CHAPTER ONE

INTRODUCTION

BACKGROUND OF THE STUDY

The concept of hyaenids being responsible for faunal accumulations has been around for over a century, as the reverend William Buckland stated as early as 1821 in relation to the Kirkdale Cave site in the United Kingdom (Brain, 1981). In that instance, Buckland established that spotted hyaenas (*Crocuta crocuta*) were responsible for the large quantity of faunal remains discovered within the cave. However, Hughes' research (1954a, 1954b, 1958 & 1961) questioned whether spotted hyaenas were major accumulators of faunal remains, as did Dart in 1956 where he concluded that indeed hyaenas are not important in the accumulation of faunal material. Nevertheless, Sutcliffe (1969 & 1970) expanded upon the hypothesis that spotted hyaenas are accumulators of bones, even suggesting that there are two different sites of accumulation. One where the assemblage would be made-up of mostly hyaenid remains and the second consisting of mostly prey species. In addition, Kruuk (1972) concluded that spotted hyaenas do not bring food per se back to their dens, but do bring back various items on which to chew. In later studies, Hill (1989) examined specific bone modifications by spotted hyaenas. Moreover, in contrast to earlier studies Bearder (1977) investigated six spotted hyaena dens in South Africa that yielded a substantial amount of remains for him to conclude that they are important accumulators of faunal remains. Further research by Henschel *et. al.* (1979) and again by Skinner *et. al.* (1986) confirmed that spotted hyaenas do indeed collect various quantities of bones and therefore could be responsible for fossil bone assemblages. In 1976 Kruuk established that striped hyaenas (*Hyaena hyaena*) in East

Africa, in contrast to spotted hyaenas, bring back quantities of faunal remains to maternity dens. In addition, research on brown hyaenas (*Parahyaena brunnea*) by Skinner (1976), Mills & Mills (1977), Mills (1978) and Owens & Owens (1978) all attribute various bone accumulations to the species, be they at maternity dens or sites to cache food for future consumption. More recently studies by Skinner & van Aarde (1991), Skinner *et al* (1998), Skinner (2006), Kuhn (2001, 2005), Lacruz & Maude (2005), Maude (2005), Maude & Mills (2005) and Wiesel (2006), have shown both striped hyaenas and brown hyaenas to be prolific collectors of faunal remains.

Brain (1981) expanded on the idea of hyaena bone collections and noted that different accumulators may share the same dens (e.g. porcupines (*Hystrix cristata*) are commonly found in both spotted hyaena and brown hyaena dens). At this time Brain also explored the taphonomic implications of hyaena tooth action upon the faunal remains. Differences between bone fragments caused by hyaenas or other agents, be they carnivore or man, were examined by both Brain (1981) and Newman (1993) and in even greater detail by Backwell (1999) in her research on bone tools and bone damage. Other studies with regards to the taphonomy, carnivore activity and general modifications of bones have been carried out by Haynes (1980), Richardson (1980), Behrensmeyer & Boaz (1980), Behrensmeyer (1984), Lyman (1994), Capaldo & Blumenschine (1994), Blumenschine *et. al.* (1996), Andrews & Fernandez-Jalvo (1997), Capaldo (1997, 1998) and Selvaggio (1998). Moreover, use of teeth marks as an indicator of carnivore identity has been studied extensively (Haynes, 1983; Dominguez-Rodrigo & Piqueras 2003, Dominguez-Rodrigo & Barba 2006 and Selvaggio &Wilder 2001). The former two studies indicating the need to examine carnivore gnawing in greater detail in order to identify the accumulator to species level. Additionally Dominguez-Rodrigo & Piqueras (2003) indicate that although relative size of punctures can yield the size of carnivore responsible, this is not indicative of species. They concluded that more research needs to be undertaken and completed over a larger region in order to extend the data set for more carnivore species, be they known collectors of faunal remains or not.

