa, but mention is also made of the work done in other southern African countries.

South Africa

Eskom Western Region (Western Cape and western part of Northern Cape)

Only one mortality was reported, presumably due to the low vulture populations. One Cape Griffon *Gyps coprotheres* was killed when it flew into a powerline near the Potberg breeding colony (van Rooyen unp. data).

Southern Region (Eastern Cape and eastern part of Northern Cape)

Burgersdorp Mitigation Project

In September 1998 a meeting was held between the Burgersdorp Farmers' Association, local Eskom staff and the Endangered Wildlife Trust to discuss the electrocution of birds on Eskom powerlines in the area. Species for which a particular concern was expressed were the Cape Griffon, Martial Eagle *Polemaetus bellicosus* (both listed as 'vulnerable' in Barnes 2000), and African Fish Eagle *Haliaeetus vocifer*. At this meeting, Eskom committed itself to a three-year project aimed at making structures in the area bird-friendly and agreed to make annual progress reports available on request. However, for three years little progress was made.

After the suspected electrocution of three Cape Griffons on the farm Krompoort, it was suggested by the landowner that Eskom fit Raptor Protectors on all structures within a 100 km radius of the Cape Griffon roost at Rooikrans. It was thought that this would cover the area in which these birds forage and effectively remove the threat of electrocution. The preliminary costing for this project (done by Eskom) revealed that the cost of mitigation devices alone would be just under R8 million. Although the Burgersdorp/Aliwal North/Molteno area is utilised by Cape Griffons for roosting and foraging purposes, it is not a major breeding area for the species. It was felt that spending this amount of money on a project of this nature, can only be on the basis of a thorough risk assessment of the problem, in order to put it in perspective as far as national priorities for Cape Griffon conservation is concerned.

It was therefore decided that a rigorous investigation of the risk to birds in the area be undertaken by the EWT, in order to provide Eskom with the information required to make informed decisions regarding mitigation actions (Smallie 2001).
Ideally all structures in the Burgersdorp area needed to be made bird-friendly in order to ensure the safety of the area's birds. It was however recognized that this would be economically unfeasible for Eskom. It was decided that, in order to generate reasonable recommendations for Eskom, the study area had to be broken down into smaller manageable cells. These cells then needed to be ranked in order of priority to enable work to be carried out in phases. To this end, it was recognized that the area could be divided into mountainous regions and plains. The plains were given top priority for the following reasons:

- Cape Griffons seem to spend most of their foraging time over flat areas, which are frequented by livestock, especially when lambing and calving takes place.
- Martial Eagles occur predominantly over the plains.
- African Fish Eagles occur mainly along watercourse and at dams on the plains.

Three "cells" were identified as priority areas for mitigation. Cell (1) in the Kramberg area was seen as the first priority. It consists of approximately 145 kilometres of powerline or approximately 1450 structures. Second priority was cell (2) on the Stormberg Plateau, approximately 87 kilometres or 872 structures. Cell (3) on the plains between Aliwal North and Jamestown consisted of only approximately 45 kilometres or 457 structures.

Within each cell, the order of priority for mitigation work was determined as follows:

- Insulate jumper cables and move lightning arrestors at all transformers,
- Insulate jumper cables and other exposed wires at all take-off points
- Cut earth-wires on all structures
- Fit Raptor Protectors on the centre phases of all structures.

All three cells were completed by the end of 2002, except the work on the transformers and take-offs. The jumper cables and transformers remain a problem and had not been actioned by February 2003.

Birds River and Carrickmore-Sterkstroom 22 kV line
Two new hot spots were identified when and investigations were conducted by the EWT. Recommendations were forwarded to Eskom for the cutting of earthwires on approximately 1500 structures. This has been accepted and work has commenced, but by February 2003 the work had not yet been completed.

Reported electrocution of African White-backed Vultures
A farmer reported the electrocution of three vultures, suspected to be African White-backed Vultures *Gyps africanus*, on his farm near Aliwal North. The EWT is investigating and, at the time of writing, the species electrocuted had not been determined with certainty.

<u>Eskom Eastern Region (KwaZulu-Natal and part of Free State)</u>
This is the only region where a Bearded Vulture *Gypaetus barbatus* mortality was recorded. The landowner left a dead cow for the vultures, but neglected to move it away from the powerline where it lay, and an immature Bearded Vulture collided with the conductors.

In 2003, Eskom requested a comprehensive risk assessment of all the distribution lines in the Eastern Region. The goal of this study is to collate and present relevant data relating to vultures in KwaZulu-Natal (KZN) in order to improve the management of vulture-related negative interaction with Eskom distribution infrastructure. In order to achieve this, the following will be established:

- Vulture distribution in KZN, especially the distribution of the Cape Griffon;
- Number and location of vulture restaurants in KZN;
- Foraging ranges;
- Distribution lines mostly likely to be impacted by vulture activities;
- Potential negative interactions in relation to specific line designs.

The ultimate objective of the project is to produce a high level risk index for all distribution lines from 33 kV to 132 kV in KZN, indicating the relative risk of interaction with primarily Cape Griffons, as this species is responsible for the vast majority of interactions with the grid. Although it is acknowledged that the reticulation grid (11/22 kV) poses a major electrocution risk to vultures, the size of the grid made it impractical to include these powerlines in this study. It was therefore decided to restrict this exercise to the larger configurations up to 132 kV, with a view to extending the study to the reticulation network once the methodology has been refined.

Eskom North-West Region (Northern Cape, Free State and part of North West Province)

Northern Cape Vulture Mitigation Project

In February 1999 the electrocution of two African White-backed Vultures was reported on a 22 kV single-phase, vertically configured line near Douglas in the Northern Cape Province. Up until that time, vertically-configured medium voltage designs were considered by Eskom to be safe for vultures, because it was assumed that the birds would always perch on the pole top, away from the potentially lethal conductors. The investigation team from Eskom and the EWT could not conclude on the dynamics as to how the birds were electrocuted, but the general conclusion was that it was a freak incident. It was recommended that the line should be monitored and any recorded faults that were possibly caused by bird electrocutions must be reported and investigated (van Rooyen *et al.* 2000). No further electrocutions were reported during the subsequent 12 months and the incident file was closed.

In February 2000, A. Maritz, project coordinator of the EWT's Kalahari Raptor Project, reported to the partnership that a landowner discovered several vulture carcasses below a 22 kV single phase, vertically configured line near Witsand Nature Reserve in the Northern Cape Province. Subsequently, two other landowners contacted him and also reported dead Cape Griffons, African White-backed Vultures and Lappet-faced Vultures under 22 kV vertically configured lines on their properties.

Due to the serious nature of these reports, a series of investigations were conducted by the partnership at all sites to try and determine the causes of death and to propose recommendations for possible mitigation measures. Several investigations followed, including an experiment where birds were filmed at a carcass on A. Maritz's farm in order to establish exactly why the birds were being electrocuted. From this it was established that the risk of vulture electrocutions on these structures was much greater than previously believed, largely because the birds attempted to perch, not only on the pole top, but also on the insulators and conductors (Figure 2).

Following on from the new information that became available as a result of the observations, the following recommendations were put forward to Eskom (Kruger *et al.* 2003):

- The areas must be identified within the Northern Cape where vultures are most exposed to the risk of electrocution
- All vulture-unfriendly lines in the high risk areas must be identified
- A programme of line modification must be undertaken in the high risk areas to prevent further vulture electrocutions
- The use of vertically configured medium voltage structures for new lines must be discontinued in areas where vultures regularly occur in the Northern Cape.

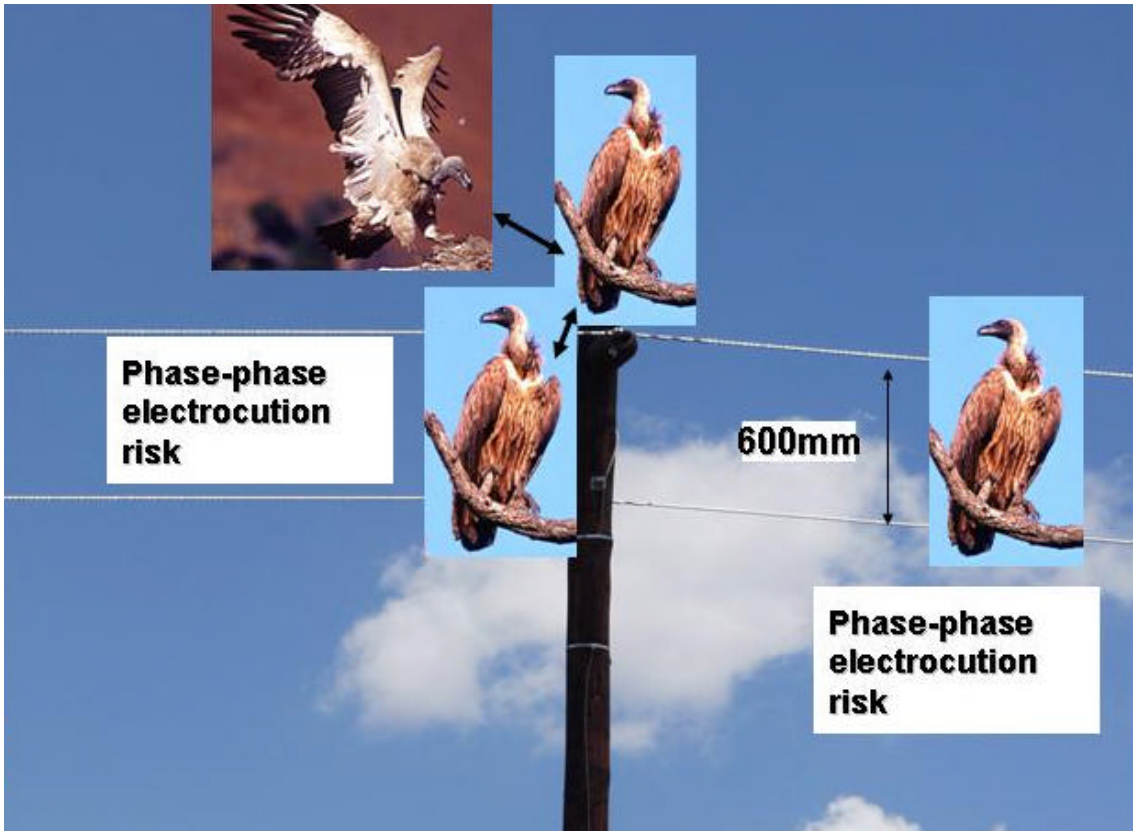

Figure 1. Schematic representation of vulture electrocution risk on vertically configured wood poles.

The recommendations were accepted in principal by Eskom. The partnership and the Nature Conservation Directorate of the Department of Tourism, Environment & Conservation have since jointly identified high risk areas, based on the known range of vultures in the Province and recorded mortalities. A final decision on what type of vulture-friendly designs should be used was finalised in January 2003 and the modification of existing vulture-unfriendly lines commenced in March 2003. The total length of line earmarked for immediate action comes to approximately 480 km, at a cost of approximately R2.3 million (excluding labour costs). Planned completion date is the end of 2004.

Watershed – Mmabatho and Watershed – Slurry 88 kV lines
In September 2002, Eskom requested the EWT to investigate vulture electrocutions on the Watershed – Mmabatho (delta suspension design) and Watershed – Slurry (Kite design) 88 kV feeders, after a line patrol found several carcasses of presumably electrocuted vultures. Both lines had been previously marked with different types of bird deterrents, thus discouraging vultures from perching on high risk areas on the structures, where they can cause faulting.

The purpose of the investigation was to determine the effectiveness of the bird deterrents and, if necessary, to suggest measures to improve their effectiveness. The line fault reports have been requested in order to get a clearer pattern of the faulting on the lines, but these were unfortunately not available at the time of writing. According to anecdotal reports from Eskom, the faulting on the Watershed – Mmabatho line has been on the increase,

after it decreased significantly when bird deterrents (BeeTee Bird Guards) were initially fitted. This suggested that electrocutions were occurring again. No information is available on the fault record of the Watershed – Slurry line since bird deterrents (PVC spirals) were fitted to the majority of structures in August 1999.

With regard to the Watershed – Mmabatho line the investigation team concluded that:
The current attachment method and fitting strategy of bird guards on the line was inadequate to eliminate the risk of electrocution-related faults and streamer-related faults. This was primarily related to collapsing bird guards due to inadequate or inferior attachment methods, and the inadequate covering of high risk areas on the pylons that still left space for birds to perch.
As more bird guards collapse with time, faulting could be expected to increase as more perching space becomes available to the vultures in high risk areas of the pylon (van Rooyen 2002a).

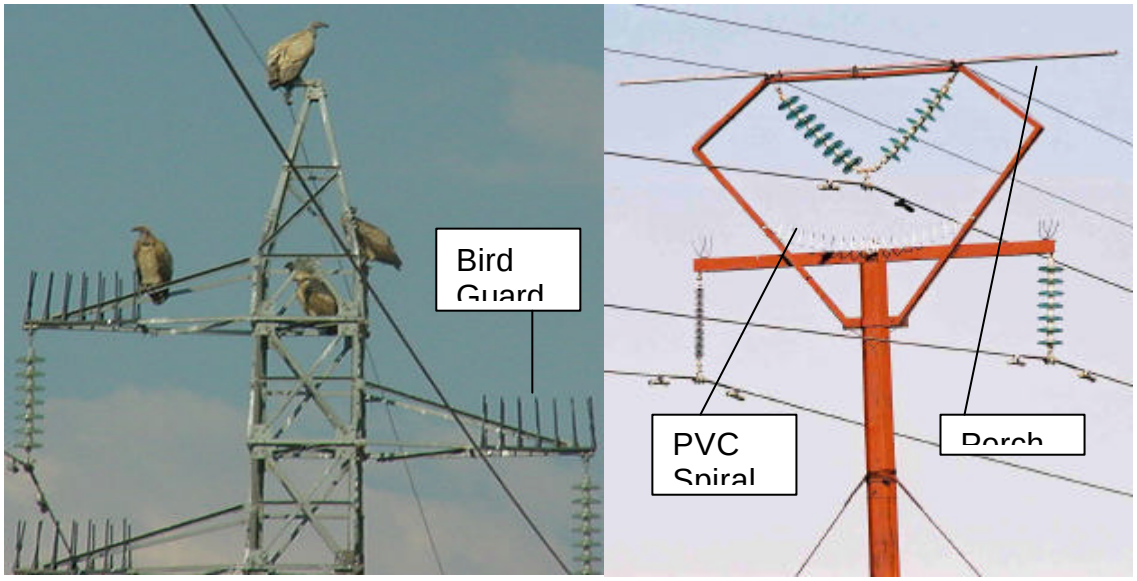

Figure 2. The Watershed–Mmabatho (left) and Watershed-Slurry (right) 88 kV lines.

