REVILED AS A GRAVE-ROBBER: THE ECOLOGY AND CONSERVATION OF STRIPED HYAENAS IN THE HUMAN-DOMINATED LANDSCAPES OF LEBANON

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Abstract

Large mammalian carnivores can prey on livestock and threaten human life, while myths that surround them can worsen attitudes towards human-carnivore conflict. Striped hyaenas suffer from such myths, and are classified globally as near threatened because of ongoing persecution throughout their range. Nevertheless, striped hyaenas are the least studied of all hyaenas.

Reports of conflict allowed selection of six study sites across rural and urban areas, and close to and far from protected areas. The ecology of striped hyaenas and their interactions with people in the human dominated landscape of Lebanon are described.

The abundance of striped hyaenas in urban areas was high relative to rural areas, and was close to zero in and around two protected areas, where no prey was available. Striped hyaenas are omnivorous scavengers, and can easily co-exist with people. In urban areas, their home range varied from 6.2 to 9.0 km^2, and was five times smaller than in rural areas. Moreover, striped hyaenas avoid contact with people in both urban and rural areas.

Local people generally knew about the ecology of striped hyaenas. Moreover, elders related 14 types of mythical story about striped hyaenas, of which 11 portrayed striped hyaenas in a poor light. The Lebanese public also know these stories, which underpin the negative attitudes they hold towards striped hyaenas.

An active awareness programme, comprising a seminar given by a conservationist and an information leaflet, changed the views of >83% of local people towards striped hyaenas. Moreover, the active awareness programme changed the views of >80% of adults and >88% of students visiting a zoo near Beirut. In contrast, passive education did little to change views of zoo visitors. Therefore, active conservation education programmes offer promising opportunities to improve negative attitudes towards striped hyaenas.

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Chapter 1

GENERAL INTRODUCTION

1.1 Introduction

The questions that this thesis seeks to address are the ecological question of how the striped hyaena (*Hyaena hyaena syriaca*) can survive in the human-dominated landscapes of Lebanon, and the conservation question of what public awareness measures can be taken to ensure their future survival. Although striped hyaenas are the most globally widespread of the four hyaena species, and are near threatened throughout their range, they have been little studied. In Lebanon, local people persecute striped hyaenas because of their bad reputation, yet they survive in low numbers across the country. Therefore, I examine the ecology of, and local attitudes towards, striped hyaenas, at both rural and urban sites, and in sites of protected and non-protected status, within Lebanon. I also examine the stories known by people about striped hyaenas, and whether attitudes of local people, and of students and their teachers can be influenced by simple conservation education techniques.

1.2 People and wildlife

The magnitude and complexity of threats to biodiversity are well-documented (Soulé 1986, Primack 2002, Wilson 2002). Human numbers have increased from 2.5 billions to 6 billions over the last two generations, and might reach 12 billions in the coming two generations (Wilson 2002). Based on current patterns of use, people currently sequester 40% of the world's net primary productivity (Vitousek et al. 1986) and >50% of the world's renewable fresh water (Raven 2002). Furthermore, the remaining tropical forests will only represent 5% of their original size in the next two generations (Primack 2002). If these trends continue, people will increasingly destroy many of the natural resources that remain. Thus, half to two-thirds of all animal species on the earth may be lost during the next four generations (Wilson 2002, Raven 2002).

The fast rate of biodiversity loss, and its effect on the wellbeing of human communities, has been documented by a growing number of scientists (Wilson and Peter 1988, Brockelman 1989, Bunting 1990, Solbrig 1991). Many people no longer question the importance of conservation objectives, but achieving success in conservation depends on adopting good management practices. One key factor to achieve success is to understand the knowledge and attitudes of local people, who suffer most of the costs of living with conservation objectives, but receive few of their benefits (Kellert et al. 1996, Hill 1997, Gillingham and Lee 1999, Riley and Decker 2000, Naughton-Treves et al. 2003). The attitudes of rural people towards wildlife can be built upon complex interactions between themselves and the wildlife species in question. The nature of this interaction is changing in many areas (Mech 1998, Rajpurohit and Krausman 2000, Treves et al. 2002) as a result of increasing human populations, of loss of natural habitats and of changes in land use patterns (Torres et al. 1996, Woodroffe 2000, Naughton-Treves et al. 2003a).

Increasing human populations usually cause loss of habitat, both in terms of its area and its quality (Gittleman and Harvey 1982). Habitat loss and fragmentation can occur through urbanization, and through agricultural and industrial expansion, and this poses the greatest threat to biodiversity (Vitousek et al. 1997, Brooks et al. 2002, McKinney 2002, Ricketts and Imhoff 2003). The loss and fragmentation of habitats can in turn fragment natural populations and lead to much smaller and discontinuous sub-populations. In turn, small sub-populations often have limited genetic variability that can reduce their chances of adapting to future evolutionary change (Sinclair et al. 2001, Cegelski et al. 2003, Anderson et al. 2004). Furthermore, reduced genetic variability at the population and individual levels can result in the reduction of fitness, and reduction in reproductive success. This, in turn, can contribute to the decline and vulnerability of several mammalian taxa, thereby affecting efforts to ensure their conservation (Flagstad et al. 2003, Hooftman et al. 2003, Bickel et al. 2006). Among the most threatened mammalian species, and among those about which conservationists and the general public care most, are the large carnivores.

1.3 People and carnivores

The members of the order Carnivora number about 226 species, almost all of which are predators. Carnivores influence biological communities through predation and competition. Competition often occurs over time and space among species that utilize the same resources (Durant 1998). Throughout the course of human evolution, the use of space and of food by both humans and large carnivores has overlapped (Clutton-Brock et al. 1996), and may in turn well have affected the co-evolution of both humans and large carnivores (Jaksic 1981). Therefore, many large carnivore populations are adversely affected by the growth of human populations. Because of their negative effects on livestock, and indeed on people, large carnivores are often not tolerated by many human societies. The largest felids, canids, and ursids suffer from habitat degradation, hunting, domestic diseases and commercial markets for their body parts (Weber and Rabinowitz 1996). Tigers (*Panthera tigris*), jaguars (*Panthera onca*) snow leopards (*Uncia uncia*), African wild dogs (*Lycaon pictus*), Ethiopian wolves (*Canis simensis*), and Asian black bears (Salenarctos thibetanus) all face the prospect of imminent extinction (Seidensticker 1980, Fanshawe et al. 1991, Gottelli and Sillero-Zubiri 1992, Mishra 1997). Out of 30 large carnivore species in five families, 22 species are listed as endangered either by the United States through their Endangered Species Act or by IUCN-the World Conservation Union through their Red List (Fuller 1995). Three sub-species of tigers have gone extinct over the past 50 years, and other tiger populations continue to decline (Weber and Rabinowitz 1996). Jaguars are no longer found in the south-western United States, wolverines (*Gulo gulo*) are extinct across the north-east of United States, and grey wolves (*Canis lupus*) have been eliminated from 97% of their range in the contiguous 48 states (Weber and Rabinowitz 1996).

In the past, national governments have adopted several key, and sometimes opposing, strategies to manage their large carnivore populations, including: eradication, regulated harvest and protection. These strategies reflect the differing social perceptions that different sectors of human society hold towards carnivores, and the differing cost and benefit structures that different stakeholder groups enjoy from large carnivores. Furthermore, diseases that pass between wild and domestic carnivores have proved an emerging threat (Murray et al. 1999, Haydon et al. 2002).

1.3.1 Human-carnivore conflict

Conflicts between carnivores and people pose an urgent challenge world-wide. Such conflicts arise for several reasons: their protein-rich diets and their large home range sizes, drive carnivores into competition with people who also have similar needs. Such competition over time and space is not just restricted to large carnivores. Likewise, smaller carnivores have long been involved in competition with humans over game species, fish stocks, crops and poultry (Reynolds and Tapper 1996).

The frequency and costs of human-carnivore conflicts appear to be on the increase in many areas (Treves et al. 2002). People are increasingly altering habitats or exploiting carnivores, because of growing economic, demographic and social pressures leading in turn to increased conflict (Liu et al. 2001). Such conflicts increase with the expansion of human populations, of farming, of housing and of human frontiers into wildlife areas (Woodroffe 2000). At the same time, large carnivore populations are sensitive to the growth of human populations, and declines of large carnivores are occurring globally, from Asia and Africa, to Europe and the Americas.

Equally, people have promoted the recovery of some carnivores, which in turn has promoted more recent conflict in some areas. For example, recovery programmes for once extirpated animals can raise new concerns about further conflicts (Breitenmoser 1998, Bangs et al. 2005, Karanth and Gopal 2005). As a result, conservationists now face the challenge of resolving human-carnivore conflicts within changing social and ecological frameworks across differing landscapes. Some new social constituencies have emerged to secure the protection of carnivores and to support nature protection and animal welfare (Breitenmoser 1998, Fox 2001). In these changing socio-political contexts, past strategies to prevent and control human-carnivore conflict need to be re-evaluated, while future strategies must be based on an improved understanding of carnivore behaviour and public acceptance of the need for their conservation. The main threats that large carnivore populations face from people include: loss of habitat, over-kill, competition and persecution, and I will now discuss each of these in turn.

1.3.1.1 Habitat loss and carnivores

Habitat loss and lack of space is the main threat facing species, and the main cause of recorded extinctions that have occurred since 1600, including for carnivores (Andren 1994, Mace and Balmford 2000, Brooks et al. 2003, Hilton-Taylor 2006). With increased urbanisation, habitat destruction and fragmentation, threats to the existence of many endemic species is inevitable in the regions in which they occur. Large carnivores are particularly sensitive to local extinction in fragmented landscapes, because of their relatively large home ranges, their relatively low densities and the heavy persecution that they face from people (Woodroffe and Ginsberg 1998). Fragmentation results in functional islands of habitat separated by barriers to dispersal that in turn are becoming increasingly isolated. These 'islands' of biodiversity reduce the areas over which species can range and subject species to edge effects that result from degraded habitat and increased predation (Lovejoy et al. 1986, Wilcove et al. 1986). Fragment size and isolation are the major determinants of carnivore abundance and distribution in human-modified landscapes, while the cover of exotic species and urban edges are the strongest predictors of carnivore abundance within urban fragments (Crooks 2002).

The expansion of human populations, and the consequent loss of habitat, underlies the declines shown by many species, and, in many cases, their subsequent extinctions. As people become more numerous, this modifies existing habitats or creates new habitats that in turn make them hostile to many species of wild animals, other than for those generalist commensal species which can live among people. Red foxes (*Vulpes vulpes*) (Harris 1981); raccoons (Procyon lotor) (Riley et al. 1998); and skunks (*Mephitis mephitis*) (Rosatte et al. 1990), can live at high densities in urban areas. Crooks (2002) found that the relative abundance of opossums (*Didelphis virginianus*) and gray foxes (*Urocyon argenteus*) was highest in small habitat fragments. The most rapid and pronounced habitat changes have taken place in urban areas, where natural habitats have been replaced by habitats of human creation. Earthworks, buildings, waste-water disposal, construction of power stations and industrial activities all contribute to alterations of habitats within urban areas. Within more natural areas, increased logging and road construction have reduced protective cover and allowed human access to formerly remote sites. In addition, urbanization of habitats can result in increased mortality, through vehicle collisions, nuisance animal trapping, or contaminant build-up. Therefore, animals more in contact with urbanized areas should have lower survivorship. Moreover, numbers of livestock have had a severe impact upon vegetation and soils through overgrazing and trampling, in addition to herders burning the protective cover, both to improve access to grazing sites and to increase grass production.

Changes in habitat and relative abundance of prey species can cause a shift in carnivore behaviour and diets (Kitchner 1991, Chellam 1993). Some large carnivores like spotted hyaenas (*Crocuta crocuta*), leopards (*Panthera pardus*), and wolves have adapted to habitats modified by people. This adaptability is reflected through their nocturnal activity (Woodroffe 2000), where livestock can be an easy prey for large carnivores (Nowell and Jackson 1996). On the other hand, other specialist species find it less easy to coexist with humans and modified habitats. Large carnivores come into conflict with humans and their domestic animals, while some more-specialized species may benefit from human-associated foods such as ornamental fruit or garbage. Furthermore, as predators in many terrestrial ecosystems, carnivores can also affect other species of carnivores (Palomares and Caro 1999).

1.3.1.2 Over-kill

Although much work has focused on extinctions caused by habitat loss, many of the recorded extinctions that have occurred since 1600 were as a direct result of over-kill, which is the second most important threat to carnivores (Diamond and Case 1986, Atkinson 1989, Reid 1992, Bodmer et al. 1997, Shively 1997). In the past, primitive methods of hunting less often caused extinctions, but the adoption of modern hunting techniques (Robinson and Redford 1991), the influence of market pressures for those species that can be hunted to produce valuable trophies (Bodmer et al. 1997) and the influence of local poverty (Shively 1997), have all combined to make local extinctions of large carnivores more rapid and common. In addition, species inhabiting increasingly fragmented areas are more susceptible to hunting pressures than species living in areas of continuous forest cover (Glanz 1991, Robinson 1996, Turner and Corlett 1996).

Even though subsistence use of wildlife has a long history, commercial use and trade is now threatening the survival of many species through the unsustainable levels of offtake of wildlife resources. Furthermore, illegal wildlife trade is becoming a concern across the world (Martin et al. 1997, Wright and Kumar 1997, Wang and Li 1998), but it is difficult to study and is thus little understood. Furthermore, poverty plays an important role in wildlife use, by undermining traditional management systems and causing over-use (IUCN 1988, Goodland 1992, Shively 1997). Regional and international trade in carnivore skins, bones and other body parts may also encourage local people to kill predators. For example, the practitioners of traditional Chinese medicines believe that the body parts of tigers have medicinal properties. Therefore, Indian villagers who have historically co-existed with predators despite their own high population density increasingly kill tigers for their body parts (Weber and Rabinowitz 1996, Kumar and Wright 1999). A rapid decline in jaguar populations occurred during the 1960s, when more than 15,000 jaguar skins were brought out of the Brazilian Amazon alone each year (Fitzgerald 1989). The red panda (*Ailurus fulgens*) in China is also threatened by local people poaching for its fur (Wei et al. 1999). Indeed, persecution killing by people remains the greatest threat to the existence of many large carnivores (Woodroffe and Ginsberg 1998).

1.3.1.3 Competition

Competition over resources, which is the heart of conflict between carnivores and people. However, competition is not a new phenomenon, as it started once people people domesticated livestock. While carnivores prey upon a wide range of livestock and game species, relatively few species of carnivores attack people and they only rarely cases cause fatal injuries (Treves and Naughton-Treves 1999, Patterson et al. 2004, Treves et al. 2004, Graham et al. 2005). In contrast, most domestic animals are highly vulnerable to predation by carnivores and most share anti-predator behaviour due to selective breeding and extensive farming (Kruuk 2002). Moreover, competition over the million of tonnes of game meat that is being exported annually from tropical forests (Robinson 1999), in turn is threatening large and medium sized carnivores by limiting their prey species (Ginsberg 2001).

Carnivores are considered as a direct threat to people even though attacks on human are rare and deaths are even less frequent (Linnell et al. 2000). Attacks by large carnivores may undermine their conservation effort and result in negative attitudes and more illegal hunting (Mohan 1997, Chauhan et al. 2002). Most of the time in response to such attacks, local people will respond by "hunting campaigns" resulting in killing large number of innocent carnivores, hence threatening their population (Clarke 1971, Jhala and Sharma 1997).

1.3.1.4 Persecution

Economic losses that arise from livestock depredation often lead to aggressive responses towards large carnivores by agro-pastoralists. These include direct persecution, poisoning, opposition to protected areas sited near farms, and resistance to reintroducing extirpated predators to areas where they once ranged. Such negative responses hinder the conservation of threatened species, and disturb the public and political aims of large carnivore management. Persecution of carnivores is widespread, ranging from the occasional poisoning of hyenas by African pastoralists, to government-sponsored eradication of wolves across the United States of America in the 19th and 20th centuries. Persecution of large carnivores by humans in response to loss of life and to livestock depredation has resulted in the elimination by people of several species of large carnivores in historical times from much of their former range (Nowell and Jackson 1996).

Carnivores have been persecuted in many different ways. Brown bears (*Ursus arctos*) in direct conflict with livestock in Norway were the focus of an intensive eradication effort, including national bounties on bear hunting during 1733–1930. These bounties persisted until 1973, when the bears were totally protected, but the species was already functionally exterminated by that time (Swenson et al. 1995, Sagor et al. 1997). Livestock depredation by the snow leopard, an endangered species (Hilton-Taylor 2001), and Tibetan wolf (*Canis lupus chanku*), a vulnerable species (Hilton-Taylor 2001), resulted in human-wildlife conflict, which has greatly hindered their conservation throughout the ranges of both species (Fox et al. 1988, Schaller et al. 1988, Oli et al. 1994, Nowell and Jackson 1996, Mishra 1997). Cheetahs were tolerated in India until the arrival of British colonists, who hunted them and introduced local noblemen to the sport (Divyabhanusinh 1995). Also, government policies may influence peoples' tolerance towards predators. Many governments have sponsored campaigns to eradicate species considered as 'vermin' in the past, either by employing professional hunters or by paying bounties to people who could show evidence of having killed a predator (McIntyre 1995). Such sponsored persecution probably explains why mountain lions and wolves declined in the USA more rapidly than predicted on the basis of rising human density (see Woodroffe 2000). To safe guard livestock, poultry and to promote human safety and also to benefit game species, several species of predators were reduced in numbers causing threatening the survival of many carnivore species (Dobson 1994, Reynolds and Tapper 1996).

As a result of conflict between humans and carnivores, persecution remains the greatest threat to the persistence of many large carnivores (Woodroffe and Ginsberg 1998). Although its habitat has also been reduced, the endemic Ethiopian wolf population decreased to fewer than 500 individuals due to illegal hunting in 1993 (Gottelli and Sillero-Zubiri 1992, Gottelli 1994), but has since recovered under better protection. Cultural and political changes may also allow carnivore declines to be reversed. For example, the gradual recovery of wolves in the USA is witness to the possibilities for conservation. Therefore, while the process is difficult, the fact remains that wolf numbers are increasing, although human populations continued to grow (Mech 1995, Thiel and Ream 1995), U.S. Census Bureau 1999b, Bangs et al. 2005).

Moreover, wildlife rangers and wildlife biologists may indirectly increase negative attitudes of farmers and decrease their tolerance of carnivores as they are trying to conserve carnivores that are affecting the farmers' economy (Bjerke et al. 2000). The impact of livestock predation needs to be considered in local perceptions of carnivores provided that it can potentially affect attitudes towards predators. The modern approach taken to solving carnivore–livestock conflicts includes the selective removal of certain individuals in high conflict areas, rather than reducing overall population sizes of large carnivores. Selective removals consist either of live captures, sometimes followed by predator translocation into other areas, or of lethal control (Linnell et al. 1997). Selective removals may help people to accept the continued presence of carnivores if livestock are less often attacked (e.g. (Stander 1990); reviewed in Linnell et al., 1996).

Solving the conflicts between carnivores and livestock is reminiscent of other social conflicts over natural resources, in the ways that political decisions are made about management and development. Power and institutional efforts can be exerted in ways that are more or less comprehensible to the public. However, lack of control over their own lives and the inefficiency of politics and institutions, constitute an important aspect of the large carnivore debate among those who suffer from conflicts with carnivores. Furthermore, those who suffer substantial economic losses can be strongly opposed or apathetic to large carnivores (Wilson 1997, Bjerke et al. 2000). Moreover, the myths and folklore found in many cultures can consider carnivores as scoundrels result in further threaten to their survival (Kellert et al. 1996).

1.3.2 Large carnivores in culture

Human attitudes towards different species of wildlife are influenced by physical and behavioural characteristics of the species, including its size, its perceived intelligence, its cultural and historical associations, its ferocity and any likelihood of conflict or competition (Kellert et al. 1996). One group of animals that elicit intense and extreme positive or negative attitudes is the large carnivores (Bjerke and Kaltenborn 1999). Humans have held intense feelings about carnivores for a long time, ranging from worshiping them as Gods, to contempt and persecution. Interactions between large carnivores and humans, and the resulting conflict are often an historical issue. For example, the indigenous people of North America regarded the wolf (*Canis lupus*) as a creature of power (Lopez 1978), while early settlers in North America despised the wolf because it was viewed as a threat to personal safety and a hindrance to progress and civilization (Young 1946). However, some now consider the wolf as an innocent victim that has lost its place in nature. Aspects of this early conflict still continue to this day, particularly among those living in close proximity to existing wolf populations, or where their economic interests are provoked by these animals (Buys 1975, McNaught 1987, Biggs 1988, Tucker and Pletscher 1989, Bjerke and Kaltenborn 1999, Vitterso et al. 1999). Indeed, anti-predator and anti-governmental attitudes were the likely causes behind the failure of the wolf reintroductions in the United States (Hook and Robinson 1982).

Similarly, polarized views appear to be held towards other species of large carnivores. The attitudes of local people towards the Andean bear (*Tremarctos ornatus*) range from considering it a pest and a dangerous animal, to a God-like deity possessing the equivalent of seven human souls (Paisley 2001). Likewise, tigers and jaguars are symbols of power that have become intricately woven into the fabric of culture and religion (Weber and Rabinowitz 1996), yet both species are also feared and persecuted because of their ill-deserved reputation as dangerous killers of humans and livestock.

1.4 Conservation of carnivores

The application of conservation biology to real world situations has as much, if not more, to do with politics and public relations as with science (Warren et al. 1990). At national and international levels, conservationists have realized the need to develop 'marketing strategies' that capture the public imagination. Two strategies usually feature: the first one focuses on a single charismatic or 'flagship species' with which the public becomes emotionally engaged (Leader-Williams and Dublin 2000), through campaigns such as 'Save the Panda' or 'Save the Tiger' (Seidensticker 1997). The other strategy focuses on ecosystem and biodiversity conservation (Simberloff 1998). There have been many attempts to unite and scientifically justify, combining both strategies, using various arguments that consider umbrella species and similar (Leader-Williams and Dublin 2000). For example, if large carnivores are conserved, the biodiversity within their habitats will be automatically conserved. The second argument states the necessity to conserve large carnivores arises because they present useful indicators or because they are vital for ecosystem functioning (Lindenmayer et al. 2002, Payton et al. 2002, Roberge and Angelstam 2004). Nevertheless, the reasons for conserving large carnivores can be subjective, based on personal or social ethics, and our recognition of what is right and wrong with respect to the human interactions with the natural world (Hunter and Hutchinson 1994, Boitani 1995, Breitenmoser 1998).

Once the decision to conserve large carnivores within a landscape has been made at national or international levels, conservation biologists need to take the required practical and economical measures to inter alia: ensure protection; reduce conflicts; and allow people and carnivores to co-exist as peacefully as possible (Boman 1995, Fuller and Kittredge 1996, Linnell et al. 1996). At the local level, the long-term survival of carnivore populations depends on creating conservation-friendly landscape mosaics outside the protected areas, to ensure contact between populations that are protected, and to increase the available habitat to hold as large populations as possible. However, species may differ in their reaction to the same threat (Lomolino et al. 1989, Jablonski 1991, Laurance 1991, Leach and Givnish 1996, Harcourt 1998, Van Vuren 1998, Cowlishaw 1999, Harcourt et al. 2001, Harcourt and Schwatz 2001). These differences constitute a reason of why IUCN's Red List criteria concentrate on the biological characteristics of species themselves, rather than on the nature and intensity of threats (IUCN 1996).

1.4.1 Protected areas and carnivores

1.4.1.1 Role of protected areas

Protected areas (PAs) can play an important role in conserving flora and fauna, including of large carnivores, and constitute live laboratories that permit the understanding of native species within functioning ecosystems (Sinclair et al. 2001). PAs, including natural reserves and national parks, can inspire the protection of biodiversity as it existed before people wrought the drastic environmental changes that are now seen outside many of these PAs. Several countries have implemented protective measures to prevent ongoing declines of their carnivore populations. Adequate protection has allowed the recovery of several carnivore populations from the brink of extinction in the last century, and such protection still holds out hope for other still threatened species of carnivore (Breitenmoser 1998). Without strictly PAs, it is nearly impossible to carry out longitudinal studies on carnivores, which are so important both for their scientific management and the improvement of public attitudes towards wildlife (Karanth et al. 1999). Furthermore, PAs can play an important role by generating income for local people. PAs are increasingly popular destinations for wildlife tourists, and tourism has the potential to generate sustainable local benefits sufficient for local people to value and hence protect their wildlife heritage as a source of income (Goodwin 1996, Walpole and Goodwin 2001).

Carnivores may, nevertheless go extinct even in relatively large PAs, as a result of persecution and edge effects along their perimeter. Consequently, the minimum reserve size calculated for the persistence of large carnivores needs to take account of their home range size. Therefore, those species of large carnivore with very large home ranges will require huge PAs and relatively un-fragmented natural areas. However, the PAs that remain are often small and fragmented. For example, there are only 19 nature reserves larger than 100 km^2 in Europe (de Vries 1995). To reduce the effects of fragmentation, managers must reconsider enlarging or linking PAs. Probable strategies include restoration of the surrounding low-quality and semi-natural areas outside PAs, setting aside of formerly cultivated areas, and connecting reserves by effective corridors through which species can move (Meffe and Caroll 1994).

1.4.1.2 Effect of PAs

Small PAs (or habitat patches) tend to lose species more rapidly than large ones (Rosenzweig 1995, Laurance and Bierregaard 1997). Indeed, the relationship between the size of a reserve, and the number of species in that area is considered a strong and consistent predictor to estimate time to extinction (Belvosky 1987, Brooks and Balmford 1996, Brooks et al. 1997), even though exceptions to this relationship exist (Turner 1996, Debinski and Holt 2000). In addition, the nature of landscape around PAs also affects the processes operating within and between PAs, thereby affecting the number of species within them (Hanski and Gilpin 1997, Wiens 1997).

If human densities correlate with extinction, and if small PAs are located in regions of relatively high human density, then these small PAs are in more precarious surroundings than in the case of large reserves. Small PAs will suffer more intense edge effects, and become more isolated. If the size of a protected area is associated with the nature of the matrix in which it is located, it should be questioned whether small reserves have few species because they are small, or rather because they are situated in fragmented landscapes. The two effects of reserve size and fragmented landscapes are potentially different, thus presenting different implications for management.

1.4.1.3 Effect of local people around PAs

The various categories of PAs can support different forms of land use, including agriculture, livestock grazing, and the benefits of minor forest products (IUCN 1994). However, the close presence of people within and around PAs often results in people-wildlife conflicts. For example, livestock grazing can be widespread in and around some PAs, with livestock holdings constituting an important component of the local pastoral and agricultural economy. In such situations, farmers may anticipate serious consequences for sheep farming as a result of the close proximity of large carnivores, which in turn can shape their attitudes towards the behaviour of those large carnivores which might cause them economic losses

(Vitterso et al. 1999). Controversies over large carnivores may also demonstrate a rural and local protest against central control by distant political authorities over land use in PAs established to achieve national objectives (Bjerke et al. 2000). Hence, people who experience external control of their daily problems tend to be less tolerant towards large carnivores and tend to accept a more limited range of carnivores in their areas.

Human density correlates with loss of natural habitat, damage to the environment and extinction of species (Harcourt 1981, Parker and Graham 1989, Harcourt 1996). Consequently, the decline and loss in populations of large carnivores is a global problem, and has occurred from Asia and Africa, and from Europe and the Americas. Even protected populations of large carnivores remain at risk, as contact with people at protected area boundaries is a major cause of mortality, given that many PAs are too small to encompass the home ranges of such wide ranging species as large carnivores (Woodroffe and Ginsberg 1998). Animals like carnivores, which have large home ranges, are more susceptible to human persecution than species with small home ranges, since they will be more likely to leave the PA and be killed (Woodroffe and Ginsberg 1998, Harcourt and Schwartz 2001). Although PAs remain a cornerstone in approaches to wildlife conservation (Wynne 1998), they are still threatened by growing human populations, especially in countries of the developing world where increasing pressure is exerted on land to be economically productive. Hence, increasing conflict between local people and wildlife is probably the most serious problem facing carnivores adjacent to PAs (Newmark et al. 1993). Harcourt et al. (2001) reported that small reserves in Africa face double jeopardy; their small size and high local people density surrounding the reserves creating a hostile environment for wildlife.

Conflicts between local people and PA managers represent a common problem in developed and developing countries. Local people living around PAs hold negative attitudes towards them for several reasons besides conflicts with wildlife (Leader-Williams and Hutton 2005). PAs management has emphasized a policy of 'fences and fines' which resulted in forcible evictions and keeping out local community members. In turn, this has increased the negative attitudes towards the PAs that is manifested by increased poaching, degradation of resources and local hostility towards PAs (Honey 1999, Conover and Munch 2002). Integrated conservation and development concepts that address poverty and conservation could provide a sustainable economic incentive for communities surrounding PAs to tolerate coexistence with wildlife (Wells and Brandon 1992). Such approaches have proved successful in developing countries with high biodiversity and economic underdevelopment (Western and Wright 1994). Promoting the use of wildlife through ecotourism and extractive use may result in greater tolerance of local people towards their PAs (Leader-Williams and Hutton 2005, Walpole and Thouless 2005). Tourism, employment and business opportunities can provide tangible economic benefits for local people and communities around PAs, which make them value and tolerate wildlife, and therefore protect it as a source of income, (Goodwin 1996, Frank et al. 2005, Walpole and Thouless 2005). Compensation programmes can help in solving human-wildlife conflict under certain circumstances. In turn, however, compensation schemes can do harm if inadequate attention is paid to certain key factors (Nyhus et al. 2005). Linnell et al. (2005) suggested zoning as a valuable tool to minimize conflicts with, and the conservation of, large carnivores. However, this is dependent on the ecology of species in question, the extent of conflict and the cultural and social economic status of local populations. In some cases, an appropriate education programme, for local people may prove one of the most valuable steps to value and preserve their native species, as well to change values and beliefs that hold negative implications for nature (Primack et al. 2002, Conforti et al. 2003)

1.4.2 Effect of environmental education

For both environmental educators and learners, environmental education realises the possibility of gaining an understanding of nature that is grounded in respect, caring and a sense of wonder, and an understanding that induces less destructive and disruptive ways of living in the world. The long-term hope of environmental education is to establish zero-order humanism, and to challenge the ideology of the necessary primacy of human enterprise (Livingstone 1994). The short-term hope, on the other hand, seeks to undertake a thorough examination of the limits of reason, science, technology and resource management. Education should occur as a conversation involving a "more direct contact with the natural aspects of a place, with soils, landscape and wildlife" (Orr 1992). Only then can educators "play a co-evolved, healthy contributory role in interspecies relationships" (Livingstone 1994). Environmental education has the potential to play a significant role in changing this trend of biodiversity loss. The goal of environmental education is to develop the social knowledge and thinking skills about biophysical environment issues, their problems, to find the strategies to deal with them (Stapp et al. 1996), and to change values and beliefs with negative effect (Williams 1979, Kellert 1996, Tessler and Shafer 1990).

Collection-based institutions, including zoological and botanical gardens, aquariums and natural history museums, can play an important role in changing this trend. Most collection-based institutions have become interested and involved in conservation issues during the last 40 years, as societies have become more aware of losses in biodiversity. Although these institutions can play a role in conservation science and education, some authors may urge them to do much more (Conway 2000, Rabb 2001, Wemmer 2002). Nevertheless, collection-based institutions can play an important role among urban populations, by offering an exceptional opportunity to observe natural life. About 50% of the world's people live in cities and this proportion is expected to grow (Brown et al. 1998). Since urban populations are so disconnected from nature, collection-based institutions have the ability to stimulate curiosity about wildlife, and play an educational role to have a chance of winning support of its preservation. Moreover, these institutions are valuable resources for environmental education in developing countries (de White and Jacobson 1994). Active approaches and programmes, in environmental education, which include training, talks, activities related to wildlife and their habitat, may stimulate the interest of public, offer opportunities in education about nature and wildlife, and can gain support of visitors towards conservation (Kellert 1996, Stoinski et al. 2002, Miller et al. 2004). However, in the face of obstacles that are of almost incomparable complexity, environmental education poses a real challenge for institutions with a message of conservation to find ways to create a new effective base of political support, financial and scientific help to save as much of nature as possible (Miller et al. 2004). Such challenges face those seeking to conserve large carnivores in human-dominated landscapes that afford little protection, as is the case with the striped hyaena in Lebabon.

1.5 Aims of the study

The striped hyaena was the first Hyaenidae species described by Linnaeus (*Canis hyaena*, 1758). It survives in open habitat or light thorn bush throughout most of its range across Africa and Asia (Kruuk 1976, Harrison and Bates 1991). Lebanon was selected for a comprehensive study of the interaction between striped hyaenas and people for several reasons. No recent research has been carried out on mammals in Lebanon. The striped hyaena is the largest carnivore remaining in Lebanon and still survives within human–dominated landscapes. Indeed, press reports and personal observations in different areas suggested that the species was in need of study due to the manner in which it was being persecuted. Moreover, the civil war in Lebanon had resulted also in the displacement of many people from their villages, and land-mining of the borders between the fighting parties, giving the striped hyaena some space in which to survive. After the war had ended, people returned to their villages, the space available for hyaenas decreased due to urbanization, hence leading to conflict and to eradication of the species, fuelled by the intense feelings of people towards carnivores arising from the myths that surround hyaenas. An additional related factor in selecting Lebanon was the opportunity to document the rich traditional related myths and to evaluate the extent to which these traditional beliefs influenced local tolerance of striped hyaenas.

This study sought to investigate the human impact on the striped hyaena in Lebanon in the context of its ecology and behaviour. I studied the role of mythical stories, education, and human social status on the distribution of striped hyaenas in different areas of Lebanon. I also sought to investigate the effectiveness of an educational programme and of public awareness strategies in conserving striped hyaenas in Lebanon. Given the theoretical conclusion about the importance of people attitudes and public awareness programmes in conserving wildlife, I predicted that by understanding local people attitudes towards striped hyaena and the application of an active awareness programme accordingly will result in a better conservation of striped hyaena. Hence this study specifically seeks to answer the following questions:

- What is the distribution of striped hyaena in Lebanon and their relative abundance in selected study sites?
- Does feeding behaviour and diet of striped hyaena differ within different human-dominated landscapes?
- What size are the home ranges of striped hyaenas living in different human-dominated landscapes, and do environmental factors affect their ranging ecology?
- How knowledgeable are people about striped hyaenas and which factors determining their knowledge?
- What kind of mythical stories are still known and prevalent among people and what are the factors explaining this knowledge?
- What factors determine the attitudes of people towards striped hyaena and what are the factors best explaining these attitudes?
- Can attitudes of adults be improved through awareness raising programmes and what approaches are most effective in changing these attitudes?
- What are the attitudes of students and their teachers towards striped hyaena, what are the factors explaining these attitudes, and what are the most effective way in changing these attitudes?

These questions are covered in sequence in the chapters and have the overall objective of exploring how the striped hyaena might be most effectively conserved in the human-dominated landscapes of Lebanon, whether through site protection or awareness programmes to change public attitudes

1.6 Thesis organisation

The first chapter of this thesis has already given an overview of the main themes, of people-wildlife conflicts, people-carnivore conflicts and ways to resolve this conflict that run through the study. Chapter 2 describes the study area and the main features of Lebanon, the study species of the striped hyaena, and the general methods used throughout the study. Chapter 3 investigates the distribution of striped hyaenas across Lebanon, as the basis for choosing study sites for more detailed study. The chapter then investigates the relative abundance of striped hyaenas across the six study sites using simple field survey methods. Chapter 4 uses scat samples and feeding remains to compare the feeding ecology of striped hyaenas in rural and urban settings, within human-dominated landscapes in Lebanon. Chapter 5 then compares the ranging ecology of, and habitat use by, radio-collared striped hyaenas living in rural and urban settings within human-dominated landscapes in Lebanon. Chapter 6 uses focal group discussions and questionnaire interviews to investigate local knowledge concerning the ecology, status and threats facing striped hyaenas across the six study sites. Chapter 7 then documents the stories known by elders about striped hyaenas and examines how well known are these stories across the six study sites. Chapter 8 investigates the role of negative and positive stories in determining the attitudes of local residents across the six study sites towards striped hyaenas. Chapter 9 examines two approaches, one field-based and the second zoo-based, to raising awareness and changing attitudes among adults towards striped hyaenas. Chapter 10 examines the effectiveness of passive and active methods within a zoo-based conservation education programme to raising awareness and changing the attitudes of students and their teachers towards striped hyaenas. Chapter 11 summarises the lessons learned from this study, and discusses their conservation implications, both in terms of management recommendations for striped hyaena in Lebanon, in particular, and for biodiversity management more generally.

Chapter 2

STUDY AREA, STUDY SPECIES AND GENERAL METHODS

Striped hyaena and its habitat in the urban site Chnaniir-Lebanon

This chapter considers further background to the study, by discussing the following:

- the main geographical and biodiversity features of Lebanon;
- the taxonomy and ecology of the hyaena family in general, and of striped hyaenas in particular; and
- the general methods used throughout the study.

2.1 Lebanon

2.1.1 Location and general features

Lebanon is a Middle Eastern country situated on the eastern shores of the Mediterranean Sea. Lebanon lies between latitudes 33° 03' 38" and 34° 41' 35" N and longitudes 35° 06' 22" and 36° 37' 22" E. The country covers an area of 10,452km^2, and has an average width of 50km and an average length of 220km. Its elevation ranges from 0 to 3080m above sea level (asl). Lebanon has four distinctive seasons: summer; autumn; winter; and, spring. Temperatures range from –10° C during winter in the mountains, to almost 40° C during summer in the coastal areas. The different bio-climatic regimes of Lebanon are determined by a combination of the country's location, physiography and geography. Its bio-climatic regimes make Lebanon unique in the Mediterranean region, and endow it with a very rich biodiversity, both in terms of its flora and fauna.

2.1.2 Physiography

In spite of its small area, Lebanon has five distinct geomorphological regions:

- the coastal area, including the shoreline, extends for over 220km and has a maximum elevation of 500m asl. The coastal area is characterised by rocky, gravel or sandy beaches, and a coastal plain that runs along the foot of Mount Lebanon, and that ranges in width from 7-30km.
- Mount Lebanon extends from the north to the south of Lebanon. Mount Lebanon has a length of 160km with a maximum elevation of 3088m asl, and a width ranging from 25km at the centre of Lebanon to 40km in the north.
- the Beqa'a plain is a depression lying between Mount Lebanon and the Anti Lebanon, with an average altitude of 900m asl. The Beqa'a plain has a length of 120km from north to south, and an average width of 8-12km from east to west, but can reach 25km in the far east of Lebanon.
- the Anti Lebanon has generally similar features to Mount Lebanon, but is situated to the east of Lebanon.

- South Lebanon is a plateau that lies to the south of the Mount Lebanon range. Its relief is tabular across the western section, rounded across the central section, and more jagged towards the eastern section, where it meets with the mountains of Anti Lebanon.

2.1.3 Administrative divisions

Lebanon's first tier of devolved administrative unit is its governorates, equivalent to provinces in other countries. These governorates are further subdivided into 26 districts (*Aqdya* when plural or *Qadaa* when in the singular). In turn, districts can also be subdivided into several municipalities. Initially, Lebanon was divided into the five governorates of Beirut, Mount Lebanon, The North, The South, and Beqa'a. In 2003, the number of governorates was increased to seven, by dividing the South into the two governorates of The South and Nabatieh, and the Beqa'a into the two governorates of Beqa'a and Baalbak - Al-Hermel. However, in this study I consider only the five original governorates, by which people still identify themselves.

I will now provide a brief description of each of the five original governorates and their land cover, which I divide into three broad habitat categories comprising:

- Urban habitats including: housing and urban areas; urban sprawl; and, non-built up artificial areas.
- Agricultural habitats including: permanent crops (fruit, vines, citrus and olives trees); field crops (vegetables); and, farms (dairy farms and poultry houses).
- Wild habitats including: bare rocks; grass land; oak forests; scrubland; other mixed wooded areas (pine trees, carob trees, deciduous wild trees, and shrubs), rivers; and, artificial lakes.

The Governorate of Beirut: comprises one district and the city Beirut, which is the national capital and home to approximately 525,000 people. Despite its small size of 21.2km^2, this governorate is considered the most important in Lebanon because of its economic, political, cultural, and social activity. The land cover of the Beirut Governorate comprises 96.4% urban areas, 0.6% agricultural areas, and 3% wild areas.

The Governorate of Mount Lebanon: comprises six districts and is home to approximately 1.5 million people. This governorate is dominated by the mountain range of Mount Lebanon and extends for 160km along the length of the country, running parallel to the Mediterranean coast and rises up to 2600m asl. The Governorate of Mount Lebanon covers an area of 1970km^2. The land cover of the Mount Lebanon Governorate comprises 16.2% urban areas, 15.7% agricultural areas, and 68.1% wild areas.

The Governorate of The North: comprises seven districts and is home to approximately 750,000 people. This governorate extends from the Mediterranean coast and rises up to 3000m asl. The North Governorate covers an area of 1973km^2. The land cover of the North Governorate comprises 6.9% urban areas, 37.0% agricultural areas, and 56.1% wild areas.

The Governorate of The South: comprises seven districts and is home to approximately 1 million people. This governorate extends from the Mediterranean coast and rises up to 2000m asl. The South Governorate covers an area of 2023km^2. The land cover of the South Governorate comprises 12.6% urban areas, 37.3% agricultural areas, and 50.1% wild areas.

The Governorate of The Beqa'a: comprises five districts and is home to approximately 550,000 people. The Beqa'a Governorate forms the main geographic extension of Lebanon and lies between the western and eastern Lebanese mountains and separates Mount Lebanon from Anti-Lebanon. The altitude of the Beqa'a Governorate ranges from 500-3088m asl.The Beqa'a Governorate covers an area of 4,258km^2. The land cover of the Beqa'a Governorate comprises 1.8% urban areas, 31.5% agricultural areas, and 66.7% wild areas.

2.1.4 Geology

The parent rocks of Lebanon can be classified into four main categories, based their role in landscape development (Walley 1997). The limestone rock massif includes both hard (Jurassic, Upper Aptian and Cenomanian, part of the Ecocene and Miocene epochs) and soft limestones and marls (Senonian and Palaeocene, part of the Ecocene and Neogene epochs). Cross-bedded rocks, with intercalations of marls, clays and siltstone characterise the early Cretaceous formation of the Aptian and the Albian rocks. Non-calcareous rocks are poorly represented in Lebanon and are limited to the basal Cretaceous and the localized basalts. Alluvions and Colluvions, the distinctive orography of Lebanon, have contributed to the transport and accumulation of material into the Beqa'a plain and the sea (Walley 1997).

Most of the soils of Lebanon are calcareous, except for sandy soils formed on the basal cretaceous strata (Hamadeh et al. 1996). The most widely represented soil is the Terra-Rossa and the Rendzinas. On the steeper landscapes of the Mount Lebanon and Anti-Lebanon ranges, where water erosion can be extreme, the fersiallitic soils often developed into Lithosols. The soils in Lebanon are young and fragile and prone to erosion, especially in the mountains and hill land that comprise 37% of the surface area of Lebanon (Hamadeh et al. 1996).

2.1.5 Climate

Lebanon has four distinctive seasons: summer; autumn; winter; and, spring. However, the bio-climatic regimes of Lebanon differ according to their location and physiography. Two mountain ranges run perpendicular to the direction of the main path of the atmospheric circulation from the core of the country and these result in highly marked climatic variability over short distances. Thus, a 50km transect running from west to east through Lebanon passes, in turn, through coastal subtropical climate, to middle slopes that are typically Mediterranean, to high areas with snow cover the whole year round, and ends in a semi-arid plain.

2.1.5.1 Rainfall

The mean annual rainfall in Lebanon is high compared to other Mediterranean countries, as well as to other subtropical countries nearby. The seasonal variation in rainfall is also high, and from 80-90% of the annual rainfall falls between November and March, while less than 5% falls between May and September. Mean annual rainfall ranges from 700-1000mm on the coast, and increases towards the north. Rainfall finds a barrier to movement around Mount Lebanon, where precipitation can reach more than 1400mm per year, most of which falls as snow. Rainfall declines sharply on the eastern facing slopes of the Mount Lebanon range, where some 600mm falls on the foot-hills. Rainfall in the Beqa'a ranges from 800mm in south Beqa'a to less than 200mm in the extreme north-east. Rainfall on the Anti-Lebanon range is around 600mm and reaches a maximum over 1000mm in Jabal Al-Sheikh.

2.1.5.2 Temperature

The mean annual temperature on the coast ranges from 19.5° to 21.5°C. The mean daily temperature then decreases by approximately 3°C for each 500m rise in altitude, and reaches 15°C at 1000m asl and 9°C at 2000m asl January is the coldest month, and its mean daily temperature can fall to –4°C in the mountains and to 7°C in coastal areas. July and August are the warmest months, in which the mean daily temperatures can rise to 28°C in the mountains and to 33°C on the coast. Daytime and night-time temperatures vary by only 6-8°C throughout the year on the coast.

2.1.5.3 Humidity

Relative humidity is fairly uniform throughout the year on the coast, and averages around 70%. In the mountains, relative humidity fluctuates more markedly, and ranges from 70-75% in winter and from 50-60% in summer.

2.1.6 Flora

Despite its small size, Lebanon has a very rich floral diversity. More than 4633 species of plants have been recorded. Of these, 3761 species comprise the terrestrial flora, and most of these species are characteristic of the Mediterranean flora, and primarily the flora of the East Mediterranean. Of these terrestrial species, 92 species are endemic to Lebanon only. Most of these endemics are found on the highest summits of Mount Lebanon. Some of these endemic plants are abundant, while 38 species are threatened due to flower picking, overgrazing and urban development, even on the tops of mountains (Abi-Saleh 1996).

The forests of Lebanon occur predominantly on Mount Lebanon, and comprise various habitat associations, in part determined by climatic factors. The species present include many valuable genetic resources. The forests include the following (Nasser 1996):

- The Fagaceae, comprising seven species of the genera *Quercus* with two species endemic to Lebanon, *Q. libani* and *Q. cedroum*. The distribution of this family covers ca 400km^2 of Lebanon.
- The Pinaceae includes three species of the genera *Pinus*, one *Cedrus* (*C. libani*) and one *Abies*. The distribution of this family covers ca 200km^2 of Lebanon.
- The Cupressaceae includes two species of the genera *Cupressus* and *Juniperus*. The distribution of this family covers ca 90km^2 of Lebanon.
- Three subordinate but important species *Ceratonia siliqua*, *Pistacia lentiscus*, and *Acer hermonuem*.

