Chapter 1: Introduction

With a slight build, deep chest, narrow waist, small, streamlined head and long legs, the cheetah is the fastest mammal on earth over short distances (Skinner & Smithers 1990; Nowell & Jackson 1996; Mills & Hes 1997). Although previously occurring throughout the drier parts of sub-Saharan Africa (Nowell & Jackson 1996), it is now listed as Vulnerable by the World Conservation Union, defined as a species with a high risk of extinction in the wild in the medium-term future (Hilton-Taylor 2000). This is mostly because it has suffered from a serious loss of range due to competition with humans (Myers 1975; Anderson 1983; Marker-Kraus & Kraus 1997). The effects are loss of habitat, a declining prey base and competition with livestock interests (Marker-Kraus & Kraus 1997). In many countries, cheetahs are considered pests and are persecuted (Marker-Kraus, Barnett & Hurlbut 1996). Being wide-ranging asocial predators, they occur at low densities across their geographical range (Myers 1975; Hamilton 1986; Caro 1994; Kelly & Durant 2000). Cheetahs are thus particularly vulnerable to local extinction, as a fragmented range is less able to support viable populations (Gilpin & Diamond 1980; Shaffer 1987; Purvis et al. 2000). Lack of genetic variation, discovered during the 1980s, is considered another threat to cheetah populations (O'Brien et al. 1983; O'Brien et al. 1985; O'Brien, Wildt & Bush 1986; O'Brien et al. 1987). A greater concern, however, than a lack of genetic diversity is competition with other large predators (Caro & Laurenson 1994). Laurenson's (1994) studies on the Serengeti Plains in East Africa revealed that 95% of cubs born never reach independence, where predation by lion *Panthera leo* was chiefly responsible for the high cub mortality. Other competitive effects of predators on cheetahs are kleptoparasitism (Schaller 1972; Caro 1994), whereby cheetahs lose their kills to more powerful competitors, and even adult cheetahs can be killed by other members of the large carnivore guild (Hunter 1998).

The discovery of high cub mortality on the Serengeti Plains prompted a number of follow-up investigations into the co-existence of cheetahs with lion and spotted hyaena *Crocuta crocuta* (Durant 1998; Durant 2000a and b), and a series of demographic studies and population viability analyses on the Serengeti Plains' cheetah population (Laurenson 1995b; Crooks, Sanjayan, & Doak 1998; Kelly et al. 1998; Kelly & Durant 2000). These

studies found that cheetahs manage to co-exist with competitors by seeking out 'competitive refuges' with low densities of lion and hyaena (Durant 1998), and actively avoiding competition with these large predators (Durant 2000a). Durant (1998) argued that the cheetah's mobility is the key to its continued co-existence with other large predators, and Kelly & Durant (2000) concluded that cheetahs would continue to live at low densities where other large predators occur in high numbers. Kelly & Durant (2000) proposed that the conservation of cheetahs may not rely solely on their protection inside national parks, but also on their protection in natural areas outside national parks where other large predators are absent. The largest population of cheetahs in Africa occurs on commercial livestock farmlands in Namibia where other large predators have been eradicated (Marker-Kraus et al. 1996).

There is, however, a skew in terms of the data collected on cheetahs. Most of our understanding on cheetah behaviour and ecology comes from the Serengeti Plains, which boasts 25 years of continuous research (Kruuk & Turner 1967; Schaller 1972; Bertram 1979; Frame & Frame 1980; Caro 1982; Caro & Collins 1986a and b, 1987; Durant et al. 1988; Caro 1989; Fitzgibbon & Fanshawe 1989; Fitzgibbon 1990; Laurenson, Caro, & Borner 1992; Caro 1994; Laurenson 1994, 1995a and b; Laurenson, Weilbnowlski & Caro 1995; Kelly et al. 1998; Conniff 1999). The Serengeti Plains is a short to medium grassland ecosystem where its most abundant herbivores, the wildebeest *Connochaetes taurinus*, Burchell's zebra *Equus burchelli* and Thomson's gazelle *Gazella thomsonii* undertake large seasonal migrations; well known as the largest extant migrations in Africa. Cheetahs, however, also inhabit a wide range of woodland savanna habitats (Caro & Collins 1987; Skinner & Smithers 1990; Nowell & Jackson 1996; Mills & Hes 1997). In these areas, the prey base is mostly sedentary, the density of prey is generally far lower than on the Serengeti Plains, and the main prey species varies across ecosystems (Mills 1998).