With regard to the Watershed – Slurry line, the investigation team concluded that the attachment method and fitting strategy of spirals on the line were inadequate to eliminate the risk of electrocution-related faults and streamer-related faults.

Recommendations for remedial action for both lines were submitted to Eskom and accepted in November 2002.

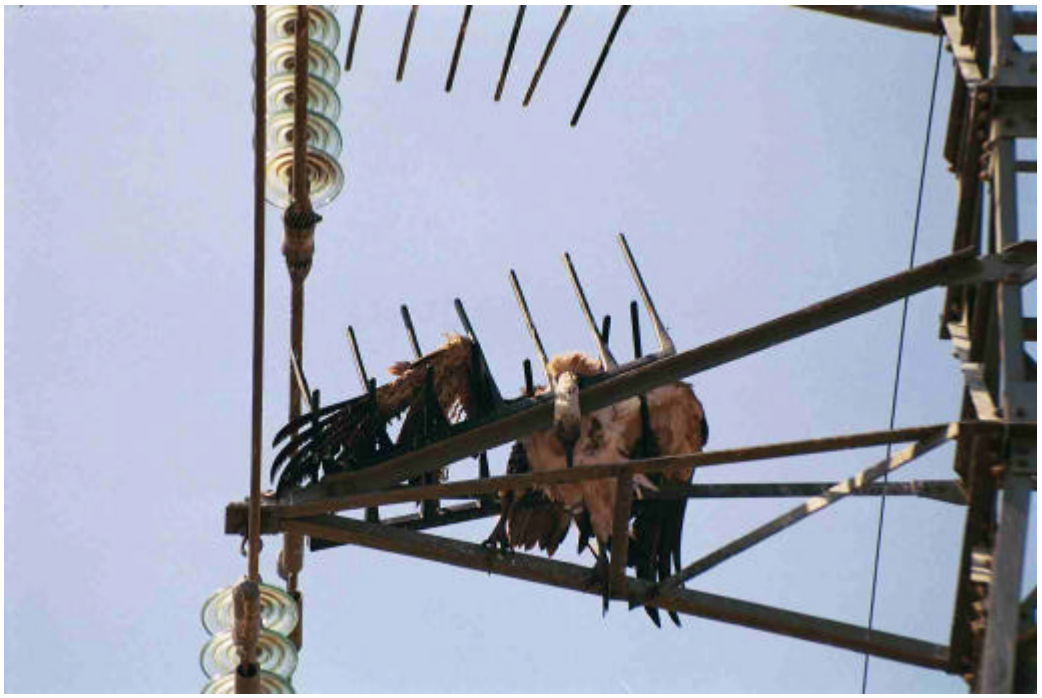

Figure 3. Collapsed Bird Guards and electrocuted Cape Griffon on Watershed-Mmabatho 88 kV line.

Eskom Central Region (Gauteng and part of North West Province)
Nooitgedacht powerline mortality
The most significant incident was the discovery of nine Cape Griffon carcasses under powerlines directly above the Nooitgedacht colony in January 2001. The powerlines had previously been fitted with Raptor Protectors, but some of those had worked loose. The location of some of the carcasses suggested that collisions with the conductors may have also taken place, but it was impossible to prove whether the birds succumbed due to electrocution or collision. New Raptor Protectors were installed in March 2001, together with Bird Flappers to prevent collisions. The site is being monitored regularly and no further mortalities have been reported.

Eskom Northern Region (Limpopo Province and part of North West Province)
Tabor-Dendron 132 kV
In March 2001 Eskom Distribution, Northern Region, reported to the EWT that several vultures were electrocuted on the Tabor - Dendron 132 kV line. The line is 47 km long and built on concrete poles with steel cross-arms. Bird Guards had previously been fitted to the line.

Eskom requested that an investigation be conducted to investigate the nature and extent of the problem. An investigation was duly done by a combined Eskom and EWT team, under the auspices of the Eskom-EWT Strategic Partnership.
The investigation team concluded that Cape Griffons are a likely contributing cause to faulting on the line through a combination of bird streamers and

electrocutions. The reason for that was inadequate and wrongly applied mitigation measures (van Rooyen 2001a).

Figure 4. Tabor-Dendron 132 kV line.

It was recommended that:

- Perches should be fitted to the top of the poles to provide additional perching space for the vultures, to lure them away from the cross-arms.
- Jumper cables on strain structures should be insulated (if possible) to prevent the birds from bridging the air gap between the phases and between phase and earth.
- Bird guards that have collapsed must be properly secured and moved to the end of the cross-arms.
- When these measures are implemented, the line must be monitored in order to assess the effectiveness of the measures.
- A comprehensive risk assessment should be undertaken for all sub-transmission lines in the region to accurately quantify the risk posed by vultures, both from a quality of supply and biological perspective.

Eskom accepted the recommendations, but the status of implementation of the proposed mitigation measures was unclear at the time of writing.

Investigation into suspected bird related faulting on the sub-transmission lines in the Thabazimbi – Amandel - Spitskop network

In May 2001, the EWT received a request for help to establish whether birds might be the cause of excessive faulting on certain lines in the Thabazimbi – Northam area. Eskom forwarded fault reports to the EWT which showed that several sub-transmission lines were being affected by unexplained faulting, mostly during the night. The Amandel - Thabazimbi Combined 132 kV and Spitskop-Amandel 132 kV powerlines seemed to be exceptionally badly affected. It was agreed that the EWT would launch an investigation into the problem with particular focus on the two lines mentioned above.

Figure 5. Cape Griffon perched on the Amandel-Thabazimbi Combined 132 kV line.

Based on the results of the investigations and analysis of fault reports, the following conclusions were proposed (van Rooyen 2001b):

The most likely cause of unexplained, nocturnal faulting on the Amandel – Thabazimbi Combined 132 kV and the Amandel – Spitskop 132 kV lines is bird streamers produced by large birds, particularly vultures, perching and roosting on the towers. Bird streamers are long streams of excrement released by large birds. A streamer that bridges the entire distance, or sufficient part thereof, between the earth plane (the steel tower and the bird perched on it above the insulator) and the nearest live hardware point, acts as a fuse and a transient earth fault occurs.
Indications were that the problem was not only restricted to these two lines, but is also a problem on other sub-transmission lines in the Northern Distribution Region. This is based on visual evidence of large birds perching on the lines, bird pollution and unexplained nocturnal faulting. In certain instances, specifically with regard to 88 kV Kite structures and certain single steel pole designs, the electrocution of vultures was also a contributing factor.

The investigation team recommended that:

- The Amandel – Thabazimbi Combined 132 kV line and the Amandel – Spitskop 132 kV line must be fitted with bird guards under the guidance of the EWT, in order to ensure the correct application.
- All sub-transmission lines in the Northern Distribution Region should be systematically investigated for similar problems with a view to eliminating birds as a cause of faulting on sub-transmission lines in that region.

Eskom management in the Northern Region accepted the recommendations. They have since indicated that they are planning to implement a large scale

programme on their entire sub-transmission lines feeding important industries (especially mines) to prevent further bird faulting, based on the recommendations of the EWT, but the status of this project is unclear.

Eskom North-East Region (Mpumalanga and part of North West Province)
Investigation into suspected bird related faulting on the Lydenburg – Merensky 132 kV powerline
During the course of July 2002, the Endangered Wildlife Trust was contacted by the North–East Distribution Region. They reported a problem with unexplained faulting happening on the Lydenburg – Merensky 132 kV line near the vicinity of Ohrigstad. It was suspected that the faulting might be related to a vulture restaurant in the vicinity of the line.

Based on the results of the investigations and analysis of fault reports, the following conclusions were put forward (van Rooyen 2002b):

- The most likely cause of unexplained faulting on the Lydenburg – Merensky 132 kV line is bird streamers produced by large birds, mostly Cape Griffons, perching and roosting on the towers in the vicinity of the vulture restaurant.
- Based on the fault reports received, indications were that the problem was not restricted to this line, but was present on other sub-transmission lines in the North-East Region.

It was recommended that the Ohrigstad T-off of the Lydenburg – Merensky 132 kV line must be fitted with bird guards under the guidance of the EWT.

Botswana
Bird impact assessment studies were conducted for the proposed Kanye-Tamaga 132 kV (van Rooyen 2001c) and Ghanzi-Mamuno 132 kV lines (van Rooyen 2001d). Recommendations were that a bird perch is fitted to the single steel pole structure to lure birds (including vultures) away from the stand-off insulators which expose them to a possible phase – earth electrocution. It is not clear at the time of writing whether the recommendations have been accepted.

Suspected bird faulting on the Gaborone – Lobatse 132 kV line was reported to the EWT and the Botswana Power Company (BPC) requested an investigation into the matter. One of the conclusions was that vultures can be encountered anywhere along the line at carcasses and may perch communally on the towers near a carcass. It was concluded that the line could pose an electrocution risk to vultures, but no evidence of recent electrocutions was found during the line inspection in February 2003. It was recommended that 30% of the line should be fitted with bird guards to prevent potential bird streamer faulting and electrocution of (*inter alia)* vultures (van Rooyen 2003). These recommendations were accepted by the BPC.

Figure 6. Lydenburg-Merensky 132 kV line

Namibia

Chris van Rooyen of the EWT (with the assistance of P. Bridgeford from the Vulture Study Group and R. Simmons from the Ministry of Environment and Tourism) conducted a bird impact assessment study on the proposed Windhoek – Walvis Bay 220 kV line, after special concern was expressed for the Lappet-faced Vulture population that breed around Ganab in the Namib-Naukluft Park.

The study concluded that the line could have a limited impact on the vultures near Ganab, especially during the construction phase, and recommended that before construction starts between tower 180 and 205, a survey must be conducted by P. Bridgeford and R. Simmons to establish if any active Lappet-faced Vulture nests are located within 1 km of the construction sites. If so, strict procedures must be agreed upon between the contractor, NamPower, R. Simmons and P. Bridgeford to eliminate any chance of disturbance to the birds. It was also recommended that the earth-wires of the line are marked with Bird Flappers where the line runs adjacent to the Ganab breeding area (van Rooyen 2002c). These were accepted by NamPower.

Table 1. Recorded vulture mortality on Eskom powerlines from August 1996 – February 2003.

Eskom Region	Sp.	Tot.	Coll.	Elect.	Loc.	Mit.	Mit. Impl.	Mon.
Western Region	CG	0	1	0	1	0	0	0
Southern Region	CG	58	4	54	15	10	9	3
Eastern Region	CG	23	2	21	15	6	6	5
	AWbV	2	0	2	2	0	0	1
	BV	1	1	0	1	0	0	0
North-West Region	CG	19	4	15	15	6	6	9
	AWbV	116	3	113	15	11	11	1
	LfV	48	1	47	6	4	4	1
Central Region	CG	21	1?	20	4	2	2	1
Northern Region	CG	15	1	14	8	3	3	2
	AWbV	8	3	5	3	0	0	0
	LfV	1	0	1	1	1	1	0
North-East Region	CG	3	0	3	1	1	1	0

Sp: Species; Tot: Total; Coll: Collisions; Elect: Electrocutions; Loc: Localities; Mit: Localities where mitigation was recommended; Mit. Impl: Localities where mitigation was implemented; Mon: Monitoring

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Vulture poisoning in southern Africa

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Introduction

Poisoning ranks high amongst the most significant threats to vultures all over the world. The current situation on the Indian sub-continent with the demise of the Oriental White-Backed Vulture *Gyps bengalensis* (Prakash & Rahmani 1999) bears witness to the vast impact that chemicals may have on these scavenging birds although most of the chemicals that poison vultures are hardly ever aimed at killing the birds. In southern Africa the situation with vulture poisoning is one of concern despite the high level of awareness generated through conservation programmes to minimize the misuse of poisons.

Southern Africa hosts nine Old World Vulture species: the Cape Griffon *Gyps coprotheres,* the African White-backed Vulture *Gyps africanus*, the Lappet-faced Vulture *Torgos tracheliotus,* the White-headed Vulture *Trigonoceps occipitalis*, the Egyptian Vulture *Neophron percnopterus percnopterus*, the Palm-nut Vulture *Gypohierax angolensis*, the Hooded Vulture *Necrosyrtes monachus,* the Rüppell's Griffon *Gyps rueppellii* and the Bearded Vulture *Gypaetus barbatus*. All species are susceptible to poisoning but the gregarious species such as the griffons and the Lappet-faced Vulture feature more prominently in poisoning cases.

The Cape Griffon is regarded as flagship species for vulture conservation in southern Africa but due to poisoning the species has lost a very large portion of its distribution range on the sub-continent (Mundy *et al.* 1992). The Great, Little and Central Karoo colonies have all disappeared during the past century and much of this tragic phenomenon may attributed to poisoning (personal communication with Karoo farmers).

Status and significance of vulture poisoning in southern Africa

Commercial agriculture – deliberate persecution by pesticide misuse

The Poison Working Group (PWG) does not regard deliberate poisoning of vultures by farmers as a significant threat. Since the inception of the PWG in 1992 not a single record of deliberate vulture poisoning of vultures has been recorded. There were a number of cases where farmers threatened to poison vultures; these incidents were addressed by positive interaction with the farmers and assistance in solving conflict between vultures and farmers. Examples of where farmers threatened to poison vulture include:

1. An incident close to Modderrivier in the Northern Cape was reported by a police officer 2001 where African White-backed Vultures attacked weakened ewes while in labor. The landowner threatened to poison the vultures but was convinced to feed

animal carcasses to the vultures during the lambing season. This resolved the issue and prevented the poisoning of vultures.