In 1980 Maguire, Pemberton and Collett listed nine specific taphonomic signatures that are indicative of hyaena activity upon faunal remains. The nine characteristics include ragged edge chewing, localized shallow pitting, punctate depressions or perforations, crescent shaped or lunate fracture scars, striations or gouging, irregular or random grooves, scooping or hollowing, acid etching or erosion of bone, and splintering or shattercracking. Furthermore, Haynes (1983) published a brief overview of the patterns of gnawing for spotted hyaenas, wolves (*Canis lupus*), bears (*Ursus arctos* and *U. americanus*), lions (*Panthera leo*), tigers (*P. tigris*), and jaguars (*P. onca*). While Haynes provides insight into the subtle differences between the taphonomic signatures of these species, he only deals with the hind limbs of large bovids and examined a relatively small sample size. Sample size is also a point of contention with Maguire *et. al.* (1980), considering they had only 335 samples from spotted hyaenas and just over 300 from striped hyaenas. While the identification of taphonomic signatures 'unique' to hyaenas is beneficial, more in depth studies should be undertaken for all three-hyaena species before any definite conclusions can be drawn with surety. Additional research by Maguire *et. al.* (1980) also examined human damage upon bones, specifically that which Khoisan do to the remains of bones from domestic goats (*Capra hircus*) they have consumed. They report that the Khoisan are capable of damaging bones extensively, specifically producing damage known as ragged edge chewing that is nearly indistinguishable from the ragged edge chewing by hyaenas. Only close observation reveals the conical depressions associated with carnivore activity. Maguire also indicated that there are other signatures unique to the Khoisan themselves, such as human molar activity upon soft bone and butchery marks. The fact that some taphonomic signatures overlap between species while others do not is of value in determining the extent of any further research. With the exception of Maguires' research, Brain (1981), Skinner *et. al.* (1980, 1986), Marean & Bertino, (1994), Selvaggio & Wilder (2001) and Pickering *et. al.* (2004) other publications fail to stress the possibility that other accumulators may have contributed to a given assemblage. In addition to extant species where there may be secondary carnivore activity (Marean & Bertino, 1994), in the fossil record one must take into account the number of extinct carnivores and rodents that may act as accumulating agents and further complicate the analysis (Ewer, 1955a, 1956a, 1956b, 1956c).

In addition to the taphonomic evidence there have been many studies investigating the composition of assemblages and then using these data to determine the collecting agent (Klein 1982; Hill & Behrensmeyer, 1984; Hill, 1984; Stiner, 1991; Cruz-Uribe, 1991; Horwitz, 1998; Pickering, 2002; Lacruz & Maude, 2005 and Kuhn, 2005). The research of Stiner and Cruz-Uribe put forward seven criteria that are indicative of hyaenas being responsible accumulating agents as opposed to ancient hominids. Moreover Stiner suggests that as a criterion, 'a purported pattern of excessive proportions of horn or antler in hyaena-accumulated assemblages' is indicative of hyaena den occupation. Similarly, Cruz-Uribe suggests the following six criteria to confirm hyaenas as collecting agents: 'A purported absence or low occurrence of small, hard, compact bones such as sesamoids, carpals, smaller tarsals, and phalanges in hyaena-accumulated assemblages'; 'A purported tendency for smaller ungulates to be better represented by cranial bones and for larger ungulates to be better represented by post-cranial bones' suggests a hyaena assemblage; 'A purported tendency for bovid mortality profiles to be attritional in hyaena-accumulated assemblages': 'A relative abundance of carnivores (≥20 percent of the total MNI) in hyaena-accumulated assemblages'; 'An abundance of limb bones with relatively complete shafts, but are lacking epiphyses, in hyaena-accumulated assemblages'; and lastly 'Hyaena-inflicted bone surface damage in hyaena-accumulated assemblages'.

