

CHAPTER 1: GENERAL INTRODUCTION

SCOPE OF THE STUDY

This thesis consolidates into one document the results of much of the research on the African elephant *Loxodonta africana africana* (Blumenbach 1797) population of Kruger National Park (KNP) conducted by me and various respective co-workers over the last decade. This has entailed a literature survey investigating the history of the population and an interpretation of the findings. It has also involved research into the impacts that elephant have had on the baobab *Adansonia digitata* population of KNP, and into impacts that management actions (such as culling and contraception) have had on the elephants, both at an individual level (through movement studies) and at the population level (through census data and data from culled animals).

The elephant population of the area now known as the KNP has undergone four distinct eras in the period of its history spanning the past 300 years or so. Each of these eras has received some attention as a separate chapter of this thesis, either through literature surveys or through research conducted by me independently or in collaboration with other co-authors. The thesis covers most of the important issues which the KNP population has undergone during this time, and in a sense it represents a history of the population.

The first of these eras (“the pre-management era”) encompasses the period up to the time that managers perceived it necessary to limit elephant numbers in KNP. This era could perhaps have been divided into smaller periods as it includes the time before the arrival of Europeans, a period after their arrival when hunting decimated the population, and the time thereafter when the area had been proclaimed as a game reserve. But little information is available on some of these periods and it seemed more logical to lump them into one “pre-management era”.

Before the arrival of Europeans, movements of elephants would have been largely unrestricted and the impact of humans on the population is not known, but some clues to their status during this era come from baobabs (due to their extreme longevity), from the paintings of the San people (Bushmen) and from a few other archaeological sources. The

evidence presented here suggests that elephant densities during these times were always low but the reasons for this are obscure. This conclusion is a personal interpretation which may be somewhat controversial, as it does not concur with that of earlier authors (e.g. Pienaar 1990; Rowland-Jones 1955). Human impacts could have been responsible for low densities, as computer modelling of the population dynamics (Whyte *et al.* 1998; see Chapter 6) suggests that an elephant population's growth can be checked by the selective removal of as little as 3% of the population per year. However, once the Europeans arrived with their guns, the population underwent a steep decline to the point of virtual extirpation, at which time the area was proclaimed a game reserve. This allowed re-colonisation by elephants and unrestricted population growth. This era ended once these two processes resulted in a perceived necessity for fencing the Park's boundaries and population limitation through culling.

"The management era" was the second of these eras and lasted while movements and population growth were actively limited through fencing and culling (including translocation) campaigns. The policy during this time was to maintain the number of elephants in KNP at around 7 000 (Joubert 1986). Aspects which receive attention in this thesis include population dynamics, a movement study, and an analysis of the impact of culling on sub-population dynamics.

Culling was suspended in 1995 due to an animal rights group who challenged the rights of South African National Parks (SANP) to kill elephant. SANP agreed to review their elephant management policy and placed a moratorium on culling until this review had been concluded. This review is now complete (Whyte *et al.* 1997; Whyte *et al.* 1999), but it still awaits final authority for its implementation. Subsequent to the moratorium, a "post-management era" has prevailed. This era has been characterised by SANP developing the capacity and equipment to move elephant family units and even the largest of bulls, and by research into contraception which was encouraged by SANP in the hope that it would provide an additional, ethically acceptable tool for the management of elephants.

The final era represents a look into the future and is mainly comprised of the new policy for the management of the elephants of KNP (Whyte *et al.* 1997; Whyte *et al.* 1999). This policy heralds a new approach to the elephant management dilemma. As with the earlier policy (Joubert 1986) its primary objective remains the maintenance of KNP's biodiversity, but it will allow unrestricted population growth in some areas, while actively reducing numbers in others. The policy was compiled through a process which encouraged considerable participation from experts outside of SANP, and also from other "interested and affected parties".

OBJECTIVES OF THE STUDY

The main objective of the thesis has been to bring together the published and unpublished results of management related research conducted by me and various respective co-workers. The various subjects covered collectively present a history of the population, but each subject has its own specific objectives.

Chapter 3 presents the results of an investigation into the baobab population (Whyte, Nel, Steyn & Whyte 1996). The objectives were to:

- Document the structure of the various sub-populations of KNP's baobabs;
- Investigate differences in these sub-populations to assess elephant impacts;
- Look for possible clues to historical elephant densities from population structure data and old scars caused by elephant utilization.