2. Several incidents of Cape Griffon predation on small stock were reported from the Eastern Cape Stutterheim region (R Wardel personal communication). Two farmers who experienced such problems threatened to poison the birds. A meeting was held with farmers and conservationists and a proposal to start a vulture restaurant to lure the vulture away from the livestock was accepted by the farming community. This solved most of the problems and prevented the poisoning of vultures.

Commercial agriculture – indirect poisoning of vultures due to pesticide misuse against problem animals

Problem animals cause livestock damage to the value of about R200 million per annum according to Cape Wools (B. Bekker personal communication). Many farmers resort to the use of a variety of chemicals to control such problem animals. Small baits are not significantly threatening vultures but any pesticide or poison laid out in a large animal carcass pose a very serious threat to vultures and other scavenging birds.

The species of terrestrial mammals that are implicated in livestock losses include the following:

1. Black-Backed Jackal *Canis mesomelas* is the principle livestock predator and occurs all over southern Africa.
2. Caracal *Felis caracal* is another animal that may have significant impacts on small stock production. Caracals are mostly problematic in the small stock farming areas of South Africa and Namibia and the game ranching areas of South Africa.
3. Feral Dogs *Canis familiaris* are becoming increasingly significant in large stock, small stock and game losses in many parts of South Africa. Recent incidents or livestock and game losses were recorded in Gauteng (Devon Farmers Association, pers. comm.), Whittlesea in the Eastern Cape (S. Webster personal communication), Westonaria in Gauteng (pers. obs.), Klerksdorp in Northwest Province (personal observation) and Harrismith in the Free State (P. Fihlo personal communication).
4. Spotted Hyaenas *Crocuta crocuta* are recorded as large stock predators in the Limpopo Province (D. Cilliers personal communication), northern regions of KwaZulu-Natal and around the Etosha Pan National Park in Namibia (M. Diekmann personal communication). These incidents are rare and do not warrant extensive intervention.
5. Brown Hyaenas *Hyaena brunnea* are seldom implicated in livestock losses but are recorded incidents of predation on sheep in Mpumalanga's Dullstroom area (B. Struwig personal communication) and Ermelo (J. Pieterse personal communication) as well as in Bothaville in the Free State (personal observation).
6. Leopards *Panthera pardus* are often the cause of significant cattle losses. Leopards are found throughout the sub-continent

but most problems are recorded in Limpopo Province, Northwest province, Eastern Cape, Namibia and Mpumalanga.

7. Lions *Panthera leo* is only a problem animal in northern Namibia and on the western boundaries of the Kruger National Park.
8. Cape Foxes *Vulpes chama* and African Wild Cats *Felis lybica* may cause losses of lambs during the beginning of the lambing season but the impacts are insignificant.

Traditional medicine harvesting of vultures with poisons

Vulture parts are often used in certain African cultures as traditional medicine. This has brought about a large number of vulture poisoning incidents in which different species were killed for traditional medicine. It is believed that the South African state controlled LOTTO lottery has resulted in an increased demand for vulture parts to forecast the outcome of the lottery. The KwaZulu-Natal Wildlife Ezemvelo has uncovered many cases of vulture poisoning in the Mkuze area since 1999 and several arrests of culprits were made.

Vultures are also often poisoned in the Phalaborwa-Hoedspruit area of the Limpopo Province for traditional medicine. Waterholes are poisoned where vulture drink and bathe and carcasses of game animals are also laced with poisons to kill vultures.

The following species are killed in traditional medicine cases:

1. African White-backed Vulture.
2. Lappet-faced Vulture.
3. White-headed Vulture.
4. Cape Griffon.
5. Hooded Vulture.

Bushmeat harvesting with poisons

The killing of wildlife with poisons as a means of harvesting so-called bushmeat is an increasing phenomenon in South Africa. This is most prevalent in the northern regions of KwaZulu-Natal in the Mkuze Game Reserve, Thembe Elephant Park and Ndumo Game Reserve areas. Ungulates such as Bushbuck *Tragelaphus scriptus*, Njala *Tragelaphus angasii*, Bluewildebeest *Connochaetes taurinus*, Warthog *Phacochoerus aethiopicus,* duiker species and a variety of game birds and waterfowl are often killed with poisons. This practice poses a serious threat to vulture populations in these regions.

Vulture poisoning case studies

The Poison Working Group investigates approximately 70 incidents of wildlife poisoning per annum. Several confirmed or alleged vulture poisonings are amongst these incidents and to illustrate the magnitude and threat posed by irresponsible and illegal use of poisons, the following incidents are listed:

1. Blouberg close to Vivo in Limpopo Province (incident recorded and reported by J. Snyman in 2000) (Snyman, 2000). This incident occurred on a farm within view of the Blouberg Cape Griffon breeding colony. A heifer carcass was found on the tomato farm with 26 dead and three surviving specimens of

Cape Griffons. The survivors were very weak and had paralysed lower limbs. All insects on the carcass were dead and this indicated a very toxic organophosphate pesticide. Analysis proved that the poison was methamidophos, an organophosphate insecticide used in cash crop production. It was believed to be a ca were someone tried to poison a Leopard.

2. Hlane National Park in Swaziland in 1994 (incident recorded by M. Reilly). A small group of 5 African White-backed Vultures were found in a totally lethargic state at a waterhole on a private nature reserve. No poisoned carcass was found and no poisons could be detected in samples taken from the birds that all died at the waterhole. In retrospect the birds most possibly were poisoned with sodiummonofluoroacetate as this chemical induces the lethargic state in vultures. Limpopo Valley west of Beit Bridge in Zimbabwe (incident reported by Zimbabwean citizens) in 1998. A farmer dumped an unknown amount of monocrotophos, an organophosphate insecticide into a natural waterhole frequented by Egyptian Geese Alopchen aegyptiacus as he feared that the geese would damage cash crops. More than 400 Egyptian Geese, 4 Nile Crocodiles *Crocodylus niloticus* and 7 Elephants *Loxodonta africana* were killed by the poison. No vultures were found dead but it could have been a disastrous event had the avian scavengers found these animals.

3. Derby in the Northwest Province in 2001 (incident reported by landowners and investigated by the author). The landowner found 58 Cape Griffons around a waterhole on his farm on a Friday afternoon and started being suspicious about their presence when the birds appeared sick. By the Saturday afternoon 38 vultures were dead or dying. Six specimens were rescued and treated for poisoning at a veterinary clinic in Rustenburg of which five survived and were released. Toxicological analysis indicated that the vultures were poisoned with the carbamate carbofuran. Although no poisoned carcass was found the assumption could be made that carbofuran was laid out in cattle carcass to kill jackals.

4. **Table 1**. Vulture poisoning cases for the year 2003 as recorded by the Poison Working Group.

Date	Locality	Species	Species	Chemical
13 Feb	Jagersfontein, FS	6 Afr WBV		Carbofuran
26 Apr	Buffelsdrift, Limpopo	1 Afr WBV		Carbamate
8 Jun	Underberg, KZN	1 Cape G		Euthanase
11 Jun	Mkuze, KZN	8 Afr WBV	1 WHV	Aldicarb
4 Aug	Swartwater, Limpopo	2 Afr WBV		Aldicarb
28 Aug	Harrismith, FS	14 Cape G		Carbofuran
27 Sept	Baltimore, Limpopo	5 Afr WBV		Aldicarb
26 Oct	Roedtan, Limpopo	1 Afr WBV	2 Cape G	Carbofuran

Chemicals that are implicated in vulture poisoning in southern Africa

1. Strychnine alkaloid. Very few wildlife poisoning cases are currently recorded in South Africa due to the fact the conservation authorities refuse to grant permits for the use of strychnine and state veterinarians also refuse to grant prescriptions for the use of strychnine. In Namibia strychnine is still dispensed to livestock farmers for problem animal control and thus the chemical features in wildlife (including vulture) poisoning.
2. Aldicarb and carbofuran carbamates are widely misused by livestock and game farmers in South Africa to kill problem animals. Table 1 illustrates the high incidence of these two products in vulture poisoning.
3. Methamidophos and monocrotophos are two organophosphates that feature in vulture poisoning in the grain and cash crop farming areas of South Africa.
4. Fenthion and diazinon are two organophosphate animal health products used against blowfly on wool sheep in the sheep farming areas of South Africa.
5. Sodiummonofluoroacetate is a classic problem animal control product that is sometimes detected in vulture poisoning cases. It appears as if all incidents where vultures were poisoned with this compound were related to traditional medicine.

New poisoning threats to vultures in southern Africa

1. The Pied Crow *Corvus albus* population appears to be on the increase in rural areas. The PWG receives increasing numbers of reports from small stock farmers who complain about the crows that peck out eyes of ewes and newly borne lambs. Unconfirmed reports have been tabled about farmers who intend poisoning crows.
2. European Wild Boar infestations in Northwest, Gauteng, Limpopo and Mpumalanga Provinces. This animal was introduced into South Africa some 30 years ago (S. Steyn personal communication) and has subsequently been introduced to some private land in the mentioned provinces. An incident in the Lichtenburg district of the Northwest Province brought the species to the attention of the PWG as a maize farmer threatened to poison 90 odd animals due to severe crop damage on irrigated grains fields. This points to a potential poisoning threat to vultures due to an invasive alien species.
3. Leopard damage to livestock and valuable game in Limpopo and Easter Cape Provinces. Some landowners are currently poisoning Leopard with aldicarb and carbofuran due to extensive stock losses caused by Leopard. This scenario will continue as long as the conservation authorities turn a blind eye to the appeals from farmers for a tangible solution.
4. Lack of support from provincial conservation authorities in managing problem animals such as Black-backed Jackal and Feral Dogs. Most provincial conservation authorities cannot offer

farmers any support in combating the detrimental impacts of jackals and dogs on their livestock. Such farmers inadvertently use poisons to combat the problem animals and therefore generate a poisoning threat to vultures.

5. Organised illegal hunting of game and livestock on private land is an immense problem in the Eastern Cape and other parts of South Africa. It is impossible to shoot such dogs successfully due to the proximity of their owners and thus farmers lay out poisons to kill such dogs. A case late in 2003 in the Harrismith area of the Free state illustrated the threat that dogs pose. Thirteen Cape Griffons died after eating carbofuran poisoned meat that was intended for Feral Dogs.

Chronic poisoning of vultures – some thought provoking questions

1. Lead for hunting bullets may end up in the crops and intestines of vultures. Personal experience with vultures that ingested small slivers of lead proved that the birds will die within five weeks. There is a chance that free roaming vultures may be poisoned by the remains of lead bullets in animals that died after being wounded.
2. Persistent organic pollutants (POPs) are prevalent in basically all living organisms. Van Wyk showed in studies on South African vultures that products such as DDT, Dieldrin and Aldrin exists in vultures at levels that may approach sub-lethal values. These pesticides may have a small yet important impact on the fecundity and breeding output of vultures.
3. Organophosphate acaricides are still used in stock farming in southern Africa and the question remains whether such products and their metabolites may not be causative mechanisms for the skeletal deformities experienced by the griffon type vultures.
4. Pyrethroid acaricides are widely used on cattle and increasingly on free roaming game animals. Pyrethroids are implicated in endocrine disruption and may have an effect on vultures that consume carcasses that were treated with pyrethroid acaricides.
5. Anthelmintics such as amizoles and abamectins are widely used in cattle and game farming and the may have an as yet unknown detrimental impact on vultures that consume treated animals.
6. Animal growth stimulants are used in feedlots to boosts production. Some of the animal that perish in feedlots are fed to vultures in vulture restaurants and may have an impact on the birds.

Challenges for the PWG in terms of vulture poisoning

1. Train conservation agency officials of all provincial conservation departments on agrochemicals and the environment. This will equip such officials with the necessary tools to combat the poisoning of vultures and other wildlife.
2. Encourage conservation agencies to implement appropriate law enforcement against illegal wildlife poisoning.

3. Act ruthlessly against those individuals who poison vultures deliberately or accidentally.
4. Market the PWG's Cape Wools Problem Animal Help Line aggressively and assist farmers with information on the management of livestock predation without causing undue harm to wildlife trough the misuse of poisons.
5. Improve the reporting rate on wildlife poisoning.

Acknowledgements

The authors wish to thank the Mazda Wildlife Fund, SASOL (Pty) Ltd, the Tony and Lisette Lewis Foundation, CropLife South Africa, the South African Animal Health Association, the Agrochemical Dealers Association of South Africa, NASHUA Limited, Royce Imaging Industries, Arrow Bulk Marketing and Du Pont South Africa for financial support of the Poison Working Group.

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Non Steroidal Anti-inflammatory Drugs – risk to vultures

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Introduction

Non Steroidal Anti-inflammatory Drugs (NSAIDs) are a large diverse chemical group of drugs used in humans and animals for the treatment of inflammation, pain and fever. Although many NSAIDs are regarded as safe and are readily available over the counter they share similar serious adverse reactions, particularly if overdosed, used over extended periods or used inappropriately. The safety of NSAIDs varies among different animals species.

The importance of NSAIDs in vultures became apparent with the identification of the causal relationship of diclofenac residues in carcasses and catastrophic vulture declines in Asia. Three species of vultures endemic to South Asia are in grave danger of extinction across the Indian subcontinent. Populations of Oriental White-backed Vulture *Gyps bengalensis*, Long-billed Vulture *G. indicus* and Slender-billed Vulture *G. tenuirostris* have declined by more than 97% in India and Pakistan and annual rates of decline appear to be increasing (Prakash 1999; Parry-Jones 2001; Gilbert *et al.* 2002; Prakash *et al.* 2003).

Classes and types of NSAIDs

The different classes and types of NSAIDs used in animals in South Africa are summarized in Table 1. Some NSAIDs, such as aspirin, ibuprofen and indomethasin that are registered for human use only are used extra-label in animals.

Table 1. Classes and types of NSAIDs used in animals in South Africa.