Of all these 'criteria' recent research by Pickering (2002) rejects all but the latter three established by Cruz-Uribe and believes that only they be used in establishing between hyaena and hominid accumulated assemblages. Research by Lacruz & Maude (2005) and Kuhn (2001, 2005) support Pickering's results with the exception of the relative abundance of carnivore remains being equal to or greater than 20%. The final two criteria, 'an abundance of limb bones with relatively complete shafts, but are lacking epiphyses' and 'hyaena inflicted surface damage on bones', that are accepted by Pickering, Kuhn, Lacruz and Maude are both based on the taphonomic signatures of hyaenas in general and not arbitrary percentages or measurements of assemblage make up.

Recognizing the importance of taphonomy in elucidating the collecting agent of given assemblages, the archaeological importance of non-human bone collectors is becoming an increasingly significant part of the investigation of archaeological and palaeontological sites as well as a topic of interest to those attempting to determine the ecological history of a specific region as previous work by Klein (1975) and Klein *et. al.* (1991) have shown. It has been well established that along with extinct forms of accumulator, three of the four species of extant hyaenas, plus porcupines (Brain, 1981), leopards (*Panthera pardus*) (Simons, 1966; Brain, 1981; Le Roux & Skinner, 1989; de Ruiter & Berger, 2000, 2001; Pickering *et. al.* 2004; Skinner & Chimimba, 2005), some raptors (Mundy & Ledger, 1976; Mayhew, 1977; Richardson *et. al.*, 1986; Davies, 1994; Berger & Clarke, 1995; Cruz-Uribe & Klein, 1998; Robert & Vigne, 2002; Sanders *et. al.,* 2003; Berger, 2006; Erlandson *et. al., 2007*) and ravens (*Corvus corax*) (Laudet & Selva, 2005) are responsible for the collection of significant amounts of bone material in both the modern and fossil record. Moreover, limited research has been done on each of the individual hyaena species specifically relating to their accumulating behaviour (Henschel *et. al.,* 1979; Skinner *et al.,* 1980, 1986, 1998; Skinner & van Aarde, 1991; Horwitz & Smith, 1988; Lam, 1992; Leakey, *et. al.*, 1999; Kuhn, 2001, 2005; Lacruz & Maude, 2005). However, to date the majority of published research deals with just one species at a time and comparative research has yet to be published. Cooper *et. al.* (Unpublished) attempt to compare the three species by comparing their extensive fieldwork with *Crocuta* to published material on both *Parahyaena* and *Hyaena*. Furthermore, many authors address only a single aspect of collecting behaviour e.g. Horwitz & Smith (1988) on the effects of striped hyaenas (*Hyaena hyaena*) on collections that include human remains from scavenging. As hyaenas have been suggested to be a major contributing factor to fossil assemblages found in Africa, Europe and Asia (Klein, 1975; Bearder, 1977; Maguire *et. al.,* 1980; Brain, 1980, 1981; Binford, 1988; Klein *et. al.,* 1991; Cruz-Uribe, 1991; Stiner, 1991; Lam, 1992; Kuhn, 2001, 2005; Boaz & Crochon, 2001; Selvaggio & Wilder, 2001; Lacruz & Maude, 2005) and because there are three extant species within the hyaenidae family in Africa, all of which overlap in the fossil record (L. Berger, pers. com.), this forms an ideal group for an expansive study of accumulations and associated taphonomy.

