Chancellor, R. D. & B.-U. Meyburg eds. 2004
Raptors Worldwide
WWGBP/MME

Proposed global Population-monitoring Scheme for the Cape Griffon *Gyps coprotheres*

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ABSTRACT

The Cape Griffon *Gyps coprotheres* is endemic to southern Africa and is rated as *vulnerable* with a population, in 2000, of about 8,000 individuals, including about 3,000 breeding pairs. There is a clear need to have an accurate estimate of the current population size and to put in place a long-term monitoring programme to detect changes in the population, in space and time. Using current estimates of the spatial distribution of the world population, priorities for a counting and monitoring scheme are advocated.

INTRODUCTION

The Cape Griffon *Gyps coprotheres* is endemic to southern Africa with only a handful of sight records to the north in Zambia (Mundy, Butchart, Ledger & Piper 1992; Mundy, Benson & Allan 1997). The population size in 2000 was estimated to be about 8,000 individuals including just over 3,000 breeding pairs and it is reckoned that the breeding population had declined by about 15% between 1980 and 2000, i.e. –0.79% p.a. (Piper, Mundy & Vernon, in prep). The global population is rated as *vulnerable* (BirdLife International 2004).

The Cape Griffon has been the focus of attention by the Vulture Study Group (VSG) and has been at the centre of vulture conservation in southern Africa for the last 30 years. It is the VSG's 'flagship species' and is likely to continue to be the focus of attention for the foreseeable future (Mundy 1984; Mundy *et al.* 1992).

In the early 1980s the VSG formulated a conservation strategy for the Cape Griffon, based on seven principles: research, protection, education, management, population modelling, population monitoring and co-ordinated planning (Plunkett 1978; Mundy 1984). This paper is primarily concerned with monitoring the entire world population. There are two principal reasons for wanting to monitor the Cape Griffon. 1. It is only with population monitoring that it is possible to evaluate the effectiveness of conservation measures. 2. Population monitoring is the best method of detecting new sources of mortality (Anderson & Mundy 2001; Anderson, Mundy & Virani 2003; Virani, Gilbert, Watson, Oaks, Chaudhry, Arshad, Ahmed, Mahmood, Ali, Baral, Giri, Benson & Kahn, 2003).

Currently all known observations of breeding and roosting Cape Griffons are being collated in a document called the *Site Register* (Piper *et al.*, in prep; see references therein). In the *Site Register* are recorded all published and privately communicated counts at all known and suspected breeding colonies and non-breeding roosts, collectively known as sites. The first Cape Griffon breeding colonies were formally recorded soon after European settlers arrived in southern Africa and a total of over 400 putative sites have been recorded to date (Piper *et al.*, in prep). These sites include documented breeding colonies and non-breeding roosts, both active and abandoned as well as vulture place names, e.g. *Vulture's Retreat*, *Aasvoelkop*, *Xalanga* etc. (Boshoff & Vernon 1980). From these data it has been possible to provide estimates of the population size and spatial distribution over the period 1975 to 2000, with estimates for some sites in earlier times. Unfortunately these estimates are of rather uneven coverage and varying levels of reliability (Piper *et al.*, in prep).

There have been some exemplary monitoring programmes for individual breeding colonies where a precise, repeatable and consistent technique has been used for many years and the results have been published (e.g. Colleywobbles: Vernon 1999; Vernon 2003). In some cases the raw data have been published as well (e.g. Vernon & Piper 1991). For some regions there have been blanket monitoring programmes for the entire region for extended periods and the results have been published (e.g. Botswana up to 1999: Borello & Borello 2002). However, there have been many extrinsic sources of variance. Among these are different counting methods used by different persons at the same colony, or colonies, in different years, e.g. Roberts' Farm, Nooitgedacht and Skeerpoort along the Magaliesberg Mountains in South Africa (Komen 1992; Ledger & Mundy 1976; Tarboton & Allan 1984; Verdoorn, Terblanche & Dell 1997). Three different census techniques were used in this example: ground-based counts with and without photographs with numbered nest sites and photographs taken from an aircraft (see above references). In some cases the monitoring of all the colonies and roosts in an entire region was successfully undertaken for a period of years, e.g. the former Transvaal Province, South Africa, for the period 1980-1985 (Benson, Tarboton, Allan & Dobbs 1990) but thereafter the coverage declined at some sites (Benson 1997). In some regions there was a well co-ordinated monitoring scheme but this was discontinued when the team leader left but was later re-instituted, e.g. the sites along the Drakensberg Mountain escarpment (Brown & Piper 1988; van Zyl 2001). The choice of region and/or colony as the object of a monitoring programme has been at the discretion of an individual or group. Consequently, the monitoring often continues because of their drive or enthusiasm and ends when they loose interest, move on or retire, etc., see examples above.

