CHAPTER 5

General Conclusion

A number of important findings, crucial to our understanding of the spatial requirements of viable populations of large herbivore species, emerged from this dissertation. The following points constitute the main findings and conclusions drawn:

- The correct choice of scale used is exceedingly important when conducting biodiversity surveys and analysing environmental data (Nicholls and Margules, 1993; Wessels, 1999). In the present study, the percentage of the total area ultimately selected to include viable populations is largely influenced by the scale at which the land classification units are defined, the number of classification units in a classification system as well as the size of the grid cells.

- Irrespective of the spatial or temporal scales employed, in general, more than 50% of each land classification unit is needed to jointly sustain viable populations of the large herbivore species in the Kruger National Park. This general trend seems unaffected by defining viable populations as comprising of 50, 500 or even 10 000 individuals. These results are consistent with those from other studies in different parts of the world, focussing mainly on the representation of all plant species or habitat types in a specific region (Soulé and Sanjayan, 1998).

- Differences in the distribution pattern of individuals between years with high rainfall and years with low rainfall figures were found. These results suggest that there is a marginal difference in the abundance and spatial distribution patterns of herbivore species in response to habitat quality changes at the scales investigated here. In a study correlating animal distribution patterns to the availability of water, it was found that patterns differed between years with a high rainfall figure and years with comparatively low rainfall figures (Redfern, pers. comm.). Hence, although environmental variation influences distribution patterns of large herbivore species, it still does not affect the considerable amount of land needed to effectively conserve these species.

- The linear relationship between the area selected and the number (and percentage) of individuals occurring in that area is mathematically expected when dealing with an area where individuals are either homogeneously (as in the KNP) or randomly distributed. According to Bayes theorem (Martin, 1967; Hartigan, 1983), when any number of individuals are randomly distributed across a landscape, and an area is randomly selected, (though a fixed percentage is selected each time) the relationship between area and number of individuals will always be linear.

- The vegetation types of the Savanna biome in South Africa does not appear to be successful as a surrogate for seven faunal taxa at the scale of our investigation. These taxa included well-studied taxa such as mammals (Mammalia), birds (Aves) and butterflies (Hesperioidae and Papilionidae) that have been frequently used in the past as biodiversity indicators (Sætersdal *et al.* 1993, Howard *et al.*, 1998), as well as less well-known taxa, including antlions (Myrmeleontidae), buprestid beetles (Buprestidae), scarabaeoid beetles (Scarabaeoidae) and termites (Isoptera). At 10% vegetation type selection on average only 56.8% of all species (of the 7 taxa mentioned above) occurring in the Savanna biome are represented in the selected area. Moving on to the 50% selection level, some 80% of all species are represented at least once.

- What are the conservation implications of the results of the present study? At the Rio Convention on Biological Diversity in November 1990 (which was signed by different governments at the Rio Earth Summit in June 1992) (IUCN, 1992) it was decided that 10-12% of each of the world's major biomes should be protected. However, subsequent literature has suggested that this target is not adequate for the protection of biodiversity. The conclusions drawn from an island biogeography perspective, is that as much as 50% of wildlands is required to represent and protect most elements of biodiversity (Soulé and Sanjayan, 1998), and that 10% is far from adequate to achieve this goal. Similarly, the present study found that from a population viability perspective, some 50% of land may be required to conserve viable populations of umbrella species. Therefore the 10-12% figure should be regarded as the absolute minimum amount of land that a country needs to protect - and *not* the upper limit. The conservation targets set will differ for each country, but the 10% target appears to be ineffective for the adequate protection of a given country's biodiversity.

- Another major problem regarding the protection of biodiversity, is the size of protected areas (World Resources Institute, 1993). The concern is that protected areas might be too small to hold viable populations of large carnivores and herbivores. With this study we have established that at approximately half of the study area (□10 000km^2) is required if the species under consideration are to be offered long-term protection.

In conclusion, given the fact that conserving 10% of each biome appears inadequate for conserving viable populations, that conserving single representations per species is not ideal, and conserving 50 - 80% of each biome is just not possible in terms of land use and land availability, stratified conservation objectives that represent different degrees of protection may have to be pursued - an objective similar to that proposed by the biosphere concept (World Resources Institute, 1994). We furthermore suggest that the fixed percentage rule be seriously reconsidered, possibly to be replaced with a system differentially concentrating on areas with higher conservation potential (e.g. source areas). Since conservation actions are only as good as the quality of the data on which they are based (Koch, in press), it is imperative that biodiversity surveys be invested in. Although compiling biodiversity inventories is very costly in terms of time and money, it has been shown by Balmford and Gaston (1999) that using well-sampled data, obtained from detailed surveys, results in the requirement of smaller representative reserve networks than when incomplete data are used. It is believed that only once the abundance-related stratification of species across a landscape is known, or if the location of source populations can be established, that the most cost-effective Minimum Viable Populations can be selected.