Woods and forests are threatened by excessive cutting, over grazing, urban development and fires (Nasser 1996).

Native fodder species are widely distributed in all geomorphological regions. They are found at their highest densities in Mount Lebanon and at their lowest densities in Anti-Lebanon. Native fodders include 96 species, 34 of which are threatened by over grazing and uncontrolled urban development (Rami 1996).

Riverside species are found on the banks and shores of rivers, and include 30 species. Many of these species are threatened by uncontrolled over-exploitation of quarries, factories and tourism (Abi-Saleh 1996).

Medicinal plant species are widespread throughout different geomorphological regions. They include 236 wild and cultivated species, 16 of which are rare and 29 of which are threatened by over harvesting, over grazing and uncontrolled urban development (Safi 1996).

Lower plants are less well-studied and included 219 species of Bryophta (Charouk 1982), 31 species of Pteridophyta, and 255 species of Thallophyta. Many of these species are threatened by exploitation and habitat destruction (Tohmé 1996).

2.1.7 Fauna

2.1.7.1 Amphibians and reptiles

Relatively few amphibian species are found in Lebanon, and these comprise two species of frogs, two species of toads, one species of salamander and one species of newt (Boulos 1995, Bloquet 1996). In contrast, 43 species of reptiles are known to occur in Lebanon, including three species of marine tortoise, one terrapin, and one land tortoise, 20 species of lizard, two of which are endemic, 13 species of non-venomous grass snakes, two species of venomous grass snakes, and three species of vipers (Groombridge 1989, Boulos 1995, Bloquet 1996).

Most of the amphibians and reptiles species that occur in Lebanon are threatened due to intense urban development and habitat destruction, the use of pesticides and through direct persecution (Bloquet 1996).

2.1.7.2 Birds

Lebanon is considered to have a rich avifauna, and some 347 species of birds have been recorded to date. Of these, 65 species have strayed into Lebanon, 100 species nest in Lebanon, 170 species are migratory and over-winter in Lebanon, two species have been recently introduced, and there are no recent records for another 10 species. Although there are no endemic species of birds in Lebanon, a number of semi-endemic species occur, including the chukar partridge, *Alectoris chukar*, together with a number of Asian species including the crested lark, *Galerida cristata cinnamomina*, Middle East warbler, *Sylvia melanocephala momus* and Rufous-tailed Scrub-robin, *Cercotrichas galactotes syriacus* (Tohmé and Tohmé 1996, Ramadan-Jaradi and Ramadan-Jaradi 1997, Porter et al. 2004).

Several factors threaten species of birds in Lebanon, including hunting, introduction of alien species, deforestation, intensive agriculture, increasing urban development, and excessive use of pesticides. Some of these threats can act directly on some species of birds, for example by poisoning them, or can affect others indirectly by killing their prey (Ramadan-Jaradi 1996).

2.1.7.3 Mammals

There are no endemic species of mammals in Lebanon. Furthermore, several wider- ranging species that formerly occurred in Lebanon are already locally extinct, including the brown bear (*Ursus aructus*), the Eurasian lynx (*Lynx lynx*), and the Mesopotamian fallow deer (*Dama dama mesopotamica*). Those mammals that currently occur in Lebanon comprise eight orders, namely:

- Insectivora, including: hedgehogs (*Erinaceus concolor*), and two genera and five species of shrews, Soricidae family, of which three species are rare.
- Chiroptera, including: five families, comprising one species of the Pteropodidae: *Rousettus aegypticaus* (Attallah 1977); one species of the Rhinopomatidae: *Rhinopoma microphyllum* (Harrison 1963, 1968); three species of the Rhinolophidae: *R. eurayle, R. hipposiderous* and *R. ferrumequinum* (Harrison 1961, Harrison and Lewis 1961, Lewis and Harrison 1962, Harrison 1964, Attallah 1970, 1977, 1978); one species of the Molossidae: *Tadarida teniotis*; and 10 species of the Vespertilionidae: *Nyctalus noctula, Myotis myotis, Myotis blythii, Myotis emarginatus, Myotis nattereri, Eptesicus serotinus, Pipistrellus pipistrellus, Pipipestrillus kuhlii, Pipistrellus savii* and *Miniopterus schreibersii* (Tohmé 1996);
- Carnivora, including five families, comprising three species of Canidae: *Canis aureus, Canis lupus* and *Vulpes vulpes* (Lewis et al. 1967, Lewis et al. 1968, Tohmé et al. 1975); five species of Mustelidae: *Martes foina, Vormela peregusna, Mustela nivalis, Meles meles* and *Lutra lutra*; one species of Viverridae: *Herpestes ichneumon*; one species of Hyaenidae: *Hyaena hyaena*; and two species of Felidae: *Felis silvestris* and *Felis chaus* (Lewis et al. 1968, Tohmé and Tohmé 1985, Tohmé 1996);
- Hyracoidea, including the one family of Procaviidae, comprising one species *Procavia capensis* (Lewis et al. 1968, Tohmé 1996);
- Artiodactyla, including the one family of Suidae, comprising one species *Sus scrofa*; (Tohmé 1996);
- Lagomorpha: including the one family Leporidae, comprising one species *Lepus capensis* (Lewis et al. 1967, Tohmé 1996);
- Rodentia: including seven families, comprising one species of Sciuridae: *Sciurus anomalus*; one species of Hystricdae *Hystrix indica*; one species of Dipodidae:*Allactaga euphratica* (Abi-Said 2004a); two species of Gliridae: *Eliomys melanurus, Dryomys nitedula*, one species of Spalacidae: *Spalax leucodon*, six species of Muridae: *Apodemus mystacinus, Apodemus sylvaticus, Rattus rattus, Rattus norvegicus, Mus musculus* and *Acomys dimidiatus*; four species of Cricetidae: *Cricetulus migratorius, Mesocricetus auratus, Microtus nivalis* and *Microtus guentheri guentheri* (Lewis et al. 1967, Tohmé 1996).

Many of these species of mammal are threatened as a result of deforestation, urban development, drying of swamps, intensive agriculture and the use of chemical products, industrial development, as well as by hunting and myths surrounding some animals (Tohmé 1996). Four species are now thought to be very close to local extinction, including the grey wolf, the wild cat, the pole cat and the striped hyaena.

2.1.8 Protected areas in Lebanon

Several institutions have a direct or indirect role in dealing with environmental and biodiversity issues in Lebanon. The Lebanese Parliament is gradually developing a better understanding of the environment and established the Ministry of Environment in 1993 to deal with such issues. Non-governmental organisations (NGOs) have also played an important role in conservation and environmental protection, both at national and local levels, and have collaborated with the Ministry of Environment, the Ministry of Agriculture, and the Ministry of Culture and Higher Education, to protect the remaining biodiversity. Following the Rio Conference in 1992, a law was passed allowing for the establishment of unoccupied Nature Reserves (NRs) as nationally important, legally protected areas with the stated purposes of:

- conserving native fauna and flora *in situ*;
- supporting ongoing research and monitoring;
- educating, training and raising of public awareness;
- promoting cooperation among different conservation bodies; and
- enhancing development of local communities.

The Government established a total of seven NRs between 1992 and 1999 and were characterized by the government as nature reserves, comprising: Horch Ehden, Tannourine Cedar, and the Palm Islands in the North Governorate; Bentael and Al-Shouf Cedar in the Mount Lebanon Governorate; Al-Yammouneh in the Beqa'a; and Tyre Beach in the South Governorate (Figure 2.1). These reserves cover a total area of 207km^2, or 2% of the surface area of Lebanon. Since their establishment, IUCN – The World Conservation Union has categorised the NRs of Lebanon under different management categories, all of which assume a high level of protection (see http://sea.unep-wcmc.org/wdbpa/index.htm?http://sea.unep-wcmc.org/wdbpa/download.cfm%7Emain). In addition, another 33 legally protected sites have been established at national and local levels under different categories of protection.

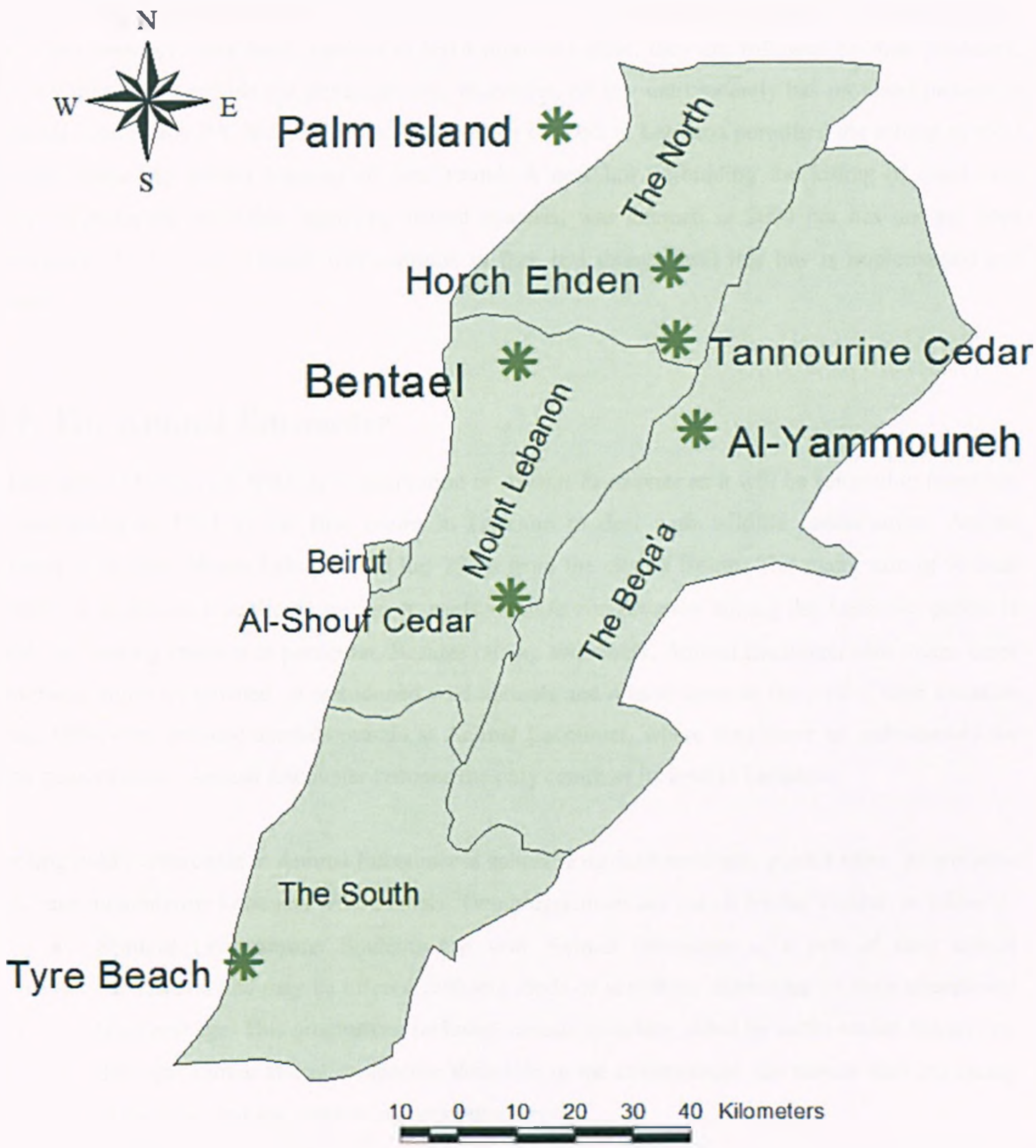


Figure 2.1. Distribution of nature reserves across Lebanon.

All protected areas in Lebanon are small and surrounded by people. Most wild antelopes are close to local extinction, while livestock and their herders are now not allowed into any category of protected areas. Thus, when livestock have been required to leave protected areas, they are followed by their predators, which are then killed outside the protected area. Moreover, no law until recently has provided protection to animals outside any PA. Indeed, the old hunting law of 1952 in Lebanon permitted the killing of most carnivores including striped hyaenas all year round. A new law forbidding the killing of carnivores species on protected schedules, including striped hyaenas, was decreed in 2004 but has not yet been implemented. As a result, wildlife will continue to face real threats until this law is implemented and enforced.

2.1.9. The Animal Encounter

The Educational Centre for Wildlife Conservation or *Animal Encounter* as it will be referred to hereafter, was established in 1993 as the first centre in Lebanon to deal with wildlife conservation. Animal Encounter is in Aley-Mount Lebanon and lies 23km from the city of Beirut. The major aim of Animal Encounter is to promote public awareness towards wildlife conservation among the Lebanese public in general, and among students in particular. Besides raising awareness, Animal Encounter also treats, cures and nurtures injured, orphaned, or abandoned wild animals and returns them to the wild if their situation permits. Otherwise, rescued animals remain at Animal Encounter, where they serve as ambassadors for species conservation. Animal Encounter remains the only centre of its kind in Lebanon.

Promoting public awareness at Animal Encounter is achieved through seminars, guided tours, information boards, and encountering Lebanese wild animals. Two programmes are put on for the visitors, as follows:

- **Student programme**: Students can visit Animal Encounter as a part of their school curriculum, and may be offered different kinds of activities, depending on their educational level and age. This programme included various seminars, aided by audio-visual displays on different animal and plant species, their role in the environment, the threats they are facing in the wild, and the ways to conserve them *in situ*.

- **Public programme**: The public can visit Animal Encounter as part of their normal weekend activities, and tour the exhibits accompanied by a guide who gives information on the animals exhibited. Such information includes: their distribution, abundance, role in the environment, the threats they are facing in the wild, and the ways to conserve them *in situ*.

2.2 The Hyaena family

2.2.1 Taxonomy and distribution of the hyaena family

Hyaenas belong to the order *Carnivora*, and family *Hyaenidae*. There are four extant species of hyaenas, comprising: the brown hyaena (*Hyaena brunnea*); the aardwolf (*Proteles cristatus*); the spotted hyaena (*Crocuta crocuta*); and the striped hyaena (*Hyaena hyaena*).

Data on the occurrence and distribution of the four species of hyaenas were derived from sources compiled by the IUCN/SSC Hyaena Specialist Group (Mills and Hofer 1998). Their records show that brown hyaenas are the least widely distributed species of hyaena (Figure 2.2). Brown hyaenas are confined to nine countries within the South West Arid Zone of the Southern Savannahs in the southern African sub-region. The next least widely distributed species of hyaena is the aardwolf. The aardwolf ranges across 18 countries, mostly in southern Africa but its range extends northwards to Eritrea and to its extreme northern limit in the southeast of Egypt. Spotted hyaenas are much more widely distributed across Africa than the two previous species (Figure 2.2). Spotted hyaenas occur within 44 African countries, but do not occur in countries to the far north of Africa, like Morocco, Algeria, Libya, and Egypt.

Striped hyaenas are the most widely distributed of the four species of hyaena, and is the only species of hyaena to occur in both Asia and Africa (Figure 2.2). Striped hyaenas are distributed in most countries of Africa to the north of Tanzania. Within Asia, striped hyaenas are distributed across the Arabian Peninsula, the Middle East, the Caucasus and central Asia (Figure 2.2). There are thought to be five subspecies of striped hyaena, characterized by differences in their pelage characters and morphometrics (Harrison and Bates 1991). *Hyaena hyaena syriaca* is the only subspecies of striped hyaena that is found in the Middle East. The other subspecies comprise: *H. h. barbara* found in northwest Africa; *H. h. dubbah* found in northeast Africa; *H. h. sultana* found in the Arabian Peninsula; and *H. h. hyaena* found in India.

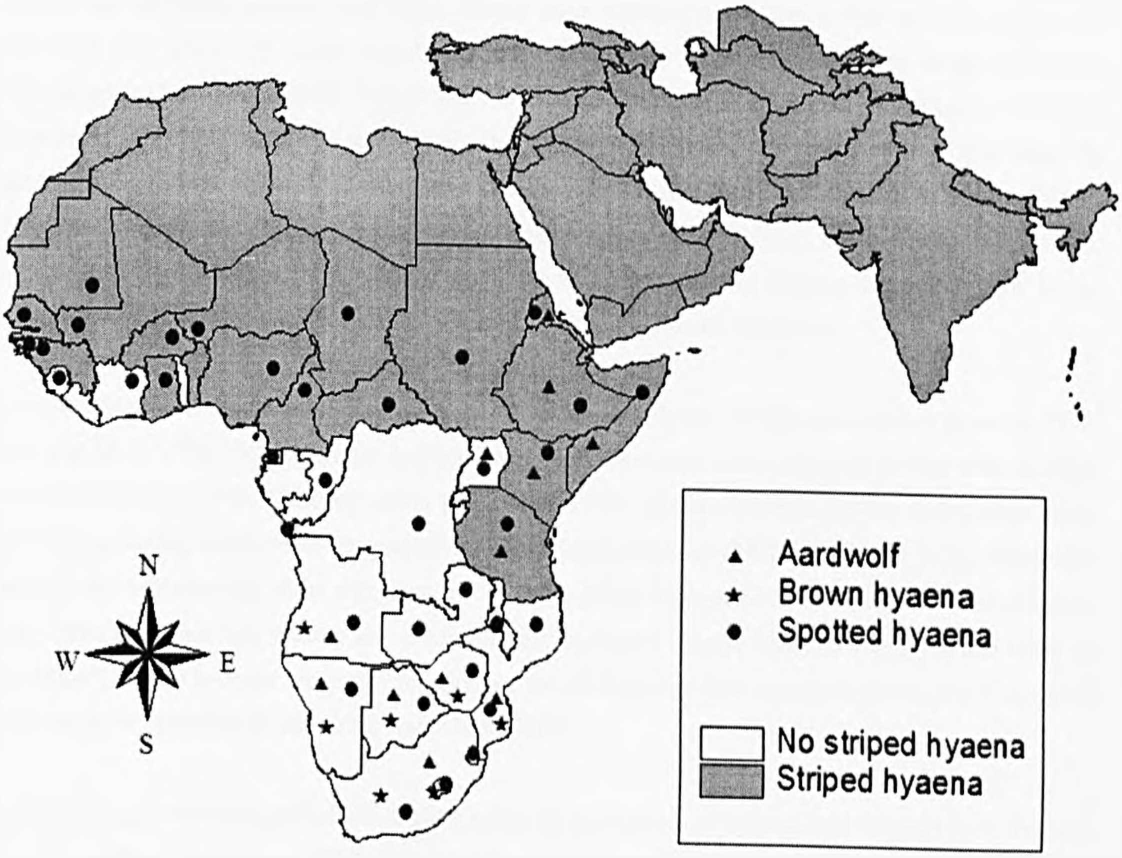


Figure 2.2. Distribution of the Hyaenidae family in the world based on Mills and Hofer (1998).

2.2.2 Behaviour and ecology of the hyaena family

The social organisation of many mammals is generally characterised by dimorphism in body size, dominance, and the aggressiveness of males. However, biologists have remained fascinated by the hyaena family, because spotted hyaena females are socially dominant to, and more aggressive than males, and have genitalia that externally resemble those of males (Kruuk 1972, Frank et al. 1989, Smale et al. 1993, Smale et al. 1995).

Spotted hyaenas are mainly scavengers but also occasionally hunt live animals (Kruuk 1972). Spotted hyaenas live in clans, comprising adult females, their offspring and immigrant males, which show a female dominance hierarchy (Smale et al. 1995). Spotted hyaenas give birth in private dens and then introduce their cubs to older cubs in communal dens that confer protection and nourishment. Cubs of the spotted hyaena are nursed for 12 months (Frame et al. 1980, Henschel and Skinner 1990). Spotted hyaenas are territorial animals and clans defend their permanent territories that usually contain the communal den. Clans are highly variable in size, and occupy territories and home ranges of widely different sizes (MacDonald 1983, Kruuk and MacDonald 1985), depending upon geographical location. Hofer and East (1993) reported a territory size for spotted hyaenas in Serengeti, Tanzania of 55.5km^2. In contrast, Mills (2003) reported a home range size for spotted hyaenas in the Kalahari of 1095±177km^2, while Tilson and Henschel (1986) reported an average home range of 570km^2, ranging from 383-861km^2, in the central Namib Desert, Namibia, and Trinkel et al. (2004) reported a home range of 160km^2 in the dry season and 320km^2 in the wet season for spotted hyaenas in Etosha, Namibia.

Brown hyaenas feed opportunistically on range of vertebrates, fruits, insects and reptiles (Skinner 1976, Mills and Mills 1978). Most records indicated that brown hyaenas are scavengers on the kills of other carnivores (Skinner 1976, Mills and Mills 1978, Mills 1990). Brown hyaenas inhabit desert areas along the coast, including semi-desert open scrub and open land savannah (Mills and Hofer 1998). They also favour rocky mountainous areas with bush cover in the broad high grass land of South Africa (Skinner 1976). Brown hyaenas are solitary and predominantly nocturnal animals with an average home range of 308±39km^2. Brown hyaenas are active for more of the 24 hour day than spotted hyaenas, and they cover distances up to 54km/day in search for food (Mills 2003).

Aardwolves have the most specialised feeding habits of any species of hyaena, and termites form the bulk of their diet (Kruuk and Sands 1972, Kruuk 1976, Cooper and Skinner 1979). Aardwolves inhabit semi-desert axis including open grassy plains but they do not inhabit pure forest or desert (Kingdon 1977, Smithers 1983). Aardwolves are solitary foragers, primarily nocturnal with a home range of 1-4km^2. Aardwolves' activity is determined largely by termite activity (Richerdson 1998).

In contrast, striped hyaenas are mainly solitary scavengers occupying a small home range compared with brown and spotted hyaenas (Harrison and Bates 1991), with no evidence of a female dominance hierarchy. Striped hyaenas mainly inhabit open habitat or habitats with light thorn bushes (see Rieger 1979). However, their home range size also varies considerably according to geographic location.

Members of the hyaena family use scent marking to advertise their territories through pasting with an anal pouch secretion (Kruuk 1972, Gorman and Mills 1984, Mills and Gorman 1987, Silwa 1996). Hyaenas scent mark their territory, either by smearing grasses from sub-caudal glands and/or by deposition of faeces at latrines. However, each species uses different scent-marking strategies to define their territories. Spotted hyaenas place their scent marks strictly along the territory borders (Kruuk 1972, Breader and

Randall 1978). In contrast, brown hyaenas deposit paste and latrines throughout their whole territory (Mills et al. 1980). Amongst aardwolf, paste marking is the predominant means of scent communication and of defining territorial borders (Richerdson 1990, Silwa 1996).

Despite its much more widespread distribution, much less is known of the factors affecting the ecology, behaviour, feeding, habitat utilisation, social organization and population dynamics of the striped hyaena, than of the other species of hyaena (Mills and Hofer 1998). This is most probably because the striped hyaena is a very shy nocturnal animal that is rarely seen during the day, and that inhabits very remote areas. The striped hyaena has been categorized by IUCN as Lower Risk, Near Threatened (LR/nt) (IUCN 2004). Therefore, although not formally recognised as a threatened species globally, several populations, including that of Lebanon, are locally threatened, often because of persecution brought about by misconceptions, myths and a generally negative attitude on the part of their human neighbours. Throughout the Arabian Peninsula and North Africa, the striped hyaena is loathed as a grave robber, and therefore severely persecuted through poison-baiting and trapping (Lewis et al. 1968, Searight 1987). Consequently, to reduce the threats facing striped hyaenas and other members of the hyaena family, solutions to their conservation will include both ensuring they have the space to live, for example in protected areas, and to change any misconceptions about the species through education.

2.2.3 Morphology of striped hyaenas

The striped hyaena is a medium sized carnivore and the second largest member of the *Hyaenidae* family. The striped hyaena's rear legs are less developed than the front legs, giving it the appearance of backward inclination (Plate 2.1). The fore legs are long and slender. The feet have four toes with non-retractable claws. The head is roundish with a pointed muzzle and long pointed ears. The coat colour of the striped hyaena is grey with 6-9 dark brown to black stripes on the body and legs and a black patch on the throat. The pelage of an adult is rough and long. In pups, the coat is short grey with clear black stripes and its ears are forward-bending (Abi-Said 2004b). The striped hyaena is distinguished from the other species of hyaena by the well-developed mane from neck to tail that is erected whenever it feels threatened. The tail is thick and fluffy with grey colour.

Plate 2.1. The striped hyaena (*Hyaena hyaena syriaca*)

Male striped hyaenas are heavier than females. The weight of an adult male ranges from 25.8 to 41kg, with a mean of 33.6kg, while the weight of an adult female ranges from 25.8 to 34kg with a mean of 30.1kg. The mean body measurements of adults are as follows: head and body (124.5cm ♂, 109.6cm ♀), tail length (26cm ♂, 29.7cm ♀), skull length (25.7cm ♂, 23.9cm ♀), height to shoulder (0.75cm ♂, 0.66cm ♀), forearm length (18cm ♂, 17.2cm ♀), hind-foot length (20.5cm ♂, 20.2cm ♀), and length of ear (14.5cm ♂, 14.4cm ♀) (Kruuk 1976, Skinner and Ilani 1979, Mendelssohn 1985, Tohmé and Tohmé 1985, Mendelssohn and Yom-Tov 1988, Harrison and Bates 1991).

2.2.4 Habitats of striped hyaena

Striped hyaenas occur across many different types of habitat throughout their range in Africa and Asia, but most often occur in open habitats or in light thorn bush areas. In North Africa, the habitat of striped hyaenas comprises woodland and bushy mountainous regions (Mills and Hofer 1998), while in East Africa they inhabit various types of *Acacia* savannahs, open grassland, little scrub trees and trees with varying densities (Kruuk 1976). Striped hyaenas avoid the desert and Sahara in Arabia (Rieger 1979). In central Asia, the striped hyaena avoids high altitudes and dense thick forests (Heptner and Sludskij 1980). In the former USSR, the habitats of striped hyaenas include savannahs, semi deserts, thickets of tamarisks, the periphery of sand deserts and special pistachio savannahs. In India, striped hyaenas are present in open country where low hills and ravines persist (see Rieger 1979). In Israel the striped hyaena inhabits ravines and rocky deserts, where the vegetation comprises a sparse cover of bushes across plains or gentle slopes with few low herbs and grasses and also close to dense human settlement. In Iraq striped hyaenas were present in the desert, while they show no clear habitat preferences and occur in most habitats types in Jordan (Hatt 1959, Kruuk 1976, MacDonald 1978, Rieger 1979, Heptner and Sludskij 1980, Bouskila 1984a, Hofer 1998, Leakey et al. 1999, Qarqaz et al. 2004). The maximum altitude at which striped hyaenas have been recorded was at 3,300m asl. in Pakistan (Roberts 1977), They have also been recorded at an altitude of 2,250 m asl. in Iran, at 2,500m asl. in India, and at 2,100m asl. in the former USSR (see Rieger 1979).

Kruuk (1976) reported that the home range of a male and female striped hyaena in the Serengeti was $72km^2$ and $40km^2$, respectively. In the Negev in Israel Van Aarde et al. (1988) reported a home range of $60.9km^2$ for female striped hyaenas. Being a scavenger, striped hyaenas cover a shorter distance to search for food than other species of hyaenas, comprising an average of 19km, and a range of 7-27km per night (Kruuk 1976). There is some evidence to suggest that striped hyaenas defend territories. MacDonald (1978) suggested that striped hyaenas have a larger home range than spotted hyaenas, but with smaller territories around their breeding dens. Striped hyaenas breed throughout the year in captivity (Skinner and Ilani 1979). Their litter size ranges between 1- 5 with a mean of 2.4 young per litter (Rieger 1979).

2.2.5 Ecology and behaviour of striped hyaenas

Striped hyaenas are generally solitary scavengers. They are rarely seen in groups, except on rare occasions when a female is accompanied by her grown up offspring (Kruuk 1976). However, striped hyaenas are reportedly less solitary in Israel, where they have more often been seen in small groups (MacDonald 1978). There is little evidence of territoriality among striped hyaenas (Kruuk 1976). However, it has been suggested that striped hyaenas might defend a small territory within their wider home range, which might be their breeding site (Ilani 1975).

Striped hyaenas are widely known as opportunistic scavengers and they rarely hunt. Where they have been previously studied in the Serengeti, Tanzania, or in Israel, striped hyaenas feed on dead animals, other carnivore kills and domestic waste and can crush long bones of large animals with their powerful jaws (Lewis et al. 1968, Kruuk 1976, MacDonald 1978). The scavenging behaviour of striped hyaenas on dead animals has been observed through remains of food carried to the den (Ilani 1975, Kruuk 1976, Bouskila 1984a, 1984b, Van Aarde et al. 1988). However, striped hyaenas have been reported to kill a horse and a donkey in Iraq, to crush and eat a tortoise in Palestine and to inflict severe damage on Bedouin goat flocks (Bird 1946, Hatt 1959). In addition they feed on insects, reptiles, birds, fruits and vegetables (Hatt 1959, Kruuk 1976, Bouskila 1984b). Striped hyaenas establish feeding sites such as human settlement or fruit trees in the areas that they visit regularly (Kruuk 1976). Moreover, striped hyaenas, like brown hyaenas, bring food back to their dens (Mills 1978, Skinner and Ilani 1979, Mills 1982a, Van Aarde et al. 1988, Leakey et al. 1999). They also practice food storage, and store food in bushy vegetation and make no attempt to cover it over (Kruuk 1976).

Striped hyaenas are exclusively nocturnal throughout their range (Kruuk 1972, Mills 1989). Striped hyaenas only start to become active after dark, and begin to lie up before day breaks. Kruuk (1976) reported that striped hyaenas are active for 53% of the night, and that their main activity during this period was searching for food. Kruuk (1976) showed that striped hyaenas can cover long distances of up to 27km per night in search of food and to discover new foraging grounds.
The striped hyaena is the largest carnivore remaining in Lebanon, and is on the edge of extinction due to loss of native ungulates, habitat removal by humans, and extensive killing as a result of the mythical stories surrounding them. Information on the social life and reproduction of wild striped hyaena in Arabia is largely lacking (Harrison and Bates 1991). The distribution of striped hyaena has only been documented in certain areas in Lebanon (Tohmé and Tohmé 1983, 1985, Harrison and Bates 1991).

2.2.6 Stories about hyaenas

Few mammals attract so many superstitions as hyaenas, and the more generic stories and myths about striped hyaenas go back to hundreds of years, and indeed not necessarily be specific only to Lebanon. Stories and myths are present wherever striped hyaenas exist; (Rieger 1979, Harrison and Bates 1991, Qarqaz et al. 2004). Many stories and myths about striped hyaena can be found in old Arabic literature, which might in turn have helped to perpetuate these stories, and to have given rise to the negative images that the striped hyaena generally attracts. Many Arabic poets and writers have written about striped hyaenas, and here I will summarise the most prominant in the Arabic literature.

2.2.6.1 Old stories about striped hyaenas and people

Stories and myths about striped hyaenas are frequently found in old Arabic literature. Al-Doumairy (1406) gave the hyaena a large space, and described how hyaenas kill their victims in his book *Hayat Al-Hawayan Al-Koubra*. He wrote:

> *"...whenever a hyaena sees a sleeping person it digs under his neck, kills him and sucks his blood..."*

He further described how eager and happy hyaenas are when eating people:

> *"...when feeding on people, hyaenas will be very happy to a point that, when you look at their faces and see their teeth, you think they are smiling..."*

Al-Doumairy (1406) also described how powerful hyaenas are, that they only eat brave and strong persons rather than weak ones:

> *"...hyaenas do not eat but brave person..."*

Al-Qazweeni (1204-1283) talked about a group of people belonging to an ancient Arab tribe called *Al-Dabeyoun*, meaning *hyaena people* in his book *Aajaeb Al-Makhlouqat*. He wrote:

> *".... If one member of this tribe was present in a group of 1000 people the hyaena will pick him up and eat him ..."*

Hyaenas have long been known as grave robbers, based on ancient writings about this behaviour, which also refer to their eagerness for human flesh (Al-Qazweeni 1204-1283, Al-Jahez 1374-1465, Al-Doumairy 1406).

2.2.6.2 Superstitions about hyaenas

The genitalia of female spotted hyaenas look externally identical to those of the males, which makes it difficult for modern biologists to distinguish the sexes in the field (Kruuk 1972). The female actually has a pseudo-penis and pseudo-scrotum, but this external similarity in their genitalia led those writing the old literature to falsely believe that hyaenas were hermaphrodites, which could change their sex and give them the character of a witch. Al-Jahez (1347-1465) described this characteristic of (spotted) hyaenas in his encyclopaedia *Kitab Al-Hawayan*, where he wrote:

> *"Hyaenas are like rabbits and they change sexes each year. One year they will be males and the second year females. In the years when they are males they mate and in the other years when they are females they reproduce"*.

This was also confirmed by Al-Doumairy (1406) and by Al-Zamakhshari (1673-1730) in his book *Rabih Al-Abrar*. Although female striped hyaenas do not have a pseudo-penis like spotted hyaenas, striped hyaenas may have gained their reputation for changing sexes from the spotted hyaenas, since they were both looked at as hyaenas.

Furthermore, medicinal and magical powers are often attributed to the body parts of large carnivores. The body parts of hyaenas are featured extensively in ritual and medicine in the Arabic literature. Every body part of hyaena is used, including the head, the eye, the canine tooth, the gall bladder, the fur and so on (Al-Qazweeni 1204-1283, Al-Doumairy 1406, Ibn Al-Wardi 1419-1457, Ibn Sina 1572-1628).

2.2.6.3 Hyaenas' Supernatural Power

Several authors described the supernatural power of hyaenas and of their magic on animals. Al-Doumairy (1406) wrote:

> "*... dogs are greatly afraid of hyaenas, ...by certain magical influence the hyaena will attract dogs as a magnet attracts iron...*"

Furthermore, Al-Daylami (1360) wrote:

> "*...coming in contact with the shadow of a hyaena, dogs will loose their voice, fall down and the hyaena will eat them ...*";

Al-Qazweeni (1204-1283) further explained that hyaenas eat dogs' meat to be cured whenever they become sick.

2.2.6.4 Hyaenas in the Arabic Proverbs

2.2.6.4.1 The intelligence of hyaenas

Many species of large carnivores have always fascinated people, but not the hyaena. In the Arabic literature, hyaenas were symbolised as the least intelligent of animals. Many authors described the stupidity of hyaenas, which made catching them so easy. Hunters could catch a hyaena by getting into their dens, and saying there is no hyaena here, so that the hyaena spread its hands and legs and closed its eyes, so in turn the hunter could get close and tie its legs and hands, and then drag it out of the cave (Shukur 1985).

Moreover this lack of intelligence among hyaenas has been mentioned in many Arabic proverbs. For example, when describing a person who has shown a lack of common sense, people will say "*a hyaena could have known this*" (Al-Doumairy 1406, Shukur 1985). Likewise, another proverb runs as follows:

"Do not be like a hyaena, whenever it hears the sound of falling rocks it goes out to hunt"

Hyaenas are thought to be so brainless that, whenever they hear falling rocks in their den, they think it is an animal which they go out to hunt (Al-Askary in *Jamharat Al-Amthal*, Shukur 1985)

2.2.6.4.2 The bad image of hyaenas

Many authors referred to the bad behaviour of hyaenas and consider them as treacherous (Al-Qazweeni (1204-1283), Al-Doumairy 1406, Ibn Al-Wardi (1419-1457), Shukr 1985). One story discussed a hyaena that ran away from a hunter and was protected by a Bedouin man who provided shelter and food for it, until one day while the Bedouin man was sleeping in his tent, the hyaena attacked him, opened his belly, ate what it could, sucked his blood and ran away. A Bedouin cousin came and found his relative in this situation but the hyaena was not there, but as he knew it was the hyaena, he followed its tracks and killed it. The cousin recounted this story in a nice poem that later became a proverb describing situations when people do good by the wrong persons, who will face the same fate as his cousin did with the hyaena.

2.3 General methodology of the study

Detailed descriptions of the materials and methods used in the study, as well as data analysis techniques, are presented at a greater length in the relevant chapters. The section below briefly describes the methods of data collection and analysis used throughout the thesis.

2.3.1 Distribution of striped hyaenas throughout Lebanon

A preliminary study was conducted in 2000–2001 to locate the habitats of striped hyaenas in Lebanon. Preliminary results suggested that striped hyaenas were still to be found in many areas of Lebanon. During the main study, more detailed information on the distribution of striped hyaenas in Lebanon was assessed in four ways: newspaper searches, personal interviews, reports from trusted informants, and by visits to see a killed hyaena in some villages.

Information on the presence and the relative abundance of striped hyaenas in each study site was initially assessed through information provided through focal group discussions and individual interviews. These were later followed up by transect surveys run from September 2002 to August 2003 that were conducted in each study site to determine the relative abundances of striped hyaena. Global Positioning System (GPS) points were taken at each location where the direct or indirect sign of hyaena were recorded along transects, including caves, resting places, footprints, scats, and meal leftovers. Difference in the abundance of striped hyaenas across different study sites were compared using relative abundance index.

2.3.2 Ecology of striped hyaenas in Lebanon

2.3.2.1 Diet

The diet of striped hyaenas was studied using the following methods:

- directly through the use of pre-baited camera traps;
- less directly through analysis of feeding remains and of scats.

2.3.2.2 Home range

Six striped hyaenas were radio-collared in two study sites between June 2003 and June 2004. Four hyaenas (one female and three males) were trapped and radio-collared in the urban site of Chnaniir, and two female hyaenas in the rural site of Bnachii. However, only four striped hyaenas were subsequently tracked, two in each study site, as two collars failed soon after collaring. Each radio-collared hyaena was followed for two to three days a week and fixes were taken each hour from sunset to dawn.

Distance walked per hour by striped hyaena at night was calculated in both sites and compared with various environmental variables.

Home ranges of the four radio-collared striped hyaenas were calculated using minimum convex polygon (MCP) and the stability of their home ranges was determined using the fixed kernel method.

2.3.2.3 Habitat use

I reclassified a digitized land use map into three main habitat types, comprising wild, urban, and agricultural, from an original coverage map that had been classified into 12 habitat types. Fixes collected for the four radio-collared hyaenas were classified according to the main habitat in which the fix was positioned. A habitat preference index was calculated for each radio-collared hyaena using a Chesson index (Chesson 1978).

2.3.3 Local knowledge and attitudes towards striped hyaenas in Lebanon

Information on the knowledge and attitudes of indigenous people towards striped hyaenas was studied using a combination of RRA and structured questionnaires.

2.3.3.1 RRA/PRA Methods

The RRA/PRA method used in this study was based on (Chambers 1992) and (Bernard 1995).

- A pre-appraisal dialogue was conducted among site officials (mayors) to introduce them to my project and to introduce me to the area and to the local residents.
- Focal group discussions were conducted from December 2001 to March 2002 with recommended key elderly residents in each site to establish facts on:
    - Basic ecology of striped hyaenas
    - Population trends of striped hyaenas
    - Conservation needs of striped hyaenas
    - Attitudes of local people towards hyaenas and their support for striped hyaena conservation.

2.3.3.2 Traditional stories

Traditional stories about striped hyaena were collected from each study site during the focal group discussions and from elderly people identified as key informants. A total 147 detailed stories were collected and were classified based on their main themes and sub-themes into 14 types of stories. A further classification was undertaken, based on whether stories of different themes and sub-themes portrayed either a negative image or a positive image of striped hyaenas, or a positive image of the bravery of people meeting striped hyaenas. The popularity of these stories were tested by asking residents whether or not they knew stories of each theme and sub-theme, by giving a brief description of each story they knew.

2.3.3.3 Structured questionnaires

Individual questionnaire are increasingly used to investigate attitudes of communities (Newmark et al. 1993). The initial questionnaire interview, conducted from March 2002 to October 2002, sought a random sample of at least 50 respondents in each study site. The questionnaire was based on the focal group discussion and interviews with elder residents from the six study sites. The questionnaire consisted of dichotomous and non-dichotomous questions, and was divided into four parts. The first part included the explanatory variables of study sites, gender, date of birth, education level, occupation and income. The second part consisted of seven questions and covered the residents' knowledge about striped hyaenas. The third part consisted of thirteen questions and addressed attitudes towards striped hyaenas. The fourth part consisted of one questions and addressed towards the knowledge of striped hyaena stories

The questionnaire was tested several times to check its reliability and validity. Checks were made for variation in answers, and testing helped to ensure the following: that each question was understood by the respondents, all the possible answers are found, to avoid redundancy between two or more questions and to check for logical flow of ideas between questions. Questionnaire testing also helped in a better organisation of the questionnaire so that the respondents and the researcher understood clearly the objectives, the time needed to conduct each interview, and that the questionnaire would not be boring to avoid unwanted answers.

Many residents who live around Horch Ehden NR spend the winter in Bnachii and go to Horch Ehden NR for the summer. To overcome possible duplication of information, the Horch Ehden NR sample of respondents included only those that reside in Horch Ehden NR all year round. Residents in all study sites were visited in their houses or stopped on the road at different localities or streets of their villages. The questionnaires were filled in by the author or by an assistant in the presence of the author, to ensure that the questions were asked and filled correctly. Moreover, interviews conducted in-person will help in judging the reaction of the respondents as recommended by (Cardinal 2004).

2.3.4 Awareness programme

2.3.4.1 Awareness at study sites

A seminar to raise awareness of residents living in each of the six study sites was conducted between July and December 2003. The seminar, conducted in Arabic, comprised a 45-minute slide show and included a discussion of: the role of carnivores in general and striped hyaena in particular, in the ecosystem, the factors affecting their conservation, and other environmental issues. The 7-minute video film showed scenes of trapping and radio-collaring a striped hyaena. The A4 awareness pamphlet (Appendix XII) contained information on the description and distribution of striped hyaenas, their role in the environment, and mythical stories about striped hyaenas.

The effectiveness of the awareness seminar was tested through a structured questionnaire interview before and after each seminar. The pre-seminar interview began with basic questions to obtain demographic and socio-economic data, including site, age, gender, and education level of the visitors. These questions were followed by four dichotomous questions to determine the attitudes of respondents towards striped hyaenas. The post-seminar interview sought answers to the change in attitudes toward striped hyaenas. The questionnaires were administered only to those people who attended the entire seminar.

2.3.4.2 Awareness at Animal Encounter for adults

An awareness programme was conducted for visitors, adults and students, from any part of Lebanon, visiting the Animal Encounter as part of their normal weekend activities between January 2003 and September 2004. Two approaches were compared in this programme: A passive approach, in which visitors were asked to tour the Animal Encounter on their own and an active approach, where adult visitors toured the Animal Encounter accompanied by a guide and were given a seminar post-tour. Likewise, student visitors were given a seminar similar to that in the study sites. As with the awareness at the study sites, the effectiveness of this awareness programme in changing the attitudes of visitors was tested following using a questionnaire interview at the entrance and on the way out of the Animal Encounter.

2.3.5 Data analysis

Data from questionnaires were analysed using the Statistical Programme for the Social Sciences (SPSS) for Windows version 12.0.1. The statistical data for each question were first analysed using descriptive statistics, and responses were compared using the Chi-square test. For questions with binary dependent variables, multivariate analysis using logistic regression was performed to model responses, as it provides a convenient way to undertake categorical data analysis. Forward Wald logistic regression was used to specify the model with a significance of $p<0.05$. Dichotomous questions were given a dummy of 1 if the response was positive and 0 if the response was negative, and these responses were taken as the dependent variable. The explanatory variables for the analyses included both factors relevant to the study site, and to individual respondents. Factors relevant to the study site comprised: which site, whether a rural or urban landscape, its protected status, and the relative abundance of striped hyaenas across sites. Factors relevant to individual respondents comprised their gender, age, education level, occupation, monthly income, claiming to have seen a striped hyaena, and their knowledge of hyaenas' stories. The likelihood ratio goodness of fit test of the model was described using chi-square goodness of fit statistics. Model performing on the testing sets was evaluated by calculating the area under the curve (AUC) of receiver operation characteristics (ROC) plots. ROC values range from 0.5 to 1.0. Values above 0.7 indicate strong model fit while those above 0.9 indicate a highly accurate model (Swets 1988). Rather than reduce a large number of related dependent variables to smaller subsets using Principal Component analysis (PCA), I have looked at each set of dependent variables independently and discuss the common themes that emerge from the related analyses.

The home range analysis was completed using the "Animal Movement Extension" for the GIS package ArcView 3.1® (September 2002, The Ontario Ministry of Natural Resources' Centre for Northern Forest Ecosystem Research in Thunder Bay, Ontario, Canada).

Chapter 3

DISTRIBUTION AND RELATIVE ABUNDANCE

3.1 Introduction

Successful management of wildlife depends on information on its status, including its abundance, distribution and population trends. Two main approaches have been used to estimate animal abundance: direct methods that involve counts of animals, or indirect methods that involve counting their signs (Wilson and Delahay 2001, Sadlier et al. 2004).

Among direct methods a wide range of approaches have been developed for counting animals (Seber 1982, Brouchers et al. 2002), including; individual recognition, capture re-capture methods, radio tracking, camera trapping and spotlight surveys. However, gaining suitable data on abundance through direct methods can prove highly problematic for many species of wildlife. For example many species of large mammalian carnivores are difficult to detect, because they are nocturnal, and they live at relative low densities, over large areas and in closed habitats (Linkie et al. 2006). Therefore, applying many of these direct and labor intensive methods to large mammalian carnivores presents considerable logistical, manpower and cost issues (Wilson et al. 2003, Sadlier et al. 2004), especially when such surveys need to be carried out over large landscapes, say regionally or nationally (Webbon et al. 2004).

In contrast, indirect methods involve collating information on field signs, such as droppings or scats, footprints, hair, burrows or dens, to gain measures of relative abundance (Mowat and Strobeck 2000, Wilson et al. 2003, Sadlier et al. 2004, Webbon et al. 2004). Indirect methods are potentially more practical for large-scale surveys, less expensive, do not require direct contact with the animal in question, and open up the possibility of a much wider range of information that can be used to inform management (Putman 1984, Smallwood and Schonewald 1998). Field signs can often be detected across most habitats, across habitats with low visibility and in habitats where species occur at low density or are nocturnal (Jachmann 1991). Such methods make the assumption that the frequency of field signs encountered, represent an index of relative abundance that bears a direct relationship to the number of animals present. Such indices of relative abundance can be used to compare relative abundance across sites or over time (Wilson et al. 2003). Furthermore, an extensive literature deals with development and use of such methods for carnivore populations (Allen et al. 1996, Sutherland 1996, Wilson and Delahay 2001).

