THESIS ABSTRACT

An Investigation into the Decline of the Bearded Vulture *Gypaetus barbatus* in Southern Africa

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The Bearded Vulture *Gypaetus barbatus* is a Critically Endangered species in southern Africa whose entire range in the Southern Hemisphere falls within the Maloti-Drakensberg mountains of South Africa and Lesotho, which forms the area of focus for this research. In this thesis I have attempted to synthesize 15 years of research on the Bearded Vulture population of southern Africa using various approaches to quantify the decline in the species, investigate the mechanisms of this decline and determine the most appropriate management actions necessary to attain the short-term species' conservation target of a positive population growth rate.

Firstly I assessed the territory occupancy, distribution and density of the population over two time periods to identify population trends. The number of occupied territories decreased by between 32%-51%, the breeding range decreased by 27% and breeding densities decreased by 20% over the past five decades. The birds occupy a breeding range of 28,125 km^2 with higher densities recorded in the core of the range than in the peripheral areas. The population is estimated at between 368-408 individuals (109-121 breeding pairs).

Three hypotheses were then examined in an attempt to explain which factors were associated with territories recorded as abandoned; those related to human impact, food availability and climate change. Of the seven covariates examined within the home range of an adult pair using a model selection process using Akaike's Information Criterion, the strongest support was for the

human impact hypothesis, with abandonment more likely in territories with higher densities of power lines and human settlements. These findings were in accordance with the main causes of mortality.

The movements of all age classes were investigated using data from satellite transmitters affixed to 18 birds to determine exposure to perceived benefits or anthropogenic risks. The overall foraging range of the population was estimated to be 51,767 km^2 and non-adults were found to use 65% of this area whereas adults focussed their activities in an area of about 286 km^2 around their nests. Non-adults increased the size of their range as they aged, with birds aged between 4-6 years facing the greatest exposure to risk factors.

The genetic risk was examined by sampling two populations in sub-Saharan Africa to ascertain genetic variation, evolutionary placement and connectivity using Mitochondrial DNA fragment analyses. My results showed little to no differentiation between populations in southern Africa and Ethiopia suggesting that translocations of individuals from Ethiopia could be considered for introduction into the local population. The reduced haplotype diversity found in southern Africa suggests that translocations may be necessary to improve genetic diversity.

Lastly I used population viability analysis models to determine the future population trend and identify the primary demographic and environmental constraints on the population. The models predicted a negative growth rate for the population over the next 50 years (λ=0.99) with a high probability (0.89) of extinction as a result of low survival estimates (particularly for adults; 86%) and reduced productivity (55%). Human activities (69%) and power line collisions (21%) were the primary reasons for the low survival rates with poisoning alone accounting for 90% of the deaths. To achieve a positive growth rate, mortality rates should be reduced by >50%, productivity increased by >25% and the population should be supplemented by at least six individuals annually for the next 20 years.

Several recommendations are listed to address the primary threat of poisoning and continued monitoring of the population is essential to evaluate the success of the implementation of these recommendations. My research demonstrates the importance of focussing on small populations, declining populations and populations at the periphery of the species' range and my

results confirm that urgent intervention is required to improve the status of the population. My findings also contribute to achieving vulture conservation objectives regionally, continentally and internationally.

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