There are three classes of monitor that have bedevilled attempts to initiate and maintain a global monitoring scheme. *Protectionists* – observers who collect good data and mantle over it, refusing to share or reveal it until they have published it. *Exclusionists* – they have exclusive rights to enter the land around a colony, but do not count there while excluding other observers. *Graveyard scientists* – they collect good data but never publish it. (Names have been withheld to protect the guilty, myself included!)

From an examination of the past and current monitoring patterns around the sub-continent, many of which have been presented at annual VSG meetings (e.g. Boshoff, Anderson & Borello 1997), it is clear that the monitoring of this flagship species is unco-ordinated, erratic and idiosyncratic.

What is required of a monitoring programme? In my opinion it should provide three classes of data: 1. a definitive once-off census of the whole population, 2. a measure of the rate of change of the whole population with time and 3. some indications of internal shifts in the spatial distribution of the population. Naturally these data are required using the minimum number of trained field personnel and at least cost. Setting priorities for a census and a monitoring scheme is not enough; it is necessary also to give consideration to four organisational issues: allocating the region's meagre resources, managing the monitoring, providing a curator for the data and ensuring feedback to the conservation community and sponsors.

In this paper a global census and population-monitoring scheme is proposed for the Cape Griffon. This is designed to count the core of the population and thereafter provide a population-monitoring scheme, within the constraints of a limited number of observers and a small budget. This scheme is based on the insights gained from monitoring this species' demography over the last 25 years.

POPULATION DEMOGRAPHY AND SPATIAL DYNAMICS

Cape Griffons are obligatory cliff nesters and form colonies that vary from a few pairs to many hundreds of pairs; however, they are almost never solitary breeders (Mundy *et al.* 1992). In *Gyps* spp. vultures it is likely that individual breeders are faithful to their mate, their nest site and their breeding colony from one year to the next (Vernon, Piper & Schultz 1984; Leconte 1985; Robertson 1986). Thus it is probable, except for natural turnover, when a colony is enumerated at successive epochs (be they days, weeks or even breeding seasons) that the same individuals will have been monitored. Also, this implies that it is unlikely that the same breeding bird will be counted twice when enumerating two different colonies a few days apart.

Enumerating the non-breeding segment of the population is more difficult. In former times non-breeders would return to a breeding colony or a non-breeding roost at night and this was almost always a cliff face (Mundy *et al.* 1992). However, counting non-breeders at colonies and roosts is likely to underestimate their numbers these days. This is because non-breeding birds are now using power-lines instead of cliffs as roosts and so are not counted when breeding colonies and roost sites on cliffs are visited (Mundy *et al.* 1992).

If the population has many small sites it is then feasible to argue that the smaller sites are more likely to be abandoned as they are probably smaller because they are in food-poor areas. Small sites are also more vulnerable to disturbance, poisons etc. (P. Benson, unpubl. data). If the Cape Griffon is behaving demographically like a metapopulation then it is probable that the most remote sites, i.e. on the edge of the species' range, are most likely to be abandoned. Thereafter, they are least likely to be re-colonised because of their isolation (examples from other species: Soulé 1987; Lawes, Piper & Mealin 2000 and references therein). This certainly seems to be the case for remote sites such as Waterberg in Namibia (M. Diekmann, unpubl. data), Wabai Hill in Zimbabwe (P.J. Mundy, unpubl. data) and the sites in the Western Cape Province, South Africa (Shaw & Scott 2003).

Close monitoring of breeding colonies in Botswana has shown that when the number of breeding pairs has dropped at a breeding colony, or group of colonies, it has sometimes risen at another colony or group of colonies a year or two later (Borello & Borello 1987, 1993; Borello *et al.* 2002). It is suggested that this phenomenon be called 'colony switching'. Colony switching has also been noted in South Africa in the Western Cape Province (Boshoff & Currie 1981; Boshoff 1987), along the Magaliesberg, North West Province (Mundy 1983) and among the Eastern Cape/KwaZulu-Natal coastal colonies (S.E. Piper, unpublished data).