Several indirect methods have been proposed, which include: measuring tracks, counting spoor and identifying footprints (Van Dyke et al. 1986, Smallwood and Fitzhugh 1995, Riordan 1998, Stander 1998), and using prey requirements to estimate density (Karanth et al. 2004). Probably, the most commonly used indirect methods to estimate relative abundance are scat surveys. Scat or faecal survey methods have proved one of the few cost effective approaches to estimating relative abundance over large areas (Davison et al. 2002, Webbon et al. 2004). Counts of scats, and scat densities, have been used as a relative index of canid abundance under many situations (Cavallini 1994, Sharp et al. 2001, Harrison et al. 2002), and such measures have been relied upon as an indicator of carnivore presence for many years (Strachan et al. 1996). However, such methods have the considerable drawback that the persistence of scats may vary over time, due to differences in the decay rates of scats caused by different climatic conditions (Laing et al. 2003). Nevertheless, these can be corrected by standardizing the timing of surveys and by calculating differences in decay rates that arise from differences in weather conditions (Webbon et al. 2004).

The difficulties in arriving at an appropriate method for estimating the distribution and abundance of a species of large carnivore are illustrated only too well for striped hyaenas in Lebanon. Striped hyaenas are the most widely distributed of the four species of hyaena, and live across 47 countries in Africa and Asia (Figure 2.2). There is little to no information on the abundance of the species across most of the countries in which it lives (Mills and Hofer 1998). As a nocturnal species living at low densities, the species has defied enumeration across most of the countries in which it lives, whether at fine scale across individual study sites, or at wider regional or national scales. Even though the striped hyaena is the largest carnivore living in Lebanon, there is little information on its distribution and abundance anywhere locally within the country, nor indeed across the country (Tohmé and Tohmé 1985, Harrison and Bates 1991). In addition, striped hyaenas in Lebanon inhabit very bushy forest and are considerably persecuted, and so remain very cryptic. Furthermore, there have been no previous studies of the ecology or conservation of the striped hyaena in Lebanon, and only very basic studies of the ecology of the species elsewhere (Kruuk 1976, MacDonald 1978, Leakey et al. 1999).

In the circumstances, it was decided that direct methods of assessing the abundance of striped hyaenas were not appropriate. Instead, I sought to apply indirect methods of counting signs that could be quickly and easily used to gain a basic idea of the wider distribution of striped hyaenas across Lebanon, in order to decide upon which study sites to base the later fieldwork. This approach was justified since my objective was not to estimate the total population size of striped hyaenas in Lebanon, but rather to compare the distribution and relative abundances of striped hyaenas across Governorates and study sites, in order to study the conflicts that arise between people and striped hyaenas. Consequently, this chapter first aims to explore the distribution of striped hyaenas across Lebanon, in order to delineate appropriate study sites. Secondly, the chapter aims to determine the relative abundance of striped hyaenas across the chosen study sites. Hence, this chapter seeks to answer the following questions:

- what is the wider distribution of striped hyaenas across Lebanon?
- which are appropriate study sites to conduct more detailed studies, based on this large scale survey? and,
- what is the relative abundance of striped hyaenas across the chosen study sites?

3.2 Methods

3.2.1 Preliminary data

Because so little was known about the distribution of striped hyaenas across Lebanon, it was necessary to glean very basic preliminary data at the beginning of the study. These preliminary data were gathered in six ways:

- Newspapers from across Lebanon and printed in the years 1999-2001, were searched in the Jaffet Library at the American University of Beirut, to gather reports on where striped hyaenas had been killed throughout Lebanon. All the newspapers searched had a national coverage, and comprised *An-Nahar*, *As-Safir*, *Addiyar*, *Al-Anwar*, and *Al-Mustaqbal*;
- Oral reports included the following and these were summed to give a total of reports:
    a. personal interviews were conducted across all five Lebanese Governorates during the period December 2001 to June 2004;
    b. reports were collected from trusted informants on the places where they have seen wild striped hyaena live, killed or trapped in the past five years;
    c. reports of conflict made to the Ministry of Environment were collated; and
    d. requests made to Animal Encounter to take action when striped hyaenas were sighted and causing concern in some villages were collated.
- Reports were collated from my visits to villages to see a killed striped hyaena after being contacted by people from that village.

These preliminary data on the distribution of striped hyaenas across Lebanon resulted in my choosing six study sites that appeared important from the perspective of striped hyaenas, that covered *inter alia*, protected and unprotected sites, rural and urban sites, and sites where hyaenas were extensively killed or reported yet that I could feasibly travel between in order to conduct a coherent study. These six study sites comprised Horch Ehden NR, Al-Shouf Cedar NR, Berqayel, Bnachii, Kafarmatta and Chnaniir (see Table 3.1, Figure 3.2), and each is discussed in more detail below in the Results section.

3.2.2 Transect surveys across study sites

Transect surveys were conducted at each study site to determine the relative abundance of striped hyaenas (Table 3.1). The transects were not of equal length, nor along straight lines, nor equally spaced, since the forests are very bushy, closed and have not been walked for several years. Instead, transects either followed very old human trails or corridors maintained by animals. Hence, I followed lines of least resistance through the bushy landscape, and maintained an approximate visibility of one metre in front of me (Plate 3.1). The start and end of all transects were marked with points in a Global Positioning System

(GPS). The same transect routes were walked a minimum of eight times each over four seasons, from September 2002 to August 2003.

Table 3.1. Number of transects walked per site, and the total distance covered at each study site

Study site	**Number of transects/site**	**Total length (km)**
Berqayel	10	51.8
Bnachii	12	66.0
Kafarmatta	12	80.0
Chnaniir	11	32.0
Horch Ehden NR	9	49.0
Al-Shouf Cedar NR	8	40.0

GPS points were also taken at each location where indirect signs of striped hyaena were recorded along each transect, including footprints, hairs, and scats. It was not possible to reliably determine whether these signs were from different animals. However, I was only seeking a coarse scale index of relative abundance that counted signs in the same way in each area, to allow general comparison between sites. The relative abundance of hyaenas in each study site by season was calculated using the following equation:

$$A = \left(\sum_{i=1}^{n} f_i t_i^{-1} + \sum_{i=1}^{n} h_i t_i^{-1} + \sum_{i=1}^{n} s_i t_i^{-1}\right) T^{-1},$$

Where, f = number of footprints encountered per transect;

h = number of hair samples found per transect;

s = number of scats found per transect;

t = total distance of transects walked;

T = total number of transects; and,

A = Relative abundance.

I assumed that the larger is the value of A, the greater the relative abundance of hyaenas at that site. However, it has not been possible to cross-check this assumption. One way analysis of variance (ANOVA) was conducted to compare the relative abundance of hyaenas across different seasons and among the different study sites.

Plate 3.1. One of the transects in Chnaniir area showing the bushy landscape of the study site

3.3 Results

3.3.1 Relative abundance of striped hyaenas in Lebanon

A total of 23 incidents of striped hyaenas having been killed were reported from 1999-2001, based on five Lebanese newspapers with national coverage. Reports were fairly evenly distributed across the three years as follows: six reports in 1999, six reports in 2000, and nine reports in 2001. All reports were from the months of December to March during the winter season when hyaenas appear to come closer to the villages seeking for food. Furthermore, these reports originated from all governorates of Lebanon, except for the Beirut Governorate. Ten reports originated from the North Governorate, seven of which were from Berqayel and one was from Bnachii, and two were from Akkar. Five reports originated from the Mount Lebanon Governorate, three of which were from Kafarmatta, and two were from Keserwan. Three reports originated from the South and five reports from the Beqa'a Governorates. Furthermore all the newspapers searched contained at least one report of a killed striped hyaena: ten reports were found in *An-Nahar*, four were in *As-Safir*, five were in *Addiyar*, three were in *Al-Anwar*, and one was in *Al-Mustaqbal*.

Moreover, sightings of killed striped hyaenas, and personal interviews that I conducted all over Lebanon between the periods of December 2001 to June 2004, showed that striped hyaenas are widely distributed across all Lebanese governorates except Beirut (Figure 3.1). Hyaenas occur at altitudes ranging from sea level, at locations like Jbeil or Chnaniir, to over 2000m above sea level (asl), at locations like Horch Ehden NR and Tannourine Cedar Reserve in the North Governorate, or Ras Baalbak in the Beqa'a Governorate. I saw one hyaena that had been killed above Horch Ehden NR, at an elevation of 2,200m asl. Following up on oral reports of hyaena sightings also helped to further clarify the distribution of striped hyaenas across Lebanon. Moreover, as a result of these surveys I was able to make a rough estimate of the relative abundance of striped hyaena across the five governorates, based on the density of the total reports per governorate. In descending order, reports of hyaenas were most frequent from the governorates of: Mount Lebanon, North, Beqa'a and South, with no reports from Beirut (Table 3.2).

Table 3.2. Number and sources of reports gathered on striped hyaenas across Lebanese Governorates.

Parameters	**Governorates**				
	Beirut	**Mount Lebanon**	**North**	**South**	**Beqa'a**
Newspaper reports (1999-2001)	0	5	10	3	5
Oral reports	0	27	15	8	21
Hyaena seen killed or trapped	0	12	8	0	4
Total reports	0	44	33	11	30
Area of Governorates (km^2)	21	1970	1973	2023	4258
Rough report density estimate/ km^2	0	0.022	0.017	0.005	0.007

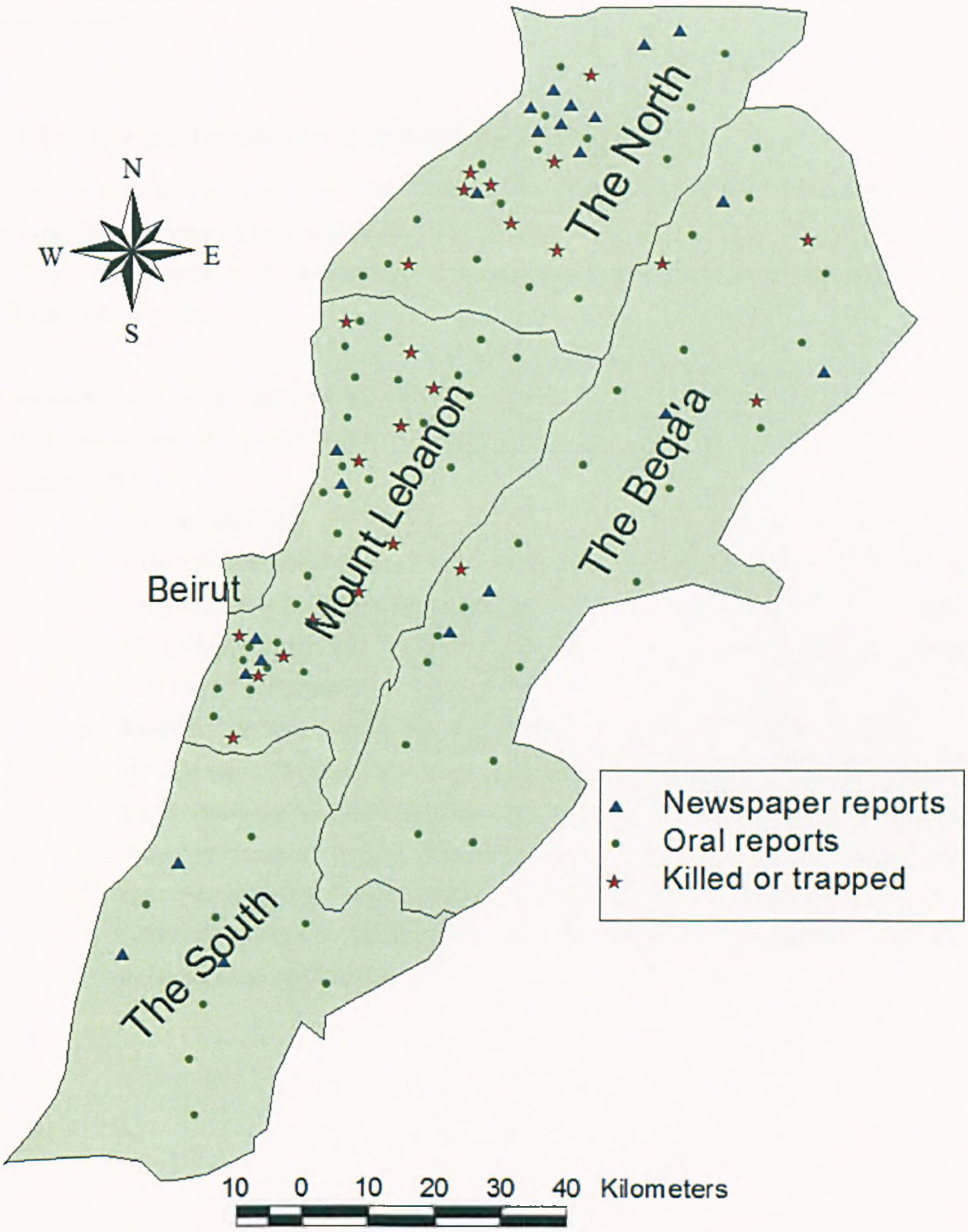


Figure 3.1. Distribution of striped hyaenas across the five Lebanese Governorates, based on newspaper reports, oral reports and sightings of killed or trapped hyaenas.

3.3.2 Chosen study sites

The main features of the six study sites are summarized and the criteria for their selection are further elaborated below.

3.3.2.1 The Berqayel study site in Akkar District (Plate 3.2):

This study site is located in North Governorate (Figure 3.2), 120km from the capital Beirut. The reasons for choosing this site were: it was mentioned seven times in newspaper reports of killed hyaenas from 1999-2001; two cubs were caught in 2000 and 2001; and I saw two killed hyaenas in 2000 after being called by people from Berqayel.

Berqayel ranges in altitude from 200-750m asl, and covers an area of 116.9km^2. The site is in a very remote area of Lebanon and is characterised by poor socio-economic conditions and low educational levels.

a. **Geology and Soil:** The rocks are mainly sedimentary from the Neogene period, while some rocks originate from the Quaternary period and even fewer originate from the Cretaceous period. The soil is young and fragile and prone to erosion. Soils are mainly formed from mixed soils, and a few consolidated dunes, sand and calcareous soils, and soils on marly limestone.
b. **Rainfall:** The mean annual rainfall ranges from 800-900mm per year.
c. **Habitat type:** The study site comprises eight main habitat types. The most extensive habitat type comprises oak forests (43.6%), while 4.0% comprises other wooded forests, including pines and other broad leaved forest trees, 15.0% comprises scrublands, 5.6% comprises grassland, 0.1% comprises bare rocks, 17.6% comprises permanent crops (~95% olive trees and 5% fruit trees), 8.4% field crops, and 5.7% comprises urban areas, including areas of urban sprawl.

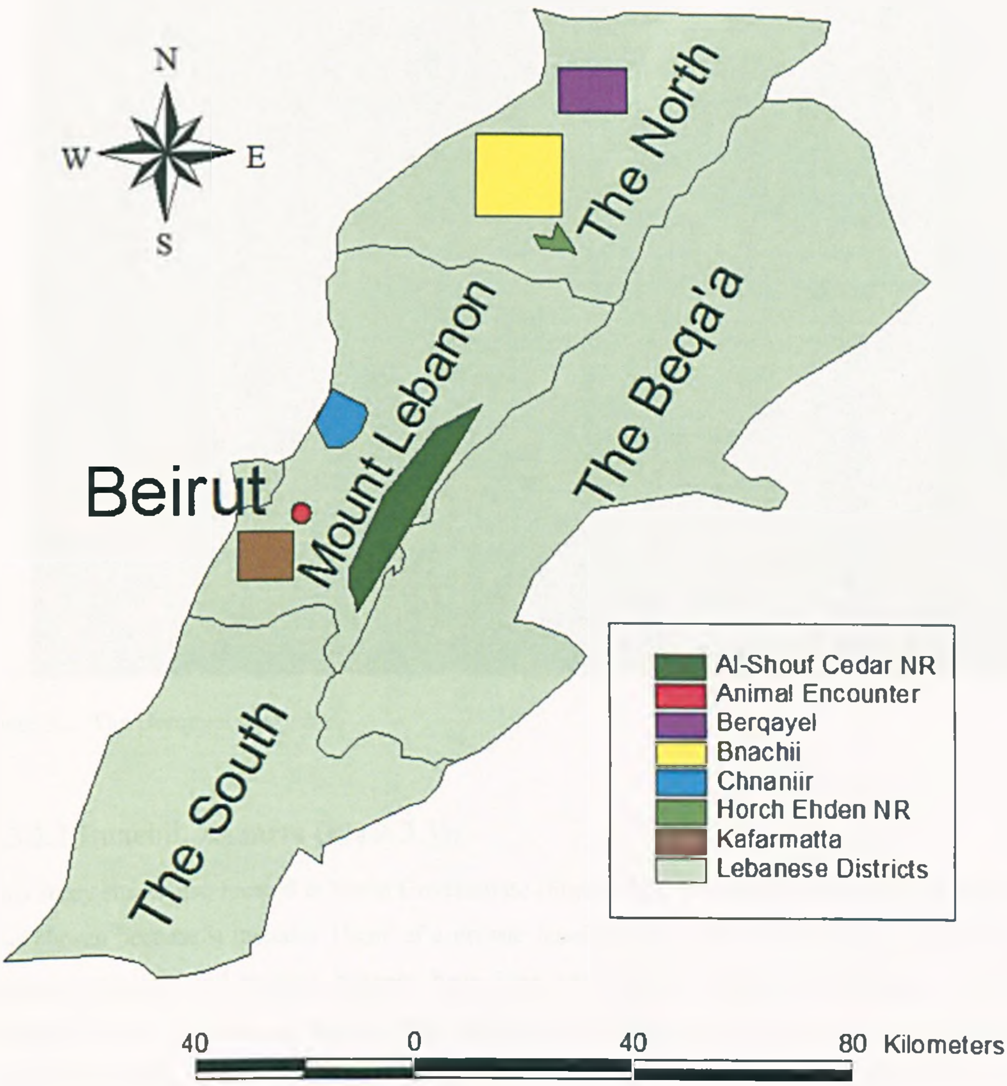


Figure 3.2. The location of study sites across Lebanon.

Plate 3.2. The Berqayel study site.

3.3.2.2 Bnachii, Zgharta (Plate 3.3):

This study site is also located in North Governorate (Figure 3.2), 100km from the capital Beirut. This site was chosen because it includes 11km^2 of a private hunting reserve where baited traps were being set to control predators, and trapped hyaenas have later been reported killed. Furthermore, the Wadi Al-Qaraqeer within this area has recently been proposed as a Nature Reserve that serves as a corridor to the Horch Ehden NR. Moreover, this area is under the control of a powerful minister which reduces the risk of radio-collared hyaenas of being killed and the radio-collars removed. I have also released three hyaenas in this area between year 2000 and 2001.

Bnachii has an altitude that ranges from 250-1100m asl, and covers an area of 269km^2. This area is another rural site with a low to medium socio-economic status as well as educational levels.

a. **Geology and Soil:** The rocks are mainly sedimentary originating from the Neogene, Cretaceous, and Quaternary periods. The soils are young and fragile, prone to erosion, and mainly formed from calcareous, and mixed soils, and few alluvial soils.

b. **Rainfall:** the mean annual rainfall ranges from 800-900mm.

c. **Habitat type:** The study site comprises eight habitat types. The most extensive habitat type comprises permanent crops (41.6%), including ~88% olive trees, 10% citrus trees, and 2% other fruit trees, while 13.9% of the study site comprises oak trees, 11.2% comprises other wooded forest, including pines and other broad leaves forest trees, 11.3% comprises scrublands, 7.7% comprises grassland, 1.1% bare rocks, 4.2% field crops, and 9.0% urban areas, including areas of urban sprawl.

Plate 3.3. The Bnachii study site

3.3.2.3 Chnaniir, Keserwan (Plate 3.4):

This site is located in Mount Lebanon Governorate (Figure 3.2), 10km from the capital Beirut. This site was chosen because hyaenas appeared to occur at high densities compared to other areas. Residents wrote a petition to the Ministry of Environment to control the hyaenas, while newspaper reports indicated that three hyaenas had been killed in less than two months.

Chnaniir has an altitude that ranges from 0-600m asl, and covers an area of 71.1 km^2. This study site is very urbanized, with high socio-economic standards and high education levels.

a. **Geology and Soil:** The rocks are mainly sedimentary, while very few volcanic rocks originate from the Jurassic and Cretaceous periods. The soils are young and fragile and prone to erosion. Soils are mainly formed from calcareous rocks, and contain a few mixed and sandy soils.

b. **Rainfall:** The mean annual rainfall ranges between 1000- 1400mm.

c. **Habitat type:** The study site comprises nine main habitat types. The most extensive habitat type comprises urban areas, including areas of urban sprawl, (40.0%), while 29.1% of the study site comprises oak forests, 15.7% comprises other wooded forests, including pines and other broad leaved forest trees, 8.4% comprises scrublands, 3.5% comprises grassland, 0.3% comprises bare rocks, 2.8% comprises permanent crops, mainly fruit trees, 0.1% comprises field crops, and 0.1% comprises beaches.

Plate 3.4. The Chnaniir study site.

3.3.2.4 Kafarmatta, Aley (Plate 3.5):

This study site is located in Mount Lebanon Governorate (Figure 3.2), 30km southeast of the capital, Beirut. This site was choosen because several requests were made by residents to the Animal Encounter, asking for action to be taken against the threat that striped hyaenas might cause to people, since their numbers are increasing and residents are encountering them more often. Moreover, the site was mentioned three times in the newspaper reports of killed hyaenas from 1999-2001, and I saw three killed hyaenas in 2000-2001 after being called by people from that site.

Kafarmatta has an altitude that ranges from 200-500m asl, and covers an area of 102.5 km^2. The area is another rural and unprotected site with a low to medium socio-economic status and medium education levels.

a. **Geology and Soil:** The rocks are mainly sedimentary, originating from the Cretaceous period. The soils are young and fragile and prone to erosion. Soils are mainly formed from mixed soil and few from sandy soils.
b. **Rainfall:** The mean annual rainfall ranges between 1200-1400mm.
c. **Habitat type:** The study site comprises seven main habitat types. The most extensive habitat type is permanent crops (26.7%), including olives and fruit trees, 5.9% comprises oak forests, 21.1% comprises other wooded forests, including pines and other broad leaved forest trees, 14.1% comprises scrublands, 12.0% grassland, 3.5% field crops, and 16.7% urban areas including urban sprawl.

Plate 3.5. The Kafarmatta study site.

3.3.2.5 The Horch Ehden Nature Reserve (Plate 3.6):

This study site is one of the three main protected areas in Lebanon (see Figure 2.1). Horch Ehden NR is located in the North Governorate (Figure 3.2), 120km from the capital, Beirut. Hyaenas have been regularly reported in villages around Horch Ehden NR, to which they have possibly been attracted by the restaurants at the Reserve boundaries. Two hyaenas were reported killed inside Horch Ehden NR in June 2000, which I saw, and the other one was killed in August 2001.

Horch Ehden NR has an altitude that ranges from 1200-2200m asl and covers an area of $10km^2$. This protected area is famous for its rich flora. Shepherds still use it as a corridor to move between their grazing sites, and livestock graze around it. Horch Ehden NR is surrounded by villages which are included in the wider Horch Ehden NR study site of $18.3km^2$.

a. **Geology and Soil:** The rocks are mainly sedimentary, while some volcanic rocks originate from the Jurassic, Cretaceous and Quaternary periods. The soil is young and fragile and prone to erosion. Soils are mainly formed from alluvial soils, and mixed soil.
b. **Rainfall:** The mean annual rainfall ranges from 1200-1400mm, and mainly falls in the form of snow.
c. **Habitat type:** The study site comprises seven habitat types. The most extensive habitat type comprises grassland (35.0%), while 0.5% comprises oak forest, 25.6% comprises other wooded forest, including cedars, fern, pines and other broad leaved forest trees, 20.2% comprises scrublands, 18.4% comprises bare rocks, 17.6% comprise permanent crops, mainly apple trees, and 0.1% comprises urban areas including areas of urban sprawl.

Plate 3.6. Horch Ehden Nature Reserve.

3.3.2.6 Al-Shouf Cedar Nature Reserve (Plate 3.7):

This study site is the largest protected area in Lebanon (Figure 2.1). Al-Shouf Cedar NR is located in the Mount Lebanon Governorate (Figure 3.2), 65km from the capital, Beirut.

It has an altitude that ranges from 900-2000m asl, and covers an area of 150 km^2. The reserve is well managed, and shepherds are not allowed to graze in the reserve, and the study site was chosen on that basis. There are no livestock or restaurants surrounding the reserve.

a. **Geology and Soil:** The rocks are mainly sedimentary from the Jurassic period. The soils are young and fragile and prone to erosion. Mainly formed from Calcareous soil, few mixed soil, and fewer from sandy soils.
b. **Rain fall:** The mean annual rain fall ranges from 1200-1400mm per year.
c. **Habitat type:** The study site comprises eight habitat types: The most extensive habitat type comprises grass land (51.3%), while 10.1% comprises oak forest, 5% comprises other wooded forest (mainly cedar trees), 27.7% comprises scrublands, 0.3% comprises

bare rocks, 1.7% comprises permanent crops (mainly apple trees), 0.5% comprises field crops, and 3.4% comprises urban areas including areas of urban sprawl.

Plate 3.7. Al-Shouf Cedar Nature Reserve

3.3.3 Relative abundance

Signs of hyaenas, comprising footprints, hair and scats, were seen on transects at all sites except in Al-Shouf Cedar NR. The abundance of each type of sign showed a clear relationship to the total number of signs (Table 3.3). Therefore the total number of signs was taken as the measure of relative abundance of striped hyaenas at each study site.

Table 3.3 Correlation between total number of signs in each site and the number of individual signs recorded in each site.

Sign	N	r_s	P
Footprint	97	0.825	<0.001
Hair	42	0.607	<0.001
Scat	88	0.779	<0.001

Furthermore, there was no difference in the number of signs across the four seasons within study sites ($F=2.104$, $df= 3,244$, $P>0.05$). Therefore, the data for all the signs in each site were pooled by season and compared across sites, to give an index of relative abundance. Based on the index, the relative abundance of hyaenas differed ($F=12.800$, $df= 5,56$, $P<0.001$) across each site (Figure 3.3). In descending order, signs of hyaenas were seen most often in:

- Chnaniir, with a mean relative abundance value of 3.08±0.59 signs per km, with a range from 0 to 5.45 signs per km;
- Berqayel, with a mean relative abundance value of 0.93±0.31 signs per km, with a range from 0 to 3.47 signs per km;
- Bnachii with a mean relative abundance value of 0.74±0.22 signs per km, with a range from 0 to 2.5 signs per km;
- Kafarmatta with a mean relative abundance value of 0.72±0.18 signs per km, with a range from 0 to 2.08 signs per km; and,
- Horch Ehden NR with a mean relative abundance value of 0.06±0.04 signs per km, with a range from 0 to 0.39 signs per km.
- Al-Shouf Cedar NR with a mean relative abundance value of 0.00 signs per km.

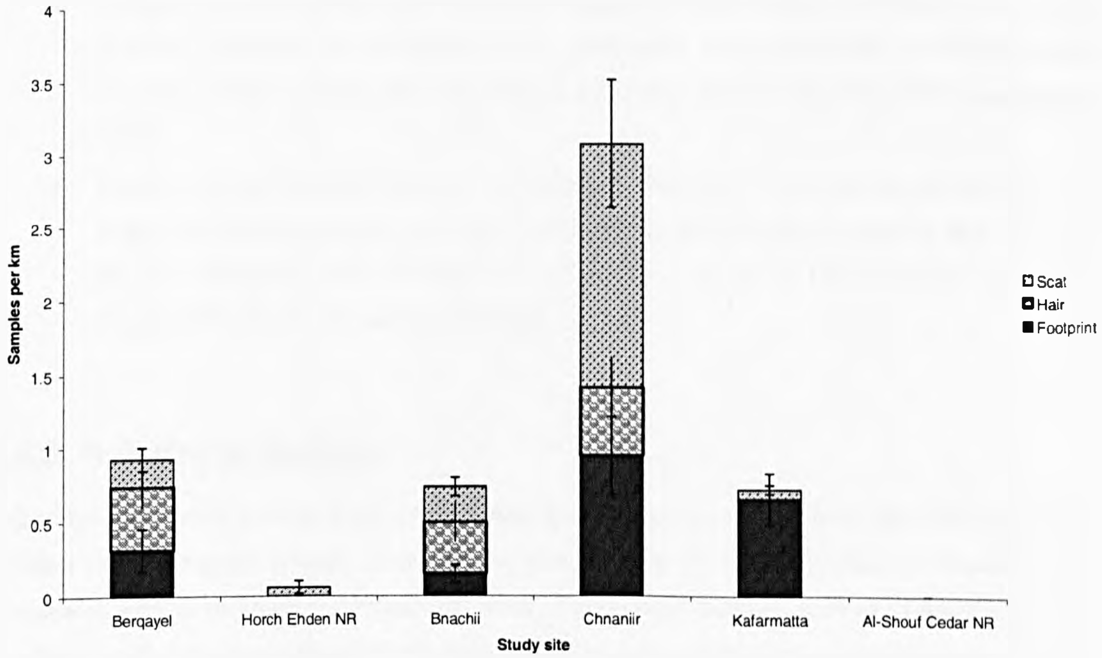


Figure 3.3. Relative abundance of striped hyaenas, based on different indirect signs across the different study sites

3.4 Discussion

Striped hyaenas are the most widely distributed species among the Hyaenidae family (Figure 2.2), yet they remain very little researched. In Lebanon, very simple methods have been used to show that the striped hyaenas are widely distributed across all Lebanese governorates, except Beirut Governorate where none was reported. Furthermore, based on surveys of indirect signs along transects, the relative abundance of striped hyaena varies widely across study sites.

3.4.1 Distribution

Reports collected from local people, newspapers and sightings of hyaenas' kills have revealed useful data on the still wide distribution of striped hyaenas across Lebanon. Although appearing to still survive at different relative densities, the wide distribution of hyaena across Lebanon can be explained by the following:

- The civil war of 1975-1991 and the Israeli invasion of 1982 resulted in the displacement of many people from their own villages. Furthermore, the land was extensively land mined by the warring parties. As a result, people were forced to leave their lands, which in turn grew wild, thereby restoring some lost habitats for wildlife.
- Unorganized waste dumps are widespread throughout most villages in Lebanon, and this has probably influenced the distribution of striped hyaenas, which are known to be opportunistic scavenging omnivores (Kruuk 1976, Skinner et al. 1980, Harrison and Bates 1991, Qarqaz et al. 2004).
- Besides their scavenging behaviour, the adaptable behaviour of striped hyaenas has probably helped ensure their survival and wide distribution across Lebanon, in habitats that have been heavily modified by man (Coman et al. 1991, Yom-Tov et al. 1995, Fedriani et al. 2001, Crooks 2002, Beckmann and Berger 2003).

3.4.2 Relative abundance

Striped hyaenas appear to occur at different relative abundances across the six study sites. Striped hyaenas occurred at their highest relative abundance in the urban site of Chnaniir, while the lowest relative abundances were to be found in the protected areas, with no signs detected at all in Al-Shouf Cedar NR. The human activities associated with urbanization, the invasion of wild areas, and the cutting of forest within urban areas, has drastically affected the habitats of striped hyaenas. However, striped hyaenas have managed to avoid people and remain in urban areas, by resorting to finding cover in the small remaining forest patches, where their relative abundance remains reasonably high. Similarly, Crooks (2002) found that grey foxes (*Urocyon cinereoargenteus*) and Virginia opossum (*Didelphis virginiana*) remained at high relative abundances in the smallest urban habitat fragments of the coastal southern California. In a study of black bear (*Ursus americanus*) in Nevada, Beckmann and Berger (2003) reported that the density of black bears in urban areas increased by more than three fold relative to base line level of abundance.

Moreover, as a scavenger (Kruuk 1976, Rieger 1979), striped hyaenas can benefit from food sources arising from the spread of refuse and garbage dumps in urban areas, as well as the presence of poultry houses, and pig farms that are fed chicken offal, and slaughter houses. While conducting transect surveys in Chnaniir, both the poultry house and the pig farm were passed, outside which were large amounts of dead chicken and chicken offal that could probably provide food for several striped hyaenas for some while. Fedriani et al. (2001) suggested that coyotes (*Canis latrans*) may increase in density in areas associated with human related food in California. In addition, Beckmann and Berger (2003) explained the movement of black bears from wild to urban areas on the profitable foraging of bears on domestic waste. Additionally, garbage dumps may support an increase in the population density of carnivores, for example of herring gulls (*Larus argentatus*) (Pons and Migot 1995); banded mongoose (*Mungos mungo*) (Gilchrist and Otali 2002); and, wolves (*Canis lupus*) (Ciucci et al. 1997). Leakey et al. (1999) suggested that striped hyaenas depended to some extent on the life style of local Turkana people in northern Kenya. This could explain why the indirect signs of striped hyaenas are relatively low in rural as compared with urban areas even though more space is available in rural areas. Indeed, in the protected areas, few to no signs of striped hyaenas were found, even though safety and space are provided. In Al-Shouf Cedar NR, where no signs of striped hyaenas were found at all, livestock are no longer allowed in, and no human settlement remains inside the reserve, to which admittance is restricted. In turn, this probably has greatly reduced the food available for striped hyaenas, which consequently hardly occur in protected areas.

3.5 Summary

1) The difficulty of sighting shy, nocturnal and persecuted striped hyaenas, living at probably low densities across a human-dominated landscape, resulted in the use of simple indirect methods to determine their distribution across Lebanon and their relative abundances across six study sites.

2) Based on various types of reports, ranging from national newspaper reports to calls from villagers to deal with problem animals, striped hyaenas remain widely distributed across Lebanon, and occur in every Governorate except the small and densely settled Governorate of Beirut, in both urban and rural sites, and across non-protected and protected areas. Compilation of these reports enabled the identification of six study sites that represented a range of ecological, socio-economic and conservation-related conditions in which to study the interactions between striped hyaenas and people.

3) Based on counts of indirect signs of striped hyaenas, including scats and dens, the relative abundance of striped hyaenas was shown to differ across the different study sites. Very few to no indirect signs of

striped hyaenas were evident in two Nature Reserves, while more indirect signs were evident outside protected areas, and most signs were evident in urban rather than in rural sites.

Given the widespread distribution of striped hyaenas across Lebanon, the next chapter will examine how living in human-dominated landscapes affects the diet and feeding behaviour of striped hyaenas within the country.

CHAPTER 4

DIET AND FEEDING ECOLOGY

Pre-baited camera trap showing a striped hyaena feeding at the Chnaniir study site.

4.1 Introduction

Feeding behaviour plays an important role in underpinning the social organisation, distribution and abundance of carnivores (MacDonald 1983, Creel and Creel 1995). The feeding behaviour and diets of many carnivore species have been investigated around the world (Fuller and Kat 1990, Creel and Creel 1995, Ashenafi et al. 2005, Breuer 2005). Many felids have specialized diets, and take very few different items of food (Kruuk 1986, Van Valkenburgh 1991, Kok and Nel 2004). Moreover, many felids are solitary hunters except for lions that hunt in packs (Bekoff et al. 1984, Estes 1991, Admasu et al. 2004). In contrast, canids eat a wide range of food items and are usually more generalist feeders (Kruuk 1986, Van Valkenburgh 1991, Kok and Nel 2004). Moreover, canids usually hunt in packs, and such communal hunting allows them to catch larger and more powerful prey (Andersson 2005, Carbone et al. 2005).

As human populations increase, areas of agricultural land and urban sprawl increase and result in considerable transformation of once natural landscapes (Western 2001). In turn, such transformations can lead to changes in the behaviour and ecology of carnivores, to the loss of natural prey species, to an increase in human-carnivore conflicts through the taking of humans and livestock, and eventually to the loss of the carnivores themselves. However, urban food sources in the form of refuse and garbage can provide some generalist and adaptable species of carnivores with new food supplies that, on the one hand, can lead to increasing carnivore density (Beckmann and Berger 2003, Hidalgo-Mihart et al. 2004), and that on the other hand can also result in further human-carnivore conflict. For example, in western North America, the presence of garbage in suburban areas has led to an increase in human-black bear (*Ursus americanus*) conflict (Beckmann and Berger 2003). In the Golan Heights, Israel, golden jackal (*Canis aureus*) populations have increased as a result of illegal garbage dumps and of the food provided by people, resulting in increased conflicts between cattle herders and jackals (Yom-Tov et al. 1995).

Of the four extant species in the family Hyaenidae (Chapter 2), three species including the spotted hyaena (*Crocuta crocuta*), the brown hyaena (*Hyaena brunnea*), and the striped hyaena (*Hyaena hyaena*), are predominantly nocturnal throughout their range and are scavengers or active predators (Kruuk 1976, Bearder 1977, Owens and Owens 1978, Tilson and Hamilton 1984, Mills 1989), while the aardwolf (*Proteles cristatus*) is specialized as a termite feeder (Kruuk and Sands 1972). Of the three scavengers or active predators, spotted hyaenas adapt least well to human-dominated landscapes (Boydston et al. 2003). In contrast, striped hyaenas appear the most adaptable (Kruuk 1976, Leakey et al. 1999).

Striped hyaenas are shy, nocturnal, generally solitary foragers. According to MacDonald (1978) and Bouskila (1984b), striped hyaenas may feed together in small parties of two or more individuals. Although primarily scavengers, striped hyaenas will take live food and have been reported to kill domestic animals such as horses, donkeys, sheep, goats, dogs and small animals (Bird 1946, Hatt 1959, Ronnefeld

1969, Heptner and Sludskij 1980, Osborn and Helmy 1980). Leakey et al. (1999) reported that hyaenas often kill goats and sheep to supplement their diet, rather than scavenging. Besides their effect on domestic animals, striped hyaenas can cause damage to dates, water and honey melons, as well as to other fruits (Kruuk 1976, Rieger 1979, Heptner and Sludskij 1980, Osborn and Helmy 1980).

Striped hyaenas are the only species of Hyaenidae to live in Lebanon, the Middle East and indeed Asia (Figure 2.2). The diet of striped hyaenas has been little studied, especially for striped hyaenas living in human-dominated landscapes, and no previous studies have been undertaken on striped hyaenas in Lebanon. As shy nocturnal mammals living in difficult habitats, striped hyaenas are hard to observe directly (Kruuk 1976). Therefore, this chapter uses more indirect methods, including pre-baited camera traps, the identification of feeding remains in caves and their surroundings, and scat analysis, to understand the feeding ecology of striped hyaenas living in human-dominated landscapes, including for hyaenas living in rural and urban settings. Hence, this chapter seeks to answer the following questions:

- has the feeding behaviour and diet of striped hyaenas responded to living in human-dominated landscapes?; and
- does the diet of striped hyaenas living in rural habitats differ from that of hyaenas living in urban habitats?

4.2 Methods

Different approaches have been taken to determining the diets of large carnivores, including: direct observation of feeding carnivores (MacDonald 1978, Williams et al. 1997, Cooper et al. 1999, Salnicki et al. 2001, Boydston et al. 2003, Mills 2003); identification of feeding remains (Skinner et al. 1980, Skinner and Van Aarde 1991, Leakey et al. 1999, Burgner and Gusset 2003); or scat analysis. Scat analysis appears to have been the most widely used technique to assess food habits of wild carnivores, including of: wolf (*Canis lupus*) (Ciucci et al. 2004); Ethiopian wolf (*Canis simensis*) (Ashenafi 2001); coyote (*Canis latrans*) (Dumond et al. 2001, Cepek 2004) ; American marten (*Martes americana*) (Bull 2000); stone martin (*Martes martes*) (Lanszki 2003); red fox (*Vulpes vulpes*) (Russell and Storch 2004); badgers (*Meles meles*) (Goszczynski et al. 2000); tigers (*Panthera tigris*) (Bagchi et al. 2003); brown hyaenas (*Hyaena brunnea*) (Burgner and Gusset 2003); and striped hyaena (*Hyaena hyaena*) (Kruuk 1976, MacDonald 1978).

In this study, the diet of striped hyaenas was studied using the following methods:

- directly through the use of camera traps; and
- less directly through identification of feeding remains and through scat analysis.

Each method is further described in the sections below.

4.2.1 Camera traps

The habitats in which striped hyaenas live in Lebanon are very bushy (Chapter 3), while striped hyaenas are nocturnal (MacDonald 1978, Bouskila 1984b), very shy and afraid of humans. Hence, it was not possible to study their feeding habits and foraging behaviour directly, without resorting to camera traps. Camera traps were used from November 2002 to July 2004 to confirm both the patterns of feeding activity, and determine the possible food items favoured by striped hyaenas. Five pre-baited DEER CAM ® active and passive remote camera traps, triggered by both heat and motion, were tied to a tree 40-60cm above ground. The cameras were programmed to take photographs 24hours/day with a 30-minute interval between photos, and to record date and time on each photograph. The camera traps were deployed for a total of 200 days. However, the limited numbers of camera traps were deployed for a total of 40 days at each study site, except Berqayel where it was not safe to leave camera traps in the field because they would be stolen. The camera traps were deployed for periods divided equally between long days (14-16 hrs of daylight) and short days (10-12 hrs of daylight), and were circulated among the sites according to a fixed programme. The 20 days allocated for each daylight period at each study site were divided into two 10-day periods, separated by 40 days without trapping, while the cameras were operating at the other four study sites. Photos taken by the camera traps were categorised by time of capture, and differences in feeding activity were compared during short-day-periods vs. long-day periods using a Chi-square test.

Baits were placed on the ground, 3 m away from the camera trap. The bait consisted of animal leftovers, fruits and domestic refuse. The animal leftovers consisted of butchery leftovers, comprising dead chicken, chicken legs and necks, and dead mammals, like rats, cats, or baby dogs, found killed on the road. The fruits differed according to availability and season. During short-day periods, apples, oranges and carrots were used, while apricots, pears, grapes, peaches and plums were added to the bait during long-day periods. Domestic refuse was not always consistent but generally contained refused meals and bread. Camera traps were visited the day after they were baited to identify, in combination with camera-trap photos of feeding hyaenas, what had been eaten in preference. Camera traps and baits were visited by striped hyaenas on the day after they were set and on the days after subsequent visits to check on the traps, suggesting that striped hyaenas were not put off by any residual human smells or signs.

4.2.2 Feeding remains

Various mammalian species, including three species of hyaena, bring back skeletal remains and prey to their dens to eat at their leisure (Kruuk 1972, Skinner et al. 1980, Skinner et al. 1986, Skinner and Van Aarde 1991, Leakey et al. 1999). Consequently, feeding remains can be left behind, consisting of animal hair, bones, horns, skull, and feathers. A total of 58 such feeding remains were located during transect surveys across the six study sites from June 2002 to December 2003 (Chapter 3). Whenever a feeding remains was encountered on a trail, in a resting area, or inside and outside caves, it was identified and its GPS location was recorded. All the feeding remains were identified in the field by the hair and skin that was left behind. Possible differences in the locations where feeding remains were encountered, and in the items found in feeding remains, were compared across study sites in urban and rural areas, using a Chi-Square test.

4.2.3 Scat analysis

The scats of striped hyaenas are of an off-white to grey colour, and are round in shape, with one side pointed and the other semi-flat with a gentle concave shape (Plate 4.1). In contrast to the scats of spotted hyaenas that are often found in latrines (Kruuk 1972, Silvestre et al. 2000), and to the scats of striped hyaena that were found in latrines in the Negev Desert, Israel (MacDonald 1978), the scats of striped hyaenas in Lebanon are scattered, hard to find and they are often covered by grass or occur in bushy areas. A total of 106 scat samples were located during transect surveys across the six study sites from June 2002 to December 2003 (Chapter 3). Whenever a scat was encountered, on a trail, in a resting area, inside and outside caves, its GPS location was recorded, put into a nylon bag, labelled and stored for later analysis. Most scats were old and dry, and could not be aged or categorised to a particular season. Those few ($n = 7$) scats found wet were oven-dried before storage, but this sample was insufficient for an analysis of content by season.

Plate 4.1. Scats of striped hyaenas in Lebanon.

A set protocol was followed for scat preparation and analysis. In contrast to the old scats of striped hyaenas in the Negev Desert, Israel that were found in a powdery form (MacDonald 1978), the old scats collected in Lebanon were very hard to break open. Therefore, scats were soaked in water for 24-72 hours to ease separation and preserve the scat content. After soaking, scats were suspended in water and carefully broken. Water was filtered out under suction and the solid residue was dried in an incubator at 37^{0}C for 24-48 hrs. After drying, the solid residue was weighed and scat contents were treated as follows: first, big pieces of bone were removed and discarded since they could not be identified to species level; second, hairs, feathers, plants, seeds and rubbish were separated into categories and identified; third, the remaining residue was successively passed through sieves with meshes of 4mm, 2mm, 1 mm, 180 and 88 microns, respectively. All identifiable material was separated and added to its respective category, each of which was later weighed dry. The remaining unidentified residue was weighed and stored for later analysis of organic matter and ash content, determined after incineration in a muffle burner at 600° C. for two hours. Organic matter was determined as follows:

$$\%\text{Organic matter} = \frac{(\text{Weight before incineration} - \text{Weight after incineration})}{\text{Sample weight before incineration}} \times 100$$

Ash content was determined as follows:

$$\%\text{Ash} = \frac{\text{Weight after incineration}}{\text{Sample weight before incineration}} \times 100$$

4.2.3.1 Mammalian hair identification

Mammalian hairs were found in most scat samples. The quills of porcupine were very obvious to identify in scat remains. All other mammalian hairs found in the scat samples were first examined macroscopically and notes were taken on hair colour and size. Hairs were then microscopically identified against a reference collection.

The reference collection was developed using hairs from humans, from known domestic species, including goat, sheep, cow, rabbit, donkey, dog and cat, and from wild animal species kept at Animal Encounter (see Chapter 2), including: fallow deer (*Dama dama*), black rat (*Rattus rattus*), red squirrel (*Sciurus anomalus syriacus*), wild and jungle cat (*Felis silvestris and F. chaus*), stone martin (*Martis foina*), badger (*Meles meles*), red fox (*Vulpes vulpes palaestina*), golden jackal (*Canis aureus syriacus*), grey wolf (*C. lupus pallipus*), striped hyaenas (*Hyaena hyaena syriaca*), wild boar (*Sus scrofa lybicus*), and brown bear (*Ursus arctos syriaca*). Hair samples were collected from these known species, soaked in alcohol to dissolve away any wax or fat, and then dried.