The density and distribution of the cheetah's main prey, suitable habitat and competing predators are the main ecological factors affecting the behaviour, density and distribution of cheetahs (Mills 1990; Caro 1994; Nowell & Jackson 1996; Mills 1998). Considering the unique ecology and dynamics of the Serengeti Plains, this area cannot be widely representative of all ecosystems within the cheetah's range. Cheetahs are

considered to need open habitat for hunting (Bertram 1979), but occur in woodland habitats across a large part of its range (Skinner & Smithers 1990). Differences in the dispersion patterns of the prey base may also affect the cheetah's ranging behaviour (Caro 1994). Furthermore, there is evidence that the exceptionally high cub mortality observed on the Plains does not occur in other areas (Hunter 1998; Purchase 1998). Therefore, threats facing the cheetah population on the Serengeti Plains may be of lesser importance compared to other more immediate dangers elsewhere. For example, bush encroachment in large parts of the South African Lowveld may be a threat to cheetah populations (Pienaar 1969; Pettifer 1981a)

Because of the status of the cheetah and the growth of the ecotourism industry in Africa, the cheetah is a focus of several captive breeding programmes and is increasingly becoming the focus of re-introduction programmes into lucrative game ranches and smaller parks (Penzhorn 1999). There is a considerable controversy associated with the success of large carnivore re-introduction programmes (Linnell et al. 1997). Any problems associated with re-introduction and management are compounded further when an understanding of the behaviour and ecology of the species is limited (Caro & Durant 1995). Trying to estimate viable cheetah densities or delineate reserve boundaries based on ranging patterns of cheetahs on the Serengeti Plains would be of little use to smaller reserves. To date, a proper assessment of the viability of cheetah populations in woodland savannas has been impossible as population viability models are simulated using long-term data collected on the Serengeti Plains (Zank 1995; Purchase 1998; Hunter 1998). There is even speculation that the Plains may be a sink for cheetahs and not a source and that woodland habitat may be more favourable to cheetahs (Kelly et al. 1998). This may have large implications regarding the conservation and status of the cheetah. Pulliam (1988) warned that conservation research and management decisions based on 'sink' habitats alone can be misleading and lead to undesirable results. In Suikerbosrand Nature Reserve, where the cheetah was the top predator, it was found that introduced cheetahs were so successful that they eventually had to be removed because of drastic declines in their main prey types (Pettifer 1981b). Mills (1998) warned of the danger of extrapolating from one area to another when making management decisions due to the flexibility of carnivore behaviour under different ecological conditions. Therefore, greater attention

given to cheetah ecology and behaviour in woodland savannas may assist and improve the re-introduction, management and conservation of cheetahs in Africa.

Recently, ecological studies have been conducted in woodland savannas in Matusadona National Park, Zimbabwe (Zank 1995; Purchase 1998; Purchase & du Toit 2000) and Phinda Resource Reserve, South Africa (Hunter 1998). A study was also conducted in the Kruger National Park (KNP), South Africa between 1987 and 1990 (Mills unpubl. data). With these additional studies, the database was large enough for me to conduct a comparative study across a variety of different African savanna ecosystems.

1.1. OBJECTIVES

The main objectives of my study are:

1. To add to the existing knowledge on cheetah ecology in woodland savannas by analysing a data-set concerning the home range size, habitat utilisation, prey selection and hunting behaviour of cheetahs in the Kruger National Park, and
2. To conduct a comparative analysis on the above aspects of cheetah ecology across a range of African savanna ecosystems using existing data synthesised from literature.

The overriding theme of my study is to extend the range of documented information on cheetah ecology across the grassland-woodland gradient in African savannas. Since the KNP is an important conservation area for the cheetah, knowledge of its ecological requirements and role within the ecosystem would provide important information for management of the park.

1.2 KEY QUESTIONS

1. How does cheetah home range size differ across African savanna ecosystems?
2. What are the habitat preferences of cheetahs across a range of grassland and woodland savanna ecosystems?

3. What is the prey composition, expressed as prey size classes and age structure, of cheetahs across a range of African savanna ecosystems?
4. How does hunting success, kill rate, chase distance, kill retention time and kleptoparasitism vary with availability of cover?
5. For a given population size, is cheetah population viability higher in a woodland savanna than a grassland savanna?

1.3 APPROACH

The key questions listed above were addressed by analysing:

1. The home range size and habitat preferences of cheetahs in the KNP (Chapter 3).
2. Differences in home range size across different African savanna ecosystems, based on predictions concerning the effects of prey dispersion patterns and density on female cheetah home range size and female cheetah density on male cheetah territory size (Chapter 3).
3. Differences in habitat utilisation and preferences across a range of grassland and woodland savannas ecosystems (Chapter 3);
4. Cheetah predation, hunting behaviour and use of habitats for hunting in the KNP (Chapter 4).
5. Differences in prey composition (in terms of prey size categories and age classes) across selected African savanna study sites (Chapter 4).
6. The effect of cover availability on hunting success, kill rate, chase distance, kill retention time and kleptoparasitism using data available from African savanna study sites (Chapter 4).
7. The viability of cheetah populations in a grassland and woodland savanna by varying life history and demographic variables for each ecosystem (Chapter 5).

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