TO COUNT INDIVIDUAL BIRDS OR BREEDING PAIRS?

In designing a global population-census and population-monitoring scheme it is necessary to consider whether it is better to count individual birds or breeding pairs. It was concluded that it is better to count breeding pairs for three reasons.

1. Breeders are tied to a breeding colony for most of the year because a successful breeding attempt takes at least nine months of the year (Mundy *et al.* 1992), while sub-adults and non-breeders are free to wander about the sub-continent, which indeed they do (Piper 1994) and so are more difficult to enumerate.
2. Of that proportion of the adult population that is capable of breeding approximately 80%, on average, attempt to breed in any one year (Robertson 1984; Vernon 2003).
3. Breeders form at least 70% of the total population (Robertson 1984; Piper 1994).

Thus concentrating on the breeding sector of the population is probably an effective way of monitoring the population's core, provided the population age structure does not change radically.

PROPOSED GLOBAL POPULATION-CENSUS AND POPULATION MONITORING SCHEME

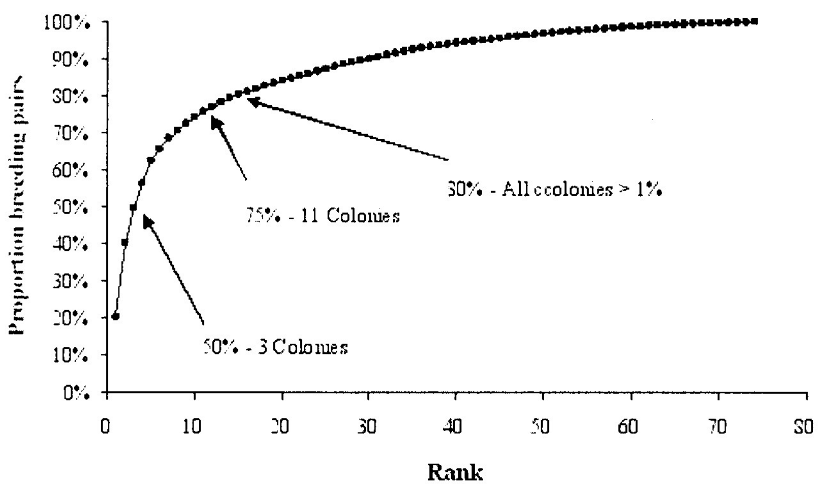
In my opinion, there are two central questions to be asked of a population-census and population-monitoring scheme: which sites should be monitored and how often should they be counted? As suggested above, monitoring breeding pairs is of higher priority than monitoring roosting non-breeders. If there was a surfeit of personnel and resources to count vultures in southern Africa then every site could be counted every year but clearly this is not so (see above), thus it is necessary to prioritise sites for counting. It is suggested that some sites should be monitored annually (Group A), others, once every five years (Group B), others, once every ten years (Group C) and that *ad hoc* visits should be made to a few sites (Group D). A rationale for each of these recommendations is presented below.

Group A.

Consideration is given first to those colonies that should be counted at least once a year.

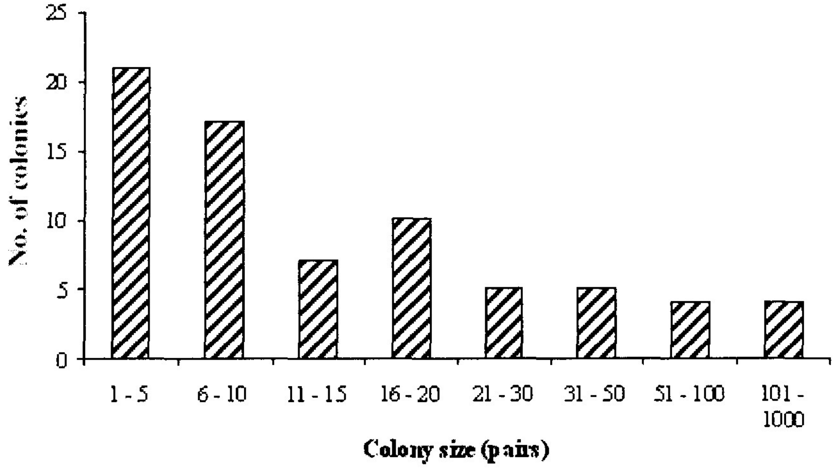
1. If the object is to monitor the highest number of breeding pairs with the least effort and cost, then obviously the best way to do this is to place the greatest effort into monitoring the largest breeding colonies. Also, the largest colonies contribute most to the estimate of total population size and so they should always be counted. Ranking the breeding colonies from largest to smallest shows that counting only the largest three colonies will result in almost half of the breeding population being monitored (Figure 1; Piper *et al.*, in prep). Counting the largest 11 colonies will result in 75% of the breeding pairs being monitored (Figure 1). This is clearly the best strategy if colony size is highly positively skewed with few large colonies and many small colonies (Figure 2).