Reference hair samples were made in two ways. The first method used a negative cuticle scale imprint for microscopic identification at 10x magnification. The reference slides were made by placing a hair along a slide covered with wet nail polish that had been allowed to stand for few seconds. After the nail polish had dried, the hair was carefully removed using forceps, to leave a well-preserved imprint of the cuticle scale that could be seen under the microscope. This technique provided clear imprints, and allowed accurate identification of hairs, as most species have distinctive scale characteristics (Teerink 2003). The second method took a cross section of the reference hair on a Cryostat (LEICA Crostat CM1850 Germany), and put this on a microscope slide for viewing under a binocular microscope at 40x magnification (Teerink 2003).

4.2.3.2 Bird identification

Feathers of birds occurred in many scat samples. Most of the feathers were easily identifiable as chicken feathers because of their shape and white colour. Only one other species of bird feather was identified, for a partridge (*Phasianidea*) since its shape was preserved and could be compared to a reference sample.

4.2.3.3 Reptile identification

Scales of reptiles were separated from several scat samples and sent for identification to Dr Riad Sadek, a herpetologist at the Biology Department of the American University of Beirut, Faculty of Arts and Sciences. Scales of reptiles were identified to the level of taxonomic group, as snakes (Plate 4.2A), turtles, and other reptiles.

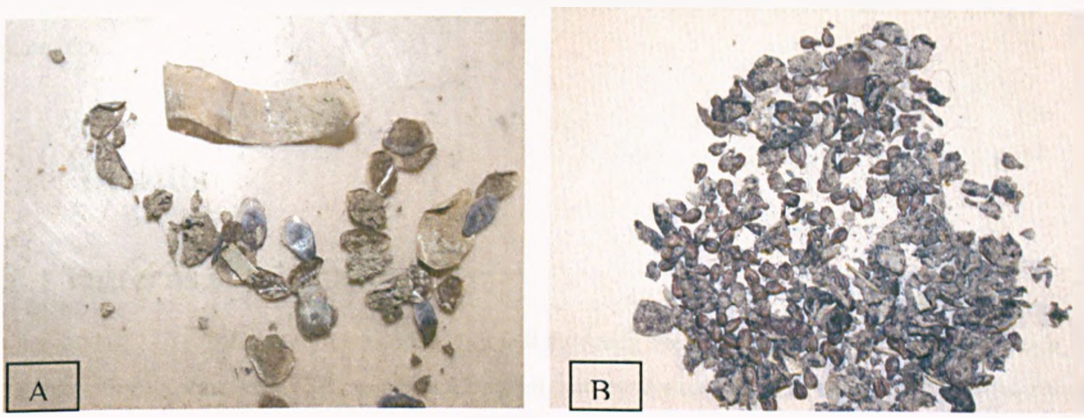


Plate 4.2. Scales of reptiles (A) and seeds of fruits (B) found in the scat samples.

4.2.3.4 Plant identification

Plant material was separated from most scat samples, and was stored for later identification. The plant material was separated into seeds (Plate 4.2B), oak leaves (*Quercus* spp.) that were easily identified by their shape, and other plant material (wood bark and other unidentifiable plant material). Remains of seeds and nuts were sent for identification to Dr. Riad Baalbaki, an agronomist, and Dr. Elsa Sattout, a forestry scientist, at the Agronomy Laboratory of the American University of Beirut, Faculty of Agricultural and Food Sciences.

4.2.3.5 Statistical analysis

The weight of the scat samples, the weights of identified and unidentified material in scat samples, and the weights of organic matter and ash in the unidentified material, were compared for possible differences across study sites using a one-way ANOVA. Furthermore, the proportions of each sample comprising identified and unidentified material, and the proportions of each unidentified material comprising organic matter and ash, were transformed to Arcsine to meet the requirement of a one-way ANOVA and then compared for possible difference across study sites and more broadly between rural and urban areas (see Chapter 2).

Since any one sample may contain more than one broad food category, or more than one species within each broad food category, the proportion of a particular item that occurred in all samples was calculated (Ciucci et al. 2004). Results were presented as percent occurrence, to represent the number of times an item was found in relation to the total number of items in all scats, as commonly reported in other studies of carnivore diet (Jaksic 1981, Novaro et al. 2000). Samples were analyzed in two ways. First, the broad food items present in scats were compared for possible differences across study sites and more broadly between rural and urban areas, using a Chi-square test. Second, items of mammal prey were compared for possible differences across study sites and more broadly between rural and urban areas, using a Chi-square test.

4.3 Results

4.3.1 Patterns of feeding activity

Of the total of 120 camera captures recorded from all the study sites, most (95.8%) were from Chnaniir, 2.5% were from Kafarmatta, 1.7% were from Bnachii, and none were from Horch Ehden NR or Al-Shouf Cedar NR. Of the 120 photos, only two photos contained two hyaenas at the same time (Plate 4.3).

Plate 4.3. A camera trap photo of two striped hyaenas at the Chnaniir study site.

A total of 71 camera captures were from short-day periods (mid-October to 31 January) and 49 were from long-day periods (mid-April to 30 July). All captures were pooled irrespective of study site, to describe the feeding activity of striped hyaenas in long-day and short-day periods. The camera captures showed that striped hyaenas only fed actively throughout the hours of darkness. Striped hyaenas became active feeders approximately 30 minutes after dusk and remained active until dawn. Overall, feeding captures were recorded as follows: 1.7% at 17:00hrs; 5.6% at 18:00hrs; 3.3% at 19:00hrs; 4.2% at 20:00hrs; 10.0% at 21:00hrs; 5.0% at 22:00hrs; 11.7% at 23:00hrs; 12.5% at 00:00hrs; 9.2% at 01:00hrs; 4.2% at 02:00hrs; 17.5% at 03:00 hrs; 10.8% at 04:00hrs; and 4.2% at 05:00hrs. However, the timing of feeding captures differed (χ^2=35.141, df=12, P<0.001) according to day length (Figure 4.1). Most (20.8%) feeding captures during long days were recorded at 01:00hrs, while most (20.8%) feeding captures during short days were recorded at 03:00hrs. Moreover, no feeding captures were recorded between 17:00hrs-19:00hrs on long days.

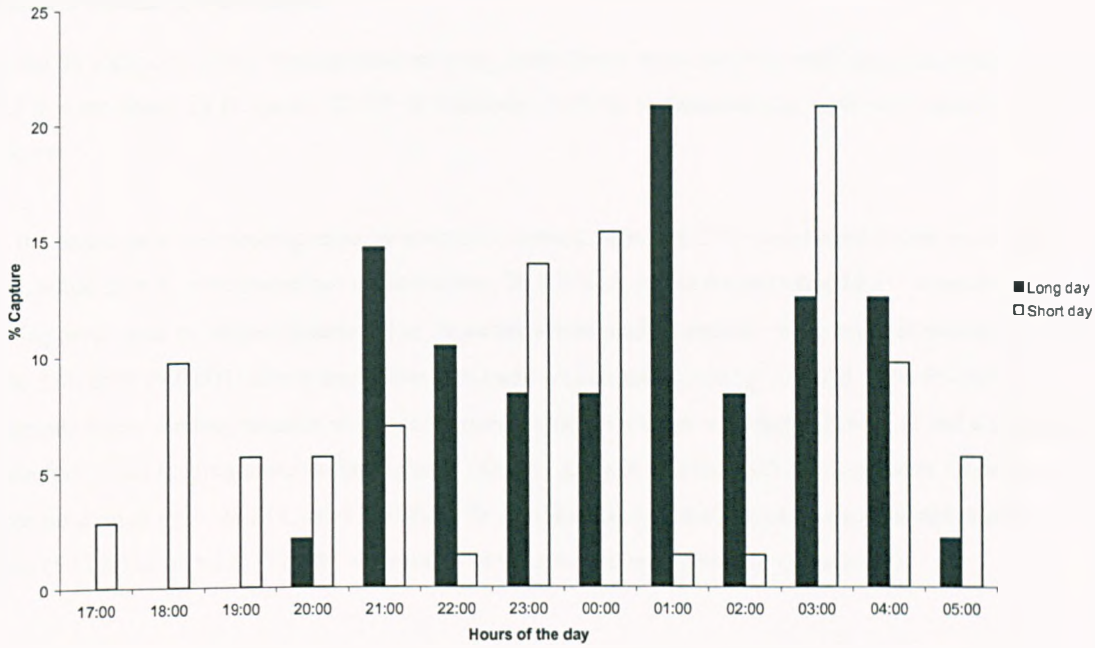


Figure 4.1. Feeding activity pattern of striped hyaenas at camera traps according to day lengths.

Striped hyaenas ate all the bait, whether meat or fruits, set in front of the camera traps, with certain preferences for some food items. Among animal remains, meat and thigh bones were eaten first, while other kinds of bones were eaten last. Among fruits, grapes were inevitably the first fruit eaten, while carrots remained until last (Plate 4.4).

Plate 4.4. Carrots remaining after removing the camera traps.

4.3.2 Feeding remains

Of the 58 locations where feeding remains were encountered, most (44.8%) were found in Bnachii, while 24.1% were found in Berqayel, 25.9% in Chnaniir, 5.2% in Kafarmatta and none was found in the two reserves.

Of the locations where feeding remains were encountered, most (36.2%) were found inside caves (Plate 4.5), while 22.4 % were found just outside caves, 29.3% were found on trails and 12.1% were found at resting areas used by striped hyaenas. The locations where feeding remains were encountered differed ($\chi^2 = 36.324$, df=9 P<0.001) across study sites, but there was no difference ($\chi^2 = 9.050$, df=6 P>0.05) in the locations where feeding remains were encountered in the rural areas of Bnachii, Berqayel and Kafarmatta. Therefore, most feeding remains found inside (48.8%) and just outside (30.2%) caves were found in the three rural areas ($\chi^2 = 28.811$, df=3 P<0.001). In contrast, most feeding remains encountered at resting areas (57.1%) or on trails (73.3%) were found in the urban area of Chnaniir (Figure 4.2).

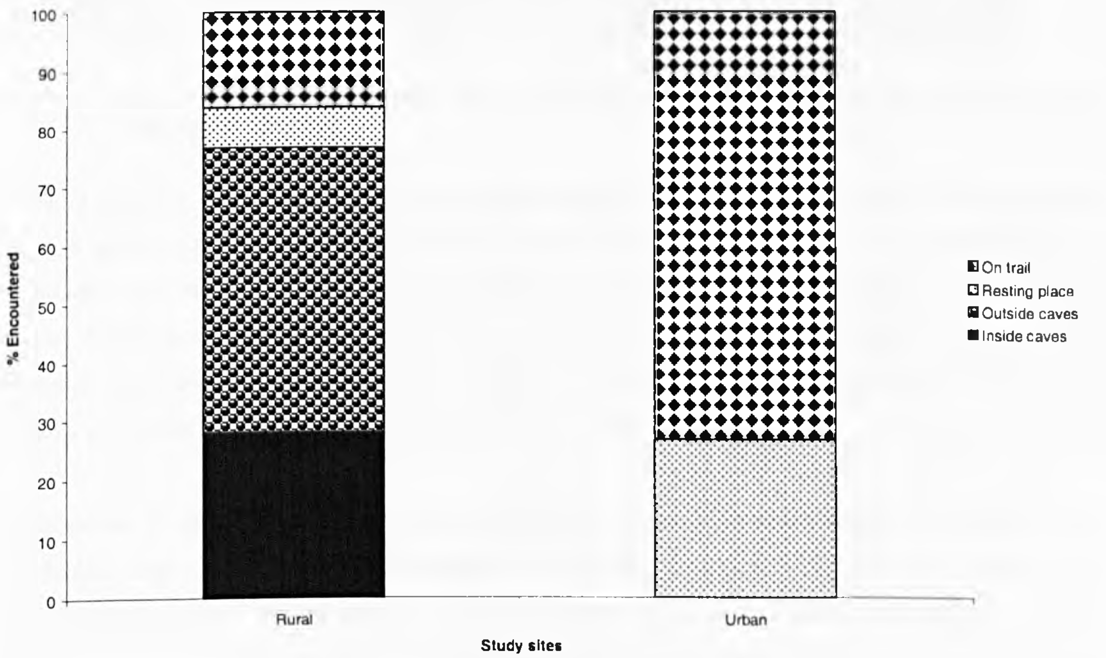


Figure 4.2. Places where feeding remains were encountered in rural and urban areas.

Plate 4.5. A dead calf in a striped hyaena's cave in Bnachii, with the inset photo showing the small entrance of the cave.

Of the 58 locations where feeding remains were encountered, 10 locations contained the remains of more than one species. Of the total of 68 items encountered in hyaena remains, species of domestic mammal comprised 77.8% of remains, wild mammals comprised 14.3% of remains, and birds comprised 7.9% of remains. Furthermore, there were no differences in the broad food categories of domestic mammals, wild mammals and birds across study sites (χ^2 = 8.859, df=6, P>0.05), across rural sites (χ^2 = 7.437, df=4, P>0.05), nor across rural and urban sites (χ^2 = 1.040, df=1, P>0.05).

At the species or species group level, domestic livestock, whether cattle, sheep or goats, comprised 66.2% of remains, dogs comprised 8.8%, and pigs and donkeys comprised 5.9% each. In contrast, wild carnivores comprised 7.4% and porcupine comprised 5.9% (Table 4.1). There was a difference (χ^2 = 39.962, df=21 P<0.01) in the species and species groups found across study sites, but there was no difference (χ^2 = 12.354, df=12 P>0.05) in the species and species groups found in the rural areas of Bnachii, Berqayel and Kafarmatta. Therefore, most remains of goats (32.1%), donkeys (7.5%), dogs (11.3%), and wild carnivores (9.4%) were found in the three rural areas (χ^2 = 25.083, df=7 P<0.001). In contrast, most remains of sheep (26.7%), cows (33.3%), pigs (26.7%), and porcupine (6.7%) were found in the urban area of Chnaniir.

Table 4.1. Percentage of food items, whether in broad categories or by species and species group, among feeding remains encountered at the four study sites.

Item	Study Site				
	Berqayel	Bnachii	Chnaniir	Kafarmatta	Total
Number of locations	14	26	15	3	58
Broad food categories					
N	19	26	15	3	63
Domestic mammals	63.2	80.8	86.7	100.0	77.8
Wild mammals	15.8	19.2	6.7	0.0	14.3
Birds	21.1	0.0	6.7	0.0	7.9
Species or species group					
N	19	28	15	6	68
Sheep	5.3	10.7	26.7	0.0	11.8
Goat	26.3	35.7	6.7	33.3	26.5
Cow	31.6	21.4	33.3	33.3	27.9
Pig	0.0	0.0	26.7	0.0	5.9
Donkey	0.0	7.1	0.0	33.3	5.9
Dog	21.1	7.1	0.0	0.0	8.8
Wild carnivore	10.5	10.7	0.0	0.0	7.4
Porcupine	5.3	7.1	6.7	0.0	5.9

4.3.3 Scat analysis

Of the 106 scat samples collected, most (34.6%) were found in very bushy areas, while 29.0% were found in open areas of short vegetation, 9.3% were found on foot paths, 17.8% were found in caves, and 9.3% were found on bare rocks. Furthermore, most (70.7%) scats were collected from Chnaniir, while 13.2% were collected from Bnachii, and 12.3% were collected from Berqayel, while only 3.8% were collected from Kafarmatta, and none was collected from Horch Ehden NR or from Al-Shouf Cedar NR.

The mean total dry weight of the 106 scat samples collected was 50.1±3.56 g (current Figure 4.3). However, the mean total weight of samples from Bnachii (94.8±14.08 g) was heavier ($F=10.094$, $df=3,102$, $P<0.001$) than the mean total weights of samples from Berqayel (43.2±9.68 g), Kafarmatta (43.2±3.20 g) and Chnaniir (43.8±10.59 g).

Of the 106 scat samples collected, a mean of 18.5% (7.1±0.96 g) by weight could be identified, while a mean of 81.5% (43.0±3.44 g) remained as unidentified material. This represents an overall ratio of 1:6 for identified to unidentified material within the scat samples of striped hyaenas.

Unsurprisingly, the mean total weights of identified and unidentified material differed across sites ($F=7.757$, df= 3,102, $P<0.001$, and $F=7.043$, df= 3,102, $P<0.001$, respectively). Furthermore, the proportions of identified and unidentified material differed across sites ($F=3.138$, df= 3,102, $P<0.05$, and $F=2.745$, df= 3,102, $P<0.05$, respectively) (Figure 4.3). However there was no difference ($P>0.05$) in the proportions of identified and unidentified materials across the rural sites (Bnachii, Berqayel and Kafarmatta). Therefore, the highest proportion of identified material was found in the three rural areas ($F=4.586$, df= 1,104, $P<0.05$) and there were no difference in the proportions of unidentified material between rural and urban areas ($F=2.933$, df= 1,104, $P>0.05$).

Of the 106 scat samples collected, the unidentified portion of the samples comprised a mean of 33.3±SE% (14.4±1.09 g) of organic matter, and 66.7±SE% (28.9±2.66 g) of ash. The mean weight of organic matter and ash differed across sites ($F=3.890$, df= 3,96, $P<0.05$, and $F=7.008$, df= 3,96, $P<0.001$, respectively). However, the proportions of organic matter and ash did not differ ($P>0.05$) across sites, across rural sites nor between rural and urban areas (current Figure 4.3).

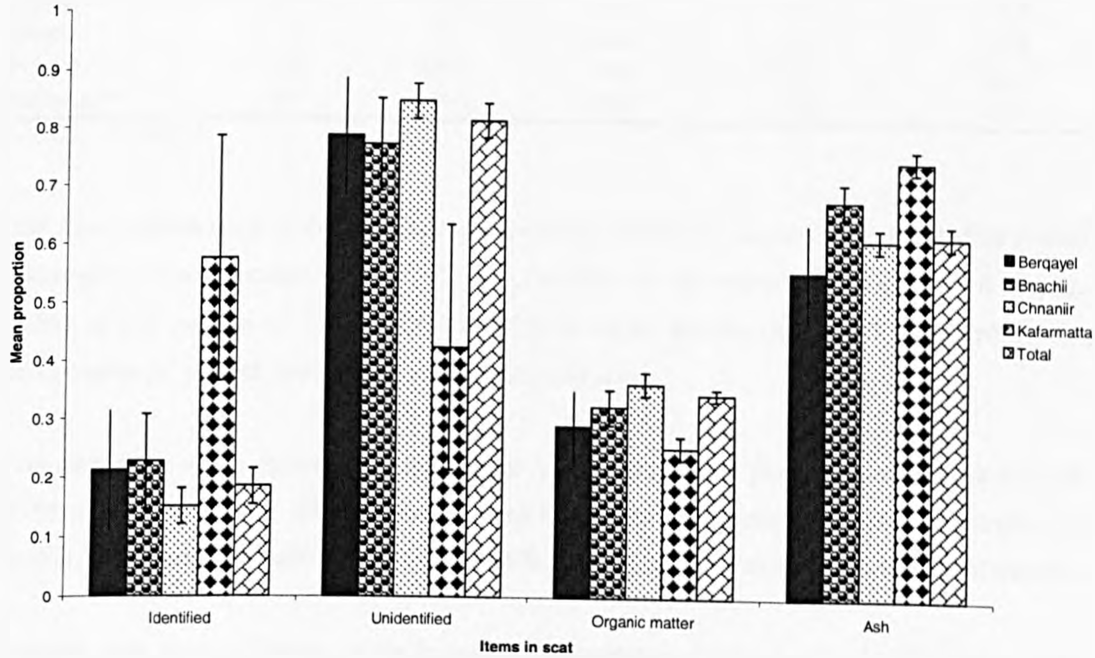


Figure 4.3. Mean proportion by weight of items found in the scat samples across the four study sites.

4.3.3.1 Identifiable remains

Seven broad categories of food item, with mammals subdivided into domestic and wild mammals, were recorded from the scats of striped hyaenas, each at different frequencies of occurrence (Table 4.2). Hairs from both domestic and wild mammals were present in 97.2% of samples. Hairs from domestic mammals were present in 83.0% of samples, while hairs from wild mammals were present in only 25.5% of samples. Bird feathers were present in 31.1% of samples, while scales from reptiles were present in 9.4% of samples, and insect remains were present in 17.0% of samples. Plant parts including leaves and grass, and fruit seeds, were present in 94.3% of samples. Finally, human domestic rubbish, including nylon, plastic, pottery and rubber, was present in 44.3% of samples (Table 4.2).

Table 4.2. Frequency of occurrence of broad categories of food item in scat samples of striped hyaenas across study sites.

Items	Study Sites				Total (%)
	Berqayel (%)	Bnachii (%)	Chnaniir (%)	Kafarmatta (%)	
N	13	14	75	4	106
All mammals	100.0	92.9	97.3	100.0	97.2
Domestic	76.9	71.4	85.3	100.0	83.0
Wild	23.1	50.0	22.7	0.0	25.5
Birds	38.5	28.6	30.7	25.0	31.1
Reptiles	15.4	0.0	10.7	0.0	9.4
Insects	15.4	7.1	20.0	0.0	17.0
Plants*	76.9	100.0	96.0	100.0	94.3
Rubbish**	7.7	42.9	53.3	0.0	44.3

*P<0.05, **P<0.01

There were no differences in the frequency of occurrence of mammal remains (χ^2 = 1.449, df=3 P>0.05), of domestic mammal remains (χ^2 = 2.780, df=3 P>0.05), of wild mammal remains (χ^2 = 6.154, df=3 P>0.05), of bird remains (χ^2 = 0.446, df=3 P>0.05), of reptile remains (χ^2 = 2.547, df=3 P>0.05) or of insect remains (χ^2 = 2.288, df=3 P>0.05) across the study sites.

In contrast, there was a difference in the frequency of occurrence of plant remains (χ^2 = 8.852, df=3 P<0.05) across study sites. All scat samples from Bnachii and Kafarmatta, and 96% of samples from Chnaniir, contained plant material, while only 76.9% of samples from Berqayel contained plant material.

Moreover, there was a difference in the frequency of occurrence of rubbish (χ^2 = 12.731, df=3 P<0.005) across study sites. Rubbish occurred more frequently in scat samples from Chnaniir (53.3%) and Bnachii (42.9%) than in scat samples from Berqayel (7.7%), while no rubbish was found in scat samples from Kafarmatta.

There were no differences (all P>0.05) between the frequencies of occurrence of the broad categories of items within scat samples from rural sites of Berqayel, Bnachii and Kafarmatta, except for their rubbish content (χ^2 = 6.108, df=2, P<0.05). Rubbish occurred more frequently in scat samples from Bnachii, compared with Berqayel and Kafarmatta. Furthermore, excluding rubbish, there were no differences (all $P>0.05$) between the frequencies of occurrence of the broad categories of items within scats from the rural and urban areas.

Among the mammals, hairs were identified from 14 species, seven of which were domestic animals, comprising sheep, goat, cow, pig, donkey, cat, and dog; four of which were wild carnivores, including red fox, golden jackal, striped hyaena, and stone martin, and three of which were generalist omnivores, including wild boars, porcupine, and black rat. However, there were some differences between the frequencies of occurrence of species across the four study sites, particularly among the domestic mammal species (Table 4.3). Goats and donkeys were frequent in scat samples from Kafarmatta ($\chi^2 = 8.818$, df=3 $P<0.05$ and $\chi^2 = 13.518$, df=3 $P<0.005$, respectively), while pigs were frequent in samples from Chnaniir ($\chi^2 = 24.484$, df=3 $P<0.001$), and cows were frequent in samples from Bnachii ($\chi^2 = 9.072$, df=3 $P<0.05$). There were also some differences between the frequencies of occurrence of wild mammals across the four study sites. For example, wild boar were present only in scat samples from Bnachii ($\chi^2 = 20.288$, df=3 $P<0.001$).

The frequency of occurrence of mammal species did not differ (all $P>0.05$) across rural sites. In contrast, there were some differences between the frequency of occurrence of mammal species across the rural and the urban areas. Among the domestic mammal species, pigs were present only in samples from the urban site ($\chi^2 = 24.484$, df=1 $P<0.001$), while donkeys were present only in samples from the rural sites ($\chi^2 = 12.696$, df=1, $P<0.001$). On the other hand, among wild mammal species wild boars occurred only in samples from the rural sites ($\chi^2 = 7.469$, df=1, $P<0.01$).

Among the birds, feathers of two species could be identified, comprising domestic chicken and wild partridge. Chicken feathers could be identified since several (N = 39) of the scats were collected beside poultry houses or pork farms that fed chicken remains to their pigs. Among reptiles, scales were identified from three groups including snakes, turtles, other reptiles (Plate 4.2A).

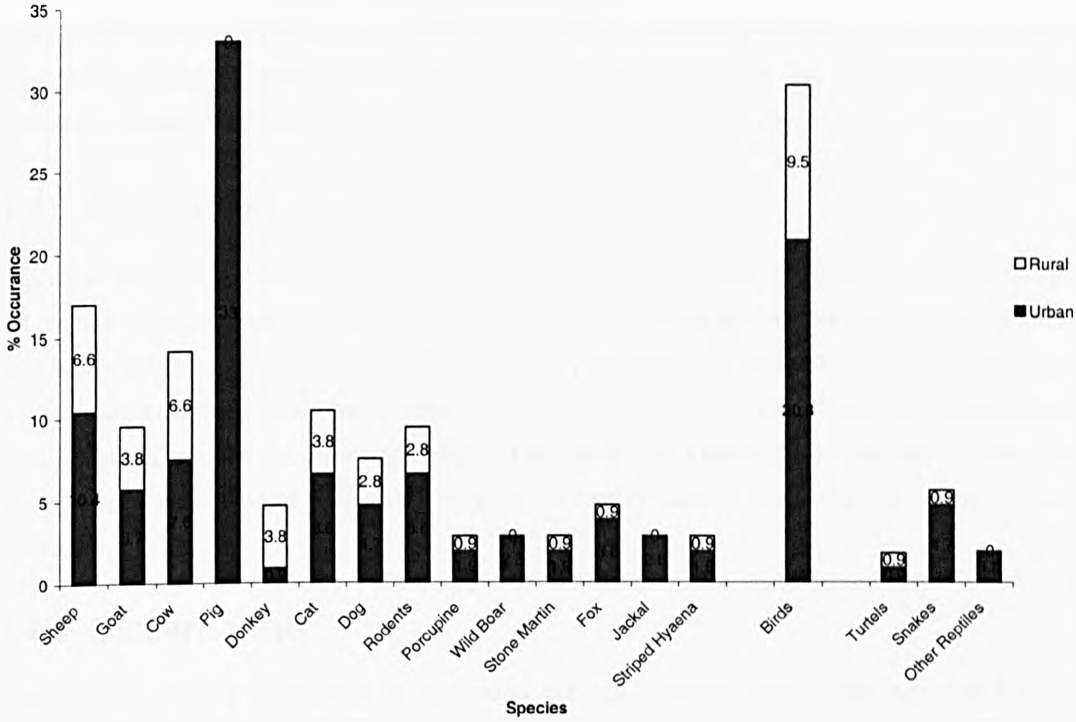


Figure 4.4. Animal species and species groups found in scat samples of striped hyaena collected from all the study sites, expressed as number of scats with the individual animal species /total number (n=106) of analyzed scats x 100.

Table 4.3. Frequency of occurrence of mammalian food items in the scat samples of striped hyaena across the four study sites.

Item	Study Sites				Total (%)
	Berqayel (%)	Bnachii (%)	Chnaniir (%)	Kafarmatta (%)	
N	13	14	75	4	106
Sheep	30.8	14.3	17.3	25.0	18.9
Goat*	23.1	7.1	8.0	50.0	11.3
Cow*	0.0	35.7	10.7	25.0	13.2
Pig***	0.0	0.0	50.7	0.0	35.8
Donkey**	15.4	14.3	0.0	25.0	4.7
Dog	7.7	14.3	6.7	0.0	7.5
Cat	15.4	14.3	9.3	0.0	10.4
Black rat	15.4	7.1	10.7	0.0	10.4
Porcupine	0.0	7.1	2.7	0.0	2.8
Wild boar***	0.0	21.4	0.0	0.0	2.8
Stone martin	0.0	7.1	2.7	0.0	2.8
Red fox	7.7	7.1	5.3	0.0	5.7
Golden jackal	0.0	7.1	4.0	0.0	3.8
Striped hyaena	0.0	7.1	2.7	0.0	2.8

*P<0.05, **P<0.01, ***P<0.001

Among plants, identifiable remains were in the form of oak leaves, wood bark, grass, nuts shell and seeds (Plate 4.2B). Seeds were present in 32.1% of samples, and the following were found: grapes, watermelon, musk melon, pumpkin, apples, pears, citrus, figs, cucumber, barley seeds and wild fruit seeds like carob (*Ceratonia siliqua*), henblass (*Myrtus communis)* and oak nuts (*Quercus* spp.).

4.4 Discussion

This is the first study of the feeding ecology of striped hyaena in human-dominated landscapes, including in Lebanon. Using various techniques from camera trapping to scat analysis, striped hyaenas in Lebanon have been confirmed as omnivorous scavengers, as they are elsewhere where their diets have been studied in less detail throughout their range (Kruuk 1976, Leakey et al. 1999). Furthermore, no concrete evidence came to light of striped hyaena preying or hunting on livestock in Lebanon. However, the methods used in this chapter cannot readily distinguish between carcass or scat remains that have been hunted or scavenged.

4.4.1 Camera traps

Camera traps provided information on the feeding ecology of striped hyaena, and indicated that striped hyaenas forage solitarily most of the time. Only two photos (Plate 4.3) showed two hyaenas at the same feeding plot at the same time. Similarly, Kruuk (1976) reported the solitary foraging behaviour of striped hyaenas in the Serengeti, Tanzania where, of 96 observations, only six were of more than one animal. However, the members of feeding groups larger than one may be of the same family, most likely a mother with her offspring (MacDonald 1978, Rieger 1979, Bouskila 1984a).

The camera traps also confirmed that striped hyaenas in Lebanon practice omnivorous scavenging behaviour, as found elsewhere (Kruuk 1976, Rieger 1979, Leakey et al. 1999). The camera trap photos showed that fruits are one of the main dietary items of striped hyaena, even when meat was available; striped hyaenas do not resort only to feeding on fruits when meat is scarce. For example, Plate 4.6 shows striped hyaenas eating apples when bones and meat were still available. Moreover, monitoring the camera trap bait showed that hyaenas favour some dietary items over others. Striped hyaenas favoured the thigh bones more than other bones since they are rich in bone marrow, while carrots were the least favoured vegetable since they often remained when the camera traps were visited to determine leftovers (Plate 4.4).

Plate 4.6. Pre-baited camera trap showing hyaena with an apple.

Striped hyaenas are nocturnal throughout their range (Kruuk 1972, Mills 1989), as has also been shown here for striped hyaenas in Lebanon. Captures taken by camera traps showed that the feeding activity of striped hyaenas was dependent on the length of the dark period (Figure 4.1). Striped hyaenas feed at any hour of the night. Striped hyaenas start foraging 30 minutes after dark till dawn. In two incidents, striped hyaenas were seen feeding while checking the traps at dawn. These captures suggested that the feeding activities of striped hyaenas peak at 1:00am during long-day-periods and at 3:00am during short-day periods. Most striking is the fact that although their peak of feeding activity differed in real time but it was the same if set in the context of time remaining to dawn.

4.4.2 Feeding remains

Brown and striped hyaena both store food items that they may carry back to their dens (Mills 1978, Skinner and Ilani 1979, Mills 1982a, Van Aarde et al. 1988, Leakey et al. 1999). This was also shown for striped hyaenas in Lebanon, where 70.9% of feeding remains were found in and just outside caves (see Plate 4.5) and in resting areas. In contrast, Kruuk (1976) reported that striped hyaenas in the Serengeti, Tanzania store food in bushy trees or dense shrubby vegetation, but this practice was not observed or reported in Lebanon.

4.4.3 Scat analysis

Scat analysis further showed that striped hyaenas are omnivorous, and feed on mammals, birds, reptiles, insects, fruits, and domestic refuse (Table 4.2). In contrast, spotted hyaenas have a far more specialized diet, mostly comprising large and medium sized mammals that they have hunted (Kruuk 1972, Mills 2003). Like brown hyaenas, wild striped hyaenas living in undisturbed landscapes feed on a wide variety of mainly small food items such as small mammals, bones, wild fruits, and insects that they predominantly scavenge (Kruuk 1976, MacDonald 1978, Rieger 1979, Heptner and Sludskij 1980, Osborn and Helmy 1980, Mills 1989, Kerbis-Peterhans and Horwitz 1992, Can 2004, Qarqaz et al. 2004).

Out of the 14 species of mammals found in striped hyaenas scats collected from human-dominated landscapes in Lebanon, around 50% of identifiable remains were of domestic animals, including sheep, goats, cows and pigs (Table 4.3). Therefore, domestic animals constitute key food items of striped hyaenas living in Lebanon, in Israel (Skinner and Ilani 1979, Bouskila 1984b), in Jordan (Al Younis 1993, Qarqaz et al. 2004) and in northern Kenya (Leakey et al. 1999). However, it appears that striped hyaenas in Lebanon had probably only scavenged dead of these domestic species, as local people in these areas did not report that they had lost animals to striped hyaenas. Instead, many confirmed that they had thrown away dead animals, upon which they had subsequently seen a striped hyaena feeding. Such observations differ from those of Leakey et al. (1999), who suggested that striped hyaenas do predate on the livestock of the local Turkana people in northern Kenya. This suggests that striped hyaenas are adaptable and can benefit from the different local feeding opportunities that are available in their area. Indeed, this was reflected in the presence of domestic pig hair only in scats from Chnaniir, due to the presence of a pork farm in this study site.

The high ash content found in the unidentifiable material of the scats, and their off-white colour, reflects the rich bone diet of striped hyaenas in Lebanon (Figure 4.3). Rieger (1978) pointed out that the white colour of the striped hyaena scats found in India by Prater (1948) *cited in* Rieger (1978) suggests that striped hyaenas in India enjoy a comparably bone-rich diet to spotted hyaenas. Indeed, striped hyaenas can crack a leg-bone of a horse with a single bite (Lydekker 1907, Ognev 1962, Prater 1948 cited *in* Rieger 1978). Furthermore, striped hyaenas kept at Animal Encounter easily break and eat all of the big thigh bones of cows. Thus, the teeth of striped hyaenas have the three more generalised functions of cutting, crushing and chopping, whereas the teeth of spotted hyaenas are more specialized for cutting only (Ewer 1954). Moreover, the digestive system of the striped hyaena is well adapted to digest bony material (Rieger 1978).

In contrast, the calcium content in the scats of striped hyaenas from the Serengeti, Tanzania was low compared to scats of spotted hyaena, which were extremely rich in calcium (Kruuk 1976). This difference was related to the high content of vegetable matter in the diet of striped hyaenas in the Serengeti. Equally, plant material was found in most (94.3%) of the striped hyaena scats in Lebanon. Fruit seeds identified in the scats of Lebanese striped hyaenas were similar to those found in Israel (Kruuk 1976, Bouskila 1984b) and in Turkey (Can 2004), except for citrus and carob fruits, which have not been documented in the diets of striped hyaenas previously.

Striped hyaenas in Jordan, in Israel and in the Serengeti, Tanzania are also known to scavenge on human waste (Kruuk 1976, MacDonald 1979, Al Younis 1993), and the presence of refuse in the scats of striped hyaena from Lebanon reflects this behaviour. Domestic refuse constitutes a major part of the striped hyaena diet, particularly in the urban site of Chnaniir, where residents put out their refuse in nylon bags each night on the roads to be collected at dawn by a refuse company. The striped hyaenas benefit from these refuse bags and feed on the items that are edible. Likewise, other generalist carnivores living around urban areas scavenge on domestic waste, for example coyotes (*Canis latrans*) living in high human populated areas in California (Fedriani et al. 2001), black bears (*Ursus americanus*) in western North America (Beckmann and Berger 2003); stone martens (*Martes foina*) in Europe (Lucherini and Crema 1993, Lanszki 2003); jackals (*Canis aures*) in Israel (Yom-Tov et al. 1995); and banded mongoose (*Mungos mungo*) in Uganda (Gilchrist and Otali 2002).

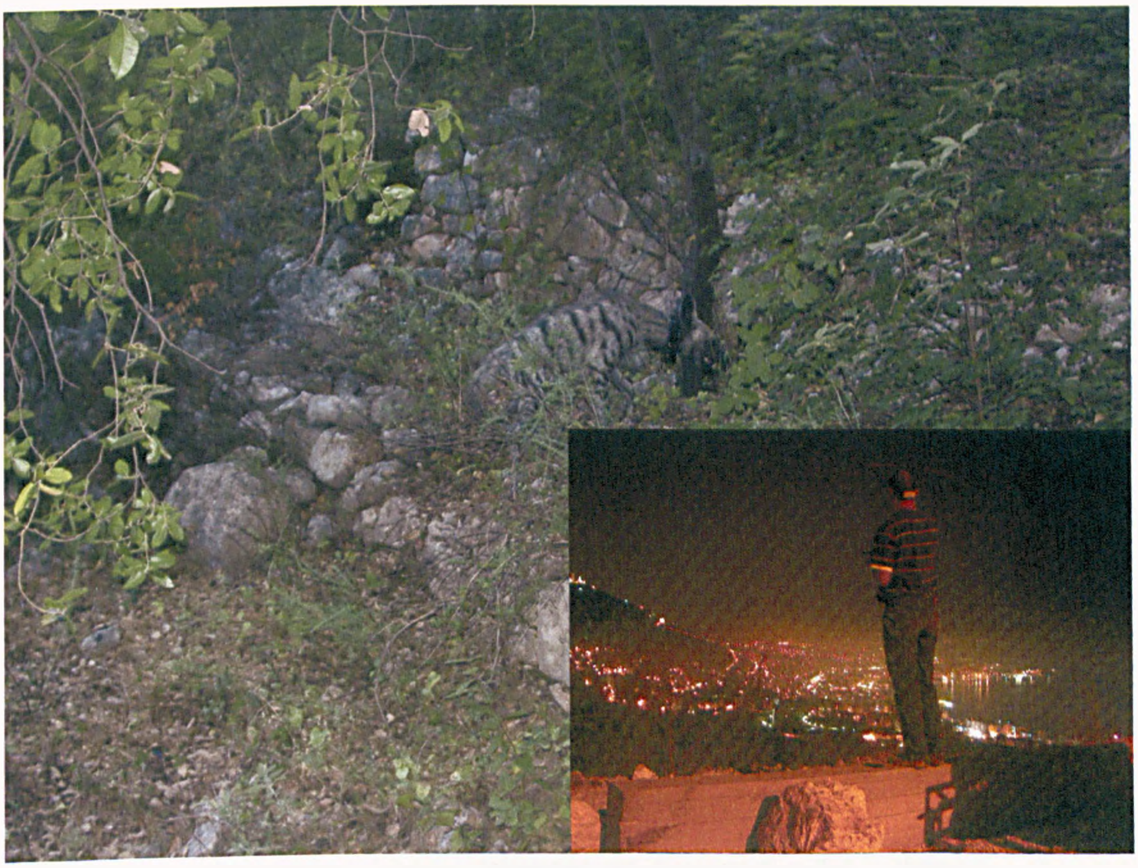
4.5 Summary

1) Using scat analysis and the identification of feeding remains, striped hyaenas in Lebanon have been confirmed as opportunistic omnivorous scavengers, as has been found in the few previous studies of striped hyaena diets carried out in other countries.
2) There is no evidence of striped hyaenas killing domestic livestock in Lebanon, but the methods used to determine diet in this chapter would not have found it possible to distinguish between killed and scavenged animals in scats or feeding remains.
3) Nevertheless, striped hyaenas in Lebanon have been shown to respond opportunistically to the opportunities local people provide, for example through the heedless discarding of refuse and the unregulated dumping of garbage.

Given the dispersion of food largely determines patterns of ranging, the next chapter will explore the home range size of striped hyaenas across rural and an urban landscape, and determines the effect of landscape on home range size and habitat utilization.

Chapter 5

RANGING PATTERNS AND HABITAT USE



Radio-collared striped hyaena at Chnaniir study site being tracked on hills over-looking the capital Beirut.

5.1 Introduction

The home range that area which encloses all their activities of individuals of particular species (Burt 1943), is determined primarily by the availability, dispersion and predictability of their food supply (Sunquist and Sunquist 1989, MacDonald 1993). Most carnivores require large home range sizes for their survival, because they live at the top of the food chain (Bekoff et al. 1984). As a result, most species of large carnivore are declining globally and now only occur in small isolated populations, due to loss of habitat caused by people, as well as due to persecution and eradication (Woodroffe and Ginsberg 1998, Gibeau et al. 2002, Lindsey et al. 2004).

Increases in human density are usually directly and inextricably associated with decreases in the abundance and distribution of local carnivore populations (Woodroffe and Ginsberg 1998, Woodroffe 2000). Many studies have suggested that increasing human populations can negatively affect the home range of carnivores, and cause a decrease in their population densities (Gittleman and Harvey 1982, Creel and Creel 1998, Harcourt et al. 2001, Woodroffe 2001). Moreover, human modified landscapes affect carnivore populations negatively and cause a change in their behaviour. For example, wolves (*Canis lupus*) and grizzly bears (*Ursus arctos*) are highly vulnerable to human activity (McLellan and Shackleton 1988, Mace et al. 1996, Mattason et al. 1996, Noss et al. 1996, Mladenoff et al. 1999, Gibeau et al. 2002). For example, roads can have a significant effect on the movements of large carnivores (Kasworm and Manley 1990, Ng et al. 2004, Clevenger and Waltho 2005).

Moreover habitat loss, arising from deforestation, urbanization, and conversion of wild areas into agricultural landscapes, is a major factor that affect carnivore populations (Childes 1988, Fahrig 2001, Lindsey et al. 2004). For example, wild dogs (*Lycaon pictus*) were heavily affected by habitat loss due to their requirements for a large home range (Woodroffe and Ginsberg 1998). Habitat destruction and persecution has led to near extinction of wolves and bears in Europe (Breitenmoser 1998, Kaczensky 1999), and of grizzly bears in Canada (Archibald et al. 1987).

Urbanization is a major cause of habitat destruction and fragmentation that is threatening carnivore survival globally (Ferreras et al. 1992, Vila et al. 1995, White et al. 1996, Adkins and Scott 1998). Such fragmentation can result in the formation of micro-habitats that might not be suitable for certain carnivores. As a result, some species of carnivores will abandon that habitat or may persist in small home ranges that might incorporate several suitable fragments. However, moving in such a hostile environment might result in their death.

Equally, more specialised species of carnivore are more sensitive to such habitat loss than the more generalised species that exhibit greater behaviour flexibility and are more tolerant to change. In turn, such differences can produce different responses among carnivores to habitat degradation (Sunquist and Sunquist 1989, Woodroffe 2000). Indeed, carnivores can adapt to changes in habitat availability by:

- changing their behaviour and reducing their observability and vocalizations (Torre et al. 2000);
- changing their activity patterns to avoid people, either by shifting to night activity, reducing their daytime activities, or by avoiding areas of high human activity (Van Dyke et al. 1986, Lariviere et al. 1994, Samson and Raymond 1995, Doncaster and MacDonald 1997, Kitchen et al. 2000, Tigas et al. 2002, Beckmann and Berger 2003, Admasu et al. 2004, 2004); and by
- incorporating several habitat fragments into their home range (Collins and Barrett 1997, Little and Crowe 1998, Crooks 2002).

Equally, some generalist and commensal species of carnivores can benefit from urbanization. For example, urban landscapes are often rich in rodents, as well as in domestic waste such as fruits, garbage, and other refused food that allow some carnivores to maintain a small home range (MacDonald 1979, Bradley and Fagre 1988, Shargo 1988, Coman et al. 1991, Yom-Tov et al. 1995, Crooks 2002, Gilchrist and Otali 2002, Tigas et al. 2002, Beckmann and Berger 2003).

Animal movements can also vary according to seasons and other environmental factors. For example, male lynx (*Lynx lynx*) in Poland moved longer distance during their mating season in January-March, while female lynx moved longer distances while providing intensive care to their kittens from May-August (Jedrzejewski et al. 2002). Also male kit foxes (*Vulpes macrotis*) travelled longer distances in spring, while females travelled farthest in summer (Girard 2001).

Moreover, environmental factors like daily temperature, rain, and lunar phase can affect animal movements. For example, the daily activity of weasels (*Mustela nivalis*) and pine martens (*Martes martes*) are affected by daily temperature, and were reduced at cold temperatures and increased with increasing ambient temperatures (Jedrzejewski et al. 2000, Zalewski 2000). In contrast, caracal (*Felis caracal*) were more active at ambient temperatures <20°C and ceased all activity above 20°C (Avenant and Nel 1998).

Moonlight is also commonly reported to affect animal movements. During full moon periods, fruit bats (Elangovan and Marimuthu 2001), marsupials (Julien-Laferriere 1997), rodents (Price et al. 1984, Wolfe and Summerlin 1989, Kolb 1992, Topping et al. 1999), lagomorphs (Butynski 1984, Gilbert and Boutin 1991), and badgers (*Meles meles*) (Cresswell and Harris 1988) decrease their foraging behaviour or restrict it to the periods of darkness. Moreover, rainfall can affect some animals like wolves (*Canis lupus*), which decrease their movement in heavy rain (Theuerkauf et al. 2003).

The Hyaenidae family has also shown varied and flexible behaviour in response to environmental variables. For example, spotted hyaena (*Crocuta crocuta*) have a very adaptable behaviour, and can hunt by day or by night, can breed throughout the year, can occupy a vast array of habitat types, from semi-desert savannahs and woodlands, to dense and dry woodlands and mountainous forest up to 4000m, and can hunt and scavenge (Kruuk 1972, 1976, Mills 1990, Sillero-Zubiri and Gottelli 1992, Holekamp et al. 1997, Mills and Hofer 1998, Mills 2003). As a result, Boydston et al. (2003) have suggested that the behavioural plasticity of spotted hyaenas might have protected the species from extinction. Nevertheless, there are no records of spotted hyaenas having adapted to live in human-dominated urban landscapes. By contrast, there is some evidence that striped hyaenas can adapt to human-dominated landscapes, although this species has been less well researched than have spotted hyaenas.