Class	Types	Names	Animal
Pyrazolones	Phenylbutazone	Equipalazone, Fenylbutazone, Phenylarthrite	Cattle, horses, pigs, dogs
Amino-nicotinic acid	Flunixin meglumine	Cronyxin, Finadyne, Pyroflam	Cattle, horses, pigs, dogs & cats
Propionic acid derivatives	Carprofen	Rimadyl	Dogs & cats
	Ketoprofen	Ketofen	Cattle, horses, pigs, dogs
	Vedaprofen	Quadrisol	Cattle, horses, pigs, dogs
Oxicams	Meloxicam	Metacam	Dogs & cats
Salicylates	Aspirin	Disprin	Dogs & cats
Acetic acid derivatives	Eltenac	Telzenac	Horses

NSAIDs are principally divided into acidic and non-acidic groups with most classes of therapeutic importance being acidic, including the pyrazolones, salicylates, propionic acid derivatives anthranilic acid derivatives, fenamates, acetic acid derivatives and aminonicotinic acids (Swan 1991).

Diclofenac an aryl acetic acid derivative, unlike its wide use in India and Pakistan (Shultz *et al.* in press; Risebrough 2004), is not authorized for use in animals in South Africa (Swan 2004). Although widely used in human medicine as an anti-inflammatory, antipyretic and analgesic and for treatment of rheumatoid arthritis (Todd & Soken 1988) there is no report of its use in animals.

Paracetamol is the only non-acidic NSAID. Its toxicity in cats and its poor anti-inflammatory activity has precluded its veterinary use (Swan 1991).

Although acidic NSAIDs share similar pharmacokinetic features and have a common mechanism of action marked differences exist, particularly in their metabolism and to a lesser extent in their specificity of action and spectrum of pharmacological effects, between the various classes. These are reflected in clinical significant differences in their efficacy and safety profiles (Swan 1991).

Mechanism of action

NSAIDs suppress inflammation, fever and pain by inhibiting the production of the cyclo-oxygenase (COX) enzymes, which are necessary in the formation of prostaglandins (Adams 2001). There are two forms of the COX enzyme: constitutive COX-1, which produces prostaglandins that act to protect tissues in the kidneys, liver, central nervous system and gastric mucosa and COX-2, which is inducible and associated with inflammatory responses (Brater 2002). The duration of effect is *inter alia* affected by whether the COX enzymes are competitive or irreversible inhibited by NSAIDs (Swan 1991).

Pharmacokinetics

Acidic NSAIDs share many common pharmacokinetic features. Most are orally well absorbed, are highly plasma protein bound and generally have a small volume of distribution (Booth 2001). Tissue concentrations are generally low with the highest concentrations of drug found in the liver and kidneys. Extent of distribution is affected by changes in body pH. NSAIDs are generally extensively metabolized.

Differences in the rate and extent of metabolism among NSAIDs and between species depend on the type of Phase I, metabolic transformation reactions and CYP iso-enzymes involved and on qualitative and quantitative differences that may exist in the synthetic Phase II conjugation reactions (Booth 2001). Quantitative deficiency in glucoronyl transferase, responsible for glucoronide conjugation of aspirin and paracetamol, causes zero-order or saturation metabolism and toxicity in felidae due to the accumulation of intermediate electrophilic metabolites. Diclofenac undergoes extensive hepatic metabolism involving aromatic hydroxylations and conjugation. Pharmacogenetic difference in the presence of genes coding for CYP2C9 enzymes in humans explain the occurrence of hepatic toxicity in some individuals.

NSAIDs are predominantly renally excreted, unchanged or as conjugated metabolite. Renal excretion among species is affected by differences in urinary pH.

Pharmacological effects

All NSAIDs, except paracetamol, have anti-inflammatory, analgesic and antipyretic activity (Swan 1991; Booth 2001). Paracetamol acts primarily in the central nervous system as a potent analgesic and antipyretic, with poor anti-inflammatory effect. In addition NSAIDs through inhibiting thromboxane prevents platelet aggregation and blood clotting. Some NSAIDs have anti-endotoxic (e.g. flunixin meglumine) and uricosuric (e.g. aspirin, indomethacin and diclofenac) effect.

The general indications for NSAIDs are musculoskeletal inflammation and analgesia, rheumatoid arthritis, fever, disseminated intravascular coagulation and other thrombotic conditions and control of endotoxaemia (Swan 1991; Booth 2001).

Adverse reactions

NSAIDs, despite being considered as safe, may be responsible for a number of serious adverse reactions in both humans and animals (Booth 2001; Roberts & Morrow 2001). These effects may either occur acutely following a single dose, such as hepatoxicity, or generally after repeated use, such as nephrotoxicity, gastro-intestinal ulceration and bleeding tendencies.

Hepatoxicity results from an overdose of NSAIDs, such as aspirin and paracetamol, due to an inability to rapidly convert intermediate electrophilic metabolites to inactive metabolites resulting in massive oxidative hepatocyte degeneration. A single dose of 300 mg of paracetamol is toxic to cats. Glutathione, due to a deficit in glucoronyl transferase in cats, is consumed in an attempt to reduce the oxidative effects of the intermediate electrophilic metabolite (thought to be *N*-acetyl-*p*-benzoquinoneimine) and instead of hepatoxicity causes methaemoglobinaemia, hypoxaemia, intravascular or extrvascular haemolysis due to Heinz body anemia, and icterus (Booth 2001).

Diclofenac may induce apoptosis in hepatocytes by alteration of mitochondrial function and generation of reactive oxygen species (ROS) (Gómez-Lechón *et al*. 2003). The mitochondrial pathway was shown as most likely the only pathway involved in diclofenac induced apoptosis related to CYP-mediated metabolism of diclofenac, with the highest apoptotic effect produced by the metabolism 5OH-diclofenac. Genetic polymorphism in CYP2C9 results in variability in the formation of 5-OH diclofenac and thus variability in appearance of hepatic toxicity in humans.

Gastro-intestinal ulceration, neprotoxicity and bleeding tendencies are associated with sustained inhibition of COX enzymes. NSAIDs that inhibit the production of both COX-1 and COX-2 are mainly responsible for these effects whereas NSAIDs such as meloxicam (Del Tacca *et al.* 2002) and carprofen, that more selectively inhibit the production of COX-2 enzymes, has been assumed to result in fewer adverse effects. The cause of nephrotoxicity generally has been ascribed to the inhibition of prostaglandin production resulting primarily in renal ischemia causing renal papillary necrosis and general renal degenerative changes, but also in a glomerular nephropathy. Gastro-intestinal ulceration is due to the inhibition of PGE_2, preventing the

production of a mucoid layer that protects the gastric mucosa against the corrosive effects of HCL and a reduced blood supply to the gastro-intestinal wall.

Other adverse reactions such as medullary aplasia, uncoupling of oxidative phosphorylation and severe injection site reactions have been observed. High doses of acidic NSAIDs may paradoxically cause the inhibition of uric acid secretion and gout in humans in contrast to their uricosuric effect at lower dose (Roberts & Morrow 2001).

Use and safety of NSAIDs in birds

Very little information on the use of NSAIDs in birds has been reported. The pharmacokinetics of flunixin, sodium salicylate and meloxicam following intravenous administration were compared in chickens, ducks, turkeys, pigeons, and ostriches (Baert & De Backer 2003). No serious side effects were revealed in this study. Flunixin and ketoprofen was suggested for use as potential anti-inflammatory and analgesic agents in waterfowl, but because of muscle necrosis at the injection site the parenteral use of flunixin was not recommended in ducks (Machin *et al.* 2001).

Variation in species responses and sensitivity to different analgesic drugs has been highlighted (Clyde & Murphy 1999). Renal ischemia with resultant nephrotoxicity is the most serious complication with the use of NSAIDs in birds. Flunixin meglumine was shown to cause nephrotoxicity in Northern Bobtailes, Whooping Cranes, Siberian cranes and Red-crowned cranes seen as acute necrotizing glomerulitis, gout tophi in the renal tubules, and visceral gout (Klein *et al.* 1994; Clyde & Murphy 1999).

Diclofenac poisoning in vultures

Current research (Oaks *et al.* 2004) indicates that diclofenac (a non-steroidal anti-inflammatory drug - NSAID) is the major cause of the observed rapid population declines across the Indian subcontinent. Diclofenac is the most commonly available veterinary anti-inflammatory in India and has been in use for at least a decade. Exposure to diclofenac occurs through vultures consuming carcasses of livestock that were treated with diclofenac before death. Recent experiments on captive Asian White-backed Vultures show that they are highly susceptible to diclofenac and are killed by kidney failure within a short time of feeding on the carcass of an animal treated with the normal veterinary dose shortly before its death (Oaks *et al.,* 2004).

To date, only diclofenac has been identified as a risk for vultures India and Pakistan (Oaks *et al.* 2004), but diclofenac, as well as other NSAIDs, pose a danger to *Gyps* vultures across their geographic range. It is not yet known if diclofenac is similarly toxic to other *Gyps* species (i.e. *G. africanus, G. ruppellii, G. coprotheres, G. fulvus* and *G. himalayensis*). The African White-backed Vulture *G. africanus* is considered the nearest relative to the Oriental White-backed Vulture *G. bengalensis*, thus potentially the most likely to be similarly affected.

Conclusions

NSAIDs are large, divergent classes of anti-inflammatory, analgesic and antipyretics drugs used extensively in animals. Large variations in the safety profiles exist among the various NSAIDs and toxicity among animal species. Acute diclofenac toxicity has been observed in vultures in Asia. NSAIDs residues in carcasses supplied to restaurants may pose a considerable risk. The African White-backed Vulture is considered the nearest relative to the Oriental White-backed Vulture, thus potentially the most likely to be similarly affected. Studies are currently planned to determine whether the African White-backed Vulture is as sensitive to diclofenac toxicity as the Oriental White-backed Vulture in order to establish its suitability for the testing of alternatives to diclofenac. Given that the three affected Asian species are now rare and critically endangered, and there are few non-releasable birds available for toxicity testing, it is necessary to find an alternative vulture species as a surrogate to test alternative drugs.

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Current conservation priorities for the Asian *Gyps* vulture crisis

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Abstract

Of the eight *Gyps* species found worldwide, the three species endemic to South Asia, the Oriental White-backed Vulture, *Gyps bengalensis*, Long-billed Vulture *G. indicus* and Slender-billed Vulture *G. tenuirostris*, face imminent extinction across most of their geographical range. The past decade has seen declines in populations of these three species of over 95%. All three vulture species were listed by IUCN, The World Conservation Union, in 2000 as "Critically Endangered" because the population declines are very widespread and rapid. The cause of the population crash across the Indian subcontinent has been identified as a veterinary drug, diclofenac, which vultures are exposed to when they consume carcasses of livestock that have been treated before death. As wild populations continue to decline rapidly and current captive populations are not viable on their own, extinction is a real possibility if no direct conservation action is taken quickly. Recent workshops in India and Nepal have identified two main conservation priorities, (1) to establish a viable captive population for each of the three species to allow for future captive breeding programmes, and (2) to remove the threat of diclofenac poisoning from the vultures' environment.

Introduction

For most of the 20th century, *Gyps* vultures were very common across South Asia. The Oriental White-backed Vulture *G. bengalensis* was considered as probably the most common large bird of prey in the world (Houston 1983). Population declines in *Gyps* species were first documented in a breeding colony of *G. bengalensis* in Keoladeo National Park, eastern Rajasthan, India (Prakash 1999). The number of breeding pairs in the park declined steadily from a high of over 300 in the late 1980s to none by 2000 (Prakash *et al.* 2003). In 2000, repeats of vulture counts along road transects that were initially conducted in 1992 indicated that vulture declines of >95% had occurred across northern and central India. Further surveys in 2002 and 2003 confirm that these declines are continuing at a rapid rate (20 to 50% per year).

To determine whether the declines were occurring outside of India, intensive monitoring of *G. bengalensis* breeding colonies in Punjab province, Pakistan, began in 2000. This monitoring documented declining numbers of breeding pairs coupled with high adult mortality rates (Gilbert *et al.* 2002; Virani *et al.*

2001). Surveys and monitoring of vultures in lowland Nepal indicate considerable population declines, although they may not be as rapid as those in India and Pakistan (Baral & Choudary unpublished report 2003). The declines appear to be more pronounced in Eastern Nepal, where numbers are currently low, than Western Nepal. Very limited information is available about the status and distribution of the least common resident Asian species *G. tenuirostris*. Little is known about the effects of diclofenac on other scavenging species. There is some evidence that there are concurrent declines in other vulture species, especially the Red-headed Vulture *Sarcogyps calvus* (Shultz *et al.* submitted), but it is not known whether this is related to diclofenac or other factors.

Causes of the declines

Over the past five years, much research has focused on the cause of the catastrophic population declines. Vultures and other large raptors are long-lived once they reach adulthood (Newton 1979). Annual adult survival rates have been reported in the range of 90-97% (e.g. Sarrazin *et al.* 1994). The observed vulture declines have occurred at rates of 20% to 50% per year, more than can be explained by breeding failure alone. Hence, the important factors causing the declines must have substantially reduced the annual survival rate of adult vultures. This effectively excludes loss of nesting habitat and any other factor that only affects breeding output as the major factor causing the rapid declines.

A number of factors can impact adult survival, and research efforts focused on investigating the most common of these. The most common pathological sign in the dead birds was visceral gout, which is most likely to be caused by toxins, dehydration or infectious disease (Cunningham *et al.* 2003). Environmental contaminants, such as pesticides, were considered unlikely to have caused the declines; tests for a wide array of potential toxic compounds originally were negative (Oaks *et al.* 2004) and the demography of the declines did not suggest regional or land-use specific patterns. Preliminary results of pathological studies on vultures from India suggested an infectious, probably viral, disease as a tenable hypothesis for the declines (Cunningham *et al.* 2003). A herpes virus has been isolated and sequenced from affected vultures by the PDRC and the Australian Animal Health Laboratory. This virus has been shown to be present in tissues from vulture carcasses collected across India and is found at the highest concentrations in and around lesions in the nervous system (Cunningham *et al*. unpublished data). However, to date there is no evidence that the virus causes serious illness or death.