Figure 1. Cumulative proportion of breeding Cape Griffons enumerated if the breeding colonies are counted in order of decreasing rank.



2. It is likely that the population is behaving as a metapopulation, see above, and so it is important to monitor those breeding colonies on the edge of the species' range.
3. In a region where colony switching is suspected, see above, it is important to monitor all the colonies in that region. Furthermore, if a colony starts to show an exceptional increase or decrease, then it is important to seek out nearby sites to see if the trend is regional in extent or if it is just a case of colony switching

Figure 2. Frequency distribution of breeding colony size.



4. In monitoring birds of wetlands of international importance the Ramsar Convention (Matthews 1993) has recommended that all sites holding more than 1% of the world's population be afforded special protection. By analogy, it is recommended that all colonies with more than 1% of the total population, i.e. about 30 breeding pairs, also be monitored annually. The largest 15 breeding colonies each hold more than 1% of the total population and between them they hold more than 80% of the total population and so have the highest priority for monitoring.

Group B.

Consideration is given to those sites that do not warrant monitoring every year. Among these are the smaller colonies and those sites that are just non-breeding roosts at which no breeding currently occurs and those at which birds bred in the past. For these sites the following recommendations are made.

1. All breeding colonies that are not included in Group A (i.e. to be monitored every year) should be counted at least once every five years. Splitting these into five approximately equal sets on a regional basis should make it possible to count all these sites by visiting just one-fifth each year.
2. All roosts holding more than 50 birds should also be visited at least once every five years.

Group C.

It is recommended that some sites should be visited once every decade. These to include all former breeding colonies, irrespective of their current status as a roost, just in case they have been re-occupied and no-one has noticed. For example, the breeding colony in Karringmelkspruitkloof held *ca.* 800 breeding birds in 1965 and these declined to a handful in 1990 (Boshoff 1990) but subsequently the colony was abandoned.

Group D.

Lastly, a case can be made for a once-off visit to certain sites: all newly reported sites, or sites that are reported to be active after having been abandoned, especially for some time.

WHEN TO CONDUCT A CENSUS?

In the above no suggestion has been made as to when during the year the sites should be counted. Outside of the coldest and wettest areas of the Eastern and Western Cape Provinces most Cape Griffons lay during the month of May. Most have completed their nests early in the month and even if they have not yet laid an egg they tenant the sites to prevent the nest site being usurped or the nest material robbed (Mundy *et al.* 1992). Thus a May count is likely to yield a good estimate of the total number of active breeding pairs. This, in turn, is likely to be about 80% of the potential breeding population size (Vernon *et al.* 1984). In the coldest and wettest parts of the sub-continent, e.g. breeding colonies in Karringmelkspruitkloof and at Potberg, the breeding season starts about a month later (Boshoff & Vernon 1987; Robertson 1983) and so these sites need to be counted a month later.

A second visit in the period mid-September through to end October will yield useful information on breeding success. In some cases this is the only way in which breeding failures caused by massive poisoning events during the breeding season can be detected. South African examples are Kransberg (i.e. Groothoek) in 1981-3 (Benson & Dobbs 1984), Kranskop in 1998 (Snow 1999), Umtamvuna in 1999 (Rush 1999) and Mkambati & Oribi Flats in 2000 (S.E. Piper, unpublished data) - all suffered large breeding losses mid-season.