While some research has been carried out on the direct effect of human activity on the ranging ecology of large carnivores (Woodroffe 2000), and very few studies are available on the Hyaenidae family. Moreover, no detailed studies have been carried out on striped hyaenas living in human-dominated landscapes, including in Lebanon. Therefore, this chapter aims to explore the ranging ecology of striped hyaenas in two different human-dominated landscapes in Lebanon, one a modified but a still rural habitat, and the other an urban habitat. Hence, this chapter seeks to answer the following questions:

- what are the home range sizes of striped hyaenas living in rural and urban study sites?;
- does the spatial organization of, and habitat use by, striped hyaenas differ in these two human-dominated landscapes?; and
- what are the environmental correlates of any differences in ranging ecology?

5.2 Methods

5.2.1 Trapping and Radio-Collaring

Attempts to trap hyaenas for radio-collaring began in March 2003 and ran until June 2004. Traps were set at two sites; one at Bnachii to represent a rural site and one at Chnaniir to represent an urban site (see Chapter 3 for descriptions of each site). Before trapping, pre-baited camera traps were used to determine whether hyaenas were present or absent, and to help select the best places to set the traps. The chosen trapping sites were pre-baited with butchery remains of meat and bones for two weeks without deploying camera traps or leg-hold traps.

Fourteen to sixteen soft leg-hold traps (COYOTE Soft Catch Wildlife Traps ® Oneida Victor Inc., Ltd., Cleveland, Ohio 44110) were deployed at any one time in attempts to catch striped hyaenas. Initially, hyaenas took the bait without being caught. Therefore, some of the bait was tied up with a rope, such that some effort had to be put into removing the bait, and so tempting the hyaena to step on the trap. Trapping positions were decided upon after several trials. Traps were placed in an irregular circle, one to the front and another to the back. Some traps were fixed lightly to the ground by loose hooks, tied with an iron wire that was fixed to a big oak tree and fully covered with dead leaves. While setting the traps, gloves were worn to prevent the smell of human hands from possibly later repelling hyaenas.

In the rural site of Bnachii, two rangers visited the set traps twice per day, during the night and at dawn. Whenever a hyaena was trapped, people from the site were called to witness the radio-collaring process and to get a glimpse of this imaginary beast, and hopefully to help raise awareness for the hyaena. After trapping the first hyaena in the urban site, scout volunteers from Chnaniir monitored the set traps all night long and telephoned to check on the traps whenever a hyaena might have been caught. However, the bushy vegetation in the urban site did not allow the traps to be seen from a distance. Therefore, a long pole was tied to a tall tree and a lamp was fixed on its end, that was tripped whenever an animal was trapped, allowing a successful catch to be seen from a distance (Plate 5.1).

Once trapped, a hyaena was sedated by an intramuscular injection of *Domitor* ® Pfizer (containing 1.0 mg of medetomidine hydrochloride per ml), at a dose of 1000 mg per sq m of body surface, usually equivalent to 1.5–2.0 ml. The hyaena was allowed to rest quietly for 20 minutes after injection, the trap was removed from its leg, standard measurements were taken and the radio-collar was fitted. The radio-collars used were MOD-500 High Capacity Transmitter, CAST-1 on CLM Collar ® Telonics 932 E. Impala Ave., Mesa, AZ, 85204-6699 USA. These collars weighed 260-270g each, and had sufficient power to last for 75 months at 60 pulses per minute. After radio-collaring, the hyaena was re-awakened by an intramuscular injection of *Antisedan* ® Pfizer (containing 5.0mg atipamezole hydrochloride per ml), at the same dose volume as used for *Domitor.*

Traps were set for a total of 367 nights, comprising 207 nights in the rural site of Bnachii and 160 nights at the urban site of Chnaniir. This trapping effort resulted in the capture and radio-collaring of six mature animals >2 years (Table 5.1). Two female hyaenas, Samira and Shafiqa, were trapped and radio collared at the rural site in November 2003 and February 2004, respectively. Four hyaenas were trapped and radio-collared at the urban site, comprising one female, Zalfa, in July 2003, and three males, Antar, Faltan, and Metaeb, in March 2004 and April 2004, respectively. However, the radio-collars fitted to the two male hyaenas, Faltan and Metaeb, failed on the same day that they were fitted. Even though the collars were working when fitted, after retrieving one of the collars, we noticed that a programming problem had occurred. The duration of the tracking period for each of the other four hyaenas depended on the date each was trapped relative to the end of the fieldwork phase of the study (Table 5.1).

Table 5.1. Details of striped hyaenas caught from July 2003 to June 2004, the number of months over which each was tracked and the number of radio fixes collected for each hyaena.

Hyaena	Sex	Site	Date caught	Tracking duration (months)	Number of fixes
Zalfa	♀	Urban	16/07/2003	20	460
Samira	♀	Rural	01/11/2003	16	274
Shafiqa	♀	Rural	09/02/2004	12	240
Antar	♂	Urban	02/03/2004	11	253
Metaab	♂	Urban	14/06/2004	0	0
Faltan	♂	Urban	20/06/2004	0	0

Plate 5.1. The pole and the clutch used to monitor the traps from a distance in the urban site of Chnaniir.

Radio-collared animals were tracked using a TR-4K Receiver, CTN 487732; 148-152MHz with RA-14K Rubber Ducky "H" Heavy Duty Flexible Element Antenna 148-152MHz (Telonics 932 E. Impala Ave., Mesa, AZ, 85204-6699 USA). Each collared animal was radio-tracked regularly by car and on foot where there were no roads. The position of the radio-collared hyaena was generally checked before sunset, upon arrival at the site. However, the hyaenas were tracked, and fixes were recorded, usually hourly, from sunset until dawn while hyaenas were active. Both hyaenas in the urban site could be tracked simultaneously, since signals from both were received from the same locations. In contrast, hyaenas at the rural site were tracked in two shifts. The first shift ran from sunset to midnight, while the second shift ran from midnight to dawn, and the shift in which each hyaena was tracked was reversed on alternate days.

from midnight to dawn, and the shift in which each hyaena was tracked was reversed on alternate days. Fixes were recorded using a mobile GPS (Garmin, Etrex Vista). At least two bearings were obtained within 10mins of each other, with a least angle difference of 30 degrees. Fixes were determined directly in the field, using an Excel program that plotted bearings directly onto a map of the study site. In this way, I sought to minimize the error arising from bounced signals, and whenever outlier positions arose, bearings were re-taken.

5.2.2 Distances walked

The distances walked per hour by hyaenas at night were compared with various environmental variables, including lunar phase, day length, season, minimum and maximum daily temperature and daily rainfall. Fixes recorded each hour over four or more consecutive hours were used to measure the straight-line distances walked per hour by each hyaena. The distance taken between different fixes are independent observations that were obtained at different times. To ensure that the hyaenas had started to become active, fixes recorded before 19:00 hrs and after 05:00 hrs in short day periods, and fixes recorded before 21:00 hrs or after 03:00 hrs in long day periods, were omitted. A one way analysis of variance (ANOVA) was undertaken to investigate if there was a difference in the distances walked according to lunar phase, day length, and season. Spearman's rank test was undertaken to investigate if there was a correlation between distance walked and minimum and maximum daily temperature.

5.2.3 Estimating home range size

The home range sizes of the four hyaenas were estimated using two standard non-parametric methods:

- The minimum convex polygon (MCP) method is the oldest and most commonly used method for calculating home range size in the literature (Mohr 1947, White and Garrott 1991), and this method was used to enable easy comparisons with other studies of hyaenas and of other carnivores. This method constructs home ranges by connecting the outermost series of points at which the subject was located, to form a polygon. The shape and configuration of individual home ranges were adequately estimated by a 100% minimum convex polygon.

- Bootstrapping was used to optimize sampling effort and smooth estimates of error, as recommended by Kernohan et al. (2001) and Worton (1995). Bootstrapping sought to determine whether the number of fixes obtained was adequate to estimate the home range size of each hyaena using the MCP method. The estimated home range size will increase with an increasing number of fixes until an asymptote is reached, after which all subsequent fixes should fall within the periphery of the polygon. The bootstrap simulation was carried out using 100 different combinations of points, and for each successive simulation the number of fixes was increased by five (Worton 1995, Kernohan et al. 2001).

- The stability of the home ranges of individual hyaenas was determined using the fixed kernel method rather than the adaptive kernel method. This was because the fixed kernel method uses the same bandwidth over the entire evaluation area that in turn gives a better probability of use of the area. In contrast, the adaptive kernel method uses the local bandwidth for each location, which in turn overestimates the area of use (Seaman and Powell 1996). Moreover, the fixed kernel method has a lower bias and results in a satisfactory analysis of animal movement within the home range (Seaman and Powell 1996, Seaman et al. 1999). In addition, the fixed kernel method is easier to understand and explain (Worton 1989), and this method was also recommended by Kernohan et al. (2001) to differentiate between discrete areas within the home range. The analysis was completed using the "Home Range Extension" (HRE) for the GIS package ArcView 3.1® (September 2002, The Ontario Ministry of Natural Resources' Centre for Northern Forest Ecosystem Research in Thunder Bay, Ontario, Canada).

5.2.4 Habitat use

The outer boundary of the two study sites included the villages and their surrounding landscapes that were initially selected as study sites (Chapter 3). I re-classified a digitized land use map for both sites into three main habitat types, based on an original coverage map that had been classified in up to 12 habitat types, as follows:

- Urban site of Chnaniir, based on 11 habitats:
    - Urban habitats (37.0%) consisting of: 28.0% housing and urban areas, 4.3% urban sprawl and 4.7% non-build up artificial areas.
    - Agricultural habitats (5.8%) consisting of: 2.8 % permanent crops (mainly fruit trees and citrus trees), and 3.0% field crops (vegetables).
    - Wild habitats (57.1%) consisting of: 0.3% bare rocks, 3.6% grassland, 29.1% oak forests, 8.4% scrubland, and 15.7% other mixed wooded areas (pine trees, carob trees, deciduous wild trees, and shrubs).
    - Beach (0.1%)
- Rural site of Bnachii based on 12 habitats:
    - Urban habitats (9.0%) consisting of: 4.3% housing and urban areas, 3.9% urban sprawl and 0.8% non-built up artificial areas.

- Agricultural habitats (45.8%) consisting of: 41.6% permanent crops (fruit, vines, citrus and olives trees), 4.1% field crops (vegetables) and 0.1% farms (scattered dairy farms and poultry houses).
- Wild habitats (45.2%) consisting of: 1.2% bare rocks, 7.7% grass land, 13.8% oak forests, 11.3% scrubland, 11.1% other mixed wooded areas (pine trees, carob trees, deciduous wild trees, and shrubs), and 0.02% artificial lake.

Boundaries of the annual and seasonal home-ranges of each hyaena were used to delineate the extent of available habitats within each home range. Each fix collected for the four radio-collared hyaenas were classified by the main habitat in which the fix was positioned, using the animal movement extension in Arc View.

A habitat preference index was calculated for each radio-collared hyaena in the four different seasons of winter, autumn, spring, summer, and across all the annual home range, using the Chesson index, as follows:

$$A = st^{-1}\left(\sum_{i=1}^{n} s_i/t_i^{-1}\right)^{-1}$$

where s = number of fixes per habitat;

t = total available habitat in the hyaena's home range;

n = number of habitat; and

A= Chesson index of preference.

This index allows comparison of habitat use independent of home-range size or habitat availability between different animals. The habitat use index ranges between -1 and 1, where 1 is the most used, and -1 is the least used, habitat. To compare habitat use by habitat availability and season, habitat use data were pooled across different hyaenas. Although pooling might mask individual variation (White and Garrott 1990), this was appropriate given the few radio-collared hyaenas. Furthermore, the study aimed to explore what brings hyaenas into contact with people rather than individual patterns of habitat selection. Fixes for each radio-collared hyaena were transformed into percentages, and a Chi-square test was conducted to detect whether the observed locations differ from those expected within each habitat. One way analysis of variance (ANOVA) was conducted to test habitat use difference among different seasons and within seasons.

5.3 Results

5.3.1 Distances walked

The distances walked per hour at night by radio-collared hyaenas showed considerable variation. For the two rural hyaenas, the distances walked ranged from: 201-1455m hr^{-1} with a mean of 710 ± 68.5m hr^{-1} for Samira (♀); and, 112-2004m hr^{-1} with a mean of 814 ± 81.6m hr^{-1} for Shafiqa (♀). In contrast, for the two urban hyaenas, the distances walked ranged from:119-1078m hr^{-1}, with a mean of 443 ± 34.3m hr^{-1} for Zalfa (♀); and 170-920m hr^{-1} with a mean of 498 ± 50.2m hr^{-1} for Antar (♂). There were no differences in the distances walked per hour between the two hyaenas radio-collared from each study site (rural hyaenas: $F=0.973$, df = (1, 48), $P>0.05$; urban hyaenas: $F=0.819$, df = (1, 64), $P>0.05$). In contrast, the mean distance walked per hour by hyaenas was much further ($F=27.519$, df= 1,114, $P<0.001$) in the rural site (758 ± 52.5m hr^{-1}) than in the urban site (462 ± 28.3m hr^{-1}). Therefore, the data were pooled for both hyaenas at each study site (Aebischer et al. 1993), and the distances walked per hour by hyaenas at each site were compared against various environmental variables.

The mean distance walked by hyaenas differed ($F=7.811$, df= 2,113, $P<0.001$) according to lunar phase (Figure 5.1). Hyaenas walked shorter mean distances per hour during the full moon phase than when there was no moon. However, the mean distance walked by hyaenas did not differ according to day length ($F=0.621$, df= 1,115, $P>0.05$), nor between the four seasons ($F=1.936$, df= 3,113, $P>0.05$). Furthermore, the mean distances walked per hour by hyaenas from the two study sites were not correlated with minimum and maximum daily temperature (Spearman's rho, $P>0.05$) (Table 5.2). Finally, the distances walked per hour by hyaenas did not differ between rainy and non-rainy days in the rural site ($t=1.210$, df=51, $P>0.05$), in the urban site ($t=-1.605$, df=64, $P>0.05$), nor among all the hyaenas in both sites ($t=0.146$, df=117, $P>0.05$).

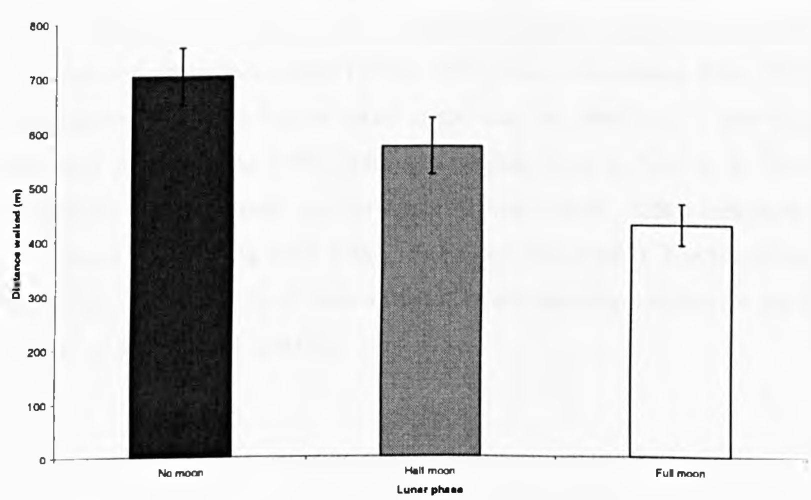


Figure 5.1. Distances walked per hour by hyaenas according to lunar phase.

Table 5.2. Relationship between the distances walked per hour by hyaenas from the rural and urban study sites, and minimum and maximum daily temperature, based on correlation coefficient values and probabilities according to Spearman's correlation test. Key: minimum daily temperature (Min. DT), maximum daily temperature (Max. DT), probability of minimum daily temperature (P value Min.), probability of maximum daily temperature (P value Max.).

Site	N	Correlation coefficient		Sig. (2-tailed)	
		Min. DT	Max. DT	P value Min.	P value Max.
Rural	53	0.233	0.194	0.093	0.165
Urban	66	-0.087	-0.115	0.486	0.357
All	119	-0.041	-0.035	0.660	0.708

5.3.2 Home range size

In the rural site of Bnachii, no signal was ever detected for the radio-collared hyaenas until after dark. This was probably because hyaenas remained inside their dens while people pursued their normal activities, including cutting wood, agricultural practices and hunting, until after dark. In contrast, radio-collared hyaenas could always be located before dark in the urban site of Chnaniir, but they remained at the same location until after dark.

The home range sizes of the four radio-collared hyaenas, based on the 100% minimum convex polygon (MCP) method, differed according to site. The home range sizes of Samira (♀): 38.1km^2; and Shafiqa (♀): 56.2km^2, in the rural site of Bnachii were much larger than those for Antar (♂): 6.2km^2; and Zalfa (♀): 9.0km^2 in the urban site of Chnaniir.

The bootstrap estimates reached asymptotes for all four hyaenas, showing that the number of fixes achieved were sufficient to estimate the home range size of each hyaena (Figure 5.2). The asymptotes for the rural hyaenas were reached after 165 fixes, while those for the urban hyaenas were reached after 45 fixes. The bootstrap estimate for the exact mean home range size for Samira (♀) was 34.2km^2, with a minimum and maximum values for the 100% exact size ranging from 34.0km^2 to 34.3km^2 (SE ± 0.18). The bootstrap estimate for the exact mean size for Shafiqa (♀) was 51.5km^2, with a minimum and maximum values for the 100% exact size ranging from 51.3km^2 to 51.7km^2 (SE ± 0.18). The bootstrap estimate for the exact mean size for Antar (♂) was 5.4km^2, with a minimum and maximum values for the 100% exact size ranging from 5.4km^2 to 5.5km^2 (SE ± 0.03). The bootstrap estimate for the exact mean size of Zalfa (♀) was 8.3km^2, with a minimum and maximum values for the 100% exact size ranging from 8.25km^2 to 8.28km^2 (SE ± 0.01).

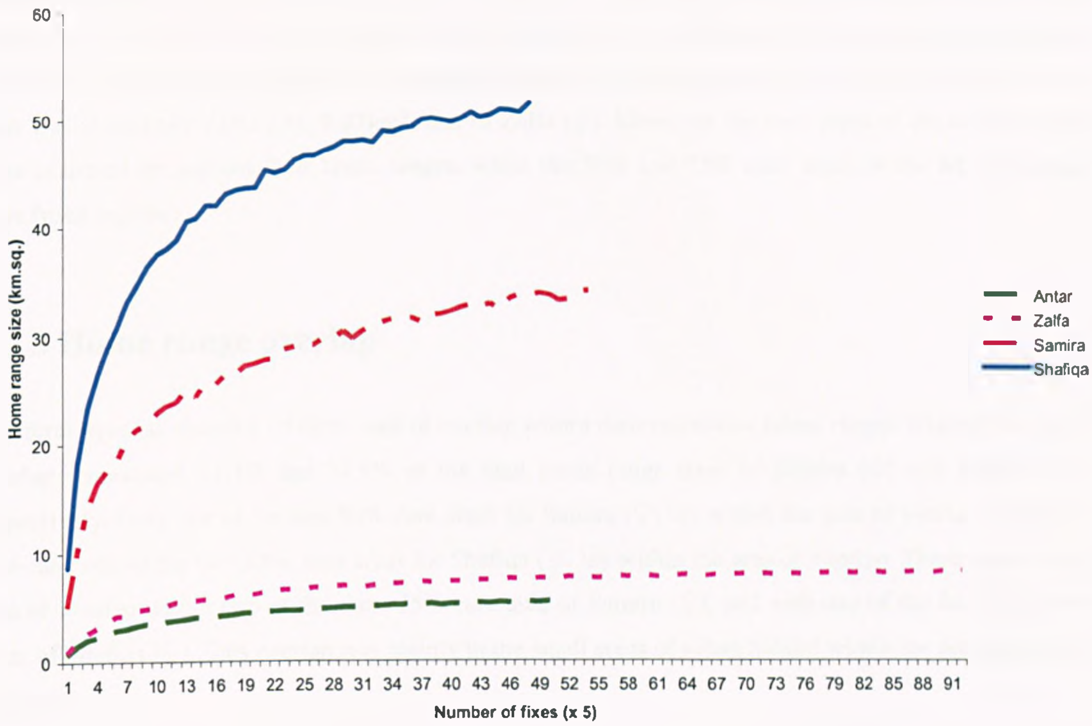


Figure 5.2. Bootstrap home range estimate of the four radio collared hyaenas.

The probability of finding an animal within different parts of its home range at any time is theoretically estimated by the fixed kernel method. The fixed kernel method gave different probabilities of finding the four radio-collared striped hyaenas within different parts of their home ranges (Table 5.3).

Table 5.3. The probability of finding each radio-collared hyaena within 25%, 50%, 75% and 95% of its home range using the fixed kernel method.

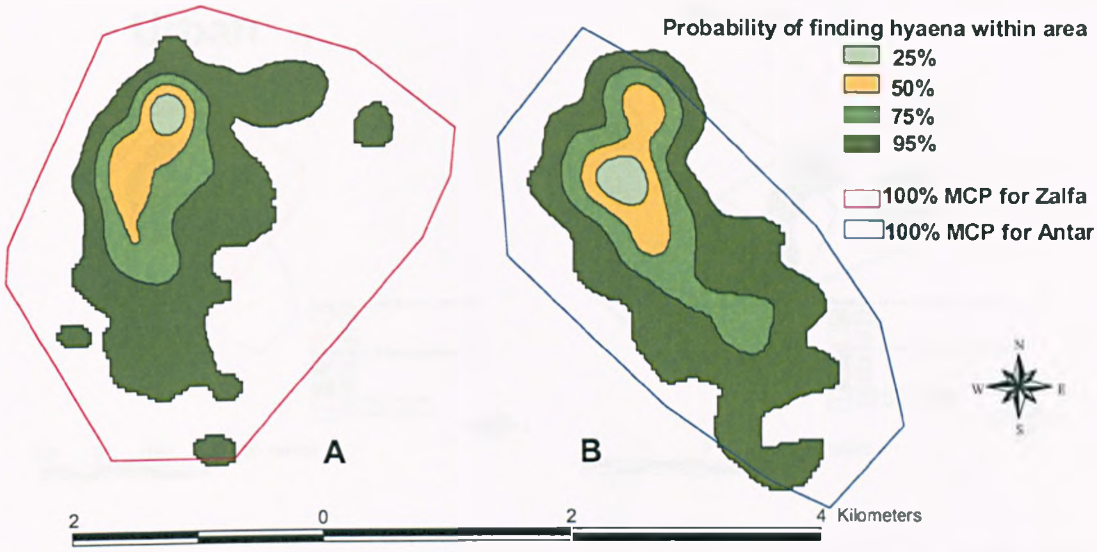
Study site and Individual hyaena	25% (km^2)	50% (km^2)	75% (km^2)	95% (km^2)
Rural				
Samira (♀)	0.65	2.94	9.29	25.08
Shafiqa (♀)	0.58	2.15	9.48	42.10
Urban				
Antar (♂)	0.12	0.51	1.39	3.84
Zalfa (♀)	0.07	0.40	1.20	3.60

The 95% fixed kernel home range of the rural hyaenas was wide and directed east-west. In contrast, the 95% fixed kernel home range of the urban hyaenas was elongated and directed south-north. The difference in shape most probably arises from the restricted area available within the urban site, where wild habitats are narrow and surrounded by urban habitats. For the rural hyaenas, the 25% core areas differed slightly between the two females (0.58-0.65km^2). Samira (♀) had two core areas of different sizes, a larger core area to the east and a smaller one to the north-west, while Shafiqa (♀) had only one core area to the east (Figure 5.3). In contrast, for the urban hyaenas, the 25% core area for Antar (♂) to the north-west was almost twice (0.12 vs. 0.07km^2) that of Zalfa (♀). Moreover the core areas of the rural hyaenas were scattered throughout their home ranges, while the 50% and 75% core areas of the urban hyaenas were fused together.

5.3.3 Home range overlap

The rural hyaenas shared a 19.6km^2 area of overlap within their respective home ranges (Figure 5.4). This overlap represented 51.4% and 34.9% of the total home range sizes of Samira (♀) and Shafiqa (♀), respectively. Only one of the two 50% core areas for Samira (♀) lay within the area of overlap, while the 25%, and one of the two 50%, core areas for Shafiqa (♀) lay within the area of overlap. There was a small area of overlap within two of the three 75% core area of Samira (♀), and with one of the four 75% core areas of Shafiqa (♀). This overlap was mainly in the small areas of urban habitat within the predominantly rural site.

Furthermore, the urban hyaenas shared a 4.8km^2 area of overlap within their respective home ranges (Figure 5.4). This overlap represented 76.2% and 53.8% of the total home range sizes of Antar (♂) and Zalfa (♀), respectively. The 25%, 50%, 75% core areas of both hyaenas lay within the area of overlap. Although there was no overlap between the 25% core areas of both hyaenas, they were only separated by a short distance of ~322m. There was an overlap between the 50% and 75% core areas of both hyaenas in the urban site.



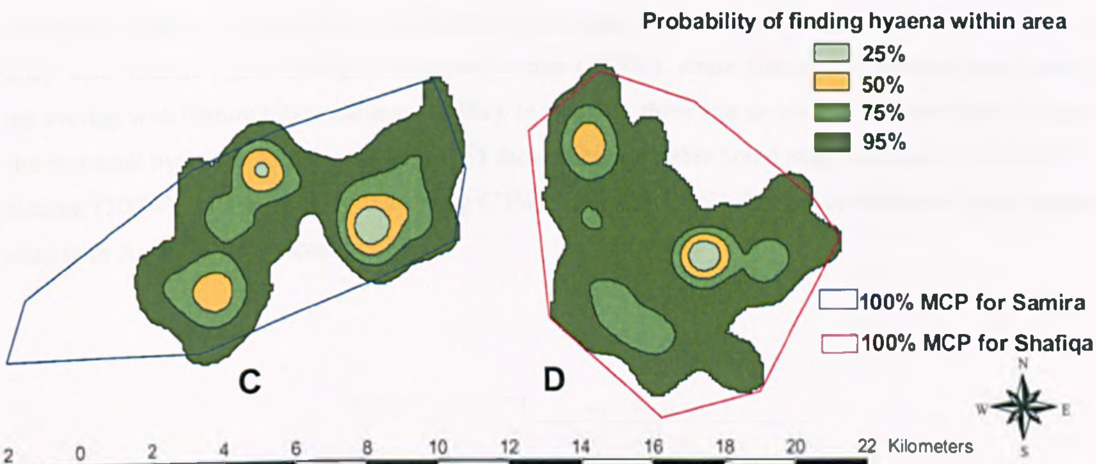


Figure 5.3. Fixed kernel home range estimator for Zalfa (A), Antar (B), Samira (C), and Shafiqa (D).

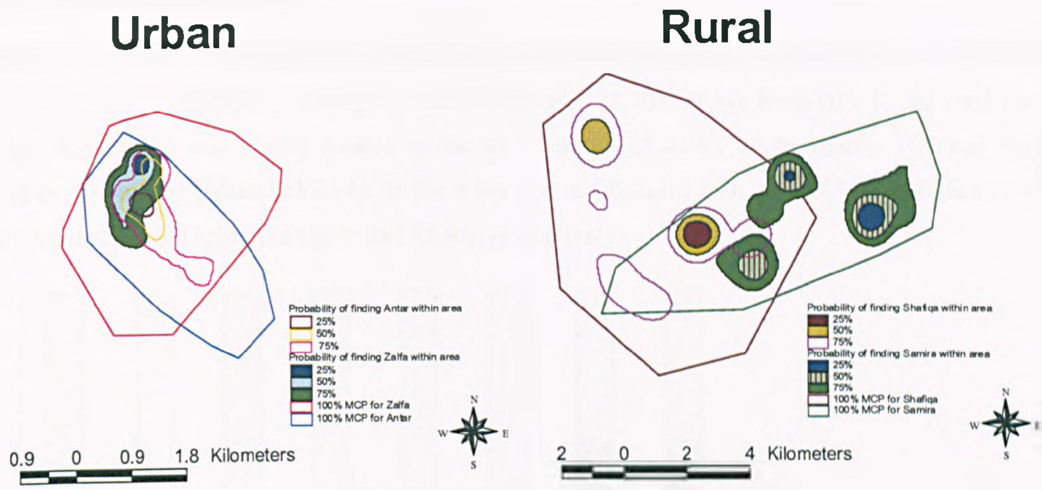


Figure 5.4. The home range overlap for the four hyaenas in the urban and rural site and their 25%, 50%, and 75% kernel estimates.

The areas of overlap between the home ranges of hyaenas differed according to season (Figure 5.4). The percentage overlap in the rural sites was less than in the urban site. Samira (♀) showed some home range overlap with Shafiqa (♀) in spring (27.9%) and winter (37.8%), while Shafiqa (♀) showed some home range overlap with Samira (♀) in autumn (20.0%). In summer, there was no overlap between home ranges of the two rural hyaenas. In contrast, Antar (♂) showed considerable home range overlap with Zalfa (♀) in autumn (100%), winter (67.4%) and spring (73%), while Zalfa (♀) showed considerable home range overlap with Antar (♂) in summer (48.2%).

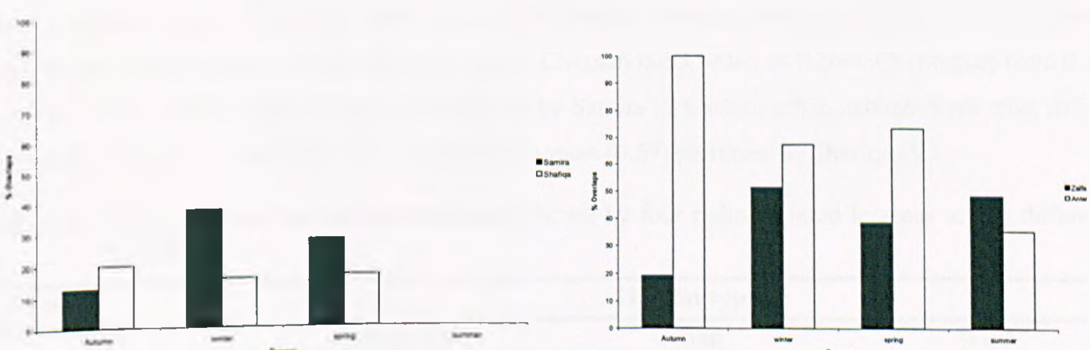


Figure 5.5. Percentage home range overlaps among the four hyaenas in the two sites.

5.3.4 Habitat selection

Hyaenas were located in all the habitats available at both rural and urban sites (Figure 5.6). However, the location of hyaenas differed according to habitat type (χ^2=172.408, df =6, P<0.001). In the rural site of Bnachii, Samira (♀) was mostly located in the wild habitat (85.04%), while Shafiqa (♀) was mostly located in agricultural habitat (61.25%). In the urban site of Chnaniir, both Antar (♂) and Zalfa (♀) were mostly located in wild habitat (64.03% and 65.4%, respectively).

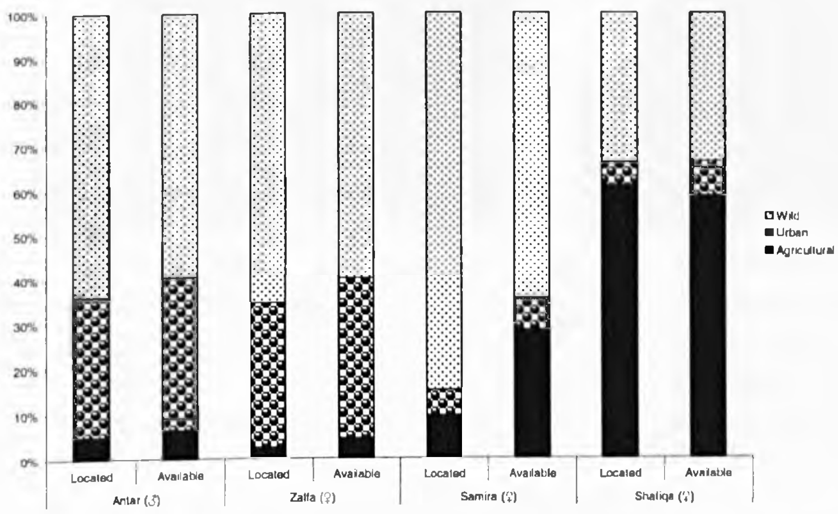


Figure 5.6. Percent locations and home ranges distributed among the habitats for the four radio-collared hyaenas.

There was no difference in habitat use across different seasons for all hyaenas (F=0, df= 3,396, P>0.05). However, even though the home ranges of the four radio-collared hyaenas encompassed all three habitats (Figure 5.7), hyaenas showed a preference (F=5.317, df= 2,397, P<0.05) for wild habitats (Table 5.4), with a Chesson index value of 0.42±0.04 (ranging from 0.38 to 0.54). Urban habitats were the second most preferred, with a Chesson index value of 0.31±0.02 (ranging from 0.25 to 0.35). In contrast, agricultural habitats were the least preferred, with a Chesson index value of 0.26±0.05 (ranging from 0.14 to 0.38). Wild habitats were most (0.54) preferred by Samira (♀), while urban habitats were most (0.35) preferred by Zalfa (♀) and agricultural habitats were most (0.29) preferred by Shafiqa (♀).

Table 5.4. Chesson index for habitat preferences shown by four radio-collared hyaenas across different habitat types.

Hyaena	Habitat type		
	Agricultural	Urban	Wild
Samira (♀)	0.14	0.32	0.54
Shafiqa (♀)	0.38	0.25	0.37
Antar (♂)	0.29	0.33	0.38
Zalfa (♀)	0.22	0.35	0.43
Mean	0.26	0.31	0.42

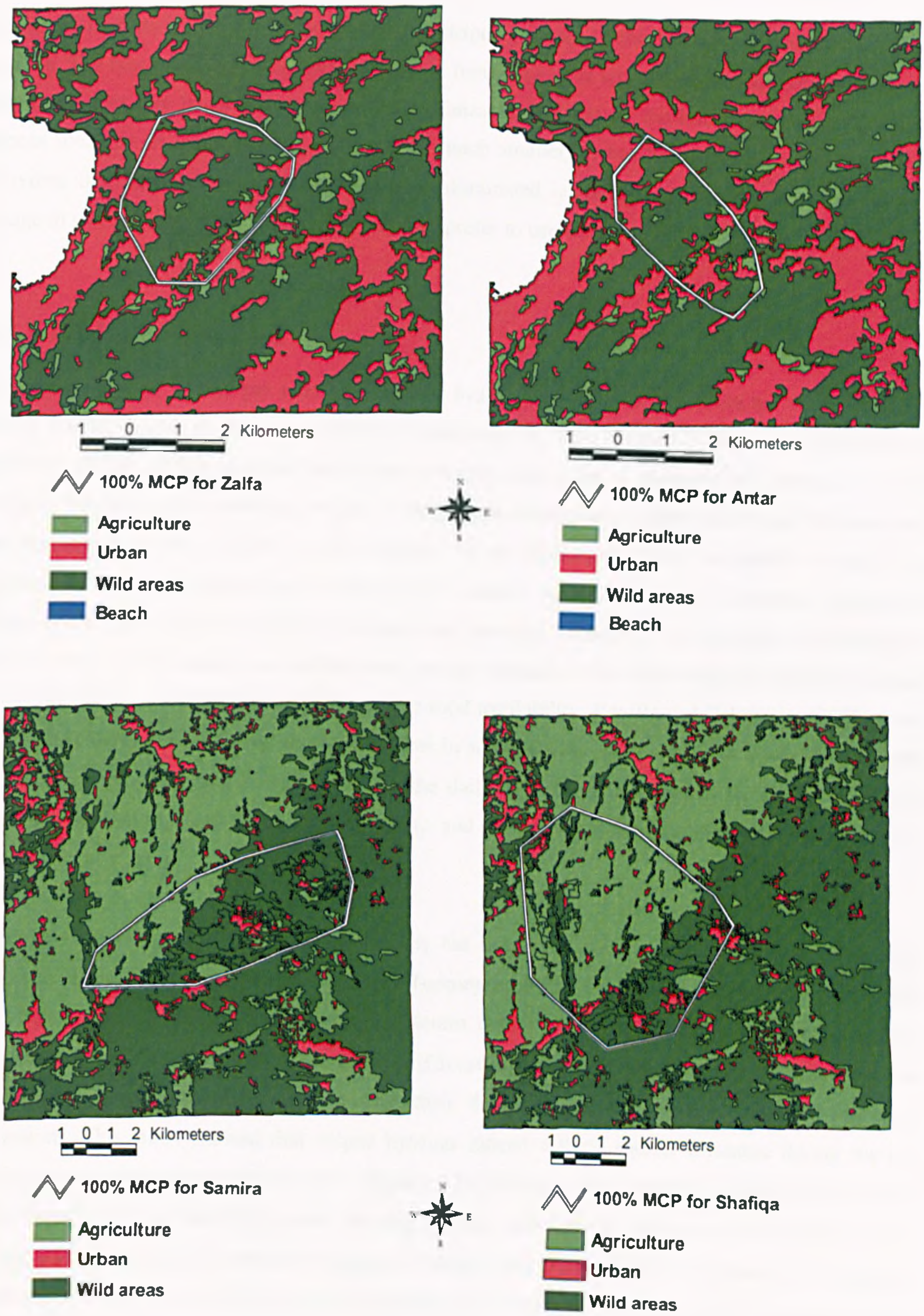


Figure 5.7. Home range based on 100% MCP projected over habitats.

5.4 Discussion

This is the first study of the ranging ecology of striped hyaenas in the human-dominated landscape of Lebanon. The home ranges sizes of striped hyaenas living in a rural site in Lebanon are similar to those in other landscapes like Israel and the Serengeti in Tanzania. In contrast, the home ranges sizes of striped hyaenas living in an urban site in Lebanon were much smaller, as has been shown for other generalist carnivores that have adapted to living in human-dominated landscapes. Even though striped hyaenas manage to live in urban areas of Lebanon, they still prefer to use wild habitats.

5.4.1 Distances walked

The longest distance walked per hour by a spotted hyaena was recorded as 6.9km hr^{-1} in the Kalahari, while a brown hyaena in the same habitat was recorded to have walked 3.92km hr^{-1} (Mills 2003). Elsewhere, Kruuk (1976) reported that striped hyaenas can cover a distances of 2-4km hr^{-1} in the Serengeti, Tanzania when searching for food. These previous estimates suggest that striped hyaenas walk short distances per hour relative to other species in the Hyaenidae family in search of food. This conclusion is further supported by the data from Lebanon, where, the longest distances recorded as walked by a striped hyaena was 2km hr^{-1} in the rural area and 1.08km hr^{-1} in the urban area Therefore, striped hyaenas in the urban site walked even shorter distances than have been recorded for striped hyaenas previously, possibly due to differences in food availability. Revilla and Palomares (2002) found that badgers (*Meles meles*) moved shorter distances in seasons when food was most available, compared with seasons when food was scarce. Likewise, the daily movement of Eurasian lynx *(Lynx lynx)* was influenced by hunting and foraging behaviour, and they moved longer distances when hunting (Jedrzejewski et al. 2002).

The effect of moonlight on behaviour and activity has been well documented for species like rodents (Price et al. 1984, Wolfe and Summerlin 1989, Topping et al. 1999), bats (Elangovan and Marimuthu 2001), lagomorphs (Butynski 1984, Gilbert and Boutin 1991, Kolb 1992), marsupials (Julien-Laferriere 1997, Biebouw and Blumstein 2003), and badgers (Cresswell and Harris 1988). Nocturnal mammals tend to respond to bright moonlight by reducing their foraging activity, their movements and their vocalizations. This study showed that striped hyaenas indeed walked shorter distances during the full moon phase than when there was no moon (Figure 5.1). However, this behaviour might also be due to human disturbance. The travelling speed, ranging patterns and time of emergence for foraging are all restricted when badgers are disturbed by people (Cresswell and Harris 1988). By contrast, the behaviour and activity of some non-carnivorous species is negatively correlated with moonlight. For example, some species change their behaviour during full moon periods to escape predators, including fruit bats (*C. sphinx*) in India (Elangovan and Marimuthu 2001), bare tailed woolly opossum (*Caluromys philander*) in

French Guinea (Julien-Laferriere 1997), old-field mice (*Peromyscus polionotus*) in Carolina (Wolfe and Summerlin 1989) and springhare (*Pedetes capensis*) in Botswana (Butynski 1984). In contrast, tabby and non-tabby cats were less active under low moonlight in Scotland (Daniels et al. 2001). Similarly, Grusky (2003) reported that spectral tarsiers (*Tarsius spectrum*) in Sulawesi, Indonesia were more active during the full moon. Lunar light levels were positively correlated with the nocturnal foraging activity of nightjars in South Africa (Jetz et al. 2003). Moreover, Avenant and Nel (1998) did not find any correlation between the distances moved by caracal (*Caracal caracal*) and the lunar phase on the west coast of South Africa.

The distances moved by striped hyaenas in Lebanon did not differ by season or day length. Likewise, the travelling speed of Eurasian lynx did not change between seasons in Poland (Jedrzejewski et al. 2002). In contrast, wolves in Poland moved shorter distances in May and longer distances in winter and spring (Jedrzejewski et al. 2001). Furthermore, dominant female badgers moved shorter distances at lower speeds than male badgers, but moved longer distances in summer (Revilla and Palomares 2002). Differences in the distances moved in both studies were determined by food availability. In kit foxes (*Vulpes macrotis*), males travelled furthest in spring, while females travelled furthest in summer (Girard 2001). Moreover, the activity of weasels increased with day length and in summer (Jedrzejewski et al. 2000).

As with striped hyaenas in Lebanon, wolves in Poland (Jedrzejewski et al. 2001), caracal in South Africa (Avenant and Nel 1998), and Eurasian lynx in Poland (Schmidt 1999), did not show any difference in movement between rainy and non-rainy days. In contrast, wolves in Poland moved more slowly during days of heavy rain than during lighter or non-rainy days (Theuerkauf et al. 2003).

The distances walked by hyaenas were not correlated with daily temperatures. Likewise, the activity of Eurasian lynx was not affected by ambient temperatures (Schmidt 1999). In contrast, caracal on the west coast of South Africa (Avenant and Nel 1998) and wolves in Poland (Theuerkauf et al. 2003) were active for longer periods during colder nights (<20° C) than warmer ones (Avenant and Nel 1998). In contrast, stone martins (*Martes martes*) (Zalewski 2000) and weasels (*Mustela nivalis*) (Jedrzejewski et al. 2000) were more active in warm, than in cold, weather in Poland.

5.4.2 Home range size

The home range sizes of two female striped hyaenas living in the rural study site of Bnanchii were 38km^2 and 56km^2, and these were similar to those reported for striped hyaenas elsewhere. Kruuk (1976) reported that female striped hyaenas had a home range size of 44km^2 in the Serengeti in Tanzania, while Van Aarde et al. (1988) reported that female striped hyaenas had a home range size of 60.9km^2 in the Negev

Desert in Israel. The results of Van Aarde et al. (1988) were obtained using the MCP method and so are directly comparable to my results from Lebanon, whereas Kruuk (1976) did not state the methods used to obtain his results.

Results from Lebanon further confirm that striped hyaenas have the smallest home ranges among species in the Hyaenidae family. Mills (1989) reported that brown hyaena group territories had a mean size of 308 ± 39km^2 in Kalahari, South Africa while Skinner et al. (1995) reported that the home range size of brown hyaenas varied from 31.9 to 220km^2 in the Namib Desert, Namibia. In contrast, the home range size of spotted hyaenas has been reported to show even wider variation between studies. Mills (1989) reported that spotted hyaenas had an average home range size of 1095 ± 117km^2 in the Kalahari, South Africa. Tilson and Henschel (1986) reported that a group of between 3-5 spotted hyaenas had an average home range size of 570km^2, with a range from 383-861km^2, in Namibia. Finally, Trinkel et al. (2004) reported a dry season home range size of 160km^2, and a wet season home range of 320km^2, for a clan of 11 spotted hyaenas in Etosha, Namibia. Striped and brown hyaenas are mostly solitary, while spotted hyaenas live in clans, travel longer distances between encountering food items, and normally feed off larger food items than brown hyaenas, and so forage over a wide area (Gittleman and Harvey 1982).

The home ranges of striped hyaenas living in heavily human-dominated landscapes in Lebanon were much smaller than any reported previously. The home range sizes of the two striped hyaenas living in the urban site of Chnaniir were 6.20km^2 for the male striped hyaena, and 9.01km^2 for the female striped hyaena. This represented a 5.2 times reduction in the mean home range size compared with those recorded in the rural site of Bnachii. Similar findings have been reported for other species of generalist carnivore that have managed to adapt to living in heavily human-dominated environments. For example, Beckmann and Berger (2003) found that the home range of urban black bears (*Ursus americanus*) was 70-90% smaller than for black bears living in wild areas. Likewise, the home range sizes of coyotes (*Canis latrans*) living in urban areas were much smaller than of coyotes living in developed and fragmented areas, which in turn were smaller than of coyote living in natural areas (Shargo 1988, Atkinson and Shackleton 1991, Bounds and Shaw 1997). Riley (1999) also found that the home range sizes of a male and female bobcat (*Lynx rufus*) were smaller in urban than rural areas. In contrast, bobcats (Riley et al. 2003) and pygmy marmoset (*Cebuella pygmaea*) (Torre et al. 2000) had a larger home range size in urban areas for the reasons that they were avoiding humans.

Urbanization in Lebanon has affected the habitats available for striped hyaena home range in two main ways. First, wild habitats are smaller in extent, so limiting striped hyaenas to small patches that, if they stray outside of, they risk being killed by people. Second, urban landscapes are often rich in human refuse, including food such as fruits, meat scraps and garbage that will serve as a good source of food for scavengers such as striped hyaenas. The territory size of large carnivores is influenced by the distribution of food and habitat productivity within the territory (Simon 1975, Mills 1982a, 1989, MacDonald 1993, Lee and Hauser 1998, Lurz et al. 2000), and food availability has allowed some animal species like bobcats, coyote, red fox (*Vulpes vulpes*), red squirrel (*Sciurus vulgaris*) and root voles (*Microtus oeconomus*) to maintain a small home range (Harris 1981, MacCracken 1982, Coman et al. 1991, Wauters et al. 1994, McClure et al. 1996, Andreassen and Ims 1998, Riley et al. 1998, Tigas et al. 2002, Hidalgo-Mihart et al. 2004). Moreover, black bears in the urban areas of Nevada have benefit from the presence of garbage, and so forage less actively than black bears living in the wild (Beckmann and Berger 2003).