Diclofenac

A breakthrough occurred in May 2003 indicating the possible involvement of a veterinary pain-killing drug, diclofenac, in the vulture declines. Oaks *et al.* (2004) reported that 219 of 259 adult and subadult *G. bengalensis* found dead in Pakistan had visceral gout. Of these birds, 38 were tested for diclofenac residues in their tissues. Twenty-five *G. bengalensis* that were found dead with evidence of visceral gout had detectable levels of diclofenac in their kidneys, whereas diclofenac was not detectable in any of 13 birds that did not have gout. To strengthen the argument, it was shown that captive *G.*

bengalensis died with pronounced visceral gout after consuming tissues of livestock treated with the normal veterinary dose of diclofenac before slaughter (Oaks *et al.* 2004). Based on this perfect correlation between the incidence of gout and the presence of diclofenac and the high incidence of visceral gout in adult and subadult *G. bengalensis* found dead in Pakistan, it can be inferred that 85% of vultures (i.e. 219 of 259) died as a result of diclofenac poisoning. Results from post-mortem examinations and diclofenac analyses of smaller samples of adult and subadult *G. bengalensis* and *G. indicus* indicate that the situation is broadly similar in India and Nepal (Shultz *et al.* submitted). Population modelling shows that a low proportion of contaminated livestock carcasses (<1%) is capable of producing the observed declines and that the observed proportion of dead vultures with visceral gout and/or diclofenac contamination is in agreement with what would be expected if diclofenac poisoning was the main or sole cause of the declines (Green *et al.* in prep).

At high doses, diclofenac causes kidney failure in vultures, which explains the severe visceral gout observed in many of the vulture carcases collected in India and Pakistan. Diclofenac is a non-steroidal anti-inflammatory drug (NSAID). NSAIDs suppress inflammation and pain by inhibiting the production of the cyclo-oxygenase (COX) enzymes, which are necessary in the formation of prostaglandins. However, COX enzymes also act to protect the stomach and intestine lining and help maintain normal kidney function. Through inhibiting the production of COX enzymes, NSAIDs can cause impaired renal function and gastro-intestinal inflammation. Experimental evidence suggests that diclofenac is quickly metabolised in mammals, with a half-life in human plasma estimated to be around 3.5-4 hours (Todd & Sorkin 1988). Although there is little documented evidence, residence times in soft tissue is expected also to be short, as diclofenac is not believed to bio-accumulate.

Exposure of vultures to diclofenac in the wild is presumed to occur through the consumption of carcasses of livestock that have been treated with diclofenac shortly before death. Diclofenac belongs to the same drug group that includes aspirin and ibuprofen, and has been widely and generally safely used in humans to treat pain, fever and inflammation since its introduction on the market in the 1970s. It is not approved for veterinary use in North America or Europe but has recently been marketed in the Indian subcontinent to treat livestock. It is the most commonly available veterinary pain-killer in India and has been in use for at least a decade (Anon 2001), probably since the early to mid-1990s. Diclofenac is manufactured and marketed in Pakistan where it has been in use since about 1998. Reports suggest that veterinary diclofenac is produced, used in, and exported from China. Diclofenac may also be in veterinary use in Nepal and Bangladesh.

Manifesto

The urgency of finding a solution to the vulture population crisis inspired the production of a manifesto, in January 2004, agreeing that diclofenac is a major cause of the vulture population declines. BirdLife International, The Peregrine Fund, the Royal Society for the Protection of Birds, the Zoological Society of London, the Ornithological Society of Pakistan, Bird Conservation

Nepal, and the Bombay Natural History Society were signatories to this manifesto (available from www.vulturerescue.org)

The manifesto was followed by two priority-setting workshops. The Peregrine Fund and Bird Conservation Nepal held a summit meeting in Kathmandu in early February to announce the results of their diclofenac research in Pakistan, and workshop participants agreed to a series of recommendations for vulture conservation. In addition, in February, the Bombay Natural History Society and the Government of Haryana State in India, together with The Royal Society for the Protection of Birds and the Zoological Society of London convened a workshop in Parwanoo, India, to develop an International South Asian Vulture Recovery Plan. Participants included government representatives from several Indian states, conservation and vulture experts from both within and outside *Gyps* range states, representatives from international and national NGOs. At this meeting, a consensus was reached with participants about the priority actions required to prevent vulture extinction. Both meetings identified two main priorities. It was unanimously recognised that these three species are so imminently threatened with extinction in the wild that viable captive populations must be established as a matter of urgency. The second major recommendation was that the threat of diclofenac poisoning must be removed from the vultures' environment for sustainable populations to exist in the wild. Recommendations from the Parwanoo meeting are available on www.vulturerescue.org.

Captive breeding

Although it is imperative that diclofenac is removed from the environment as a matter of urgency, it is unlikely that this will happen with immediate effect. The continuing rapid declines of vulture populations make captive holding and breeding, until diclofenac is effectively removed as a threat, the most plausible and possibly the only way of ensuring the long-term survival of these species. After evaluating the various captive management options, the Parwanoo workshop concluded that captive breeding programmes should be established for all three vulture species and that it is particularly urgent to begin programmes immediately for *G. tenuirostris* and *G. bengalensis*. A suggested minimum of 60 birds, to establish 25 pairs, of each species should be brought into each breeding centre and populations of each species should be held in at least three centres. An international committee will be formed to advise on various aspects of management at the captive centres. A captive breeding centre is already under construction in Haryana State, India, as a joint initiative between the Bombay Natural History Society and the State Government of Haryana. This centre has existed for several years as a vulture care centre, and is currently being expanded with support from the RSPB, NBPT and the ZSL.

Banning or replacement of diclofenac as a veterinary drug

Diclofenac is currently the most widely used veterinary analgesic in the Indian sub-continent. For the removal of diclofenac from the vultures' food supply to be successful, it is becoming more apparent that it is necessary to identify safe alternatives that can take its place in the veterinary marketplace. However, very little information is available about how different classes of

drugs affect different birds. In addition, the effects of NSAIDs are often species specific, so the information that does exist cannot necessarily be extrapolated from one species to another.

There are currently very few of the three critically endangered vulture species held in captivity and these are required for captive breeding programmes. Consequently, surrogate species need to be used to test the safety of alternatives to vultures. As the side-effects of NSAIDs can vary between species or groups of birds, it is important that surrogates are as similar to the critically threatened species as possible. The closely related African White-backed Vulture *G. africanus*, although listed as vulnerable in South Africa (Anderson 2000), is not globally threatened and is the obvious candidate as a surrogate. A two phase research project has been initiated; the first step is to determine whether African White-backed Vultures are as susceptible to diclofenac poisoning as the three Asian species (i.e. to verify its suitability as a surrogate), the second step is to confirm the safety of alternative NSAIDs for vultures. Potentially safe alternative NSAIDs are being identified through worldwide distribution of a questionnaire to zoos and people who have kept vultures. Information is requested on any NSAIDs used to treat vultures, the doses and outcomes. Details of the questionnaire and how to respond are given on www.vulturerescue.org.

NSAIDs and *Gyps* vultures outside India

Currently, diclofenac is not widely used in veterinary medicine outside of South Asia. However, other commonly used NSAIDs present unknown risks to vultures. For example, in South Africa, ten NSAIDs are approved for use in veterinary medicine, and five of these are commonly used to treat livestock. We also recognise that NSAID use in livestock presents a potential threat to vultures in southern Africa; 'vulture restaurants', or locations where dead livestock are provisioned to vultures, are a common source of food for resident vulture populations. The extent to which potentially harmful NSAIDs are used to treat livestock before death is unknown, as is the risk of NSAID poisoning of southern African vultures feeding at vulture restaurants. Future research needs to quantify the risks NSAIDs present to species of vultures and other scavenging birds outside of South Asia.

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Traditional use of vultures: some perspectives

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Introduction

There is a widely held belief in many African cultures that health, disease, success or misfortune are not chance events but the result of the active influence of individuals or ancestral spirits (Berglund 1976). For this reason, traditional medicine is held in high esteem in such cultures and is regularly used by a large proportion of the population. Traditional medicines represent herbal, animal and mineral material used for physiological as well as symbolic/psychological purposes (Cunningham 1991). Approximately 80% of the population in South Africa uses traditional medicine in one form or another because pharmaceutical drugs are too expensive or traditional methods are considered more appropriate (Cunningham 1991; Mander 1998).

Stimulated by rapid urbanization and high levels of unemployment, the demand for traditional medicines is probably higher than at any time in the past. Population increases, declining economy, rising unemployment and increasing uncertainty about the future are all indicators that demand for traditional medicines will continue to increase in the future (Cunningham 1991). These factors have also given rise to a rapidly expanding commercial trade in plants and animal parts for traditional medicine. The value of the trade in indigenous plant species for traditional medicine in KwaZulu-Natal was estimated at R65 million per annum with 4 500 tonnes of plant material being sold annually (Mander 1998). Despite the persistence of customary controls on use of many species, the commercial trade and consequent economic benefits has eroded many of these controls to the detriment of the species involved and the systems in which they occur.

Little information is available on the extent of the trade in animal parts, particularly vultures, for traditional medicine. The trade in animal parts is secretive and mostly illegal in South Africa. This makes it extremely difficult to obtain reliable information on amounts and turnovers of species traded, which is essential to assess potential impact on species populations. Also, the control over animal medicines relate to the politics of control over supernatural power from animals with powerful symbolism (e.g. vultures) (Cunningham 1991). Approximately 150 animal species are traded for traditional medicine in KwaZulu-Natal (M^{c}Kean 1995). All vulture species appear to be used, particularly as capture methods such as poisoning do not discriminate between species and all vulture species are in high demand (Ngwenya 2001).

This short paper is concerned with traditional use and its potential impacts on vultures. It briefly discusses species and parts used, uses and value of vulture parts. Poisoning trends from 1984 to the present, based on Poison Working Group data (van Zijl *et al.* 2003) are analysed and discussed. Potential impacts of trade for traditional use on vulture populations in southern Africa (South Africa, Namibia, Botswana) are examined. Some suggestions for

actions to address the challenge of commercial use of vultures for traditional purposes are made.

Species and parts used, use and financial value

Existing data suggest that all vulture species are used. Despite reports that "poisoned" vultures lose the clairvoyant properties for which they are killed, poisoning is the main method of capture (Cunningham 1991; Ngwenya 2001). Poisoning is indiscriminate and thus any species killed through eating from a poisoned carcass will be used. Most parts, particularly heads, feet, vertebrae and hearts are used (Cunningham 1991). Data on values of parts sold and turnover rates are extremely difficult to obtain due to the secrecy of the trade, illegal nature of trade, random sizes of pieces sold and a history of mistrust between the traders and conservation authorities. However, personal observations suggest that a vulture carcass could be sold for R1 000 or more in the larger urban informal markets. I have recently seen a pile of approximately 20 vulture heads on sale at an informal market in Durban for R650 each. Traders tend to prefer to sell pieces of parts rather than whole heads/feet etc.

Vultures are used in many African cultures for the prediction of future events. It is difficult to obtain specific information but Cunningham (1991) reports that vulture brain is used as part of "*isibunge*" mix by Zulu Traditional Healers to attract customers. Bones are reported to be used for making racehorses run faster. Kingfishers or ostrich can be substitutes for this but there are no substitutes for parts believed to have clairvoyant properties (Cunningham 1991). The many reports of vultures being used to predict winning "Lotto" numbers, major horse race winners and the outcomes of important football matches could be stimulating demand. Demand is likely to fluctuate with events like important football matches, elections etc.

Use of vultures for traditional purposes is dynamic. Seldom is any use done away with but new uses are added. In the same way, changes occur through use of additional species rather than stopping use of historically used species (Cunningham 1991). These belief systems also develop ways to return the "powers" to medicines which were believed to have been lost if certain cultural rituals or customary restrictions were not adhered to. For instance, in Zulu culture a vulture's clairvoyant properties are attributed to a worm ("*iThuku*") reportedly found in the head. Poisoning is reported to destroy *iThuku*. To solve this problem, the herb *Myrothamnus flabellifolius* (resurrection plant) is included with the vulture part to revive its clairvoyant powers (Cunningham 1991).

Impact of traditional use on vulture populations

Assuming that most vultures killed for traditional purposes are poisoned, data (van Zijl *et al.* 2003) were analysed to assess poisoning trends over time (Figure 1). It was not possible to distinguish between incidental poisoning and deliberate poisoning for traditional medicine from available data. The data (Figure 1) do show a dramatic increase in numbers of vultures poisoned in 1994. This could be due to improved data gathering at this time. However, the data do show a correlation with the first democratic election in South Africa,

an event which most people in South Africa would no doubt have liked to predict the outcome of. This could well have boosted the demand for vulture parts at this time. Although this is speculative and the data do not allow conclusions to be drawn, poisoning peaks do correlate with events likely to cause high demand. The need for data which distinguishes incidental from deliberate poisoning for traditional medicine is highlighted. There are also likely to be many additional poisoning incidents which are not reported in the data. Numbers of birds poisoned is therefore likely to be a gross underestimation.

Figure 2 shows the trend in numbers poisoned over time for the regionally endemic Cape Griffon (van Zijl *et al.* 2003). This species has the highest number of birds poisoned (348 since 1984, 276 (85%) since 1994). Given that these data are likely to be a gross underestimate, the potential impact of poisoning for traditional purposes on this species is serious. Cape Griffons are gregarious birds and as such are highly vulnerable to mass poisonings. The number of birds poisoned has risen dramatically since 1994 but this may be a function of more efficient reporting and data collection. It may, however, also be an indication of increasing demand and therefore increased pressure on the species.

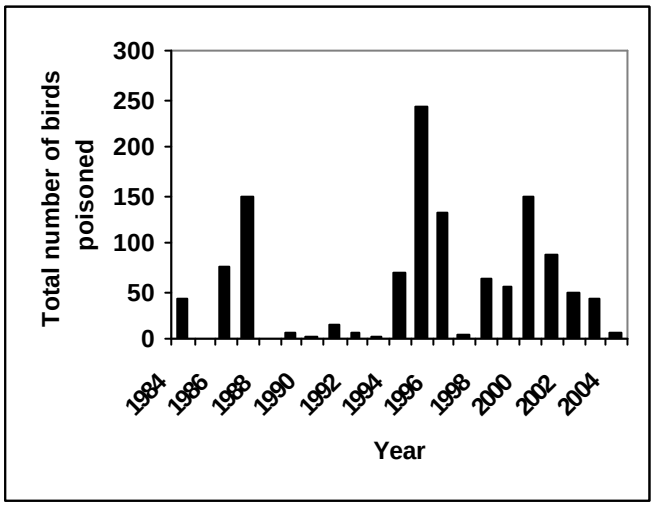

Figure 1 Total number of vultures (all species) poisoned annually since 1984.