DISCUSSION

There are two lessons that come out of the Asian vulture crisis (Virani *et al.* 2003). Firstly, a species can easily lose the vast bulk of its population without anyone noticing unless there is a reliable monitoring scheme. Secondly, the spatial extent of that loss can be greatly underestimated if the monitoring programme does not cover the species' entire range, especially the sites on the periphery. Furthermore, a monitoring programme is needed to be able to assess the success, or otherwise, of conservation action and to detect localised concentrations of unnatural mortality. In the light of these factors it has been recommended that the monitoring of vultures in Africa be intensified (Anderson *et al.* 2003; Anderson *et al.* 2001).

There is a need for a once-off census of the world population of the Cape Griffon to be able to provide a base-line against which to measure future monitoring actions and to assist in making a definitive assessment of the species' conservation status (BirdLife International 2004). Enumerating the breeding pairs at the sites identified under "Class A" above should cover about 80% of the known population.

The global population-census and population-monitoring programme presented here is specifically designed to incorporate these two lessons. By counting the largest colonies first, the bulk of the population is monitored. By monitoring peripheral sites changes in range can be detected. This monitoring programme also takes into account the fluidity of the population by selecting for monitoring those groups of sites between which colony switching may be taking place.

This set of priorities is based upon estimates of the breeding population at each site in 2000, drawn from the data assembled in the *Site Register* (Piper *et al.*, in prep). The *Site Register* is based on over 380 published papers and many thousands of unpublished and privately communicated records of breeding and roosting. This data set is very variable in its quality from sites counted every year for over 20 years to sites last visited up to 15 years ago. Because this base data set is imperfect, the set of priorities presented here is in turn unsound, in part at least. However, this is the best that is available and in the interests of conserving this species no further delays should be permitted.

Implicit in the design of this monitoring protocol is an assumption of stasis, i.e. breeding pairs are tied to their breeding site for life with little or no breeding dispersal. Notwithstanding this, it is understood that there have been sudden changes in numbers at groups of sites with increases at one or more sites and decreases at adjacent sites and an inference of colony switching has been drawn. However, without studies based on marked individuals it is impossible to know where the population lies on the continuum from perfect stasis to instability (P. Benson, pers. comm.) and the counting scheme presented here is designed to be robust against this lack of knowledge.

The resources (people and money) available to census vultures in southern Africa are limited and it is not possible to count every site within the species' range; hence it is necessary to prioritise the sites to be counted here. If the Group A sites are counted in the first year and all the Group B sites are counted in the first five years then all the known and suspected breeding colonies and major roosts will have been enumerated in five years. This will provide an excellent base-line estimate for the population as well as a consistent and reliable assessment of the population's trends in space and time. Naturally as the data flow in it will be possible to reprioritise sites when it is found that their breeding complement is higher or lower than originally believed. If the Class C sites are all counted in the first ten years, then all the known active colonies and roosts will have been enumerated.

In addition to just monitoring a colony once a year to assess its status it is strongly recommended that some sites be visited more than once a year in order to assess breeding success and exceptional breeding losses due to factors such as poison. While an initial census is recommended in May-June this will need to be adjusted in those regions where pairs breed earlier or later and existing local knowledge should be used to modify the counting date (P. Benson, pers. comm.). Where it is suspected that significant numbers of nest losses are missed, steps should be taken to vary the counting date, add more counts, if possible, and apply corrective measures (Mayfield 1961, 1975).

The population-census and population-monitoring scheme presented here puts in place a set of priorities for choosing which sites to count first and most often. However, it does not address four organisational issues. 1. How will the meagre resources available to the VSG be allocated? 2. How will the counting process be managed and who will ensure that the targets are met and quality standards are maintained? 3. Who will collate the data collected and who will archive and analyse it? 4. Who will prepare the annual reports and feedback to the counters, sponsors, nature conservation agencies etc? These are all important issues that have to be tackled collectively if the proposed base-line census and subsequent population-monitoring programme is going to be a success.

ACKNOWLEDGEMENTS

All those many people who contributed vulture observations are thanked, as are Ms. Angela Segal, Ms Christine Koenig and Ms Kate van Niekerk who helped with the computerised and annotated vulture bibliography and *Site Register*. Dr. P. Benson and an anonymous referee are thanked for their critical comments.

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