Spotted hyaenas in Kenya, by contrast, avoid areas of high human activity, such as intensively grazed livestock areas, even though such areas have relatively high levels of prey abundance (Boydston et al. 2003). However, striped hyaenas have tolerated human development in Lebanon, and were located many times crossing roads, while local residents confirmed seeing the hyaenas eating garbage under street lights. Similarly, many studies have reported the tolerance of coyotes to urban, suburban and agricultural landscapes (Bradley and Fagre 1988, Shargo 1988, Atkinson and Shackleton 1991, Bounds and Shaw 1997, Crooks 2002, Tigas et al. 2002) as well as small carnivores like raccoons (*Procyon lotra*) (Riley et al. 1998), skunks (*Mephitis mephitis*) (Rosatte et al. 1990) and red foxes (Harris 1981). Therefore, species that show greater flexibility in behaviour and adaptability in feeding are more readily able to adapt to life close to humans (Woodroffe 2000). In contrast, golden (*Canis aureus*) and black backed (*Canis mesomelas*) jackals have larger home ranges in farmland than in wild areas, and this was attributed to a decrease in prey and human disturbance (Rowe-Rowe 1976, Ferguson et al. 1988, Admasu et al. 2004).

Radio-collared striped hyaenas could not always be located in the rural site during the day since they were hiding, while they could almost invariably be located in the urban site. This is probably due differences in human activity and the availability of caves within these sites. In the rural site of Bnachii, people hunt and cut wood throughout the day and at dusk, when striped hyaenas tend to hide in caves. In contrast, the remaining wild habitats in the urban site of Chnaniir were rarely used by people, which in turn provide a secure lying up place for striped hyaena during the day. It has been shown previously that some species of carnivores have shifted to nocturnal patterns of activity when they feel less secure in the presence of humans in non-natural habitats (Doncaster and MacDonald 1997, Quinn and Keough 2002, Tigas et al. 2002). Boydston et al. (2003) reported that spotted hyaenas in Talek, Kenya had changed their activity patterns due to the presence of pastoralists. Riley et al. (2003) reported that bobcats and coyote were more often present in developed areas at night-time than during daylight hours. Kitchen et al. (2000) also found that coyote had shown more diurnal patterns of activity once the heavy persecution they experienced in the past had ceased. Marmosets became less visible and reduce their vocalizations due to tourism pressure in northern Ecuador (Torre et al. 2000). Large carnivores like black and brown bears also adapt to human disturbance by shifting their patterns of activity (Olson et al. 1997, Reimchen 1998, Gibeau et al. 2002, Beckmann and Berger 2003). However, striped hyaenas appear to be nocturnal wherever they have been studied in the wild (Kruuk 1976), and in Lebanon there is no evidence of a shift in patterns of activity between the rural and urban site.

The striped hyaenas in both study sites frequently followed the same paths. In the rural site, they used many of the same routes each night. In the urban area, the striped hyaenas also often followed one path that leads from their resting place to their feeding sites and back to their resting place. They kept using the same trail for more than six months before moving into a new area, due to the start of new building activity. Similarly MacDonald (1978) found that striped hyaenas frequently followed the same path leading to their feeding sites. In contrast, striped hyaenas in East Africa rarely followed the same paths (Kruuk *cited in* MacDonald (1978).

5.4.3 Home range overlap

Home-ranges may overlap more extensively when resources are more abundant (Boutin 1990). Gilchrist and Otali (2002) reported that garbage dumps may represent a concentrated source of food that in turn affected home range use, but not home range size in the banded mongoose (*Mungos mungo*) in Queen Elizabeth National Park, Uganda. Mongoose groups with garbage dumps in their home range have similar sized annual home ranges to those without garbage dumps, but use much smaller core areas than those without garbage dumps. The size of the spotted hyaenas' territory depends on food availability and distribution (Tilson and Henschel 1986, Trinkel et al. 2004). Moreover, Tilson and Henschel (1986) found that clans of spotted hyaenas constitute three, four and five adult individuals in the central Namib Desert, which each occupied exclusive home range that have no overlapping boundaries and in which the core area contains breeding dens, lairs and water sources. There is little evidence of territorial defence for either the brown hyaena in the Kalahari (Mills 1978) or the striped hyaena in Israel (Kruuk 1976). Furthermore, Skinner et al. (1995) reported a territory overlap between the two clans of five and nine brown hyaenas in the Namib Desert coast, where seals and carcasses of seal are available. However, Ilani (1975) found that striped hyaena in Israel defend a core area within their home range which might be the breeding ground.

Among striped hyaenas in Lebanon, there was a difference in the percentage of home range overlap between rural and urban hyaenas. There was little home range overlap between the two rural hyaenas, and what overlap there was occurred in urban habitats. Furthermore, there was no overlap in the home ranges of rural hyaenas in summer, when each hyaena resorted to its urban habitat. This is probably because more food was available due to people returning to their villages for their summer vacations. There was much more home range overlap between the two urban hyaenas, probably because of restricted habitat availability and food distribution in the urban site.

5.4.4 Habitat Use

Striped hyaenas in Lebanon used all habitats available to them in both rural and urban sites. Striped hyaenas showed only a weak preference for agricultural habitats, and showed much stronger preferences for wild habitats, followed by urban habitats. The wild habitats that were used by the striped hyaena in Lebanon comprised closed bushy mixed forest, including oak, pine, carob, other deciduous trees, and bushy shrubs. Similarly, striped hyaenas favoured denser vegetation in Kenya (Kruuk 1976). In contrast, striped hyaenas occur mainly in open habitat or light thorn bushy areas in India, the former Soviet Union, Pakistan and East Africa (see (Rieger 1979). Moreover, striped hyaenas in Israel occur among sparse vegetation, comprising low bushes and a very few low herbs and grasses (Kruuk 1976, MacDonald 1978, Bouskila 1984a). Furthermore, striped hyaenas avoid dense and thick forests in central Asia (Heptner and Sludskij 1980). In India and the former Soviet Union, striped hyaenas inhabit open and hilly country (see Kruuk 1976). In Iraq, striped hyaenas are common in the desert but rare in the mountains (Hatt 1959). In North and East Africa and Kenya, striped hyaenas have been observed in various types of *Acacia* savannah, open grass with a dense grass layer (Kruuk 1976, Hofer 1998, Leakey et al. 1999).

Striped hyaenas strongly prefer wild habitats in Lebanon, probably to escape from human disturbance and persecution. Similarly, bobcats found more security in natural areas than in non-natural areas in Southern California (Riley et al. 2003), while similar findings were reported for golden jackal in human-modified landscape in Africa (Admasu et al. 2004). In contrast, striped hyaenas also prefer urban habitats because of the availability of food arising from human settlements, as reported elsewhere (Kruuk 1976, MacDonald 1978, Hofer 1998, Leakey et al. 1999). Hidalgo-Mihart et al. (2004) speculated that coyote populations had increased as a direct consequence of human activity. Likewise, Beckmann and Berger (2003) reported that black bears had depopulated wild areas, and moved to urban areas because of better foraging opportunities. Moreover, coyote and bobcat are both tolerant of human development, and incorporate many fragments of urban habitats into their home range, and they also frequently cross major roads (Tigas et al. 2002). Baker and Timm (1998) suggested that the tolerance of coyotes to people explains why coyotes and humans have come into conflict in some urban areas of southern California. Striped hyaenas show similar tolerance and adaptability to urban habitats, which has also brought them into conflict with people.

5.5 Summary

1) Based on a small, but difficult to achieve, sample of radio-collared animals, striped hyaenas living in the rural but human-dominated landscapes of Lebanon, were shown to have similar sized home ranges (38.1 - 56.2km^2) to those recorded for striped hyaenas living in the wild elsewhere.

2) In contrast, the home range size of striped hyaenas living in an urban landscapes in Lebanon has responded to the benefits of urban remains, and the challenges posed by a human disturbance by reducing their home range by a factor of 5 times.

3) Despite the differences in home range sizes between rural- and urban-living striped hyaenas, all hyaenas showed greatest preference for the use of wild habitats, followed by urban habitats, with least preference for agricultural habitats.

Having now formally described the ecology and ranging pattrns of striped hyaenas in Lebanon, the next chapter explores the knowledge of local people concerning the ecology and population trends of the striped hyaenas among which they co exist, and how this knowledge relates to their views on conserving striped hyaenas in Lebanon.

Chapter 6

LOCAL KNOWLEDGE

Focal group discussion with local people and elders

6.1 Introduction

Local people are often very knowledgeable about the plants and animals among which they co-exist, including their identification, classification, ecology and population status (Redford and Padoch 1992). Local knowledge has also been widely used to assess animal presence and trends in their population. Indeed, Gros (1998, 2002) have reported that interview-based surveys can produce valuable results for monitoring elusive high-profile carnivores. Hence, local knowledge may prove essential for human development and biodiversity conservation, by providing detailed information crucial for the management of local ecosystems (Menzies 2004). However, social scientists in the 19th century either ignored local knowledge, or considered it as simple, primitive, and static (Warren 1989). Nevertheless, more recently local knowledge has been recognised as far more sophisticated and complex than previously assumed (Colchester 1981, Chandler 1991, Everett 1992, Rusten and Gold 1992, Walker et al. 1995, Ford and Martinez 2000). Moreover, such knowledge offers new models for development that are ecologically and socially sound (Posey 1985). Furthermore, local knowledge can offer an alternative to formal knowledge, as well as perspectives that are based on local practices of resource use (Berkes et al. 2000). Local knowledge is now well recognized by international and national development agencies as key to decision-making for sustainable development approaches (Warren 1992).

The best way to collect and understand the extent of local knowledge on biodiversity is to focus surveys on particular species or groups of species (Martin 1995, Sherry and VGFN 1999, Cardinal 2004, Menzies 2004). Hellier et al. (1999) indicated that the use of rapid surveys of local knowledge to assess biodiversity, including both status and trends of a particular species, can prove a valuable source of information. Furthermore, local knowledge will provide another way to better understand a particular species, and consequently to improve decision-making and management for that species and promote its conservation (Cardinal 2004). Carnivores are a group of animals towards which people hold intense feelings. Conflict between people and carnivores is a world-wide problem (MacDonald and Sillero-Zubiri 2002, Treves and Karanth 2003, Graham et al. 2005). Most carnivore species are experiencing ongoing global declines caused mainly by human activity, and primarily hunting and habitat destruction (Jhala and Giles 1991, Breitenmoser 1998, Woodroffe and Ginsberg 1998, Landa et al. 1999, Can 2001, Jackson and Wangchuk 2001, Linkie et al. 2003, Can and Togan 2004). African carnivores have declined sharply during the past 30 years, and several species are listed as severely threatened, whether endangered or critically endangered (IUCN 2004). Many of these declines are blamed on the conflict that occurs between local people and carnivores. Such conflict can arise for several reasons. First, carnivores compete with people over food resources, since both require protein rich diet. Second, carnivores are at the top of the food chain, and their large home range draws them into contact with people. Third, many large carnivores are specialized ungulate predators, which brings them into conflict with people when they kill domesticated ungulates (Cozza et al. 1996, Hussain 2003, Zimmermann et al. 2005). Fourth, several large carnivores can kill and injure people (Packer et al. 2005). Moreover, some species of carnivore are solitary, nocturnal and shy, and there may be little knowledge about such species. In these cases, local knowledge and attitudes may play a larger role in the success of conservation strategies (Cardinal 2004). An important issue for those promoting carnivore conservation, therefore, is to understand the knowledge and attitudes of local people towards the carnivores among which they live. Such understanding may be as important as knowledge of carnivore ecology, if strategies to promote carnivore conservation are to prove successful.

In Lebanon, formal information on the ecology and conservation of carnivores in general, and of striped hyaenas, in particular, has proved scarce. Yet, most carnivore species in Lebanon are thought threatened by habitat destruction, urbanisation, excessive hunting and persecution. Several species like the caracal (*Caracal caracal*), and brown bear (*Ursus arctos*) have become extinct nationally, while others like wolves (*Canis lupus*), wild and jungle cats (*Felis silvestris* and *F. chaus*) and striped hyaenas (*Hyaena hyaena syriaca*) are locally threatened. Local knowledge of the ecology and status of striped hyaenas in Lebanon may prove key to the better understanding of striped hyaenas and of hyaena-human conflict, in order to better promote the conservation status of striped hyaenas and other carnivores. No studies have yet been conducted on local knowledge of striped hyaenas in Lebanon. Hence, this chapter aims to examine the local knowledge of residents across the six study sites about striped hyaenas, by asking the following questions:

- how many local people claim to have seen a striped hyaena?;
- what understanding do local people have of the basic ecology of striped hyaenas, such as of their foraging times and diet?;
- what views do local people have of the population trends and threat status of striped hyaenas?;
- what views do local people have of the conservation needs of striped hyaenas? and in all cases; and,
- which factors are most important in determining such claims, understanding and views?

6.2 Methods

Information on local knowledge about striped hyaenas was collected from focal group discussions, and from individual interviews (see Chapter 2), undertaken in each study site.

6.2.1 Focal group discussions

Elders from each study site were selected as key informants (Chambers 1992, Bernard 1995) to articulate and record their knowledge of key aspects of the ecology and status of striped hyaenas, from December 2001 to March 2002. Their responses were compiled qualitatively, as well as being used to formulate the content of the questions in the main questionnaire.

6.2.2 Questionnaire interview

Seven questions in the main questionnaire interview conducted across the six study sites from March 2002 to October 2002 sought to explore respondent's knowledge of basic ecology of, and threats faced by, striped hyaenas, before any research was conducted in their local area (see Chapter 2). Two dichotomous questions requiring positive or negative responses sought to determine whether respondents claimed to have seen striped hyaenas in the wild, whether alive or trapped or dead, and whether they knew the status of striped hyaenas. Three other non-dichotomous questions sought to explore local knowledge about the activity and foraging periods of striped hyaenas, the diet of striped hyaenas, and trends in the striped hyaena population in Lebanon. Finally, two questions sought to explore reasons why respondents considered this population trend to be increasing, stable or decreasing.

6.2.2 Statistical analysis

The Statistical Programme for the Social Sciences (SPSS) for Windows version 12.0.1 was used to conduct a statistical analysis to determine which factors might explain the knowledge of respondents about striped hyaenas. The statistical data for each response were first analysed using descriptive statistics, and responses were compared using Chi-square test, but these are not shown for reasons of space. Based on these initial tests, multivariate analyses, using logistic regression, were then performed to model responses, as these provide a convenient way to undertake categorical data analyses. Forward Wald logistic regression was used to specify the model with a significance of $P<0.05$. Dichotomous questions were given a dummy of 1 if the answers of respondents were positive and 0 if answers were negative, and these responses were taken as the dependent variable. The explanatory variables for the analyses included both factors relevant to the study site, and to individual respondents. Factors relevant to the study site comprised: study site; whether a rural or urban landscape; its protected or non-protected status; and the relative abundance of striped hyaenas (see Chapter 3). Factors relevant to individual respondents comprised: gender, age, education level, occupation, and monthly income. The likelihood ratio goodness of fit test of the model was described using Chi-square goodness of fit statistics. Model performance on the testing sets was evaluated by calculating the area under the curve (AUC) of receiver operation characteristics (ROC) plots. ROC values range from 0.5 to 1.0. Values above 0.7 indicate strong model fit, while those above 0.9 indicate a highly accurate model (Swets 1988).

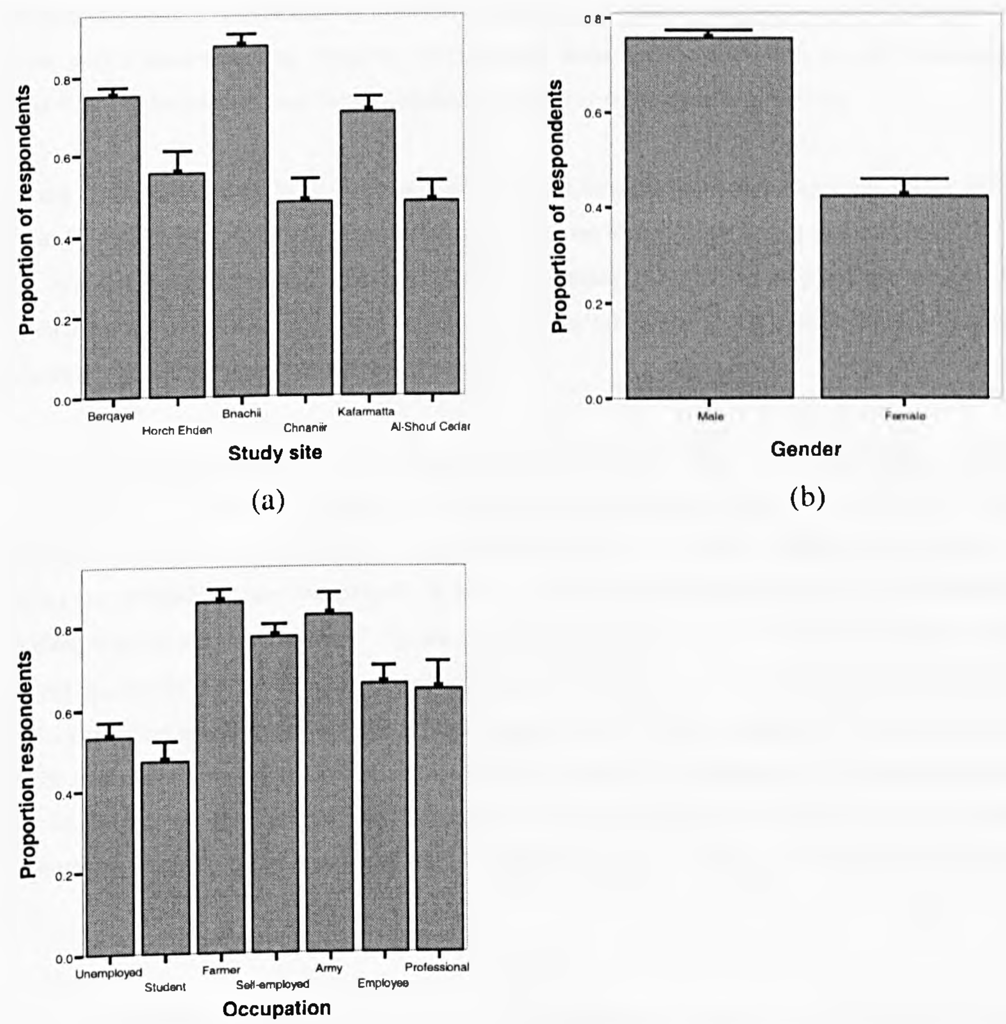
6.3 Results

6.3.1 Sightings of wild striped hyaenas

During interviews, most (67.6%) respondents overall claimed to have seen striped hyaenas in the wild. The overall model for factors that might have determined whether or not respondents claimed to have seen striped hyaenas explained 75.0% of the variance, with an ROC value of 0.782, indicating a strong fit to the model. Study site, gender, and occupation of respondents played the most important role in determining the likelihood of claiming to have seen a striped hyaena (Table 6.1). Hence, respondents from Bnachii were most likely to have claimed to have seen striped hyaenas (Figure 6.1a), as were male respondents (Figure 6.1b). In contrast, student respondents were least likely to have claimed to have seen striped hyaenas (Figure 6.1c).

Table 6.1. Factors determining whether or not respondents claimed to have seen a striped hyaena in the wild, based on logistic regression.

Variables	B	S.E.	Wald	df	Significance
Study site			67.440	5	0.000
Berqayel	1.489	0.263	32.123	1	0.000
Horch Ehden	0.784	0.348	5.083	1	0.024
Bnachii	2.809	0.388	52.334	1	0.000
Chnaniir	0.644	0.328	3.839	1	0.050
Kafarmatta	1.492	0.313	22.684	1	0.000
Al-Shouf Cedar	0	-	-	0	-
Gender (Male)	1.531	0.247	38.279	1	0.000
Occupation		0.406	26.435	6	0.000
Unemployed	0.030	0.404	0.006	1	0.941
Student	-0.868	0.383	5.139	1	0.023
Farmer	0.577	0.425	1.849	1	0.174
Self-employed	0.335	0.370	0.819	1	0.365
Army	0.773	0.511	2.294	1	0.130
Employee	0.074	0.375	0.039	1	0.844
Professional	0	-	-	0	-
Constant	-1.654	0.445	13.819	1	0.000



(a) (b)

(c)

Figure 6.1. The importance of (a) study site, (b) gender and (c) occupation in explaining the proportion of respondents who claimed to have seen a striped hyaena in the wild, based on logistic regression.

6.3.2 Foraging times of striped hyaenas

During focal group discussions, elderly residents across the different study sites reported that striped hyaenas forage at night. They claimed that striped hyaenas forage from after sunset until dawn, and they are seen travelling during daylight hours only if they have been disturbed by people. Informants added that the periods that striped hyaenas spend foraging vary with day length. During long days, striped hyaenas forage from 20:00hrs-04:00hrs. In contrast, during short days, striped hyaenas start foraging earlier, from 17:00hrs, and return back to their dens later, at 5:00hrs. Moreover, elderly residents in the urban area of Chnaniir reported that striped hyaenas start foraging much later, some 3-4 hours after sunset, because of ongoing human activity after dark. Furthermore, elderly residents reported that striped hyaenas cover long distances during foraging which brings them into conflict with people, especially in urban areas where they have to pass through residential areas to reach their feeding sites.

During interviews, many (42.4%) respondents overall thought that striped hyaenas forage only at night, while 19.4% of respondents thought that striped hyaenas forage from sunset to dawn, and 23.7% thought that hyaenas forage from midnight until dawn. In contrast, many fewer respondents thought that striped hyaenas forage over 24 hours (4.3%) or only during daylight hours (0.6%), while 9.6% of respondents had no idea of the foraging time of striped hyaenas.

Knowledge among respondents on the foraging times of striped hyaena was verified against the findings in Chapter 4. Accordingly, responses stating that striped hyaenas forage from sunset to dawn, from midnight until dawn, and during the night, were pooled as "correct" responses. In contrast, responses stating that striped hyaenas forage over 24 hours, or only during daylight hours, or where respondents had no idea, were pooled as "incorrect" responses. During interviews, most (85.6%) respondents overall gave correct responses on the foraging times of striped hyaenas. The overall model for factors that might explain why respondents gave correct responses about the foraging times of striped hyaena explained 85.6% of the variance, with an ROC value of 0.633, indicating a satisfactory fit to the model (Table 6.2). The study site of respondents was important in determining the likelihood of correct answers, and respondents from Berqayel were most likely to know the correct foraging time of striped hyaenas (Figure 6.2).

Table 6.2. Factors determining whether or not respondents gave a correct answer on the foraging times of striped hyaena, based on logistic regression.

Variables	B	S.E.	Wald	df	Significance
Study site			21.917	5	0.001
Berqayel	0.966	0.331	8.507	1	0.004
Horch Ehden	-0.435	0.368	1.402	1	0.236
Bnachii	0.017	0.354	0.002	1	0.962
Chnaniir	0.490	0.422	1.346	1	0.264
Kafarmatta	0.069	0.344	0.041	1	0.840
Al-Shouf Cedar	0	-	-	0	-
Constant	1.198	0.254	34.857	1	0.000

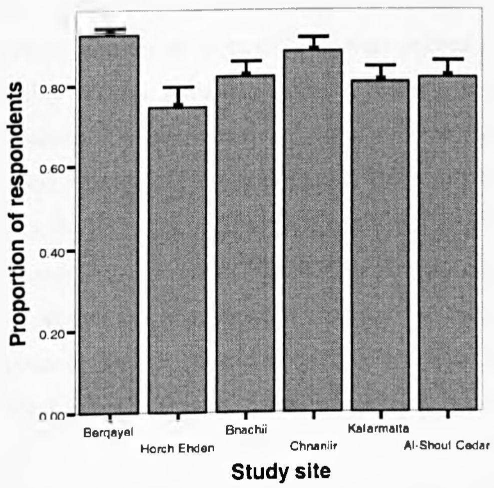


Figure 6.2. The importance of study site in explaining the proportion of respondents who gave the correct response on the foraging times of striped hyaena, based on logistic regression.

6.3.3 Diet of striped hyaenas

During focal group discussions, elderly residents across the different study sites reported that striped hyaenas mainly feed on seven animal species, comprising: sheep, goats, donkeys, cows, dogs, wild boars, and chicken; and on several plant species, mainly comprising fruits including: apples, pears, avocados, atemoyas, grapes, watermelons, peaches, plums and apricots; as well as scavenging on domestic refuse. Most informants agreed on the main animal species and fruit varieties that constitute the diet of striped hyaenas. Besides having witnessed hyaenas feeding on carcasses, some respondents also claimed to have seen striped hyaenas feed on tethered or weak live animals, and to have seen striped hyaenas following wild piglets. Furthermore, many respondents had witnessed striped hyaenas feeding at garbage dumps and eating fruits.

During interviews, many (42.2%) respondents overall thought that striped hyaenas feed on both dead animals and by hunting on tethered or weak live domestic animals. In contrast, some 20.2% of respondents thought that striped hyaenas feed only on dead animals, while 12.6% thought that striped hyaenas feed only by hunting live domestic animals. Very few (1.9%) respondents thought that striped hyaenas depend only on fruits. However, some 13.0% of respondents thought that striped hyaenas depended on all the types of food that were previously mentioned, while 10.1% had no idea of the striped hyaena's food.

Knowledge of respondents on the diet of striped hyaena was verified against the findings in Chapter 4. Accordingly responses that included feeding on dead animals, on both dead and tethered or weak live animals, and on all types of food were pooled as "correct" responses. In contrast, responses that included hunting on live domestic animals, feeding on fruits only, or with no idea, were pooled as "incorrect" responses. During interviews, most (75.4%) respondents overall gave correct responses on the diet of striped hyaenas. The overall model for factors that might explain why respondents gave correct responses about the diet of striped hyaena explained 79.9% of the variance, with an ROC value of 0.789, indicating a strong fit to the model (Table 6.3). The protected status of the study site, and the gender, education level, and occupation of respondents played the most important role in determining the likelihood of correct responses. Hence, people from protected areas were least likely to give a correct response on the diet of striped hyaenas (Figure 6.3a). In contrast, male respondents were most likely to give a correct response (Figure 6.3b). Furthermore, less well-educated respondents were much more likely to give a correct response (Figure 6.3c). Finally, student respondents were least likely to give a correct response (Figure 6.3d).

Table 6.3. Factors determining whether or not respondents gave a correct answer on the diet of striped hyaenas, based on logistic regression.

Variables	B	S.E.	*Wald*	*df*	*Significance*
Protected areas	-1.543	0.217	50.627	1	0.000
Gender (Male)	1.053	0.254	17.164	5	0.000
Education level			17.917	1	0.001
Illiterate	1.942	0.476	16.628	1	0.000
Elementary	1.136	0.416	7.441	1	0.006
Intermediate	0.974	0.340	8.211	1	0.004
Secondary	0.923	0.313	8.698	1	0.003
University	0	-	-	0	-
Occupation			23.685	6	0.001
Unemployed	- 0.749	0.488	2.360	1	0.124
Student	-0.884	0.416	4.505	1	0.034
Farmer	0.251	0.538	0.218	1	0.640
Self-employed	-0.121	0.471	0.066	1	0.798
Army	0.638	0.632	1.018	1	0.313
Employee	0.382	0.395	0.934	1	0.334
Professional	0	-	-	0	-
Constant	0.193	0.379	0.260	1	0.610

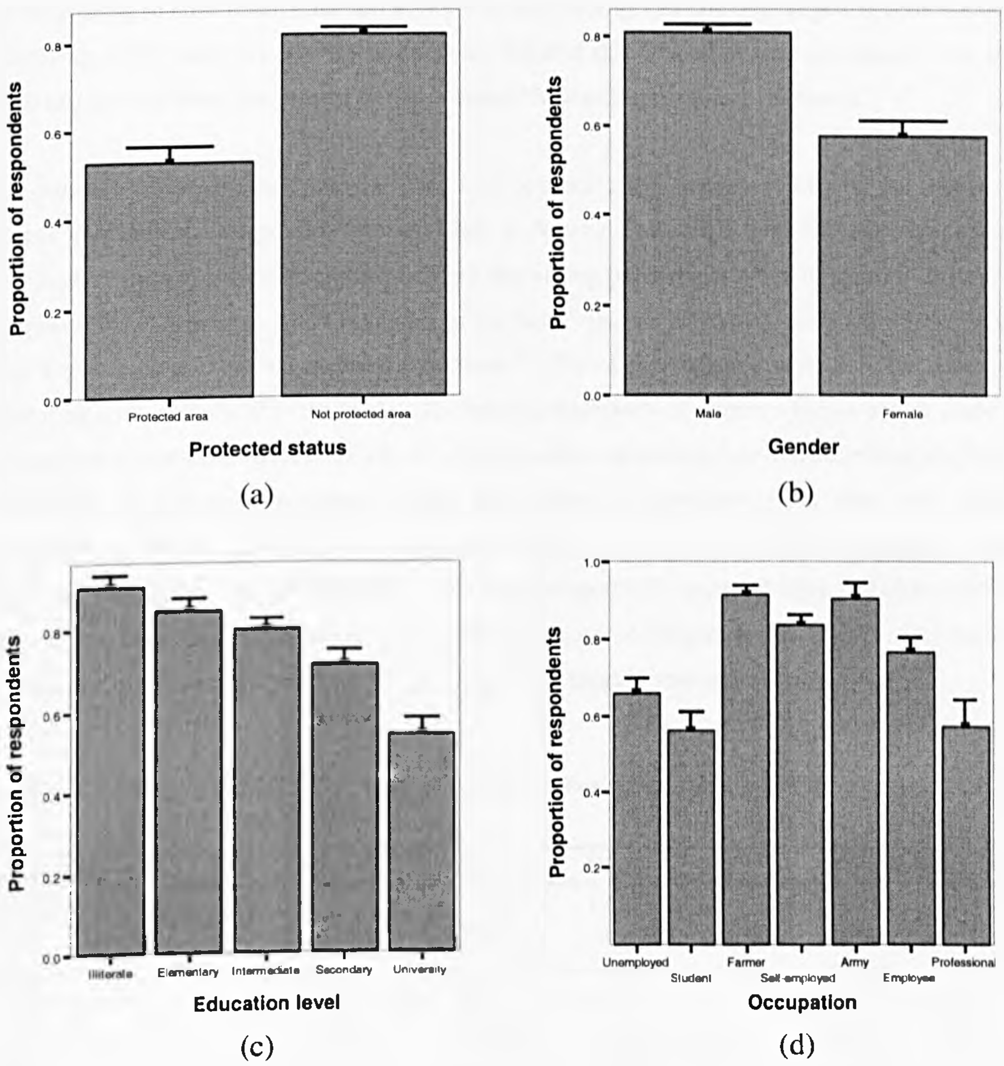


Figure 6.3. Importance of (a) study site, (b) gender, (c) education level and (d) occupation in explaining the proportion of respondents who gave a correct answer on the diet of striped hyaena, based on logistic regression.

6.3.4 Population trends among striped hyaenas in Lebanon

During focal group discussions, elderly residents across different study sites expressed varied viewpoints over trends in striped hyaena populations across Lebanon. Most elderly residents reported that striped hyaena populations were declining and were being negatively affected by hunting and habitat destruction. In contrast, a few elderly residents reported that striped hyaena populations are increasing or stable.

During interviews, most (63.9%) respondents overall claimed that striped hyaena populations in Lebanon are decreasing in size. In contrast, some 24.2% of respondents claimed that striped hyaena populations are increasing, while very few (2.9%) respondents claimed that striped hyaena populations are stable, and 9.0% had no idea about the present trends of striped hyaena populations in Lebanon.

The answers of respondents were assigned into optimistic and negative views of the trends of striped hyaena populations. Responses that included increasing and stable populations were pooled under "optimistic" responses, while responses noting decreasing populations and having no idea were regarded as "pessimistic" responses. The overall model for factors that might have determined whether respondents held a pessimistic or optimistic view explained 71.2% of the variance with an ROC value of 0.673, indicating a satisfactory fit to the model. The relative abundance of striped hyaenas across study sites, and the age and education level of respondents played the most important role in determining the likelihood of pessimistic or optimistic responses (Table 6.4). Hence, respondents from sites with high relative abundance of striped hyaenas were much more likely to give an optimistic response (Figure 6.4a). Moreover, age group was also important with the youngest (<24 years of age) and oldest (>55 years of age) respondents most likely to give an optimistic response (Figure 6.4b). Finally, less well-educated respondents were increasingly more likely to give an optimistic response (Figure 6.4c).

Table 6.4. Factors determining the views of respondents on the population trends of striped hyaenas, based on logistic regression.

Variables	B	S.E.	Wald	df	Significance
Relative Abundance			17.629	5	0.003
0.00	-0.714	0.362	3.886	1	0.049
0.06	-0.426	0.398	1.145	1	0.285
0.72	-0.457	0.340	4.745	1	0.029
0.74	-0.143	0.329	0.189	1	0.663
0.93	-1.024	0.308	11.076	1	0.001
3.08	-	-	-	0	-
Age group			13.268	4	0.010
< 24 yrs	0.555	0.288	3.716	1	0.054
25<yrs<34	-0.221	0.294	0.563	1	0.453
35<yrs<44	-0.305	0.275	1.223	1	0.269
45<yrs<54	-0.195	0.294	0.441	1	0.507
> 55 yrs	0	-	-	0	-
Education level			22.442	4	0.000
Illiterate	1.631	0.385	17.959	1	0.000
Elementary	1.244	0.342	13.219	1	0.000
Intermediate	0.637	0.288	4.889	1	0.027
Secondary	0.248	0.309	0.646	1	0.422
University	0	-	-	0	-
Constant	-0.921	0.366	6.318	1	0.012

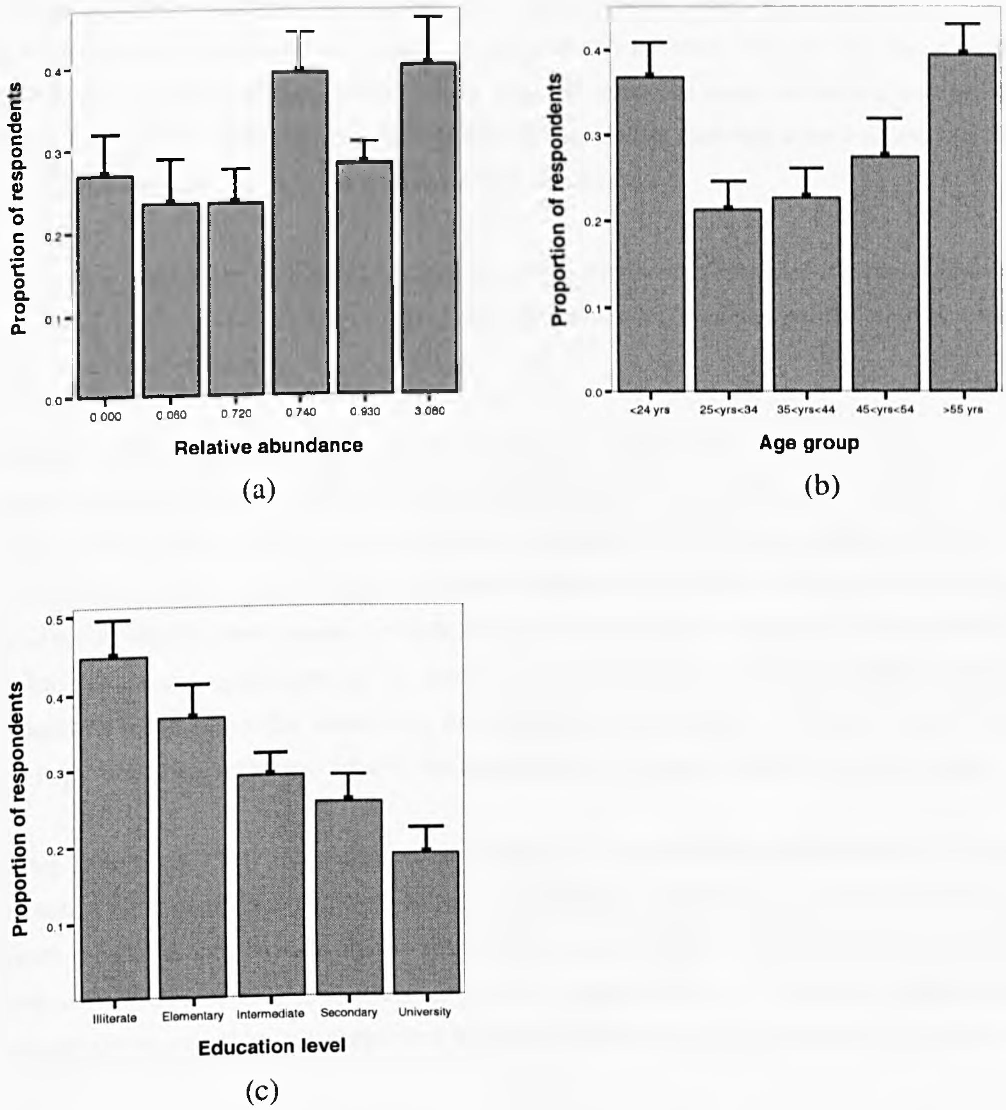


Figure 6.4. The importance of (a) relative abundance of striped hyaenas across study sites, and (b) age and (c) education level in explaining the proportion of respondents who gave an optimistic response, based on logistic regression.

6.3.5 Factors underlying trends in striped hyaena populations

During focal group discussions, elderly residents who believed that striped hyaenas were declining claimed that the easy access for people nowadays to effective, automatic and powerful firearms can place hyaenas and other wildlife at great risk. They also claimed that habitat destruction occurs because forests are more accessible nowadays than in the past. Most, once remote areas can be reached and have electricity, while people settle randomly and their buildings drastically affect wild habitats.

In contrast, elderly residents who believed that striped hyaenas were increasing claimed that this was occurring for several reasons. The volume and distribution of refuse was one key reason given for the increase in striped hyaena populations. Elderly residents noted that people nowadays have become heavy consumers, so more refuse is produced and heedlessly discarded, such that some wild animals like striped hyaenas can benefit. A 75 year-old male elder from Berqayel said:

> *"In the past when they used to slaughter a sheep they used to advertise it a couple of weeks ahead and nothing was wasted from it, and even the bones were used. In contrast, nowadays much more meat is thrown away".*

Furthermore, those elders who thought that striped hyaena populations were increasing across Lebanon reported reduced killing of striped hyaenas, and they reasoned this arose because of a declining economy. Elderly residents reported that the forested areas of Lebanon were increasing, and these increases arise for several reasons. First, people living in rural areas are using an alternative energy source for wood, so less wood is cut. Second, most people have left their agricultural land and joined the army or gone to work in the city, so unused agricultural land is reverting to wild habitats suitable for wildlife. Therefore, such increases in forest are another reason why striped hyaena populations are increasing. Elders also reported that improved reproduction was a factor that supported an increase in striped hyaena populations.

During interviews, those respondents who claimed that striped hyaena populations in Lebanon were decreasing attributed this to two main factors, namely hunting and habitat destruction. Most respondents overall attributed the decrease in the striped hyaena population in Lebanon, either to both factors combined (36.9%), or to hunting alone (36.1%). In contrast, fewer (17.3%) respondents attributed the decrease among striped hyaena populations to habitat destruction alone, while 9.6% of respondents had no idea of the causes of decrease.

In contrast, during interviews respondents who claimed that the striped hyaena populations were increasing or stable, attributed this to four main factors, namely: increasing garbage; reduced killing; improved reproduction; and increases in forested areas. Most (42.9%) respondents overall thought that reduced killing was the main cause of population increases among striped hyaenas in Lebanon. In contrast, fewer respondents thought that garbage increase (12.4%), improved reproduction (10.9%) and increases in forested areas (21.2%) were the main cause of the increasing populations of striped hyaenas in Lebanon. A few (13.5%) respondents had no idea why striped hyaenas are increasing.

6.3.6 Threatened status of striped hyaenas in Lebanon

During focal group discussions, elderly residents across the different study sites thought that striped hyaenas might be threatened but that they will never go extinct. Informants said that hyaena populations might fluctuate in number, depending on seasons, climate and food availability. However, very few elders recognised that wider environmental problems may affect wildlife populations, and were less optimistic about the status of striped hyaenas.

During interviews, respondents were evenly divided overall on whether or not they considered striped hyaenas as threatened. The overall model for factors that might have determined whether or not respondents considered striped hyaenas threatened explained 64.1% of the variance, with an ROC value of 0.699, indicating an almost strong fit to the model. Study site and education level of respondents appeared to play the most important role in determining their views (Table 6.5). Hence, respondents from Bnachii were least likely to think that striped hyaenas are threatened (Figure 6.5). Moreover, increasingly well educated respondents were much more likely to think that striped hyaenas are threatened (Figure 6.5).

Table 6.5. Factors determining whether or not respondents considered striped hyaena threatened, based on logistic regression

Variables	B	S.E.	Wald	df	Significance
Study site			16.172	5	0.006
Berqayel	0.030	0.287	0.011	1	0.917
Horch Ehden	-0.139	0.374	0.138	1	0.710
Bnachii	-0.794	0.324	6.006	1	0.014
Chnaniir	0.400	0.353	1.281	1	0.258
Kafarmatta	-0.026	0.322	0.006	1	0.937
Al-Shouf Cedar	0	-	-	0	-
Education level			59.322	4	0.000
Illiterate	-2.447	0.352	48.391	1	0.000
Elementary	-1.588	0.294	29.254	1	0.000
Intermediate	-0.809	0.242	11.153	1	0.001
Secondary	-0.529	0.260	4.147	1	0.042
University	0	-	-	0	-
Constant	0.917	0.303	9.159	1	0.002

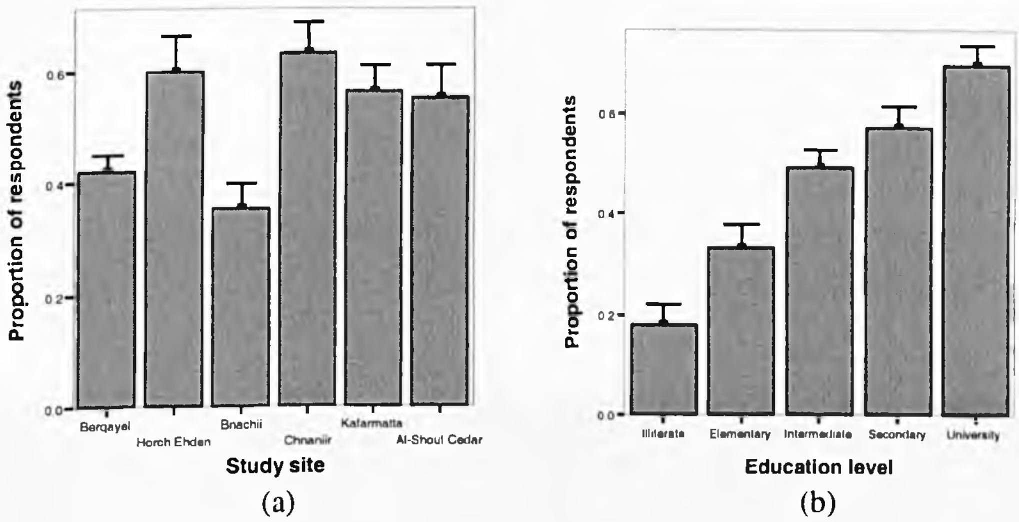


Figure 6.5. The importance of (a) study sites and (b) education level in explaining the proportions of respondents who thought that striped hyaenas are threatened, based on logistic regression.

6.4 Discussion

The attitudes of local people towards wildlife in general, and to carnivores in particular, have been well studied and continue to be so (Kellert et al. 1996, Riley and Decker 2000, Kaltenborn and Bjerke 2002, Treves and Karanth 2002). Equally, attitudes towards carnivores are influenced by the existing knowledge about these carnivores. In Lebanon and its wider region, there have been no previous studies of the local knowledge of carnivores in general, or of striped hyaenas in particular. The results of this study have shown that most residents in the six study sites claimed to have seen a striped hyaena in the wild. Furthermore, most local knowledge on the ecology of striped hyaenas agrees with what is known from the formal scientific literature discussed in Chapter 2, and from the local findings presented in Chapters 4 and 5. Most residents considered that striped hyaena populations across Lebanon were decreasing for various reasons. However, respondents were fairly evenly balanced over the threatened status of striped hyaenas. The local knowledge of residents across the six study sites was determined by a range of factors, including the study site from which they came, by the different relative abundance of striped hyaena across sites, and by various socioeconomic factors.

6.4.1 Local claims to have seen striped hyaenas

Most residents across the six study sites claimed to have seen a striped hyaena in the wild. However, more residents at the rural site of Bnachii site made such claims than at the urban site of Chnaniir (Figure 6.1a), where the greatest relative abundance of striped hyaenas was recorded (Figure 3.4). However, more striped hyaenas have been killed and trapped because of the local private hunting reserve at Bnachii. Furthermore, I have also released three hyaenas in this area between 2000 and 2001 (Chapter 3). Moreover, news of a trapped and killed hyaena travels fast in rural areas, and local people gather to see the beast (*AlWahesh* in Arabic) of which they had heard in their fairy tales (Plate 6.1). In contrast, urban residents at sites like Chnaniir are less concerned about issues with striped hyaenas. When some Chnaniir residents were asked during individual interviews whether or not they had heard about or seen the hyaena that was killed in their neighbourhood, some answered they had not heard about it, while others said they had heard about but they did not go to see it.

Plate 6.1. Local people gathering to see the dead hyaena.

More male than female respondents claimed to have seen a striped hyaena in the wild (Figure 6.1b). In rural Lebanon, males spend most of their time outdoors working their land, cutting wood, or hunting, while females spend most of their time indoors. Similarly Nyhus et al. (2003) found that men living near Way Kambas National Park, in southern Sumatra, Indonesia were more knowledgeable about wildlife since they are more likely to enter the forest than women. In contrast, Aipanjiguly et al. (2003) found no association between gender and knowledge of manatees in Florida, where females are as likely to make recreational trips as males.

Nyhus et al. (2003) also reported that younger villagers were more aware of the wildlife in Way Kambas National Park because they were more likely to enter the forest than older respondents. In contrast, students were least likely to have seen a striped hyaena in Lebanon (Figure 6.1c). In the past, young people in rural areas spent their free time outside, but with easy access to computers, televisions, and owning cars, young people nowadays spend less time in contact with nature, and so are less likely to have seen wildlife in their area. Therefore, this difference between studies is most likely to reflect differences in societal development.