Chapter 4 covers the "pre-management era" from results of a literature survey. Objectives were to:

- Document the known history from information gained from the survey;
- Provide an interpretation of possible historical elephant densities and/or trends from this information;

Chapter 5 is a compilation of published papers (van Aarde *et al.* 1999; Whyte 1993) and hitherto unpublished research covering aspects of the management of the elephant

population. Management aspects which receive attention are census and culling methods, population dynamics, and movements and home ranges. The objectives were to:

- Review and document census and culling techniques, and numbers of elephants removed from the population;
- Calculate estimates of the major determinants of the population's performance – sex ratios, pubertal age, calving interval, and from these, the rates of increase and mortality;
- Determine how sub-population rates of increase responded to culls;
- Determine clan home ranges and how movements of radio-collared individuals responded to culls.

Chapter 6 focuses on the post-culling era which was characterised by research into contraception of elephants. Two papers have been incorporated into this chapter (Whyte *et al.* 1998; Whyte & Grobler 1997). Objectives were to:

- Model the dynamics and logistics of a contraception program to limit an elephant population;
- Use the model to identify a sex and age class in the population which would limit the culling to the least number of animals;
- Review the contraception research techniques as prospective means of managing the population;
- Assess the respective contraception techniques' effects on the behaviour of treated animals.

Chapter 7 presents and reviews the new management policy for the elephant population of KNP (Whyte *et al.* 1997; Whyte *et al.* 1999). The objectives were to:

- Document the process through which the policy was formulated;
- Present the policy;
- Give a personal evaluation of the new policy.

Finally, Appendix I presents a device developed for the estimation of birth and conception dates from foetal mass and date of collection (Whyte 1986).

OTHER ELEPHANT RESEARCH IN KRUGER NATIONAL PARK

Although the management of elephants in KNP has attracted a considerable volume of media and other interest, relatively little research has been conducted on this aspect. Much effort has been put into censusing the population since 1967 as annual culling quotas were based on census results. These results have remained confined to internal (SANP) reports (see Chapter 5). Only one study on the dynamics of the population has been published (Smuts 1975) and a later study examined the impacts of culling on sub-population dynamics (van Aarde *et al.* 1999).

A long-term study of elephant home ranges has been underway since 1989 and receives some attention in this thesis (Whyte 1993; see Chapter 5). A cursory examination of the effects of culls on movements of radio-collared animals is included.

Other workers have focussed on the impacts that elephants have had on vegetation. These include the original work on which the acceptable upper limits of the elephant population were based (Pienaar *et al.* 1966; van Wyk & Fairall 1969). From data gained from aerial photographs, Viljoen (1988) noted a decline in mature trees which he attributed to elephants. Trollope *et al.* (1998) also examined long-term changes in the woody vegetation with reference to the effects of fire and elephants. Impacts on particular tree species were conducted on marula *Sclerocarya birrea* (Coetzee *et al.* 1979) and knobthorn *Acacia nigrescens* (Engelbrecht 1979). Two more recent studies have also focussed on baobabs *Adansonia digitata* and star chestnut *Sterculia rogersii* (Kelly 2000), and marula (Jacobs 2000).

Two studies of contraception in elephants have been conducted. The first used subcutaneous oestradiol-17 β implants. This project was terminated due to behavioural aberrancies (Whyte & Grobler 1997; see Chapter 6) and the results have not been published. The other used porcine zona pellucida immuno-contraceptive vaccine (pZP) and had some successes (Fayrer-Hosken *et al.* 2000; Whyte & Grobler 1997). An evaluation of these as a management tool was made by Whyte *et al.* (1998).

Endocrinological studies have been conducted mainly from material collected at culls (de Villiers *et al.* 1989; Hodges *et al.* 1994; Hodges *et al.* 1997; McNeilly *et al.* 1983; Greyling *et al.* 1997; Greyling *et al.* 1998). The phenomenon of “musth” in elephant bulls has also been investigated (Hall-Martin & van der Walt 1984; Wheeler *et al.* 1982).

A physiological study on the effects of succinylcholine chlorides (Scoline) on elephants (Hattingh *et al.* 1984a; 1984b; Hattingh *et al.* 1990a; 1990b) led to the cessation of the use of these compound as a means of culling elephants on humane grounds.

The structure and chemical composition of ivory from KNP has received considerable attention (Prozesky *et al.* 1995; Raubenheimer *et al.* 1989; Raubenheimer *et al.* 1990; Raubenheimer *et al.* 1991; Raubenheimer *et al.* 1995; van Niekerk *et al.* 1988). Whyte & Hall-Martin (In prep.) studied the growth of tusks of KNP elephants.

A scientific bibliography on the National Parks of South Africa was drawn up by Bryden & de Vos (1994).