What is the potential impact on Cape Griffon populations? Based on Cape Griffon population data from 1994 (Piper 1994), approximately 4 400 breeding pairs (12 000 individuals) occurred in South Africa, Swaziland and Lesotho at that time. Cape Griffons have a clutch size of 1 egg, a fledgling period of 16 weeks and 11% of chicks reach 4 years old (Mundy 1984). From available data (van Zijl *et al.* 2003), approximately 87 birds are known to have been poisoned between 1994 and 1998. Therefore known poisoning incidents between 1994 and 1998 accounted for at least 4.5% (22 individuals) of potential population increase (484 individuals) before immigration, emigration and any natural or other causes of adult mortality are considered. Poisoning data are likely to be grossly underestimated as not all cases will have been

reported and captured. It is not possible to distinguish how the 4.5% of the potential population increase poisoned may have been distributed geographically. Some populations may have been more adversely affected than others. The population data on which these thoughts are based are also 10 years out of date. Although this is speculation, it does highlight that there is a need for much improved poisoning monitoring and population dynamics data for the Cape Griffon (and indeed all vulture species) before any firm conclusions on the impact of use for traditional purposes on species can be made, and whether current use levels are likely to be sustainable or not.

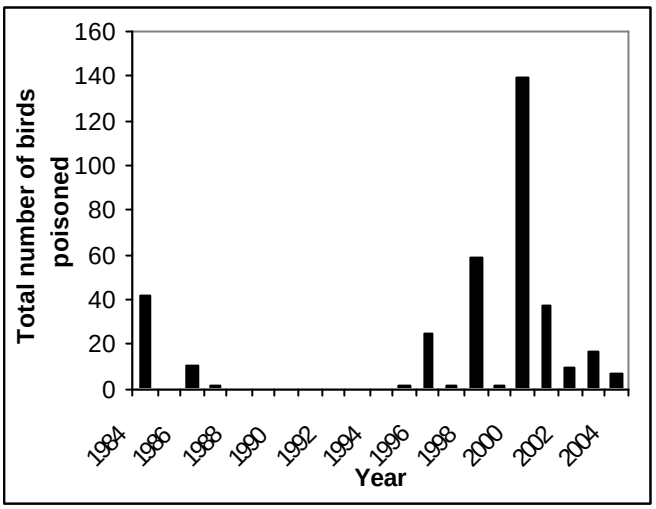

Figure 2. Reported total number of Cape Griffons poisoned annually since 1984.

Regional variation in vulture poisoning

According to data (van Zijl *et al.* 2003), Limpopo (22 birds) and KwaZulu-Natal (8 birds) are the two provinces where most vultures were poisoned between 1995 and 2002. Hence populations in these provinces are at highest risk. Many anecdotal reports about vultures being poisoned in Mozambique for sale in Durban and Johannesburg have been received but no data are available to confirm this.

Factors supporting vulture trade for traditional use

There are a number of factors supporting increasing trade in vulture parts for traditional purposes. Many conservation authorities are adopting a “quiet diplomacy” approach to the plant trade in an attempt to work with, rather than against, the plant traders. This may not be the ideal approach to take with regard to trade in animal parts for various reasons. Partly as a result of such approaches, there is often open trading of vulture parts at large informal markets such as those found in Johannesburg and Durban.

There is easy access to poisons along with a general break down of law and order (including traditional authority). These factors are making it relatively easy for traders to attempt to meet the demand for vulture parts created by continuing poverty, unemployment and rapid urbanization, all of which are likely to enhance the desire for people to obtain the ability to predict future

events. As mentioned, the ability to predict the winning "Lotto " numbers and thereby relieve poverty is widely believed to be a cause of high demand for vulture parts. The belief amongst many people that vultures have clairvoyant properties is the basis on which the trade for traditional use exists. It is this belief which conservation must aim to change if vulture populations are to remain viable in the medium to long term. A lack of public awareness of status and function of vultures is also a major contributing factor. It is likely that many rural people do not believe vulture populations to be declining, as they may often see vultures in rural areas. Vultures do not have a particularly favourable "image" amongst many people in the way that whales or elephants have and this makes obtaining "public sympathy" for their plight difficult. Public awareness about traditional use issues is perhaps not aimed at the correct targets and not done through the most appropriate media. A large proportion of the people who should be targeted with awareness campaigns are illiterate, emphasizing the need for appropriate media to be used, e.g. radio.

Suggestions for a way forward

There is an urgent need to address the factors driving the illegal killing and trading of vultures. These factors are complex and nature conservation agencies and NGOs are unable to address many of these on their own. In the long term, it may be possible to change current perceptions and beliefs regarding vultures. This needs to be seriously attempted through specific and targeted public awareness campaigns aimed at changing destructive beliefs, improving knowledge on the need to conserve vultures and promoting their value to society at large. Killing of vultures needs to be frowned upon in African societies, thereby removing or considerably reducing the demand for the birds. Appropriate media, e.g. radio, television, must be used to target user groups who may be largely illiterate or who may not have easy access to literature. Attempts to dispel beliefs that vultures have clairvoyant properties and to change attitudes toward vultures should also be made through newspapers and prominent African personalities, e.g. well known football players, pop stars. Conservation agencies and NGOs need to engage Traditional Healer associations constructively by positively communicating the vulture conservation concerns to the National Traditional Healers' Association and, if possible, using their influence to help reduce or eliminate demand.

Concurrent to these actions, access to poisons must be limited by using appropriate law enforcement and public awareness aimed at poison manufacturers, farmers and other users of poisons. Law enforcement efforts in informal markets should be stepped up and the disincentive to trade illegally by way of harsher penalties increased dramatically. To this end, police, prosecutors, magistrates, etc., need to be targeted and educated on the importance of vultures, the threat posed by their trade and the need to impose harsh penalties for convicted offenders. If possible, co-operation with traders should be established to investigate and encourage alternative livelihood forms to vulture trade. An increased effort to promote "vulture restaurants" in an attempt to keep birds at "safe" feeding sites is also urgently required.

There is an urgent need for research to be done on the vulture trade. Data on species and parts used, values, turnovers, sources of supply, profile of

customers, etc., are required to estimate the impact on populations and to underpin public awareness and education. Poisoning monitoring data need to be improved to include whether poisoning was deliberate (for traditional use) or incidental, species poisoned, place of poisoning incident, etc.

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Vulture restaurants

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Introduction

The conventional view in conservation circles is that vulture restaurants are an excellent tool for the provision of supplementary food to vultures (Verdoorn 1997; van Rooyen & Vernon 1997). A survey of vulture restaurants in southern Africa was conducted and their potential for vulture conservation was evaluated. This evaluation was undertaken by examining three sets of postulates: hypothesized benefits, potential sources of conflict and possible disadvantages of vulture restaurants.

Hypothesised benefits

At the 1997 Vulture Study Group conference in Kimberley six benefits of vulture restaurants to vulture conservation were hypothesised (Verdoorn 1997; van Rooyen *et al.* 1997).

1. *Supplementary food*. By placing food at a vulture restaurant more food is made available to the vultures than they would normally receive in that area (van Rooyen *et al.* 1997).
2. *Provision of bone fragments as a source of calcium supplementation*. The problem of calcium deficiency and osteoporosis and other skeletal abnormalities in Cape Griffon *Gyps coprotheres* nestlings was first documented almost 30 years ago (Mundy & Ledger 1976). The use of vulture restaurants to provide a calcium supplement in the form of bone fragments together with fresh meat has been a successful conservation tool for over 20 years (Richardson *et al.* 1986).
3. *Provision of poison-free food*. It was suggested that placing poison-free carcasses at a vulture restaurant would draw vultures away from nearby regions where poison was being employed, possibly for problem animal control (Verdoorn 1997) and this is being tried in the Indian sub-continent (I. Rushworth personal communication).
4. *Attracting vultures back to previously used areas*. Examples were provided of vulture restaurants being used to attract Cape Griffon, African White-backed *G. africanus*, Bearded *Gypaetus barbatus* and Lappet-faced *Torgos tracheliotos* Vultures back to areas where they had previously occurred (Verdoorn 1997).
5. *Stabilising vulture populations*. Evidence was advanced to suggest that providing supplementary food at the right place at the right time could improve the survival probabilities of fledgling Cape Griffons (Verdoorn 1997). The Cape Griffon breeding colony at Potberg was the case in point, where the provision of supplementary food was correlated with an increase in the proportion of first-year birds surviving (Piper *et al.* 1999).
6. *Diverting vultures away from lamb-predation*. A convincing argument was presented for the use of supplementary food placed at vulture restaurants to divert vultures, especially young birds away from

vulnerable livestock, especially small-stock during the birthing season (Verdoorn 1997), though no concrete examples were given of this.

However, it is the nature of all solutions that they are never perfect and an earlier investigation into the conflicts generated by vulture restaurants (Piper 2004) identified seven areas of potential conflict.

1. *Fences*. Birds fly into fences and injure themselves.
2. *Unwanted species attracted to vulture restaurants*. These include feral and domestic dogs, Black-backed Jackal, Brown Hyena, mongoose spp., Porcupine, Chacma Baboon, Warthog, Bushpig and fly spp. Furthermore, cattle attracted to a vulture restaurant sometimes eat the bones lying around (i.e. osteophagy) and may become ill.
3. *Theft of meat*. Meat is stolen from vulture restaurants by farm labourers and other local people.
4. *Power-lines*. If a restaurant is placed too close to a power-line then birds will be attracted to sit on it and potentially increase the number of collisions and electrocutions.
5. *Reservoirs*. Especially in the drier parts of the subcontinent, vultures are attracted to livestock watering points wherein they may drown.
6. *Poisons*. Livestock that have been killed using barbiturates and other drugs may in turn cause the death of vultures. Furthermore, the use of non-steroidal anti-inflammatory drugs (NSAID's) to treat livestock, that subsequently die and are then made available to vultures can cause high numbers of mortalities (Oaks *et al.* 2004).
7. *Other human interactions*. Photographers may find the presence of a ringed (i.e. marked) bird irritating.

In addition to the above advantages and disadvantages of vulture restaurants three human uses of vulture restaurants have been identified.

1. *Eco-tourism*. It is now well-established that certain popular vulture restaurants attract many visitors wishing to see and photograph vultures (Verdoorn 1997).
2. *Research*. Vulture restaurants are places where vultures may be observed and researched at close quarters (van Rooyen *et al.* 1997).
3. *Education*. Vulture restaurants have a great potential for introducing vultures and other scavengers to people, especially children (van Rooyen *et al.* 1997).

To understand the context in which Vulture Restaurants operate in southern Africa it is necessary to take into account two additional factors.

1. *Loss of natural, or conserved areas.* As the human population grows and as the demand for a higher standard of living grows with it the pressures on land are increasing. This has two consequences. First, the area of untransformed land is continuously decreasing with time thus leaving less and less land for large birds to forage over. Second, the areas between these conserved patches are becoming more and more different and so the conserved lands are more and more isolated (van Rooyen *et al.* 1997).

2. *Livestock farming is in decline*. Around southern Africa commercial livestock farming is in decline – this is due livestock theft and a drop in profitability.

The Cape Griffon is already largely commensal with humans and is dependent on domestic livestock for the major portion of its food. All that has changed is the mode of delivery, once they used to feed on dead livestock left in the veld but today they feed at vulture restaurants. To provide some insight into the role that vulture restaurants actually play in southern Africa the following set of key questions is asked. How many vulture restaurants are there? Where are they located? How has their number grown with time? Who operates them? How much food goes to vulture restaurants? How much extra food goes to vulture restaurants? How many vultures can survive on the food put out at vulture restaurants? Can vultures become dependent on food put out at vulture restaurants? In what ways are vultures vulnerable when they come to vulture restaurants?

Methods

To answer these questions a data base was designed, a telephonic survey was undertaken of all known vulture restaurants and on-the-ground visits were made to many vulture restaurants around southern Africa.

Data-base: a spatial and relational database was constructed in *MS Access* in which all data relating to the location, provisioning and operation of a vulture restaurant could be recorded. The data base was spatial in as much as it had the co-ordinates of each vulture restaurant and was linked to a geographic information system. The database was relational in that there was no duplicate information, information required for two or more vulture restaurants, e.g. names and address of operators and informants were stored in a single table with pointers to the vulture restaurants where the data were required.

Telephonic survey: all known vulture restaurant operators were contacted and interviewed over the telephone. Their names were gleaned from conversations with nature conservation officers, leading farmers etc. Once vulture restaurant operators were contacted they were telephoned each year, or so, and asked for the names of other vulture restaurant operators in their district.

On-the-ground survey: many vulture restaurants were visited by a field-worker or Nature Conservation officer and the operators were interviewed and their entries in the database updated.

In addition, my annotated and computerised bibliography of vulture references was scanned for any references referring to vulture restaurants or supplementary feeding and these were also added to the database.

Results

<u>How many vulture restaurants are there? Where are they located?</u>

From the database it was found, in late 2002 and early 2003, that a total of 257 vulture restaurants had been documented around the world (Table 1).

However, no attempt was made to ensure complete coverage outside southern Africa. Of these 242 were in southern Africa and of these 137 were active in the region and 124 were active in South Africa (Table 2).

Table 1. List of vulture restaurants located around the world.

Country	Total	Active	Closed	Dormant	Never Started	No restaurant	Not yet used	Unknown
Austria	2	1	1					
Belize	1							1
Botswana	3	1	2					
France	1							1
Greece	1							1
India	1							1
Israel	1	1						
Italy	1							1
Mallorca	1							1
Namibia	9	7	1	1				
North America	2	1	1					
Sardinia	1							1
Serbia	1							1
South Africa	220	124	51	13	5	5	14	8
Spain	1							1
Swaziland	8	5	1	1	1			
Yugoslavia	1							1
Zimbabwe	2		2					
Totals	257	140	59	15	6	5	14	18

How has the number of vulture restaurants grown with time?

Vulture restaurants in southern Africa have grown exponentially in number since the first reported in 1948, growing at about 9.6% p.a., though this rate may be falling off since 2001 (Figure 1).