6.4.2. Local knowledge of basic ecology

Local knowledge of foraging times and diet of striped hyaenas mostly agrees with findings in Chapter 4 and 5 and from what is known from previous scientific studies (Kruuk 1976, Reiger 1978). However, residents from the rural site of Berqayel were more correct in their knowledge of the foraging times of striped hyaena (Figure 6.2). In Berqayel, the landscape is little disturbed, modernisation is still not advanced, and the relative abundance of striped hyaena is still relatively high (Figure 3.4). Most residents in Berqayel still work their lands, while those who work in the city have to leave their houses very early in the morning, and so are more likely to encounter wild animals like striped hyaena foraging or returning from a foraging trip.

Most residents also had good knowledge of the diet of striped hyaenas. However, the knowledge of residents in areas lacking protected status was better than of residents living around protected areas (Figure 6.3a), probably because the relative abundance of striped hyaenas was very low around protected areas (Chapter 3). Moreover, males were more knowledgeable than female respondents, probably because males spend more time outside the house than females, which in turn increases their chances of seeing striped hyaena feeding (Figure 6.3b). In contrast to better-educated Indonesian people (Nyhus et al. 2003), better-educated Lebanese residents in this study were less knowledgeable of striped hyaena diets than less well-educated residents. In Lebanon, wildlife is not a priority and wildlife education was not included in the school curriculum until 2003. Thus, most people gain information on wildlife through their personal experience, rather than through learning it at school. Overall, these data suggested that residents across the six study sites had a good knowledge of the basic ecology of striped hyaenas. Likewise, local people in Bolivia had a good knowledge about the local ecology of Andean bears (*Tremarctos ornatus)* (Paisly 2001).

6.4.3. Local knowledge of the status of striped hyaenas

The residents across the six study sites generally believed that striped hyaena populations are decreasing across Lebanon. People residing in sites where the relative abundance of striped hyaenas is high were least likely to think that striped hyaena populations are declining (Figure 6.4a). In sites where the relative abundance of striped hyaena is high, the chances of encountering them is greater, allowing the impression that the striped hyaena population in that area is increasing or stable. These results are similar to those reported by Cardinal (2004) on wolverines (*Gulo gulo*) in Canada where people reported that wolverines are increasing or stable where they are more often hunted and trapped. Residents over >55 years of age are less aware of the factors that affect wildlife populations, leading to their thinking that their local striped hyaena population is increasing (Figure 6.4b). Education levels of respondents were also important (Figure 6.4c), and illiterate respondents were most likely to think that the striped hyaena population is increasing. In contrast, better educated residents are more aware of the situation that wildlife now faces in Lebanon.

Canadians reported that hunting and habitat destruction affected wolverine populations negatively in Canada (Cardinal 2004). Similarly, Lebanese residents across the six study sites noted the importance of these same factors in affecting striped hyaena populations. Hunting was considered the major factor affecting striped hyaena populations negatively, probably because many people have only seen a dead striped hyaena brought by hunters to the village. Hunting is a widely practised sport in Lebanon among people of different ages. Furthermore, the old hunting law still allowed the killing of striped hyaenas all year round and considered them as dangerous animals. However, the new hunting law that was passed in late 2004 has banned the hunting of hyaenas, but has not yet been implemented (Chapter 2).

In addition, wild boar populations are increasing across Lebanon and causing much damage to agricultural land and produce. To solve this problem, farmers have resorted to hunting boars, using animal offal as bait. This bait, in turn, also attracts striped hyaenas, which may be mistakenly killed for wild boars. Such a case was reported in Kafarmatta, where the hunter claimed to have mistakenly shot a striped hyaena on a dark night rather than a wild boar. Furthermore, reports in the press (Chapter 3) have encouraged people to kill hyaenas, either because they fear them or because of the attention it will bring them in the news. Therefore, such acts of bravado may be encouraged by the media, which pictures hunters as heroes and includes them in the news.

In contrast, some residents claimed that striped hyaena populations are increasing because of less hunting, and they reasoned this because the poor economy was affecting people, who had to put in more time at work. In turn, this resulted in less free time to go out hunting. Furthermore, reduced earnings would not allow people to spend money on bullets and firearms.

Some residents believed that striped hyaenas are sensitive to humans and to human activity, while some claimed that habitat loss has affected striped hyaena populations negatively. Habitat loss has been caused by different factors in Lebanon: whether cutting wood for fire or for coal, and transforming forest areas into agricultural land or into urban areas. The issue of habitat destruction was always raised during focal group discussions, and residents were aware of its consequences. For example, a 52 year-old male teacher from Berqayel said:

"The biggest crime was to open new roads. That made the forest more accessible for people, hence opening the forests to destruction, increasing deforestation and spreading of garbage and domestic waste".

Another 72 year-old male from Kafarmatta said:

> *"In the past there were a lot of Whoush* (meaning wild animals in Arabic) *since there were no roads, no electricity, no cars, and more domestic animals. But now, the wild areas are being urbanised, with electricity everywhere, a big network of roads so how do you expect those animals to survive? Wild animals need space, need freedom and need to be away from people".*

Similarly, Canadians expressed similar worries that development and habitat destruction may affect wolverine numbers negatively (Cardinal 2004).

In contrast, some residents claimed that striped hyaena populations are benefiting because the wild areas have increased in extent. Such respondents explained that agriculture and farming is no longer a good business, and is proving very costly in the absence of any government subsidy. As a result, people are leaving their land and going to the city to seek a better income. Moreover, during the civil war in Lebanon from 1975-1991, people in some areas were displaced from their village and were forced to leave their lands. This grew wild, providing a suitable habitat for wild animals. Livestock numbers are also decreasing due to high rearing costs, competition with cheaper imported meat, and fewer people practising farming, resulting in less grazing, which also contributes to increases in the forested area. Furthermore, the available energy sources other than wood, has made some people less dependent on wood for their domestic use, further allowing an increase in forested areas.

While these results appear contradictory, the different answers of respondents may simply reflect the local situation that first surfaced in comments made by many elders during focal group discussions. For example, the mayor of Berqayel said:

"In the past people depended on agriculture as their main income but now most people have left their land and joined the army or gone to work in the city as casual workers. Moreover, numbers of livestock have decreased due to the lower income they produce and due to competition with neighbouring countries. Furthermore, wood was substituted by gas and electricity, so the forest area is increasing".

In contrast, the mayor of Chnaniir said that the forest area is decreasing because it is being transformed into urban areas.

Another factor that was thought to have caused an increase in striped hyaena populations across Lebanon is the increase in the amount of refuse and domestic waste that is heedlessly discarded. People are consuming more goods; garbage collection is not well organized; and people throw their domestic garbage on the road-side away from residential areas. Illegal waste dumps build up, through collection and dumping of refuse collected from villages, which is left uncovered in remote places. Such *fly-tipping* will attract wild animals, especially those generalised scavengers seeking the rich food remains that may be available in these dumps. Similarly, the population of golden jackals (*Canis aureus*) in the Golan Heights, Israel has increased as a result of illegal dumps (Yom-Tove et al. 1995). Moreover, numbers of the banded mongoose (*Mungos mungo*) in Uganda have increased due to domestic waste (Gilchrist and Otali 2002).

6.4.4 Threatened status of striped hyaena

Even though most respondents believed that striped hyaena populations are declining, fewer respondents thought that striped hyaenas in Lebanon were threatened. Indeed, respondents were fairly evenly divided in their views on the threatened status of striped hyaenas. The residents of Bnachii site (Figure 6.5a) were least likely to consider the striped hyaena as threatened in Lebanon. Extensive killing can sometimes have a reverse effect on local knowledge. When an animal is frequently trapped or killed, this can lead to the impression for local residents that this animal is very common, or else it would not be killed in such large numbers. This was the situation in Bnachii, where striped hyaenas were killed and trapped more often because of the presence of the private hunting reserve (Chapter 3).

Furthermore, the education levels of respondents were important in determining their knowledge of the threatened status of striped hyaenas in Lebanon (Figure 6.5b). Less well educated respondents are probably less aware of the threats facing striped hyaena. Nyhus et al. (2003) reported that better educated people had greater opportunity to gain access to information about animals than less well educated people.

6.5 Summary

1) Using the techniques of focal group discussions and questionnaire interviews across the six study sites, this study of local knowledge of striped hyaenas in Lebanon has provided an important understanding of the views of local people about the striped hyaenas among which they co-exist.
2) Most respondents claim to have seen a striped hyaena in the wild, and most local people were correct in knowing about the nocturnal habits and omnivorous feeding patters of striped hyaenas, but differences in their claims and knowledge depended on certain socio-economic factors.
3) Most respondents thought that striped hyaenas were declining in number, but fewer respondents thought striped hyaenas were threatened or would likely go locally extinct, but differences in the views depended both on socio-economic factors and the relative abundance of striped hyaenas in each study site.

The next chapter will examine knowledge of the stories about striped hyaenas among local people across the six study sites as the basis for better understanding of local attitudes towards striped hyaenas, which will be examined in detail in later chapters.

Chapter 7

STORIES AND MYTHS

An elderly at Berqayel site narrating his brave encounter with striped hyaena

7.2 Introduction

The deeply held, often irrational and emotional attitudes that local people may hold towards particular groups of animals has for long been affected by stories and myths embedded within their culture (Boitani 1995). Such stories represent the outcome of interactions between man and the species in question (Lopez 1978). Moreover, the stories that people learn from an early age can persist to adulthood and influence their attitudes (Campbell 1965). Therefore, investigating the stories written about particular topics can prove very useful in the understanding of human attitudes and culture (Tomkins 1974, Teglasi 2001).

Large carnivores have long elicited intense, and often extreme, attitudes among the people with which they co-exist, ranging from the worship of carnivores as gods, to contempt for, and persecution of, carnivores (Bjerke and Kaltenborn 1999). As meat eaters, carnivores compete with people for food and sometimes threaten people's lives, which in turn have made carnivores the subject of many myths. Furthermore, some species of large carnivores have always fascinated people and can be symbols of power and magic. Big cats like lions (*Panthera leo*), tigers (*Panthera tigris*) and leopards (*Panthera pardus*) were symbols of power (Hook and Robinson 1982). The African lion has been considered by many cultures as the king of the jungle and a symbol of power, while the snow leopard was symbolized in India as the magical character of nature (Hussain 2002). Jaguars (*Felis onca*) were also believed to be a symbol of power, becoming intricately woven into the fabric of Central and South American culture and religions, while the tiger has also been revered as a cultural icon throughout its range (Weber and Rabinowitz 1996). Furthermore, wolves (*Canis lupus*) were viewed by Europeans and North Americans as creatures of power and intelligence (Lopez 1978); while the Andean bear (*Tremarctos ornatus*) is considered a god-like deity among Andean people in South America (Paisley 2001).

By contrast, some large carnivores like hyaenas have been looked at in a much more negative light. With their unearthly laughing cry and unpleasant reputation, all species of hyaenas have long been an object of hatred and superstition (Tristram 1888, Lewis et al. 1968, Harrison and Bates 1991, MacDonald 2001). Peoples' superstitious fears of striped hyaenas have been widely reported (Satunin 1905, Bodenheimer 1920, 1935 *cited in* Rieger 1978, Bunaian et al. 2001). Some believed that striped hyaenas release hallucinating substances to kill people (Al Younis 1993, Bunaian et al. 2001, Qarqaz et al. 2004). Previous studies have reported that striped hyaenas have attacked children in Russia, India and Israel (see Rieger 1978), or have carried men or women to their den (Buckland 1822 *cited in* Dart 1956). Others have reported the cannibalistic behaviour of striped hyaenas (Buckland 1823 *cited in* Dart 1956). The unpleasant reputation of striped hyaenas as grave-robbers (MacDonald 2001) has also led people to cement the graves, or to put stones or thorny shrubs over the graves to avoid disturbance (Searight 1987, Harrison and Bates 1991). For example, the reputation of striped hyaenas to dig for human bodies and drag them to their den led the Turkish people to lay large stones upon graves to protect the dead from striped hyaenas (Dart 1956).

Equally, various fables have been told and written of hyaenas from ancient times. Spotted hyaenas were considered to be hermaphroditic or to change sexes each year (Dart 1956, Harrison & Bates 1991, Qraqaz et al. 2004). Striped hyaenas also appeared frequently in the ancient Arabic literature and lots of stories were interwoven with their activities (see Chapter 2). Many poets and writers incorporated striped hyaenas in their writing, and have mostly portrayed a negative image, and described hyaenas as killing people, robbing graves, eager to eat human meat, and using its body parts in medicine (Al-Jahiz (1374-1465), Al-Zamakhsahri 1374-1465, Al-Doumairy 1406, Ibn Sina (1572-1628)).

Despite the poor reputation of hyaenas, little has been documented by different authors of their stories (Al-Younis 1993, Reiger 1978, Harrison and Bates 1991, Qarqaz et al. 2004), and none has been related to striped hyaenas in Lebanon. Lebanon provides a good opportunity to explore stories about striped hyaenas in some depth, due both to the strong traditional culture still present within the communities, and to the continuing interactions between people and striped hyaenas. This chapter seeks to understand the nature and persistence of stories about striped hyaenas in Lebanon, as the basis on which to gain an insight into about the attitudes that people hold towards striped hyaenas.

The overall objective of this chapter is to document fully the different kinds of stories about striped hyaenas in the Lebanese culture and how prevalent knowledge of these stories remains among the Lebanese people. Hence, the questions this chapter seeks to answer are:

- what types of stories are still known by elders and how can they be classified?;
- how prevalent is current knowledge of these stories among local people?; and
- what factors might explain the any different levels of knowledge across study site, and how might these factors affect perpetuation of these stories?

7.2 Methods

Information on the local knowledge of stories about striped hyaenas was collected from focal group discussions, and from individual interviews (see Chapter 2), in each study site.

7.2.1 Collection and classification of stories

A total of 147 detailed stories about striped hyaenas were collected during focal group discussions and from elderly people identified as key informants (Chambers, 1992, Bernard 1995). Stories were tape-recorded and transcribed in Arabic, and later translated to English. The themes and sub-themes of the stories told by different individuals across the six study sites did not differ greatly in their main content, even though the finer details of some stories did differ. As a result, 14 types of stories were classified, based on their main themes and sub-themes. A further coarser grouping of the stories was undertaken, based on whether stories of different themes and sub-themes portrayed either a negative image or a positive image of striped hyaenas, or a positive image of the bravery of people when meeting striped hyaenas.

7.2.2 Questionnaire interview

The main questionnaire interview was conducted across the six study sites from March 2002 to October 2002, with a sample size of 797 respondents, and sought to explore local knowledge of the stories about striped hyaenas. Once all the stories collected from the focal group discussions and from key informants had been classified by their different themes and sub-themes, respondents were asked whether or not they knew stories in each theme and sub-theme, by giving a brief description of each story they knew.

7.2.3 Statistical analysis

The Statistical Programme for the Social Sciences (SPSS) for Windows version 12.0.1 was used to conduct a statistical analysis to determine which factors might explain the likelihood of respondents knowing stories within each main theme. The statistical data for each theme were first analysed using descriptive statistics, and responses were compared using Chi-square test, but these were not shown for reasons of space. Based on the initial tests, multivariate analyses, using logistic regression were then performed to model responses, as these provide a convenient way to undertake categorical data analyses. Forward Wald logistic regression was used to specify the model with a significance of $P<0.05$. Dichotomous questions were given a dummy of 1 if respondents knew stories of a particular theme and 0 if respondents did not know such a story, and these responses were taken as the dependent variable. The explanatory variables for the analyses included both factors relevant to the study site, and to individual respondents. Factors relevant to the study site comprised: site, whether a rural or urban landscape, and its protected or non-protected status. Factors relevant to individual respondents comprised: their gender, age, education level, occupation, and monthly income. The likelihood ratio goodness of fit test of the model was described using Chi-square goodness of fit statistics. Model performance on the testing sets was evaluated by calculating the area under the curve (AUC) of receiver operation characteristics (ROC) plots. ROC values range from 0.5 to 1.0. Values above 0.7 indicate strong model fit, while those above 0.9 indicate a highly accurate model (Swets 1988).

7.3 Results

7.3.1 Themes and sub-themes of stories

A total of 147 stories were collected during focal group discussions and from key informants. Once all these stories were transcribed, it was evident that they comprised six main themes (Figure 7.1), ranging from:

- striped hyaenas killing people;
- striped hyaenas eating dead people;
- striped hyaenas as cowards;
- striped hyaenas possessing supernatural powers;
- striped hyaenas as good animals; and to
- men showing bravery towards striped hyaenas.

Five of these themes could be further divided into different sub-themes (Table 7.1). This resulted in the classification of 14 types of story, based on their themes and sub-themes. The 14 different types of story were further grouped into 11 types of stories that portrayed the striped hyaena in a negative light, one type of story that portrayed the striped hyaena in a positive light, and two types of story that portrayed the bravery of people when meeting a striped hyaena. I will now describe these stories by their different themes and sub-themes, based on focal group discussion, and discuss how widely each theme (Figure 7.2) and sub-theme (Figure 7.3) is known among local people, based on questionnaire interviews.

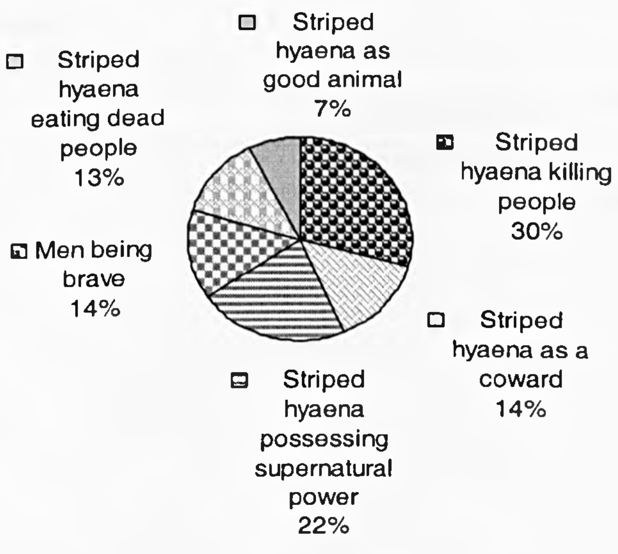


Figure 7.1. The main themes to which stories collected (N=147) from focal group discussions and from key informants were assigned.

Table 7.1. Themes and sub-themes of the 14 stories collected during the focal group discussion and from key informants across the six study sites.

Reference	Main theme	Sub-theme(s)	Image of hyaena
1	Striped hyaenas killing people by:		
1a		mesmerizing their victims with urine	Negative
1b		accompanying their victims	Negative
1c		pushing doors open	Negative
2	Striped hyaenas eating dead people by:		
		robbing graves	Negative
		finding unburied corpses	Negative
3	Striped hyaenas as cowards by:		
3a		kidnapping an infant	Negative
3b		attacking an old woman	Negative
4a	Striped hyaenas possessing supernatural powers through	Their effect on people by:	
4a(i)		flashing magic eyes	Negative
4a(ii)		making hair stand on end	Negative
4a(iii)		smelling bad	Negative
4b		Their effect on animals	Negative
5	Striped hyaenas as good animals		Positive
6	Men being brave by:		
6a		riding a striped hyaena	Brave men
6b		having their fear tested	Brave men

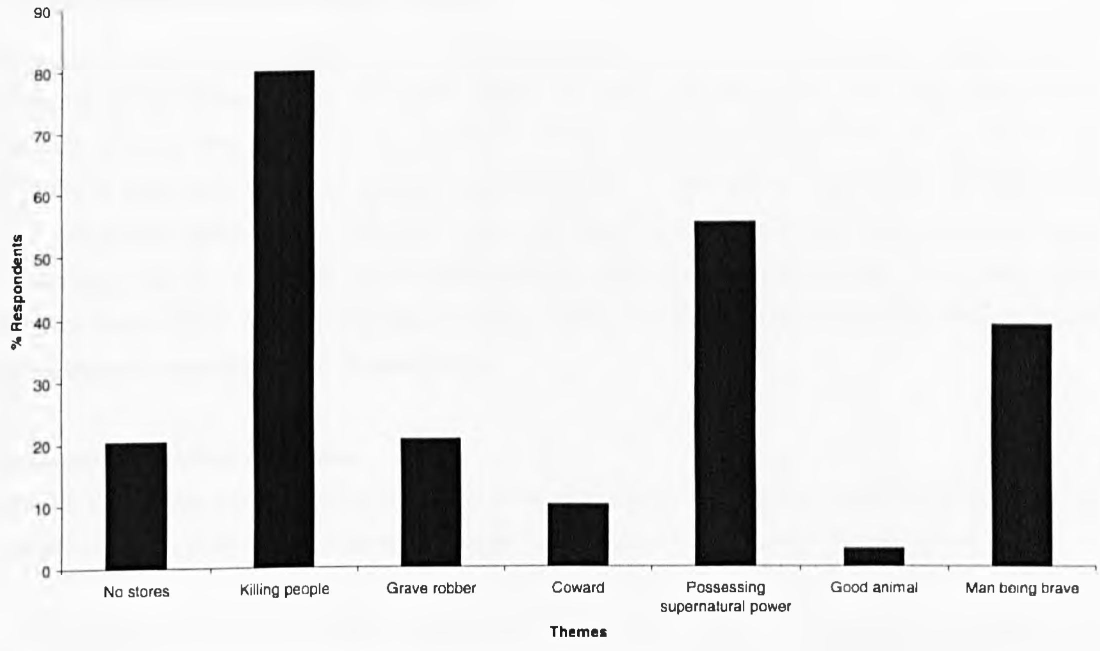


Figure 7.2. Knowledge of the six main story themes among the 797 respondents from the main questionnaire interview across the six study sites.

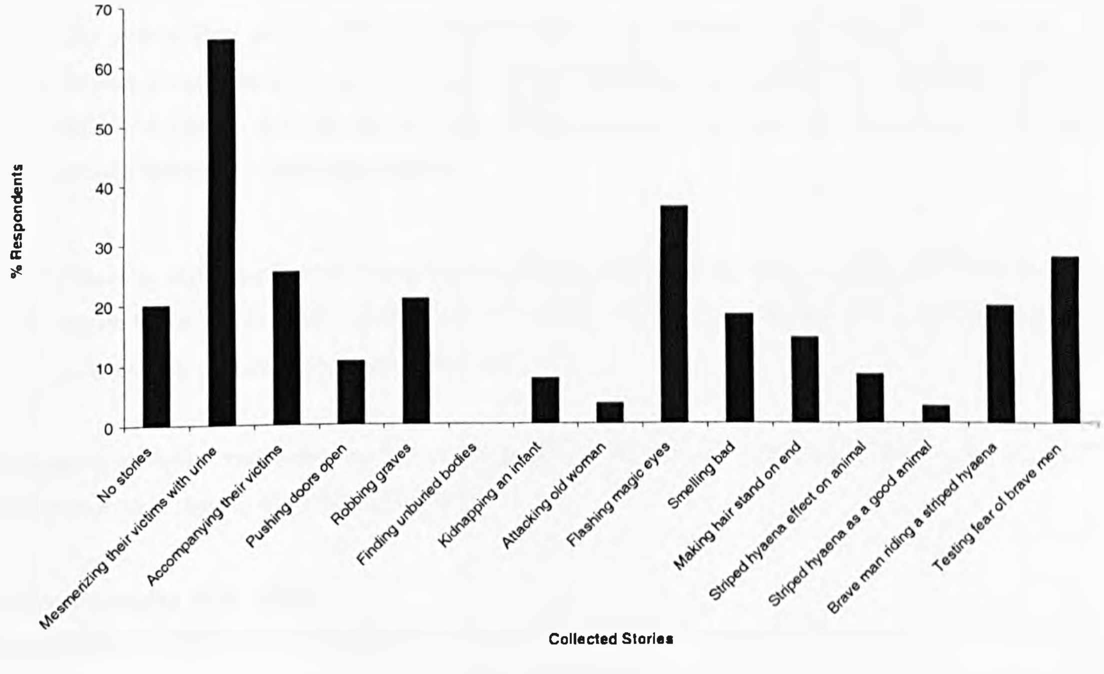


Figure 7.3. Knowledge of the 14 different sub-themes of story among the 797 respondents from the main questionnaire interview across the six study sites.

7.3.1.1 Striped hyaenas killing people

Focal group discussions revealed one story theme where striped hyaenas kill people, and all stories belonging to this theme portray a negative image of striped hyaenas (Table 7.1). The questionnaire interview showed that stories in this theme were very widely known (79.9%) among those 639 respondents who knew stories of striped hyaenas (Figure 7.2). This theme was further subdivided into three sub-themes based on the different ways that striped hyaenas select their victims, comprising: mesmerising victims with their urine; accompanying their victims; and pushing doors open using powerful hands (Table 7.1). Respondents believed in these stories and always described them as if they had happened to their relative, or in their village.

a) Mesmerizing victims with urine

This sub-theme tells how striped hyaenas select their victims by mesmerising them with their urine. An example of such a story told by a 70 year-old male informant from Kafarmatta is given below:

> *"When a striped hyaena smells a person coming its way, it hides in the bush until the person gets close enough. The hyaena then jumps out and catches its intended victim by surprise. It then urinates on its tail and flushes the urine over the face of its victim. This urine serves, first to mesmerise the victim, and, second, to make the victim dizzy so that he follows the hyaena.*
>
> *The hyaena then starts moving towards its den with its intended victim following. In the den, the hyaena starts tickling the victim on his feet until he passes away with laughter. After the victim has died, the hyaena does not eat the body straight away, but leaves it for three days to rot, since striped hyaenas do not eat fresh flesh.*
>
> *There is one remedy to counteract the dizziness induced by the urine of hyaenas. If the intended victim hits a sharp object, whether a tree, a thorn, or a rock, and bleeds, on the way to the den, he will wake up and can escape from the hyaena".*

The questionnaire interview showed that stories in this sub-theme were very widely known, among 64.5% of respondents across all study sites (Figure 7.3).

b) Accompanying their victims

This sub-theme tells how striped hyaenas select their victims by accompanying a man or woman along their way, and then uses its tricks to kill them. An example of such a story told by 65 year-old male informant from Al-Shouf Cedar Reserve is given below:

"A long time ago, forests were abundant and people used to walk on foot from one rural area to another. Sometimes, people might leave early or return late when it was still dark, so increasing the chances of meeting a hyaena on their way.

The hyaena accompanies its intended victim for some distance, before getting closer and closer, and then encircling the victim. The hyaena does not attack as it gets closer, but starts to fool around, going back and forth, jumping from one place to another, or hiding between trees and sometimes obstructing the route of the intended victim, or trying to make itself look bigger. In other words, the hyaena plays on the fear of the intended victim. The hyaena then waits until its victim loses consciousness and then attacks him. The hyaena does not eat the body straightaway, but drags the body to its cave and allow it to rot before eating it. However, victims can escape from the accompanying hyaena by throwing gravel or by screaming, or by running fast to the village, or starting a fire or putting on a light."

Stories in this sub-theme were quite widely known, among 25.3% of respondents across all study sites (Figure 7.3).

c) Striped hyaenas pushing doors open with powerful hands

This sub-theme tells how striped hyaenas invade houses in small villages in winter, by pushing doors open with their powerful hands, and killing and eating people inside the house. An example of such a story told by a 72 year-old male informant from Al-Shouf Cedar Reserve is given below:

"A long time ago, during cold winters, and especially on freezing nights, striped hyaenas used to invade small villages and attack isolated houses, looking for food. The "Sheeb" or "Al-Wahesh" meaning the "beast" or "striped hyaena", used to get in through the main wooden door, by pushing, digging beneath or biting the door until it opened. After opening the main door, the hyaena used to attack the people sleeping inside the house, kill them, and either eat them inside the house, or drag the bodies to their caves to eat at leisure".

Stories in this sub-theme were less widely known, among 10.5% of respondents across all study sites (Figure 7.3).

7.3.1.2 Striped hyaenas eating dead people

Focal group discussions revealed one story theme where striped hyaenas eat dead people they have not killed, and all stories belonging to this theme portray a negative image of striped hyaenas (Table 7.1). The questionnaire interview showed that stories in this theme were quite widely known (20.2%) among the 639 respondents who knew stories of striped hyaenas (Figure 7.2). This theme was further subdivided into two sub-themes, based on the different ways that striped hyaenas find dead bodies, comprising: robbing graves; and, finding unburied dead people (Table 7.1).

a) Robbing graves

Many stories were collected during focal group discussions of striped hyaenas as grave robbers. There were several different narrations of the sub-theme, but all stories told of hyaenas robbing graves and scavenging on human corpses. As a solution to the behaviour of robbing graves, people began to bury their dead in deeper graves and covered them with cement blocks and thorns, so that the hyaena could not steal the dead. An example of such a story told by a 79 year-old male informant from Berqayel site is given below:

> *"In the past when the dead were buried they were placed in the ground and covered in soil without the protection of stones or concrete blocks. A hyaena, with its sensitive nose, was able to sense where a body was buried. It would come at night, smelling the ground, cautiously looking around to make sure no-one could see it. It would dig the body up, eat what it could, and drag the remains to its cave".*

Stories of this sub-theme are quite widely known, among 20.7% of respondents across all study sites (Figure 7.3).

b) Finding unburied bodies

Focal group discussions revealed one sub-theme that was only known among eight elders from Berqayel, where hyaenas found unburied bodies. During the main questionnaire interview, no respondents reported knowing this story (Figure 7.3). Nevertheless, the story is reported because it shows how hyaenas gained their negative image. An example of such a story told by a 92 year-old male informant from Berqayel is given below:

> *"Striped hyaenas began to gain a bad reputation during World War I. At that time, people escaped from Mount Lebanon to Akkar in the north of Lebanon for two reasons:*
>
> *First, 'Safar Barlek' was an obligatory period of military service in Mount Lebanon imposed by the Turkish at that time. Young men were forced to enrol and fight in the war, and most were killed and never returned back. To prevent this happening to their families, parents fled to the north with their children.*

Second, starvation was also prevalent at that time around Mount Lebanon, and this also caused people to flee to the north, where the situation was better and food was more plentiful.

On the way north, weak people became sick, could die, and were then left behind unburied. Striped hyaenas took advantage of this situation and scavenged on the dead bodies. Since then, striped hyaenas have dominated people and started attacking and eating them".

7.3.1.3 Striped hyaenas as cowards

There is an Arabian proverb describing the striped hyaena as "*Bilnhar Dabaa wa Billayl Sabaa*" which means that by day the hyaena is a hyaena, which is the symbol of a coward animal, but by night is a lion, the symbol of a strong animal. Indeed, focal group discussions revealed one story theme where striped hyaenas were seen as cowards, and all stories belonging to this theme portray a negative image of striped hyaenas (Table 7.1). The questionnaire interview showed that stories in this theme were less widely known (9.9%) among the 639 respondents who knew stories of striped hyaenas (Figure 7.2). This theme was further subdivided into two sub-themes, based on the different ways that striped hyaenas showed their cowardly behaviour, comprising: kidnapping an infant, or attacking old women (Table 7.1).

a) Kidnapping an infant

This sub-theme tells how people look at striped hyaenas as cowards that kidnap young helpless babies. An example of such a story told by a 92 year-old male informant from Berqayel site is given below:

"*Once, when a woman was washing the clothes, she kept her infant on a swing outside in the garden in front of her house. After a while, a hyaena came along and grabbed the infant from her diaper and ran away. The woman heard her baby crying and ran after the hyaena. The infant fell out of her diaper and was safe, while the hyaena ran off with the empty diaper and without the baby.*"

Stories in this sub-theme were not widely known, among only 7.4% of respondents across all study sites (Figure 7.3). However, those who knew stories in this sub-theme were mostly from Berqayel, where such an incident was said to have happened in that village in the past, as well as some respondents from Bnachii.

b) Attacking an old woman

This sub-theme tells how people look at striped hyaenas as cowards that attack an old helpless woman. An example of such a story told by a 72 year-old male informant from Berqayel site is given below:

"A long time ago in winter, an old woman was collecting some wood for her fire. When she left her house, the old woman left the door open. A hyaena entered the house and hid behind the door. When the old woman returned home and closed the door, the hyaena jumped on her and knocked her to the ground".

Stories in this sub-theme were even less widely known, among only 3.3% of respondents across all study sites (Figure 7.3).

7.3.1.4 Striped hyaenas possessing supernatural powers

Focal group discussions revealed one story theme where striped hyaenas were seen to possess supernatural powers, and all stories belonging to this theme portray a negative image of striped hyaenas (Table 7.1). The questionnaire interview showed that stories in this theme were widely known (55.1%) among the 639 respondents who knew stories of striped hyaenas (Figure 7.2). This theme was further subdivided into four sub-themes, based on the different ways that striped hyaenas showed their supernatural powers, comprising: striped hyaenas using their magic eyes; striped hyaenas causing the hair of people to stand on end; striped hyaenas smelling bad; and striped hyaenas mesmerising animals such as donkeys (Table 7.1).

a) Flashing magic eyes

This sub-theme tells how striped hyaenas use their shining magic eyes to hypnotise people. An example of such a story told by a 52 year-old male informant from Chnaniir site is given below:

"If you encounter a hyaena in the wild, it can hypnotise you when you look into its brightly shining eyes. Even if you had a gun, you would not be able to press the trigger because of the magic of the hyaena's shining eyes".

Stories in this sub-theme were widely known, among 36.1% of respondents across all study sites (Figure 7.3).

b) Making hair stand on end

This sub-theme tells how striped hyaenas use their supernatural powers to cause the hair of people to stand on end. An example of such a story told by a 57 year-old informant from Kafarmatta site is given below:

"If a person is moving in a place that is close to a hyaena, their hair will stand on end, even though the person may not have seen or heard the hyaena. The presence of the hyaena will just produce such supernatural power that it affects the person and causes hyaena magic".

Stories in this sub-theme were less widely known, among 14.0% of respondents across all study sites (Figure 7.2), most of whom came from Kafarmatta.

c) Smelling bad

This sub-theme tells how striped hyaenas use their supernatural powers to produce a bad smell that announces its presence. An example of such a story told by a 63 year-old male informant from Chnaniir site is given below:

"Hyaenas announce their presence by a using bad smell. When passing human settlements hyaenas produce a bad smell to announce their presence. This bad smell is hyaena magic makes people fear them".

Stories in this sub-theme were quite widely known, among 17.9% of respondents across all study sites (Figure 7.3).

d) Effect on animals

Stories under this sub-theme tell how striped hyaenas use their supernatural powers to hypnotise animals, especially donkeys and dogs. An example of such a story told by a 72 year-old male from Berqayel site is given below:

"Once a man was riding his donkey from one place to another. Suddenly, the donkey stopped moving and started to dance on the spot with its ears erect. The man tried to force the donkey to walk on, but it refused. The man then tried to drag the donkey, but again it would not move. The man then remembered that his grandfather had said if a donkey felt that a hyaena was close by, it would not move. The man then looked above him and saw a hyaena, which he shouted at saying "Ya Abou Alfatayes" meaning "the one who eats the dead", get lost. He then threw stones at the hyaena, which ran away, after which the donkey continued to walk".

Stories of this sub-theme were less widely known, among only 8.0% of respondents across all study sites (Figure 7.3).

7.3.1.5 Striped hyaenas as good animals

Focal group discussions revealed one story theme that described striped hyaenas as a good animal (Table 7.1). Nevertheless, in all its variants, the striped hyaena still remained a fearsome beast, but no one was hurt in these stories. Instead, the hyaena took on the positive role of a good animal that pays back those who helped him. Stories of this theme were not widely known, among only 2.7% of the 639 respondents who knew stories of striped hyaenas (Figures 7.2, 7.3). An example of such a story told by a 73 year-old male informant from Berqayel site is given below:

> *"Once upon a time, a woman was baking bread on a wood stove outside her house and a hyaena, approached her. Although she was very afraid of the big beast, it gave her its hand to remove a thorn. The woman removed the thorn from the hyaena's hand, and the beast left. However, the hyaena returned back the next day bringing in his mouth a sheep that it threw in front of the house of the woman, as if paying her back for her help".*

7.3.1.6 Men being brave

Focal group discussions revealed one story theme where men showed bravery towards striped hyaenas (Table 7.1). The questionnaire interview showed that stories in this theme were well known (38.9%) among the 639 respondents who knew stories of striped hyaenas (Figure 7.2). This theme was further subdivided into two sub-themes, based on how men showed bravery towards striped hyaenas, comprising: striped hyaena being ridden by a brave man; and, striped hyaena testing a man's fear (Table 7.1).

a) Man riding a hyaena

Stories narrated about men riding hyaenas are told in different ways and have different heroes, but all follow the same sub-theme. When this type of story was being told by respondents, it was narrated in a very excited and heroic way, especially if it involved a close relative of the story teller. All these types of story told of a striped hyaena being ridden by brave men to the village, and killed. An example of such a story told by an 84 year-old male informant from Kafarmatta is given below:

> *"A man was returning home late after spending part of the night at his friend's house in the neighbouring village. On his way back, the man heard something following him. He stopped and the sound stopped, he moved and then the sound started again. The sound started to become louder as the hyaena draw closer. The man jumped on the wall of the terrace and then over the hyaena's back. He caught the hyaena by the ears and took him home. On reaching home, he called for his wife to fetch a rope. The man tied up the hyaena with the rope, and then tied the hyaena to a tree in front of the house until the morning. In the morning, the people gathered around the brave man's house to see the hyaena. Afterwards the hyaena was killed".*

Stories of this sub-theme were quite widely known, among 19.3% of respondents across all study sites (Figure 7.3).

b) Testing the fear of man

Stories in this sub-theme again described man as brave, but differed from the previous sub-theme in that the hyaena is not killed. Informants always told the story in terms of brave men from whom the hyaena runs away; because the man has what the hyaena can see is a 'brave' walk. Equally, a man who proves to be a coward may be eaten. An example of such a story told by a 67 year-old male informant from Bnachii site is given below:

> *"The hyaena knows a brave man from his walk. Upon encountering a man, the hyaena starts moving round the man in decreasing circles, getting closer and closer with every round, until it touches that man. If that man is a coward, the hyaena will eat him. Otherwise, if that man is brave the hyaena will run away".*

Stories of this sub-theme are quite widely known, among 27.5% of respondents across all study sites (Figure 7.2).

Having classified the different types of story, I will now examine in more detail the knowledge of these stories among respondents across the six study sites.

7.3.2 Images of stories

Of the 797 respondents interviewed, many knew of at least one or two stories that portrayed a negative image of the striped hyaena (Figure 7.4). In contrast, many fewer respondents knew of stories either that portrayed a positive image of striped hyaenas or that portrayed a positive image of the bravery of men meeting a striped hyaena (Figure 7.4).

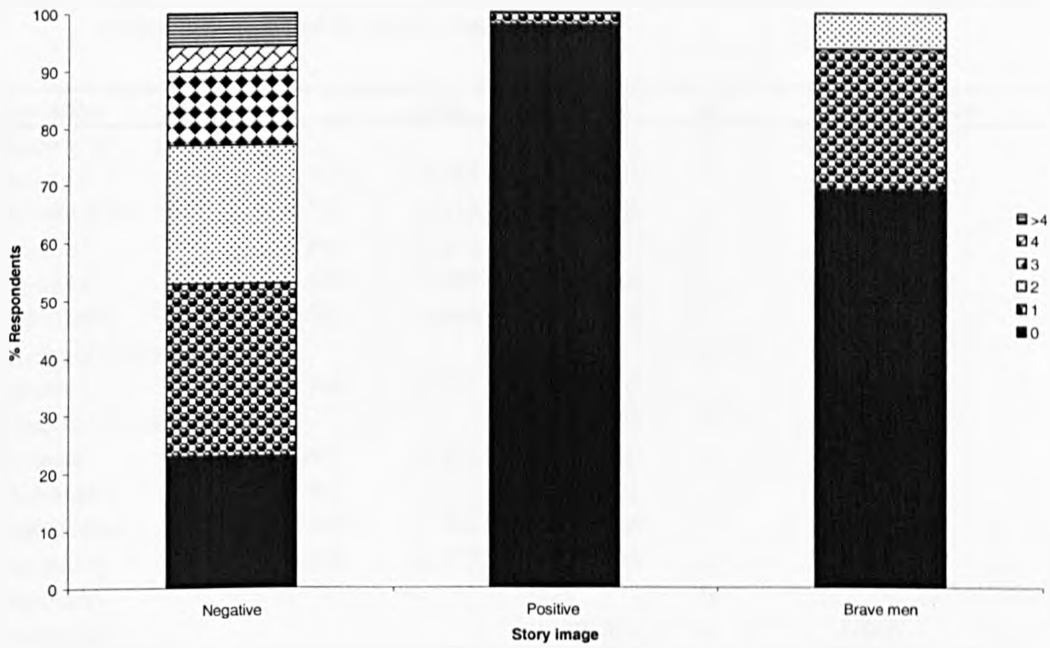


Figure 7.4. Comparison of the percentage of stories known by 797 respondents, according to the type of image that each story portrays.

7.3.2.1 Negative images of striped hyaenas

During individual interviews, most (77.0%) respondents overall knew of stories that portrayed a negative image of the striped hyaena (Figure 7.4). The overall model for factors that might have determined whether or not respondents knew such stories explained 79.3% of the variance, with an ROC value of 0.747, indicating a strong fit to the model. Study site, gender, education level and occupation of respondents played the most important role in determining the likelihood of knowing stories that portrayed a negative image (Table 7.2). Hence respondents from Chnaniir were least likely to know such stories. In contrast, respondents from Kafarmatta were most likely to know of such stories (Figure 7.5a), as were male respondents (Figure 7.5b). Moreover, less well-educated respondents were most likely to know of such stories (Figure 7.5c), while students were least likely to know of such stories (Figure 7.5d).

Table 7.2. Factors determining whether or not respondents knew of stories portrayed a negative image of striped hyaena, based on logistic regression.

Variables	B	S.E.	Wald	df	Significance
Study site			41.456	5	0.000
Berqayel	-0.923	0.355	6.761	1	0.009
Horch Ehden	-0.722	0.433	2.785	1	0.095
Bnachii	-0.817	0.392	4.350	1	0.037
Chnaniir	-1.673	0.399	17.564	1	0.000
Kafarmatta	1.056	0.496	4.532	1	0.033
Al-Shouf Cedar	0	-	-	0	-
Gender	0.743	0.261	8.105	1	0.004
Education level			14.202	4	0.007
Illiterate	1.605	0.453	12.540	1	0.000
Elementary	0.968	0.413	5.495	1	0.019
Intermediate	0.682	0.346	3.896	1	0.048
Secondary	0.828	0.325	6.502	1	0.011
University	0	-	-	0	-
Occupation			29.814	6	0.000
Unemployed	-1.219	0.567	4.613	1	0.032
Students	-1.974	0.509	15.020	1	0.000
Farmers	-1.181	0.572	4.257	1	0.039
Self-employed	-0.903	0.554	2.660	1	0.103
Army	-0.177	0.739	0.058	1	0.810
Employee	-0.576	0.494	1.358	1	0.244
Professional	0	-	-	0	-
Constant	1.722	0.580	8.817	1	0.003

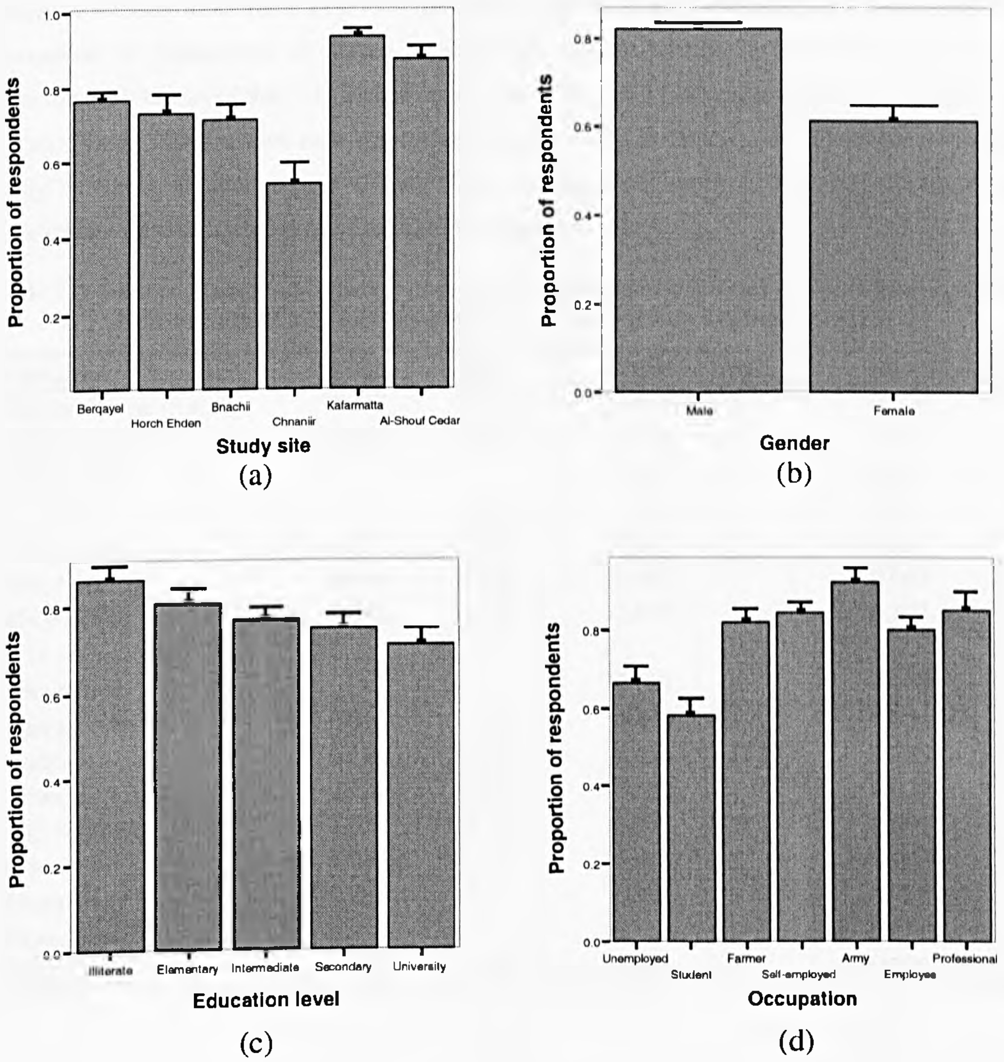


Figure 7.5. The importance of (a) study site, (b) gender, (c) age group and (d) occupation in explaining the proportion of respondents who knew stories that portrayed a negative image of striped hyaena, based on logistic regression.

7.3.2.2 Positive images of striped hyaenas

During individual interviews, very few (2.1%) of the 797 respondents knew of the story that portrayed a positive image of striped hyaenas (Figure 7.4), and none of the explanatory factors played any role ($P>0.05$) in determining the likelihood of respondent's knowing such stories.