AIMS AND OBJECTIVES

Faunal assemblages of unknown origin found in the archaeological and palaeontological records need to be identified with as much certainty as possible. The taphonomic signatures left behind by the collector or collectors should be identified to species where possible and not assumed to be that of hyaenids, leopards, or hominins as has been done in the past (Dart, 1956). Since only a certain percentage of faunal remains in a given assemblage will actually display diagnostic taphonomic marks, the entire assemblage must be studied and any species-specific signatures as well as the frequency of said marks should be documented. Complete analysis of the assemblages should identify the collector or possibly collectors. However, several questions need to be answered in order for this to be accomplished. Such as are there observable differences in assemblages of striped hyaenas, brown hyaenas and spotted hyaenas? Do spotted hyaenas create smaller assemblages than either striped hyaenas or brown hyaenas? Are the bone fragments left by spotted hyaenas consistently smaller than those of striped hyaenas or brown hyaenas? Are the striped hyaenas and brown hyaenas truly similar in their collecting behaviours as suggested by independent studies of the two species (Owens & Owens, 1978; Skinner, 1976; Kruuk, 1976); Bearder, 1977; Skinner *et. al.,* 1980; Skinner & van Aarde, 1991; Leakey *et. al.,* 1999; Kuhn, 2001, 2005 and Lacruz & Maude, 2005)? Or will there be distinctive patterns established to differentiate between the two species? Are there noticeable differences in the collecting behaviours and den usage of the three hyaena species in question? Are there differences between populations of the same species from different environments? Do spotted hyaenas bring back larger faunal remains than either striped hyaenas or brown hyaenas as hypothesised by numerous previous researchers (Kruuk, 1972; Bearder, 1977; Skinner *et. al*, 1986; Cooper *et. al.*, unpublished)? Which species leaves behind more distinctive taphonomic signatures, and which of these signatures is more prevalent? Are there distinguishing taphonomic signatures of hyaenids that separate them from other carnivore collectors such as leopards? These are just a few of the questions that arise when one tries to differentiate between the assemblages of all three species of hyaenas.

This project will examine the associated den accumulations and relative taphonomic signatures of all three hyaenids known to collect faunal remains. Specifically the goal of this research is to determine species-specific taphonomic signatures as well as to determine similarities between the three species in collecting behaviours and taphonomic signatures. Specific aspects of carnivore, particularly hyaena, damage upon faunal remains will be investigated along with the presence of non-carnivore damage and combinations of specific carnivore damage. A by-product of this study will determine the partial diets of hyaenas in various regions, as well as examine behavioural differences between the same species in different habitats. In addition all previously established criteria for hyaena accumulations will be reviewed and new criteria suggested.

MATERIALS AND METHODS

Faunal analysis will consist of material collected from den sites within the home ranges of the various species, in situ examination of dens and previously collected assemblages attributed to one of the specific species in question. Unhindered access to the reference collection housed at PURE (Palaeoanthropology Unit for Research and Exploration), Bernard Price Institute, University of Witwatersrand, was granted for study and use in identification of specimens. Additional identification was done using various manuals and publications. These included *Mrs. Walkers Bone Book: A Guide to Post-Cranial Bones of East African Animals* (Walker, 1985), *Mammal Bones and Teeth* (Hillson, 1992), *A Guide to the Measurement of Animal Bones from Archaeology Sites* (von den Driesch, 1976), *A manual to the skeletal measurements of the seal genera* Halichoeru*s and Phoca (Mammalia: Pinnipedia)* (Ericson & Stora, 1999), and Schmid's 1972 *Atlas of Animal Bones*. *Syncerus caffer* was distinguished from domestic *Bos* using Peters' 1986 paper.

With the exception of material from Namibia and assemblages previously collected, all material was carefully collected, bagged, labelled and then transported to laboratory facilities at the Bernard Price Institute, University of Witwatersrand for identification and analysis. All analysis of samples in Namibia were done in situ at the den sites in order to comply with protocol set by NAMDEB Diamond Company and the Namibian Ministry of Environment and Tourism. In all cases 18 specific data sets were recorded, these are; 1) Context number, (this provides den identification, location, and collection method), 2) Skeletal Element, 3) Species, 4) Proximal Fusion, 5) Distal Fusion, 6) Body Side, 7) Fragmentation patterns of long-bones, 8)

Modification, 9) Butchery, 10) Sex, 11) Length, 12) Punctates/Punctures, 13) Scouring, 14) Acid Etching, 15) Crenulated Edges, 16) Striations, 17) Collector and 18) Weathering. Weathering information is based upon the work by Behrensmeyer in 1978 and is a loose guideline for the time faunal remains have been exposed to the environment. Given that weathering will vary depending upon climate, soil make up, and regional differences, the data collected were only rough estimates for the range in years since death. NISP (number of identified specimens) and MNI (minimum number of individuals) were assessed using Grayson (1984) bearing in mind the quantitative problems as indicated by Gilbert & Singer (1982), Gautier (1984), Marean & Spencer (1991) and de Ruiter (2001).