Table 2. List of vulture restaurants located in southern Africa.

Country	Total	Active	Closed	Dormant	Never Started	No restaurant	Not yet used	Unknown
Botswana	3	1	2					
Namibia	9	7	1	1				
South Africa	220	124	51	13	5	5	14	8
Swaziland	8	5	1	1	1			
Zimbabwe	2		2					
Totals	242	137	57	15	6	5	14	8

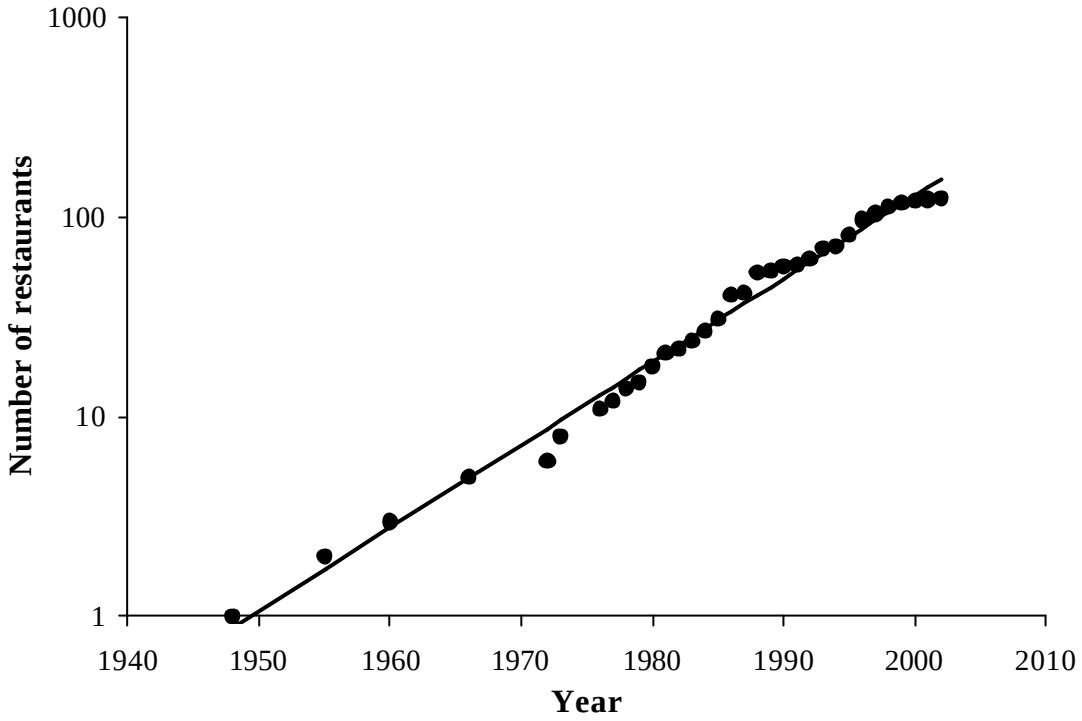

Figure 1. Growth in new vulture restaurants started each year. Growth rate is about 9.6% p.a.

Who operates them?

Approximately 18% of active vulture restaurants are operated by public-sector organisations (i.e. Nature Conservation agencies etc.) but the vast majority, 82% are operated by commercial livestock farmers who see vulture restaurants as a tool for live-stock management.

How much food goes to vulture restaurants?

How many vultures can survive on the food put out at vulture restaurants?

As far as I can ascertain, there is only one vulture restaurant where a complete record is currently being kept of the total quantity of food supplied to the vultures. This is on the farm *Minnehaha* on the Oribi Flats in southern KwaZulu-Natal (M. Neethling personal communication). Approximately 40 cow-sized carcasses p.a., i.e. 16 000 kg p.a. or 43.8 kg per day of which approximately two-thirds is available to vultures (Mundy *et al.* 1983), i.e. 29.2 kg per day. An adult Cape Griffon needs approximately 0.52 kg per day, on average (Komen 1992). Thus about 56 adults could survive at this restaurant, outside the breeding season, provided the food supply was regular. This colony holds about 40 breeding pairs that produce just under 30 fledglings each year (Piper & Neethling 2002). Thus just before they start breeding there is enough food for about 70% of the birds and just after they have fledged their young there is enough food for about 50%. Notwithstanding this analysis, it is not possible to say for the any part of southern Africa how much food is being provided to vulture restaurants nor how many vultures can feed from this food.

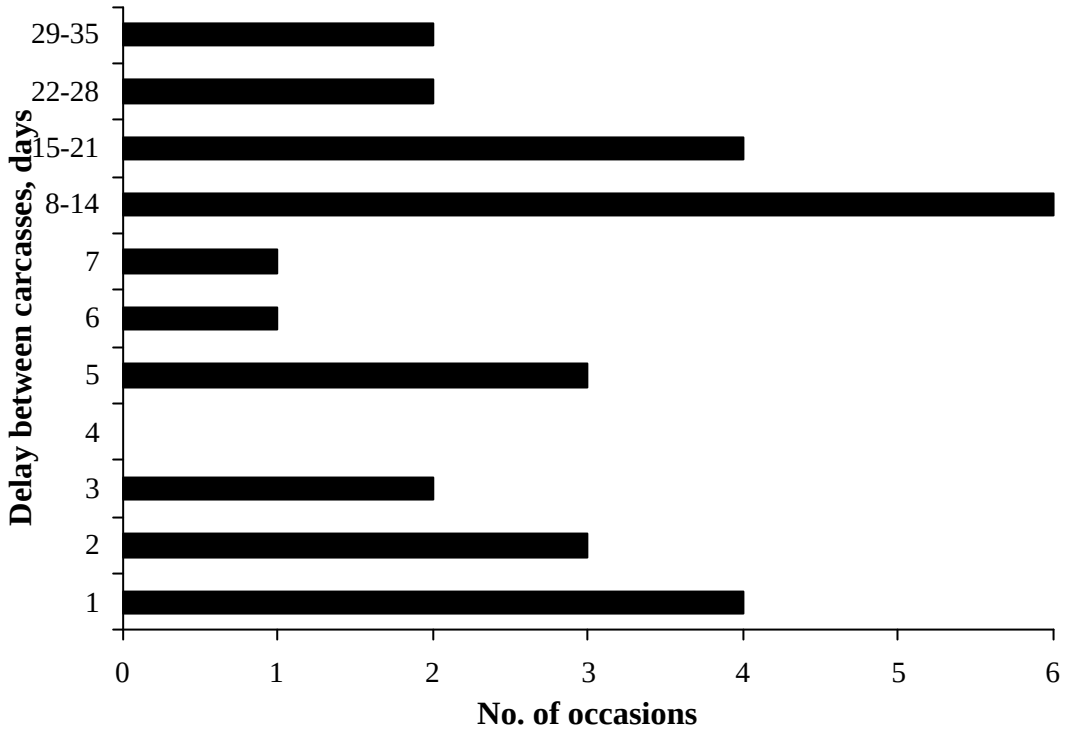

Figure 2. Delays between the delivery of successive carcasses to the vulture restaurant on the farm Minnehaha, Oribi Flats, southern KwaZulu-Natal, data over nine and a half months from Mr. Mike Neethling (personal communication).

How much extra food goes to vulture restaurants?

In days gone by if a beast died on a commercial livestock farm it was either given to the staff or buried, provided it was not fit for human consumption. It only went to the vultures if they got to it first. These days dead livestock is not left out for fear of disease and fear of theft. Furthermore, many commercial livestock farmers deliberately take their dead animals to vulture restaurants, often on another farm, because they fear that giving the meat to their own staff will encourage the staff to kill more livestock.

Can vultures become dependent on food put out at vulture restaurants?

It is easy to suspect if reasonable quantities of food are placed at a vulture restaurant that vultures could become dependent on it. However, this does not take into account that the carcasses may be placed at the vulture restaurant in a temporally random fashion. Some carcasses may arrive one after another while others may only come after a long delay. To test this, the temporal sequence of carcasses arriving at the *Minnehaha* vulture restaurant was examined (Figure 2). From this it can be seen that there were at least eight periods of more than 14 days when there was no food available for the vultures. Given that 14 days is about the period of time that a vulture can starve for and still survive (Jarvis et al. 1974; Mundy 1984; Boshoff & Robertson 1985) though it has been suggested that it could even survive for up to a month without food (Mundy & Marais 1981) it is likely that the vultures of Oribi Flats would have had to go and forage elsewhere in order to survive.

This suggests that they would not become dependent on the vulture restaurant.

In what ways are vultures vulnerable when they come to vulture restaurants?
Because vultures congregate at vulture restaurants they are susceptible to direct (harvesting for traditional medicine) and inadvertent (animal was killed using a barbiturate etc.) poisoning and to persecution. If the vulture restaurant is close to a power-line or a reservoir birds can die as a result of collision, electrocution or drowning.

Conclusion

Vulture restaurants are increasingly seen as an integral part of livestock management in the commercial sector and in general this has lead to an improved attitude to vultures by that landowner and the surrounding landowners. By and large, vulture restaurants are here to stay but need to be managed so that they do not endanger an already endangered suite of birds.

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Section D

Review of progress since 1997

Seven years hence – what have we been up to? A summary and review of progress made since the 1997 workshop

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Introduction

This invited paper provides a broad, independent summary and review of progress made in implementing the main outcomes of the Vulture Study Group (VSG) workshop held in Kimberley in 1997 (Boshoff *et al*. 1997). The aims of the 1997 workshop were as follows:

- To bring together people interested in vultures to exchange information and ideas, and establish collaborative networks.
- To determine whether the research and conservation momentum of the 1970s, 1980s and early 1990s has been maintained.
- To obtain a "snapshot" of the current situation regarding vulture status and research and conservation activities.
- To identify gaps and priorities.
- To explore ways of making research and conservation activities better planned and co-ordinated.

Approach followed

This paper is structured around the three sections listed below. Comment is provided where this is considered to be necessary and appropriate.

1. A brief summary of actions related to the Research and Conservation Priorities identified in 1997.
2. A list of topics discussed at VSG meetings in the 2000-2004 period.
3. Commentary on each of the points listed under the chapter titled "The Way Forward" in the 1997 workshop proceedings.

1. 1997 Research and Conservation Priorities (*cf.* Boshoff *et al.* 1997)

1.1 Research Priorities

Each topic identified in 1997 is listed, together with a brief statement that captures the essence of the topic or issue at stake and actions taken, in Table 1.

Table 1. Research topics identified in 1997 and commentary on actions taken.

Research priority	Brief description	Actions taken since 1997
Collection of specimens	Specimens are useful for research and education purposes and therefore their effective collection needs to be promoted.	Little progress.

Research priority	Brief description	Actions taken since 1997
Foraging and food	How do vultures locate their food? What is the daily foraging range of a vulture? What is the relationship between vulture population size and the food base?	Projects initiated on Cape, African White-backed and Lappet-faced Vultures in Namibia. A project that models foraging in KwaZulu-Natal.
Calcium metabolism in nestlings	Needs to be investigated further	No new studies; scientific paper in press.
Population dynamics	More effort is required to count, map and age populations, and to establish the fecundity, immigration and emigration rates.	Some work in progress on Cape, African White-backed and Hooded Vultures in South Africa, Namibia and Swaziland. Opportunistic data collected. Analysis of data to determine survival rates of adults and juveniles at the Potberg colony.
Population structure and dispersal	These parameters need to be researched and understood.	Studies conducted on African White-backed Vultures in the Kimberley area. Some marking of Cape, African White-backed and Lappet-faced Vultures in Namibia, Swaziland and South Africa.
Anthropogenic causes of mortality and their effects	The impacts of each cause of mortality need to be quantified. Does unnatural mortality replace natural mortality?	Some opportunistically collected records but no data analyses and interpretation.
Impacts of vulture restaurants as management tools	Are they really effective? Do they actually contribute to vulture survival? Can and will the vultures survive without them? What are the social consequences?	No action, apart from a limited study to investigate possible "dependency" in KwaZulu-Natal.
Population genetics of southern African vultures	What are the intraspecific genetic relationships of the Cape Vulture? How great is the genetic diversity?	Study completed on genetic variation in African White-backed Vultures. Study completed on the phylogenetics of four species.
Global warming and changing land-use patterns	What will the effects be on vultures?	No action.
The behavioural repertoire of vultures	Still more to be learned about behaviour and calls – and their biological significance.	No action.
Impacts of the use of vultures for traditional medicine	What is the impact of harvesting?	Investigations conducted in Namibia and KwaZulu-Natal. Identified as a possible threat in Lesotho.

Research priority	Brief description	Actions taken since 1997
Effects of agrochemicals on fecundity	What are they?	No new initiatives. Identification of the possible threat of NSAIDS (e.g. diclofenac) to African vultures; scientific paper published; detailed investigation in southern Africa being planned.
The need for more effective marking and tracking devices Evaluation of some marking techniques	Evaluate the current ones and consider new and more effective ones.	Good progress in the use of satellite telemetry on vultures in Namibia; some progress in KwaZulu-Natal. Report produced on the use of colour rings.
Cohort studies	What is the importance of cohorts in social interactions? More studies on this complex phenomenon are required.	No action.
Re-introduction of the Egyptian vulture to South Africa	This may be feasible and suitable sites exist, but first research the reasons for the decline in these areas. Analyse literature records and records of vagrants.	No progress.
Centralised information service	Essential if effective research is to be conducted. VSG should be responsible for making it happen, and for housing it.	No effective action.

Additional research activities

A number of additional research activities, i.e. not related to the 1997 priorities, were initiated and conducted in the post-1997 period. These are listed below.

Disease

Study on blood parasites in African White-backed Vultures in the Kimberley area.

Initiatives to investigate anthrax and botulism in vultures in Namibia.

Nest site selection

Studies on African White-backed Vultures in the Kimberley area, and in Swaziland.

Capture techniques

Investigation conducted In Namibia.

Physiology

Measurements on Cape and African White-backed vultures in Namibia.

Field guide for collecting biomaterials produced.

Biology and biometry

Project initiated to sex male and female Cape Vultures initiated in Namibia.

Measurements and moult of White-backed and Cape vultures in progress in Namibia.