Data from material examined in laboratory conditions were logged onto an excel spreadsheet on an Apple iBook laptop computer. Data from material examined in situ were logged onto data sheets and later transferred to the laptop. The excel spreadsheet was then converted into a FileMaker Pro 8 database which yielded all relevant data with regards to species scavenged/hunted, age of various species at death, weathering data, and of course all the taphonomic data recorded and combinations of carnivore damage. All dens were logged into a GPS (Garmin IV) to aid in relocating dens and for future work with GIS.

In regions with little knowledge of hyaena activity approximately two months were spent locating and conducting daily observations of dens as well as nocturnal activity in relation to the dens. In other regions local knowledge aided in the location of potential den sites, and in many cases local researchers provided not only den locations but also a history of den usage and occupation.

SYNOPSIS

Chapter two discusses the current ranges of all three species, plus gives a brief behavioural ecology of said species. Regions of species overlap are discussed and how behavioural traits may be influenced by habitat overlap.

Chapter three is a short description of the regions surveyed in southern Africa for this study. Included are yearly rainfall amounts, size of parks, reserves, or private lands surveyed, and species found along with the particular hyaena species of the study. In addition the assemblage previously collected by Skinner and re-examined for this study if briefly described.

Chapter four discusses the dens located in each of the surveyed regions. GPS coordinates as well as den type and numbers of faunal remains associated with said dens are all discussed here. Activities in and around the individual dens are noted, as well as den history where applicable.

Chapter five is the results portion of the thesis. After a brief overview of the fieldwork conducted and the re-examined collections each individual den, by region, is analysed. For every den and previous collection this includes the number of remains analysed, a break down of species identified (NISP and MNI) and skeletal elements identified. Data from each specimen includes relative age (via fusion data of long bones), fragmentation patterns, length, weathering and specific types of carnivore damage.

After introducing and discussing data from previous fieldwork on striped hyaenas in Jordan, chapter six discusses the results of the previous collections and all the dens analyzed during this study. Broken down by species, with a brief overview of species followed by the regions surveyed for said species and a brief summation for the species in question. This is followed by a comparison of all three species of collecting hyaenids. This chapter ends with a discussion on the criteria for distinguishing between hyaenas versus hominids as fossil accumulators of faunal remains.

Chapter seven is the conclusion section of the thesis. Discussed here are trends of hyaenid assemblages with specific questions asked in the introduction revisited and answered. Additionally the criteria for determining hyaenas as fossil collectors are re-evaluated and the need for future research expounded upon.

CHAPTER TWO

ECOLOGY

DISTRIBUTION

The current range of extant brown hyaenas (*Parahyaena brunnea*) is confined to areas of southern Africa including South Africa, Namibia, Botswana and parts of Zimbabwe, Mozambique and Angola. Spotted hyaenas (*Crocuta crocuta*) are found from south of the Sahara to southern Africa, excluding the Congo and today are conservation dependant in South Africa, thus are not as widespread as they once were (Skinner & Chimimba, 2005). Striped hyaenas (*Hyaena hyaena)* range from as far south as northern Tanzania, across all of North Africa through the Middle East, and as far east as the Gulf of Bengal and north into southern Siberia (Kruuk, 1976; Stuart & Stuart, 1997). Thus today the only overlaps in range that exist are between spotted hyaenas and striped hyaenas in northern Sub-Saharan Africa and spotted hyaenas and brown hyaenas in southern Africa (Figure 1). In the past however, there has been an overlap between all three extant species as well as with a number of extinct species of hyaenids in southern Africa and other parts of the world (Hughes, 1954a & b; Ewer, 1955b, 1955c; Sutcliffe, 1969; Klein, 1972; Hendey, 1974, 1978; Howell & Petter, 1976; Galliano & Frailey, 1977; Maguire *et. al.,* 1980; Berta, 1981; Brain, 1981; Scott & Klein, 1981; Binford *et. al.,* 1988; Turner, 1993; Watson, 1993; Boaz & Crochon, 2001; Mutter *et. al.,* 2001; Boshoff, 2003). Additionally, there is evidence of extinct species becoming extinct corresponding with the introduction of extant species (Brain, 1981; L. Berger, pers. com., 2003).