Crop content differences of male and female Cape Vultures being studied in Namibia.

Comment
Of the 16 research priorities identified in 1997, some have been addressed reasonably well, some have received relatively little attention, and others have received no attention at all.

With hindsight, a shortcoming of the 1997 workshop was the lack of any attempt to prioritise the listed topics. However, to what extent such a process may have directed and focused post-1997 activities is not known.

A number of new activities, that are not directly related to the priorities listed in 1997, have been initiated.

1.2 Conservation Priorities

Each self-explanatory topic that was identified in 1997 is listed, together with a brief report on action taken, in Table 2.

Table 2. Research topics identified in 1997 and commentary on actions taken.

Conservation priority	Action taken since 1997
Address the threat of farm reservoirs	Database maintained in Kimberley. Scientific paper published.
Monitor the impacts of agrochemicals and problem animal control methods	Project to measure lead levels in African White-backed Vultures in the Kimberley area. Advice on controlling problem animals. Information provided on poisons by the Poison Working Group. Recording of poisoning events.
Address a lack of, or unsuitable, policy and legislation and illegal trade	Policy developed for Gauteng Province; other provinces are expressing interest in this document.
Habitat destruction and unsuitable land-use	Project to investigate the effects of different land-use practices on African White-backed Vultures in the Kimberley area.
The threat of electrocutions	A mitigation project in KwaZulu-Natal and in the Northern Cape (modeling vulture movements and the mechanics and impacts of vulture streamers). Investigation of electrocutions caused by certain types of pylon configurations. Investigation of pylon modifications.
Address the issue of traditional medicine	No specific actions taken?
Non-sustainable hunting of game	No action.
Reduce levels of persecution	An awareness campaign has resulted in farmers being more tolerant of vultures in the Overberg (Potberg) area.
Reduce disturbance levels	Attempts made to reduce disturbance from low-flying aircraft at Potberg and in the Magaliesberg area. A Cape Vulture colony in Botswana now in a government reserve.

Conservation priority	Action taken since 1997
Improve co-ordination between vulture conservation initiatives	No evidence of focused action.
Monitor breeding colonies and roosts	Various initiatives undertaken to monitor Cape, African White-backed and Lappet-faced vultures in South Africa, Namibia, Botswana and Swaziland. Most monitoring is of an irregular, opportunistic, non-systematic and uncoordinated nature. Cape Vulture site register being maintained. Occasional records of Egyptian and Palm-nut vultures.
Address food shortages	The possibility of obtaining carrion for vultures from feedlots being investigated in KwaZulu-Natal; little progress to date. A number of vulture restaurants are being maintained, new ones are being established and the VSG is encouraging farmers and conservationists to consider establishing them.
Attitudes and ignorance (within the farming community)	A largely successful awareness campaign in the Potberg area.
Evaluate the conservation effort	No action.
Threat of declining conservation budgets	No evidence of action.
Address socio-economic priorities	No action.
Collect additional biological and ecological information	Little progress made; some action in Namibia.

Additional conservation activities

A number of additional conservation activities, i.e. not related to the 1997 priorities, were initiated and conducted in the post-1997 period. These are listed below.

Vulture restaurants

A comprehensive list of sites and a bibliography has been compiled. Various articles and reports have been produced, including a brochure and booklet.

Articles

Articles have been produced on various topics, e.g. disease vectors.

Bibliographies

Work has been conducted on vulture bibliographies for Zimbabwe, South Africa and the world.

Comment

Of the 17 conservation priorities identified in 1997, some have been addressed to a greater or lesser degree, whereas others have received no attention at all.

As with the research priorities, no attempt was made to prioritise the conservation topics listed in 1997. This may have contributed to the seemingly *ad hoc* approach to addressing these topics.

A number of new activities, not directly related to the priorities listed in 1997, were initiated in the post-1997 period.

2. Vulture Study Group activities

This section provides a simple list, grouped according to five categories, of the activities discussed at VSG committee meetings during the period 2001 to early 2004. This aims to provide an overview of the scope and nature of the VSG's interests during this period.

2.1 Research matters

No references to any new and fundamental research questions are evident, other than mention of a planned investigation of the possible NSAID threat to African vultures. Some work is being conducted in Namibia on new capture, marking and tracking techniques.

2.2 Conservation matters

The following topics were discussed:

- A PHVA for the Cape Vulture.
- Monitoring of Cape Vultures in KwaZulu-Natal.
- A marked bird database, including colour ring data.
- Sampling of vulture carcasses.
- The Sasol Vulture Monitoring Project.
- A site register for the Cape Vulture
- Collection of opportunistic data on mortalities and numbers of birds from regional workers.
- African White-backed Vultures in the Kimberley area.
- Survey of African White-backed Vulture breeding colonies in the Northern Cape.
- Certain local monitoring initiatives (Kruger National Park, Little Karoo, KwaZulu-Natal).
- An action plan for the Lappet-faced Vulture.
- The re-introduction of Cape Vultures into Namibia.
- Vulture restaurants: resultant conflicts with farmers.
- A guide to vulture restaurants.
- Feed lots: making food available to vultures.
- The Blouberg vulture project.
- The use of captive Cape Vultures in powerline projects.
- Advice on controlling problem animals.
- The provision of information on poisons by the Poison Working Group.
- The African Vulture Monitoring Committee.
- Vultures, powerlines and the Addis Ababa abattoir.
- Rehab and captive breeding at the De Wildt Vulture Unit.

2.3 Awareness and Information Dissemination

A wide range of topics was discussed:

- The species accounts for Roberts VII.
- A "Farmer's and Vultures" booklet.
- A documentary film on vultures.
- A vulture roadshow.
- The AfRap Centre.

- The Marakele vulture trail.
- Displays.
- *Vulture News* and *Gyps Snips*.
- An annotated vulture bibliography and a vulture restaurant register and bibliography.
- Brochures, decals, stickers and posters.
- Popular articles.
- Assorted radio and TV items.
- The Kalahari Raptor Route initiative.

2.4 Fund raising

Various initiatives were discussed, some of which were acted upon.

2.5 Co-ordination and planning

The following items were discussed:

- The VSG strategic plan.
- Activities of the VSG regional representatives.
- A KZN-VSG partnership.
- The Eskom-EWT partnership.
- Plans for the 2004 VSG workshop in Kimberley.

Comment

The broad range of topics listed under 2.2 fits reasonably well with the 1997 conservation priorities, listed in Table 2. Whilst virtually all the activities listed in 2.1-2.5 above are specifically or broadly relevant to the outcomes of the 1997 workshop, and to the work of the VSG, the overall impression gained is one of matters being discussed by the VSG committee on a largely individual and *ad hoc* basis. In other words, there is apparently no conscious attempt by the committee to link individual activities to an overarching strategic plan. This was particularly noticeable when funding for certain activities was discussed. There did not seem to be any "big picture" analysis.

3. Opinions and perspectives on general progress since 1997.

In the 1997 Proceedings nine points were listed under the heading "The Way Forward". Each point is repeated here, together with the author's opinions and perspectives relating to each point, based on his interpretation and broad analysis of the contents of Sections 1 and 2 above, and on discussions and presentations at the 2004 workshop.

1. *Future research and conservation actions require prioritization, and also better planning and co-ordination.*

Comment:

We do not seem to be asking any new, fundamental research questions. Instead, we appear to be continuing to implement conservation actions suggested by earlier research (albeit it of high quality and appropriate in nature).

There is no clear indication of the overriding questions and hypotheses that underpin current research projects. It is therefore not clear how the results from these projects will be used to improve our overall knowledge of vulture biology, ecology and conservation.

Vulture workers are as enthusiastic and committed as ever and data gathering continues apace. However, most of this is on an unco-ordinated, non-systematic and opportunistic basis, thereby detracting significantly from its overall value. Data gathering is not research, *per se*, and for it to be of maximum value, better planning is required.

Clearly, many data and much information exists but it is not easily accessible to other vulture workers. It is important that actions be taken to remedy this situation.

There is still no obvious attempt to prioritise research and conservation activities within the southern African sub-region. A number of seemingly unco-ordinated and individually planned activities are taking place, mostly within two "hotspots", namely the Northern Cape and Namibia (with a third "hotspot" developing in KwaZulu-Natal). In order for these activities to have maximum effect on the survival of the vultures, especially the endemic and near-endemic species (Cape and Bearded vultures, respectively), higher levels of prioritisation, co-ordination and co-operation are necessary.

The VSG needs to be far more pro-active and firm in identifying, catalyzing, co-ordinating and facilitating strategic and systematic research and conservation programmes in southern Africa (without being prescriptive in the process). Given the diversity of the VSG members, there will probably always be a situation where individuals will initiate and pursue local activities that interest them, and that they can find the time and funds for. The challenge for the VSG, and the broader vulture worker community, is to try and direct these activities in such a manner that they have maximum benefit for our declining vulture populations in the wild.

2. A regular and objective evaluation of current research and conservation programmes is necessary. Conservation actions must be based on good research.
Comment:
There has still been no proper evaluation of our conservation effort (*cf.* 1997 Proceedings). Are we winning or losing the fight for the survival of the sub-region's vultures? It appears that, despite all the good work of the past 25 or so years, the Cape and Bearded vulture populations continue to decline; that of the latter at an alarming rate. In this regard, we require more effort to evaluate the data and information that we have collected, and continue to collect.

Increasing attention is being paid to the establishment of vulture restaurants but we still do not understand the possible threats and benefits associated with them (*cf.* 1997 Proceedings). Surely this is now a high research priority?

There are no obvious attempts to measure our actions against the VSG's strategic plan and the priorities identified in 1997. No "impact indicators" could be identified during the course of the review presented here. Hopefully, the more objective process followed in the 2004 planning workshop to identify research and conservation priorities for the future will lead to a plan of action that will be broadly adhered to and regularly monitored. Unless this is done, these VSG workshops will fail in their endeavours to compile and implement a framework for the future.

There are a number of VSG-supported activities that soak up a lot of time, effort and funding but seem to have little or no direct or indirect impact on the survival of the vultures in the wild. We must ensure that our limited human and financial resources have maximum impact. To address this issue, it is suggested that each VSG-supported activity be evaluated (ranked) in terms of its relative contribution to conserving vultures in the wild. Those with a low ranking could be downgraded in the quest for funding, and those that have a high ranking could receive priority for funding. Put alternatively – initiatives with direct impact/benefit should get preference over those with indirect impact/benefit. Further to this, perhaps more attention should be given in the future to critical fieldwork requirements, at the expense of "nice to have' desktop products. Finally, it is considered that scarce VSG funds should not be used to keep large number of non-releasable vultures in captivity.

3. There needs to be better communication between vulture workers, and better dissemination of information.
Comment:
It was not possible to evaluate progress here. This could perhaps only be done with the aid of a questionnaire survey, an action that is beyond the scope of this paper. It is recommended that such an action be attempted by the manager of the VSG.

4. A centralized and up to date information database is urgently required (housed and curated by the VSG).
Comment:
This is still not in place. For example, the VSG does not have a list of the current research projects and conservation actions being undertaken across southern Africa. Data and information remain largely scattered throughout the region, in the files of individual vulture workers. Data and information currently at the VSG are not being properly curated in an electronic and easily accessible format.

S. Piper has done a tremendous job over the years to create and maintain various databases (which he is happy to share with other workers) but should his personal circumstances change they will be discontinued or lost. In addition, it is surely not appropriate for S. Piper to have to be bothered by other workers who seek access to his databases.

5. The relationship between the scientists and the "hands-on" conservationists must be improved.
Comment:
It was not possible to evaluate progress here. This could perhaps only be done with the aid of a questionnaire survey, an action that is beyond the scope of this paper. It is recommended that this action be attempted by the manager of the VSG.

6. The activities of volunteers must be such that they retain their interest and motivation.
Comment:
Judging by the excellent attendance at the 2004 workshop, it is considered that volunteer interest and motivation is being successfully retained.

7. The VSG needs to re-assess and re-plan its role as an action and co-ordinating body. Given the challenges facing the vultures of southern Africa, all our research and conservation efforts must be focused, for the present, on this region.
Comment:
The VSG is still not successfully fulfilling its mandated task. Hopefully the outcomes of the planning session at the 2004 workshop will successfully address this issue.

The point was made that the VSG should perhaps consider introducing a mentorship programme for young people that are becoming involved in vulture research and conservation activities.

The greater part of our work continues to be focused on southern Africa.

8. Hold similar workshops at three-yearly intervals.
Comment:
Perhaps this is too ambitious, given the costs and logistic challenges. A five-year interval may be more appropriate.

9. Many vulture workers are ageing and a new generation needs to be spawned.
Comment:
The relatively large number of young people, reflecting an increased gender and racial diversity, at the 2004 workshop is extremely encouraging and bodes well for the future. However, there is perhaps cause for concern at the paucity of young scientists in the vulture research and conservation field.

General comment

Undoubtedly, much has been achieved in the period since the 1997 workshop. There are, however, still many challenges facing us in our endeavours to secure the conservation of the vultures of our region. Notwithstanding the problems mentioned in this review, it is highly encouraging that there a lot of enthusiastic and committed people out there who are doing their best, usually under very difficult circumstances, to contribute to the achievement of this overall goal.

Clearly we must do more to achieve our stated aim of compiling and implementing a framework for action that includes better identification, prioritisation and co-ordination of activities, and more effective allocation of funds for key projects. The outcomes of the planning workshop at the 2004 workshop (these Proceedings) will undoubtedly make a significant contribution here. Unless we can get this right, we shall continue to witness the decline of our vulture populations, and especially those of the Cape and Bearded Vultures.

It is also very clear that the role, functioning and performance of the VSG need to be re-assessed. Many vulture people see it as a "home" and expectations have been created that it will provide a range of associated services, e.g. direction, advice, materials, and information. These expectations have not been fully met and this has impacted negatively on its reputation as a dynamic and successful conservation body.

Acknowledgements

Grateful thanks go to the VSG for the invitation to present this paper at the workshop, and specifically to Kerri Wolter (VSG manager) for providing a selection of VSG documents, and to Mark Anderson for assistance in sourcing information on recent and current research and conservation activities. Colleague Mark Anderson kindly commented on an early draft of this paper.

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