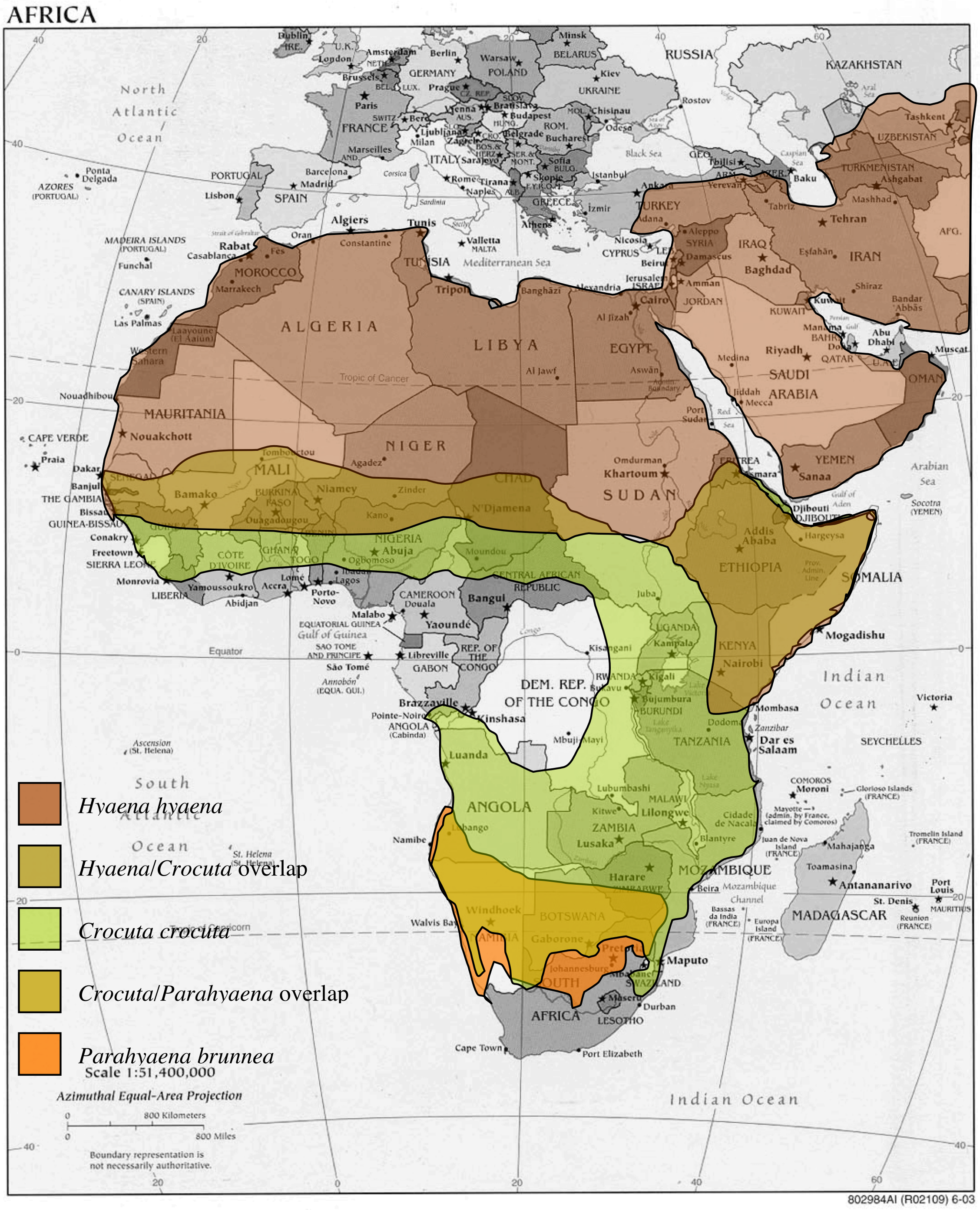

Figure 1: Ranges of *Hyaena*, *Crocuta* and *Parahyaena*

BEHAVIOURAL ECOLOGY

In the family hyaenidae there are four extant species, *Crocuta crocuta, Hyaena hyaena, Parahyaena brunnea* and *Proteles cristatus*. Of these, aardwolves (*Proteles cristatus*) have evolved into an insectivore and are therefore not included in this study. Of the other three species, the spotted hyaenas are the largest (males average ca. 59.0kg and females 70.9kg). Brown hyaenas average 49.0 kg for males and 45.6 kg for females (Skinner, 2006) while striped hyaenas average 33.6kg and 30.7 kg for males and females respectively (Skinner & Ilani, 1979; Yom-Tov & Mendelssohn, 2002). In spotted hyaenas, sexual dimorphism favours the females, while in the brown hyaenas and striped hyaenas males are larger. Brown hyaenas and striped hyaenas are similar, filling the south and north niche separated by the Kunene-Zambezi river dividing line. In appearance, both have shaggy coats, long pointed ears and the typical hyaena build of a stout chest and neck and sloping back. Indeed they are so similar that Skinner & Ilani (1979) conclude that *Parahyaena* is a 'larger edition of *Hyaena*'.

Current studies on their ecology and behaviour indicate that both brown hyaenas and striped hyaenas are quite similar in their feeding/scavenging and bone collecting behaviours, foraging alone (Mills, 1973, 1990; Skinner, 1976; Mills & Mills, 1977; Owens & Owens, 1978; Yom-Tov & Medelssohn, 2002; Maude, 2005; Maude & Mills, 2005; Skinner & Chimimba, 2005; I. Wiesel, 2006; pers. obs.) and both tend to carry large quantities of food back to cubs at their prospective maternity dens (Kruuk, 1976; Bearder, 1977; Owens & Owens, 1978; Skinner *et al.,* 1980; Skinner & van Aarde, 1991; Horwitz & Kerbis, 1991; Leakey *et. al.,* 1999; Kuhn, 2001, 2005; Lacruz & Maude, 2005; Wiesel, 2006). In contrast, this behaviour is not a feature of spotted hyaenas (Kruuk, 1972; Bearder, 1977; Skinner *et. al*, 1986; Cooper *et. al.*, unpublished), which hunt either alone or in clans that can range in size from five or six to over 100 individuals depending upon the region (Kruuk, 1966; Sutcliffe, 1970; Skinner & Chimimba, 2005; Cooper *et. al.*, unpublished).

It has been shown that *Parahyaena* and *Hyaena* only kill smaller prey species and occasionally domestic stock, if they kill at all (Kruuk, 1976; Skinner, 1976, 2006; Mills, 1990; Yom-Tov & Mendelssohn, 2002). Apart from infrequent reports in Israel that striped hyaenas attack livestock (Yom-Tov & Mendelssohn, 2002) there is little evidence for striped hyaenas making significant kills other than small mammals (Kerbis-Peterhans & Horwitz, 1992). Reports of attacks on livestock by striped hyaenas, although rare, should be viewed with reservation as on more than one occasion the author was told that a Bedouin farmer had captured a young hyaena only to discover a young golden jackal (*Canis aureus*) upon arrival at the farm in question. Current research on brown hyaenas in Namibia indicates that they routinely kill young seals during the pupping season (Wiesel, 2006; pers. obs.). Reports of brown hyaena attacking livestock in South Africa are also rare and occurred on farms where brown hyaena are common and had little or no history of such attacks (Skinner, 1976; Skinner & Chimimba, 2005). On the other hand, both smaller hyaenids are very effective scavengers (Mills, 1973; Skinner 1976; Skinner & Ilani, 1979; Skinner & van Aarde, 1981; Skinner *et. al.,* 1980; Kerbis-Peterhans & Horwitz, 1992; Kuhn, 2001, 2005; Maude, 2005), and are even known to scavenge from human graves in Israel (Skinner *et. al.,* 1980; Horwitz & Smith, 1988; Kerbis-Peterhans & Horwitz, 1992). Recent research on striped hyaenas in eastern Jordan yielded substantial amounts of adult camel bone, among other larger domestic species (Kuhn, 2001, 2005) indicating that striped hyaenas are capable of scavenging from much larger species as well as smaller prey species. Spotted hyaenas on the other hand are effective hunters and, whether foraging alone or in groups, are capable of catching large prey species (Kruuk, 1966; Sutcliffe, 1970; Bearder, 1977; Skinner & Chimimba, 2005; Cooper *et. al*. unpublished). Up to 95% of consumed meat is obtained via the successful hunting of medium to large ungulates (Cooper *et. al.* unpublished); the remaining diet is made up of scavenged material and smaller mammals (Skinner, 2006).

Previous research indicates that both striped hyaenas and brown hyaenas are nocturnal or at most crepuscular, emerging from their dens to forage at dusk and through the night with occasional activity during the day (Mills, 1973; Skinner, 1976; Yom-Tov & Mendelssohn, 2002; Skinner & Chimimba, 2005). Current research shows that brown hyaenas (at least along the Namibian coast) are both nocturnal and diurnal and kill seal pups (*Arctocephalus pusillus*) amongst their colonies at all hours, day or night (Wiesel, 2006). In contrast, the population of brown hyaenas at the Rietvlei Nature Reserve agrees with previous research as being nocturnal. It is unknown as to why there is such a difference between the two populations as in both cases the brown hyaenas are the largest carnivore present. Spotted hyaenas are principally nocturnal, foraging and hunting at night, but at times are active during the day, although lying up during the hottest portion of the day (Kruuk, 1966, 1972; Sutcliffe, 1970; Skinner & Chimimba, 2005).

Even today there are a number of beliefs, superstitions, and erroneous ‘facts’ surrounding hyaenas in general. For years, and to this day in some circles, it was thought that spotted hyaenas were strictly scavengers, relying entirely upon carrion for survival. Moreover, they have generated an image of being an unsavoury thief amongst the common people and this image is perpetuated by movies like the Lion King. The Bedouin beliefs regarding striped hyaenas make the animal seem supernatural. One of their many myths says that the urine of the striped hyaena will turn a person into a hyaena. Another is that the striped hyaena can put a person under a spell with its breath and said person will follow the hyaena back to its den where the hyaena will suck out their brains and feed upon the person. It is possibly due to the superstitions surrounding the striped hyaena that whenever a member of the local population sees a golden jackal, wolf (*Canis lupus arabs*), or striped hyaena they assume it is the striped hyaena coming for them. Either way, the Arab world views striped hyaenas with revulsion and fear, and will kill them at every opportunity. This is true in Jordan (pers. obs.), Lebanon (A. Garrard, pers. comm.) and Saudi Arabia (H. Bertschinger, pers. comm.) and evident in the United Arab Emirates where the striped hyaena has been eradicated as a result (ArabianWildlife.com).