7.3.2.3 Men being brave

During individual interviews, few (31.0%) of the 797 respondents overall knew of stories that portrayed a positive image of the bravery of men meeting striped hyaenas (Figure 7.4). The overall model for factors that might have determined whether or not respondents knew of such stories explained 71.7% of the variance, with an ROC value of 0.728, indicating a strong fit to the model. Landscape, gender, age and occupation of respondents all played an important role in determining the likelihood of respondents knowing such stories (Table 7.3). Hence respondents from rural landscapes were most likely to know such stories (Figure 7.6a), as were male respondents (Figure 7.6b). In contrast, fewer younger respondents were likely to know of such stories (Figure 7.6c). Furthermore, more farmer, self-employed and army respondents were likely to know of such stories (Figure 4.6d).

Table 7.3. Factors determining whether or not respondents knew of stories that portrayed a positive image of the bravery of men meeting striped hyaenas, based on logistic regression.

Variables	**B**	**S.E.**	**Wald**	**df**	**Significance**
Site landscape (Rural)	1.347	0.375	12.886	1	0.000
Gender (male)	0.700	0.303	5.336	1	0.021
Age groups			13.975	1	0.007
< 24 yrs	0.937	0.326	8.249	1	0.004
25<yrs<34	-0.821	0.247	11.028	1	0.001
35<yrs<44	-0.461	0.250	3.408	1	0.065
45<yrs<54	-0.461	0.282	2.670	1	0.102
> 55 yrs	0	-	-	0	-
Occupation			30.607	6	0.000
Unemployed	0.318	0.472	0.453	1	0.501
Students	0.143	0.525	0.074	1	0.785
Farmers	0.920	0.406	5.128	1	0.024
Self-employed	1.320	0.390	11.438	1	0.001
Army	1.045	0.459	5.198	1	0.023
Employee	0.138	0.424	0.106	1	0.745
Professional	0	-	-	0	-
Constant	-2.773	0.599	21.456	1	0.000

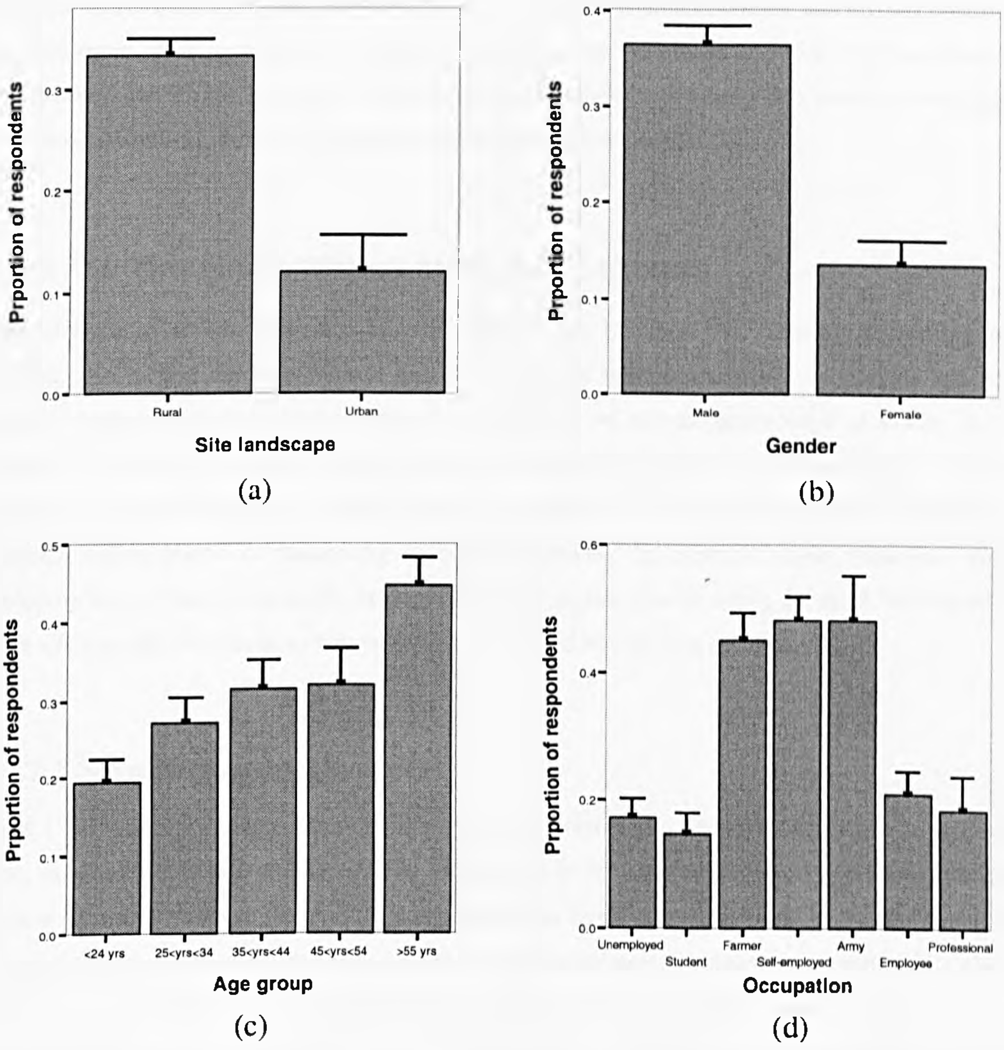


Figure 7.6. The importance of (a) site landscape, (b) gender, (c) age group and (d) occupation in explaining the proportion of respondents who knew stories portrayed a positive image of the bravery of people meeting striped hyaenas, based on logistic regression.

7.4 Discussion

This is the first study to demonstrate the thriving diversity of stories about striped hyaenas. Although stories and myths about striped hyaena are widely known, both in historical Arabic texts (Chapter 2), and across their range (Satunin 1905, Bodenheimer 1920, 1935 *cited in* Rieger 1978, Dart 1956, Harrison and Bates 1991, Qraqaz et al. 2004), this study has explored in some detail the knowledge of these stories across a wide sample of respondents in Lebanon, that might in turn play a key role in explaining and resolving conflicts between striped hyaenas and people. Hyaena stories were widely known among the Lebanese people, and most people interviewed knew of at least one such story. However, most of these stories portrayed striped hyaenas in a negative light, whether as cruel animals that kill people using different techniques, or as grave robbers, or as cowards that attack women and kidnap children, or that possess supernatural power that put fear into their victims' hearts. In contrast, only one story is known that portrays the striped hyaena as a good animal, even though this story also portrays the striped hyaena as a beast. Moreover, this story was known by relatively few people.

7.4.1 Stories about striped hyaena in Lebanon

Striped hyaenas are the largest carnivore remaining in Lebanon. As, scavengers, feeding mainly on carrion, also having the reputation of grave robbers, and with an unearthly cry, striped hyaenas are the perfect characters around which stories and myths can be woven. Knowledge of stories about striped hyaena was widespread across the six study sites, and only 20.3% of respondents did not know of any stories about striped hyaenas. Some stories are better known among respondents, including those of hyaenas killing people or possessing supernatural powers. In contrast, others were less well known, including stories that portrayed the bravery of men or striped hyaena eating the dead. Furthermore, others were site-specific like the story that portrayed the striped hyaena as a good animal.

7.4.1.1 Negative image of hyaenas

Most (79%) stories collected from elderly residents portrayed a negative image of the striped hyaena, most of which described striped hyaenas killing people or using supernatural powers to overcome their victims. Some of these stories had the same themes as those that were found in the old Arabic literature (Chapter 2), for example the themes of hyaenas as grave robbers or attracting animals, while other themes were somewhat modified but still portrayed the negative images of striped hyaena.

Stories that portrayed the negative image of striped hyaenas were widespread among residents in the study sites (Figure 7.4). A likely explanation is that work is seasonally dependent in rural areas. People have less to do in winter and spend more of their time in social gatherings meeting at a friend's house to spend the evening. Moreover in winter hyaenas range closer to human settlement in search for food (Chapter 5), so someone might see or kill a hyaena that in turn will become the dominant subject for discussion during the whole evening. Everyone will talk about the hyaena, tell of his experience and what he knows about striped hyaenas, so further spreading these stories.

Furthermore, when a hyaena is killed in a rural area, the people will gather to see this beast of which they had heard in their fairy tales. I witnessed a hyaena kill in Kafarmatta, where people almost from the entire village gathered to see it (Plate 6.1). Elders were also there, who started talking about their experience with hyaenas, about stories told by their elders and about incidents that happened to them or to their relatives. Hence, these stories will pass from one person the other. In contrast, people living in cities and urban areas are less social and gather less frequently since they work all year round. Moreover, they rarely gather to see a killed hyaena. When residents in the urban site were asked during individual interviews whether they had seen the striped hyaena killed in their neighbourhood, few responded positively. Even when hyaenas were being trapped in the urban site of Chnaniir (Chapter 5), I called on local residents to see the hyaena and the trapping process, but very few responded. This probably explains why people in urban areas were least likely to know stories about striped hyaenas (Figures 7.5a, 7.6a).

Male residents were more likely to know more stories that portrayed a negative image of striped hyaenas (Figure 7.5b), as were illiterate residents (Figure 7.5c). Most of the illiterate respondents are elders (Appendix VI) who might have accumulated many stories throughout their life, while educated respondents may be less likely to believe in such stories. Furthermore, more males are likely to gather at a hyaena kill, and so will hear and generate more stories about the killed hyaena.

It was interesting that students were least likely to know of stories about striped hyaenas (Figure 7.5d). This suggests that these stories are less transmitted across generations than previously. This may be explained by the changing social lives of families these days, the influence of modernization on young people and the easy access to the new technology such as computers, internet and television. A 61 year-old male resident from Kafarmatta said:

> *"In the past during winter we used to gather all the family and the neighbours beside the fire place and the kids would be around listening to and sharing in our conversation. But these days, with presence of computers and internet, the younger generation has their own life.*

7.4.1.2 Men being brave

A few (22%) of the stories collected from elderly informants portrayed a positive image of the bravery of people meeting a striped hyaena Moreover, such stories were known by fewer (31%) respondents, and mainly those living in rural landscape (Figure 7.4). When the stories were being collected, elderly informants narrated these stories in a different tone of voice, giving the impression of strength in which their voices became rough and loud (see photo on the cover page of this chapter). Moreover, any young people present were very attracted by these stories and happy to hear about the bravery of their ancestors. People living in rural areas still appreciate stories that relate to the bravery of men and stories that tell of what brave men have done. Furthermore, people in rural areas still appreciate the role of adult males in their traditional societies, and these stories can be seen in such a context of elders and their accumulated knowledge.

Stories that describe hyaenas killing people may raise fears, and negative attitudes towards striped hyaenas, which in turn may result in retribution being taken on local hyaena populations. Moreover, stories of brave men killing hyaenas might have encourage people to kill hyaenas to prove their strength and bravery. Furthermore, the media have a clear role in propagating such 'heroic' acts (see Chapter 3). The media will describe the hyaena as the beast which invaded the village and planted fear in women's and children's hearts, and will also describe the man who killed the hyaena as the hero who saved the village from this beast. Such descriptions may have further promoted negative attitudes and encouraged the indiscriminate killing and persecution of hyaenas, as previously suggested in Jordan and in Saudi Arabia (Nader and Buttiker 1982, Bunaian et al. 2001, Qarqaz et al. 2004). Likewise, the mass media in Norway has encouraged negative attitudes towards wolves and bears, by publishing articles that describe them as dangerous animals (Roskaft et al. 2003).

7.5 Summary

1) During focal group discussions, elders told 14 different types of stories about striped hyaenas that could be classified under six main themes. Eleven story types (and four of the themes) portrayed the striped hyaena in a negative light, while one story type (and theme) portrayed the striped hyaena in a positive light, and two story types (and one theme) showed men being brave towards striped hyaenas.
2) During interviews, it became clear that many more (77.0%) local respondents knew stories that portrayed striped hyaenas in a negative light, than did the very few (2.1%) respondents who knew stories that portrayed striped hyaenas in a positive light, or the 31.0% or respondents that knew of stories that portrayed a positive image of the bravery of men meeting striped hyaenas.

The next chapter will explore the attitudes currently held by local people towards striped hyaenas and what factors, whether stories or socio-economic considerations, determined those attitudes.

Chapter 8

LOCAL ATTITUDES AND SUPPORT

For locals good hyaenas are dead hyaenas

8.1 Introduction

A critical aspect to achieving successful carnivore conservation is to resolve conflicts between carnivores and people (Treves and Karanth 2003). Part of this requires resolving diverging economic interests, while another part is more complex and requires analysis of cultural, social and political factors to achieve a full understanding of this conflict. Concerns over safety, and the protection of life and property, have always been a priority for rural people living among wildlife. In broad and simplistic terms, people have evolved two types of attitude towards animals. Positive attitudes occur when the species in question offers advantages and incentives to people, and negative attitudes occur when the species in question causes threats (Diamond 1993, Ulrich 1993). Hence, the harbouring of negative attitudes towards carnivores does not always have to involve economic interests. Moreover, much of fear of carnivores is irrational and unrealistic, but has an adaptive value in our evolutionary past (Hawkes et al. 1995). Furthermore, understanding human attitudes towards carnivores, and the biological and cultural factors that influence their successful conservation, are vital.

Carnivores can threaten people and their property, and these are the main reasons for the urgent focus worldwide on people-carnivore conflict (Woodroffe 2000, Sillero-Zubiri and Laurenson 2001, Zimmermann et al. 2005). Such conflicts have caused negative attitudes among local people towards carnivores, and even among some people who work in for conservation (Treves and Karanth 2002). Human-carnivore conflict is a global issue and it occurs wherever carnivores and people seek to co-exist. This conflict is on the increase with increasing human populations, farming, and agriculture, all of which are resulting in habitat loss for carnivores and for carnivore prey, bringing carnivores into further conflict with people (Jackson and Nowell 1996, Mech 1998, Rajpurohit and Krausman 2000, Woodroffe 2000, Treves et al. 2002, Naughton-Treves et al. 2003). Furthermore, when carnivore populations are allowed to recover through changing land use practices (Mladenoff et al. 1997), or through successful reintroduction programmes (Breitenmoser 1998, Davies and du Toit 2004), conflicts between people and carnivores can escalate.

Attitudes towards carnivores have been largely negative and threaten their future co-existence with people. The physical appearance and behaviour of large carnivores can affect how people perceive and value them (Kellert 1993). Moreover, attacks on people by large carnivores may hinder their conservation, and this can result in more entrenched negative attitudes and more illegal killing (Woodroffe and Ginsberg 1998, Roskaft et al. 2003, Gunther et al. 2004, Leo and Roskaft 2004). Indeed, negative attitudes towards large carnivores are often based on concerns for personal security, on healthy respect for, and loyalty towards elders and their traditions, and for social income and social power (Kaltenborn and Bjerke 2002).

Understanding the factors that influence attitudes towards carnivores is important for their conservation. Many such studies have been carried out and continue to be so, for example those describing human fear of large carnivores (Bjerke and Kaltenborn 1999, Roskaft et al. 2004). Several authors have studied human conflicts with big cats (see Leo and Roskaft 2004). In the Gir Forest, India the majority of people expressed hostility towards the presence of lions (*Panthera leo*) near their villages, because of the threats that lions can pose to human lives and livelihoods (Saberwal et al. 1994). Similar attitudes were reported for the man-eating tigers (*Panthera tigris tigris*) in Nepal (McDougal 1987) and India (Seidensticker et al. 1976), for cougars (*Panthera pardus*) in the US (Conard 1992), and for leopards (*Puma concolor*) in India (Mohan 1997).

Similarly, Zimbabweans hold negative attitudes towards having wild dogs (*Lycaon pictus*) in their area, primarily for fear of livestock depredation (Davies and du Toit 2004). Likewise, perceptions towards wolves (*Canis lupus*) have been studied intensively, and fear of wolves plays an important role in establishing negative attitudes through out the range of wolves in North America (Hook and Robinson 1982), in Japan (Kanzaki et al. 1996), and in Europe (Bjerke et al. 2001, Roskaft et al. 2003, Kleiven et al. 2004). Brown bears (*Ursus arctos*) were considered the most dangerous and fearsome animal by Norwegians (Roskaft et al. 2003, Keleiven et al. 2004), by Slovenians (Kaczensky et al. 2004), and by Latvians (Andersone and Ozolins 2004). Similar attitudes were held by Americans and Canadians towards black (*Ursus americanus*) and grizzly (*Ursus arctos*) bears (Herrero and Higgins 2003, Gunther et al. 2004).

Moreover, several studies have demonstrated that attitudes towards carnivores may be delineated by demographic and socioeconomic factors, including age, gender, education level, occupation and income (Oli et al. 1994, Kellert et al. 1996). Indeed, several authors have shown that many women, many people of old age, many rural residents, and many ranchers and farmers, hold negative attitudes towards carnivores. In contrast, those with a good education and with high income levels mostly hold positive attitudes towards carnivores (Kellert et al. 1996, Bjerke et al. 1998, Breitenmoser 1998, Swenson et al. 2000, Williams et al. 2002, Ericsson and Heberlein 2003, Roskaft et al. 2003, Kleiven et al. 2004).

In contrast with many groups of carnivores, attitudes towards members of the Hyaenidae family have been less well studied. The striped hyaena, with its unearthly laughing cry and its unpleasant reputation as a grave robber (MacDonald 2001, Lewis et al. 1968), has long been an object of hatred and superstition (Harrison and Bates 1991). Previous studies (see Rieger 1978) have also reported attacks by striped hyaenas on children in Russia, India and Israel, while others have reported superstitious fear towards striped hyaenas (Satunin 1905, Bodenheimer 1920, 1935 *cited in* Rieger 1978).

In previous chapters, I have explored local knowledge of striped hyaenas and of stories and myths about striped hyaenas, in Lebanon. Many respondents claimed to have seen striped hyaenas in the wild, and they generally knew about their foraging behaviour and diet. Furthermore, most respondents considered that the striped hyaena population in Lebanon was decreasing, but they were more evenly divided about their threatened status (Chapter 6). In addition, I found that most people knew stories about hyaenas and most of these stories portrayed a negative image of striped hyaena (Chapter 7). Therefore, gaining further understanding of attitudes and fears is important for future approaches to conserving striped hyaenas (Kellert et al. 1996). In this chapter, I aim to examine attitudes of local people within the six study sites towards striped hyaenas, and the factors that influence these attitudes by asking the following questions:

- to what extent do rural people hold positive and negative attitudes towards striped hyaenas, and to what extent do they support striped hyaena conservation?; and
- what factors best explain those attitudes towards, and support for striped hyaenas?

8.2 Methods

Information on local attitudes towards striped hyaenas was collected from focal group discussions, and from individual interviews (see Chapter 2), in each study site.

8.2.1 Questionnaire interview

Thirteen questions of the main questionnaire interview conducted across the six study sites from March 2002 to October 2002 sought to explore local attitudes towards the striped hyaena before any research was conducted, or any workshops were held, in their areas. Six dichotomous questions requiring positive or negative responses were asked to determine whether respondents considered the striped hyaena as a harmful animal, whether they had heard of attacks on people by hyaenas, whether they feared encountering hyaenas in the wild, whether they considered the striped hyaena as a dangerous animal or a beneficial animal, and whether they supported conserving the striped hyaena. Two other non-dichotomous questions sought to explore respondents' views on the likely reaction of striped hyaena if they encountered people, and the likely reaction of respondents if they encountered a striped hyaena in the wild. Finally, four non-dichotomous questions sought to understand reasons why local people held the attitudes they did.

8.2.2 Statistical analysis

The Statistical Programme for the Social Sciences (SPSS) for Windows version 12.0.1 was used to conduct a statistical analysis to determine which factors might explain respondents' attitudes towards striped hyaenas. The statistical data for each theme were first analysed using descriptive statistics, and responses were compared using Chi-square test, but these were not shown for reasons of space. Based on the initial tests, multivariate analyses, using logistic regression were then performed to model responses, as these provide a convenient way to undertake categorical data analyses. Forward Wald logistic regression was used to specify the model with a significance of $P<0.05$. Dichotomous questions were given a dummy of 1 if respondents' answers were positive and 0 if respondents' answers were negative, and these responses were taken as the dependent variable. The explanatory variables for the analyses included both factors relevant to the study site, and to individual respondents. Factors relevant to study site comprised: which site, whether a rural or urban landscape, its protected or non-protected status, and the relative abundance of striped hyaenas (Chapter 3). Factors relevant to individual respondents comprised: their gender, age, education level, occupation, monthly income, their claims to have seen a striped hyaena (Chapter 6), and their knowledge of stories about striped hyaenas (Chapter 7). The likelihood ratio goodness of fit test of the model was described using Chi-square goodness of fit statistics. Model performance on the testing sets was evaluated by calculating the area under the curve (AUC) of receiver operation characteristics (ROC) plots. ROC values range from 0.5 to 1.0. Values above 0.7 indicate strong model fit, while those above 0.9 indicate a highly accurate model (Swets, 1988).

8.3 Results

8.3.1 Is the striped hyaena a harmful animal?

During focal group discussions, many elderly residents across the different study sites reported that striped hyaenas are harmful to people and their property. During interviews, most (82.1%) respondents overall considered striped hyaenas as harmful animals. The overall model for factors that might have determined the likelihood of respondents considering the striped hyaena as harmful explained 82.1% of the variance, with an ROC value of 0.672, indicating a satisfactory fit to the model. Gender, age, education level and their knowledge of stories that portrayed a positive image of striped hyaenas played the most important role in determining their attitudes (Table 8.1). Hence, male respondents (Figure 8.1a) and respondents of between 35-44 years of age (Figure 8.1b) were least likely to consider striped hyaenas as harmful. In contrast, increasingly less well-educated respondents were more likely to consider striped hyaenas as harmful (Figure 8.1c). Finally, respondents who knew stories showing a positive stories of striped hyaenas were least likely to consider striped hyaenas as harmful (Figure 8.1d).

Table 8.1. Factors determining whether or not respondents considered striped hyaenas as harmful animals, based on logistic regression.

Variables	B	S.E.	Wald	df	Significance
Gender (male)	-0.722	0.258	2.673	1	0.005
Age group			17.490	4	0.002
< 24 yrs	0.556	0.348	2.673	1	0.104
25<yrs<34	0.198	0.325	0.371	1	0.543
35<yrs<44	-0.565	0.305	3.422	1	0.064
45<yrs<54	-0.353	0.342	1.063	1	0.302
> 55 yrs	0	-	-	0	-
Education level			14.448	4	0.006
Illiterate	1.643	0.466	12.441	1	0.000
Elementary	0.773	0.327	5.583	1	0.018
Intermediate	0.364	0.254	2.054	1	0.152
Secondary	0.260	0.284	0.835	1	0.361
University	0	-	-	0	-
Positive image	1.183	0.533	4.932	1	0.026
Constant	0.545	0.650	0.702	1	0.402

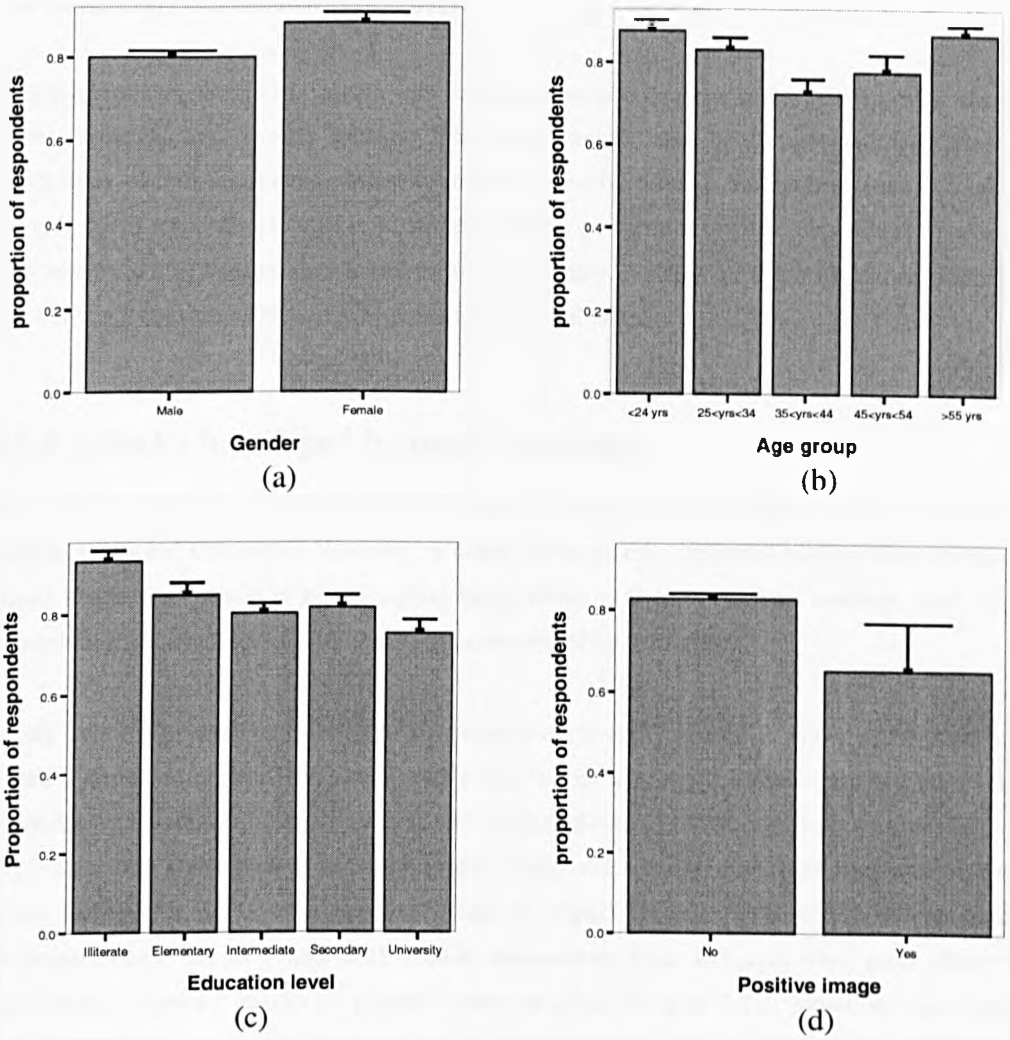


Figure 8.1. The importance of (a) gender, (b) age group, (c) occupation and (d) stories portraying a positive image of striped hyaena in explaining the proportion of respondents who considered striped hyaenas as harmful animals, based on logistic regression.

8.3.2 Reasons for considering the striped hyaena as a harmful animal

During focal group discussions, elderly residents said they considered striped hyaenas as harmful because they can attack people and cause them injuries. However, few informants reported having witnessed a striped hyaena attack on people, but referred their knowledge of such attacks to stories told by their elders. In contrast, very few informants stated that striped hyaenas cause damage to farm animals. Indeed, elderly residents considered striped hyaenas much less harmful towards farm animals than wolves. Most informants described striped hyaenas as weak animals that cannot run after their prey, although they might kill animals that are weak or tied to ropes. Indeed, a few informants reported having witnessed striped hyaenas attacking tethered donkeys and dogs.

During interviews, those respondents who considered striped hyaenas as harmful animals, attributed this to two main factors, namely because they attack people and harm farm animals. Most (44.3%) respondents overall considered striped hyaenas as harmful animals for both reasons combined, while fewer (37.9%) respondents considered striped hyaenas as harmful because they attack people only, and even fewer (14.5%) because they harms farm animals only. Equally, very few (3.2%) respondents had no idea why they considered the striped hyaena as a harmful animal.

8.3.3 Attacks by striped hyaenas on people

During focal group discussions, elderly residents across the different study sites reported that striped hyaenas attack and kill people. However, as noted above, no one confirmed having witnessed an attack by striped hyaenas on people or of any person being killed by hyaenas. On the contrary, most respondents referred their knowledge to stories that they had been told by their elders.

During interviews, relatively few (27.9%) respondents overall claimed to know of reported attacks by striped hyaenas on people. The overall model for factors that might have determined the likelihood of respondents claiming to know of such attacks explained 72.5% of the variance, with an ROC value of 0.685 indicating a satisfactory fit to the model. Study site, gender, education level and the number of stories known that portrayed a negative image of striped hyaena, played the most important role in determining their claims (Table 8.2). Hence, respondents from Berqayel were most likely to claim knowledge of reported attacks by striped hyaena on people (Figure 8.2a). Moreover, male respondents were least likely to claim knowledge of reported attacks by striped hyaenas on people (Figure 8.2b). Furthermore, respondents who had elementary education (Figure 8.2c), and respondents who knew increasing numbers of stories that portrayed negative image of striped hyaena (Figure 8.2d) were most likely to claim knowledge of reported attacks by striped hyaenas on people.

Table 8.2. Factors determining claims by respondents of reported attacks by striped hyaena on people, based on logistic regression.

Variables	B	S.E.	Wald	df	Significance
Study site			16.247	5	0.006
Berqayel	0.448	0.286	2.452	1	0.117
Horch Ehden	-0.312	0.389	0.643	1	0.422
Bnachii	-0.010	0.326	0.001	1	0.977
Chnaniir	-0.404	0.388	1.085	1	0.298
Kafarmatta	-0.527	0.346	2.327	1	0.127
Al-Shouf Cedar	0	-	-	0	-
Gender (male)	-0.915	0.199	21.165	1	0.000
Education level			12.720	4	0.013
Illiterate	-0.174	0.337	0.266	1	0.606
Elementary	0.684	0.302	5.136	1	0.023
Intermediate	0.483	0.264	3.335	1	0.068
Secondary	0.074	0.286	0.068	1	0.794
University	-	-	-	0	-
Number of negative image stories			20.988	5	0.001
0	-1.579	0.382	17.098	1	0.000
1	-1.168	0.359	10.587	1	0.001
2	-0.993	0.356	7.775	1	0.005
3	-1.307	0.395	10.922	1	0.001
4	-0.488	0.477	1.049	1	0.306
>4	0	-	-	0	-
Constant	0.529	0.445	1.410	1	0.235

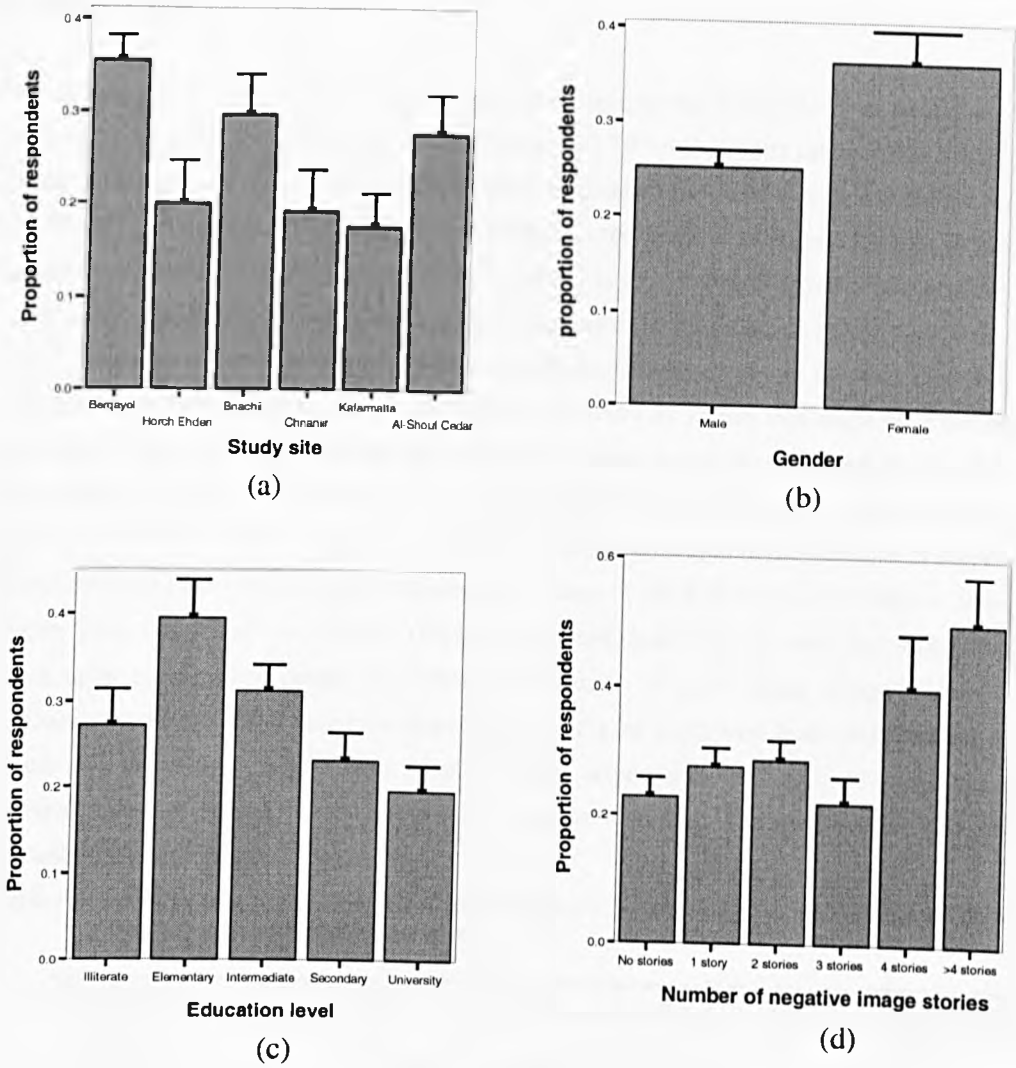


Figure 8.2. The importance of (a) study site, (b) gender, (c) education level, and (d) the number of stories they know that portrayed a negative image about striped hyaena in explaining the proportion of respondents who knew of reported attack by striped hyaena, based on logistic regression.

8.3.4 Reaction of striped hyaenas to people

During focal group discussions, elderly residents across the different study sites noted ways that a striped hyaena might attack upon encountering people. It either attacks straight away or it accompanies the person until it finds an opportunity to attack them. Respondents claimed that striped hyaenas will attack people only at night, and referred to the famous saying that, by day the hyaena is a hyaena, which is the symbol of a coward animal, but by night is a lion, the symbol of a strong animal (see also Chapter 7). However, people can escape from the hyaena by running to their villages or by throwing stones to force it to run away. In contrast, only a few elderly residents reported that a striped hyaena will run away when it encounters people.

During interviews, many (46.5%) respondents overall thought that a striped hyaena would attack straight away upon encountering people. In contrast, fewer (27.7%) respondents thought that a striped hyaena would run away, even fewer (17.9%) thought that a striped hyaena would accompany people, while a very few (7.8%) had no idea. The views of respondents on the reaction of striped hyaenas to encountering people were pooled into those resulting in an attack and in a neutral response, while respondents who had no idea were removed from the analysis as their response does not represent any of the above categories. Attack responses included an immediate attacking and accompanying people to attack them later, while a neutral response comprised running away. The overall model for factors that might have determined how respondents thought a striped hyaena might react to encountering people explained 71.8% of the variance, with an ROC value of 0.690 indicating a close to strong fit to the model. Study site, gender, age, claiming to have seen a striped hyaena, and knowledge of stories that portrayed negative image of striped hyaenas, played the most important role in determining their views (Table 8.3). Hence, respondents from Chnaniir (Figure 8.3a) and female respondents (Figure 8.3b) were most likely to think that striped hyaena will attack upon encountering people. In contrast, respondents of 35-44 years of age (Figure 8.3c), and respondents who claimed to have seen striped hyaenas (Figure 8.3d), were least likely to think that striped hyaena will attack upon encountering people. Finally, respondents who knew of stories that portrayed negative image of striped hyaena were most likely to think that a striped hyaena will attack upon encountering people (Figure 8.3e).

Table 8.3. Factors determining thoughts of respondents on the reaction of striped hyaena to encountering people, based on logistic regression.

Variables	B	S.E.	Wald	df	Significance
Study site			22.968	5	0.000
Berqayel	-0.288	0.280	1.060	1	0.303
Horch Ehden	-0.469	0.366	1.643	1	0.200
Bnachii	0.412	0.352	1.369	1	0.242
Chnaniir	1.025	0.434	5.584	1	0.018
Kafarmatta	0.390	0.338	1.333	1	0.248
Al-Shouf Cedar	0	-	-	0	-
Gender (male)	-0.472	0.231	4.168	1	0.041
Age group			11.291	5	0.023
< 24 yrs	0.285	0.280	1.037	1	0.309
25<yrs<34	-0.158	0.253	0.388	1	0.533
35<yrs<44	-0.555	0.251	4.880	1	0.027
45<yrs<54	-0.365	0.286	1.627	1	0.202
> 55 yrs	0	-	-	0	-
Seen a striped hyaena	-0.719	0.220	10.709	1	0.001
Negative image	0.524	0.221	5.602	1	0.018
Constant	1.266	0.386	10.757	1	0.001

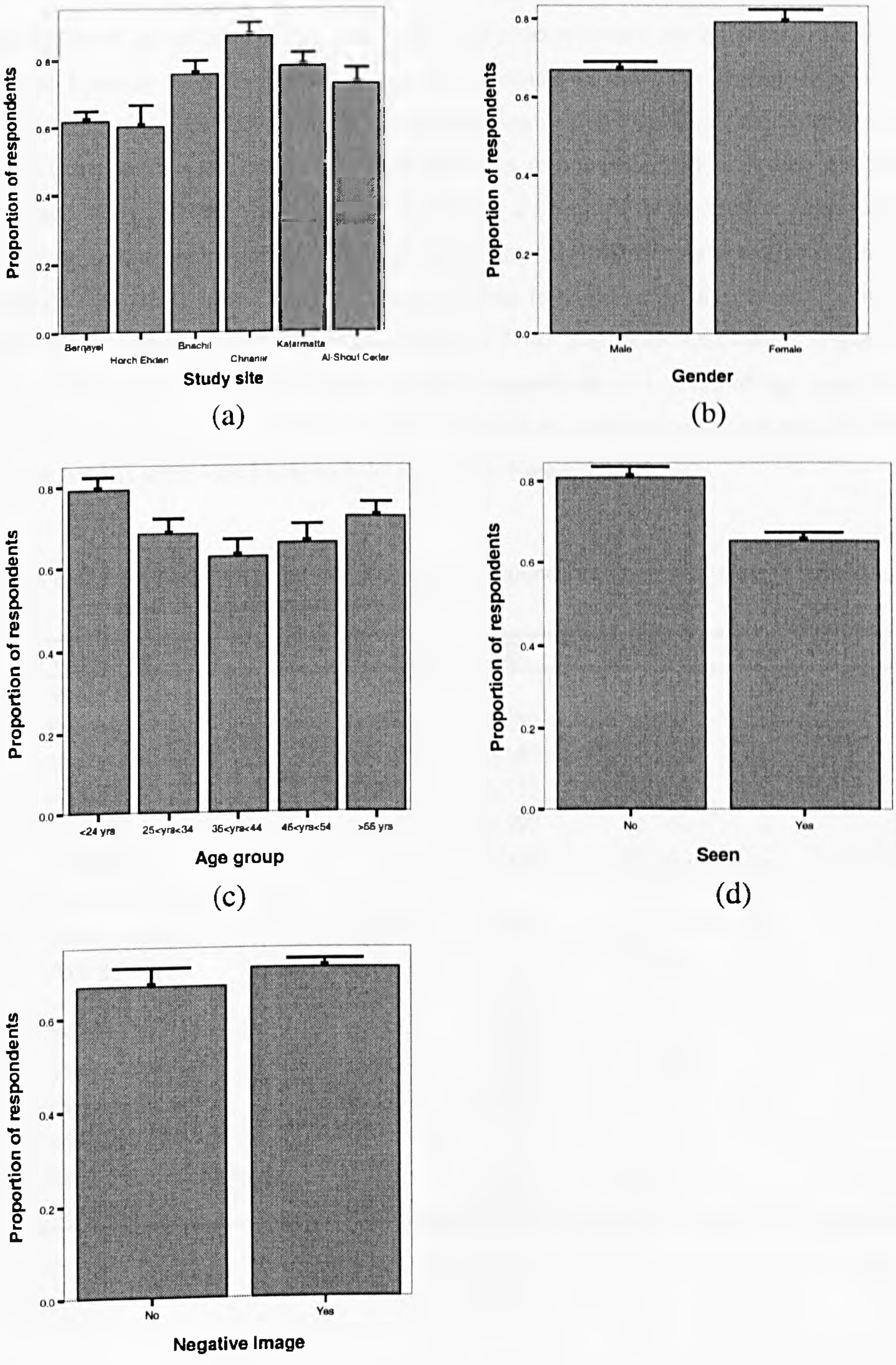


Figure 8.3. The importance of (a) study site, (b) gender, (c) age, (d) claiming to have seen a striped hyaena, and (e) knowledge of stories that portrayed a negative image of striped hyaenas, in explaining the proportion of respondents who thought that striped hyaenas will attack upon encountering people, based on logistic regression.

8.3.5 Fear of encountering the striped hyaena in the wild

During focal group discussions, many elderly residents across the different study sites considered the striped hyaenas as a frightening animal to encounter in the wild. During interviews, most (72.3%) respondents also reported their fear of encountering striped hyaenas in the wild. The overall model for factors that might have determined whether or not respondents held such fears explained 74.3% of the variance, with an ROC value of 0.734 indicating a strong fit to the model. Study site, gender, age and claiming to have seen a striped hyaena played the most important role in explaining their fear (Table 8.4). Hence, respondents from Chnaniir were most likely to hold fears of encountering a striped hyaena in the wild, while respondents from Berqayel (Figure 8.4a), and male respondents (Figure 8.4b), were least likely to hold such fears. Moreover, younger respondents <24 years of age were most likely to fear encountering a striped hyaena in the wild (Figure 8.4c), while respondents who claimed to have seen a striped hyaena were least likely to hold such fears (Figure 8.4d).

Table 8.4. Factors determining the attitudes of respondents to encountering a striped hyaena in the wild, based on logistic regression.

Variables	B	S.E.	Wald	df	Significance
Study site			29.069	5	0.000
Berqayel	0.785	0.270	8.422	1	0.004
Horch Ehden	1.306	0.389	11.266	1	0.001
Bnachii	1.499	0.352	18.170	1	0.000
Chnaniir	1.424	0.399	12.761	1	0.000
Kafarmatta	1.376	0.338	16.540	1	0.000
Al-Shouf Cedar	0	-	-	0	-
Gender (male)	-1.249	0.290	18.557	1	0.000
Age group			10.180	4	0.038
<24 yrs	0.799	0.277	8.293	1	0.004
25<yrs<34	0.437	0.253	2.982	1	0.084
35<yrs<44	0.235	0.255	0.849	1	0.357
45<yrs<54	0.035	0.285	0.015	1	0.902
<55 yrs	0	-	-	1	-
Seen a striped hyaena	-1.025	0.236	18.820	1	0.000
Constant	0.497	0.419	1.408	1	0.235

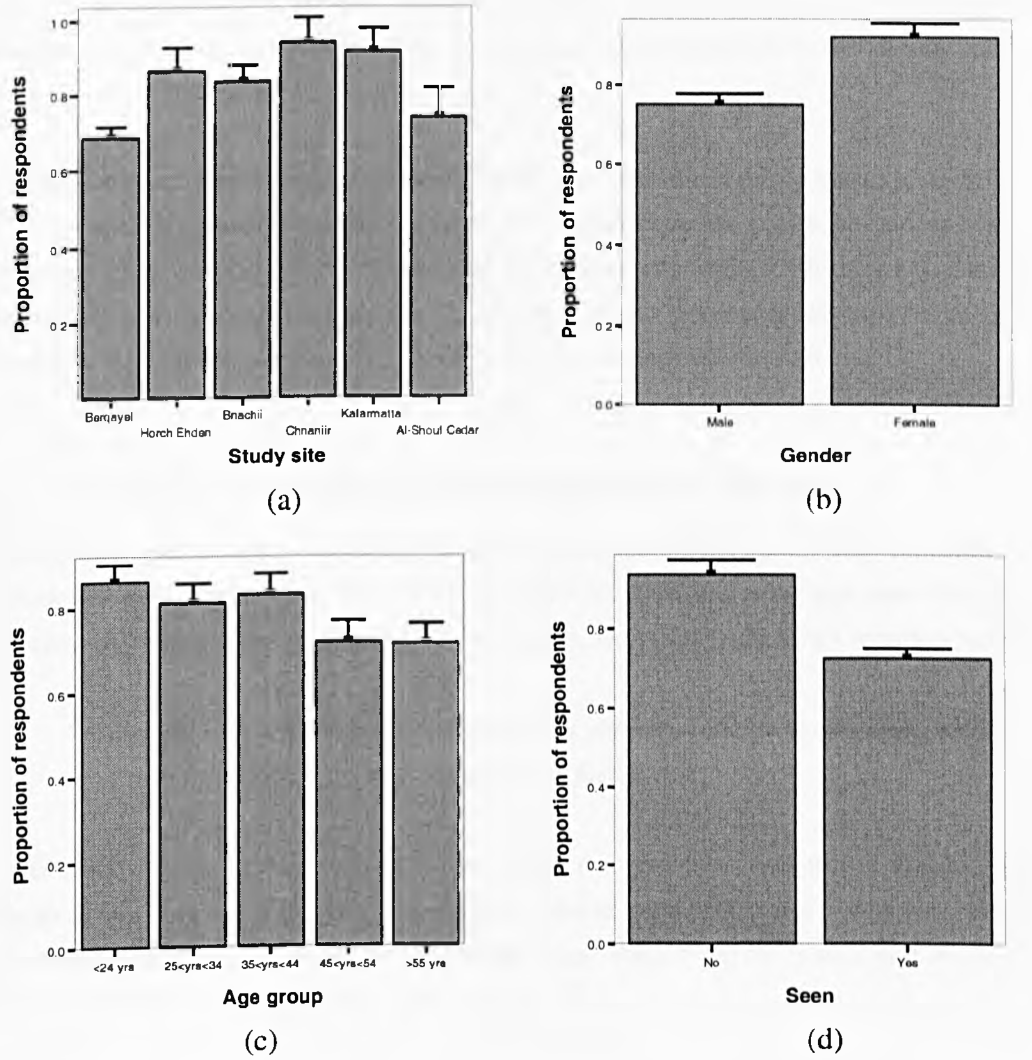


Figure 8.4. The importance of (a) study site, (b) gender, (c) age group, and (d) seeing a striped hyaena in explaining the proportion of respondents who feared encountering striped hyaena in the wild, based on logistic regression.

8.3.6 Reasons for fearing an encounter with a striped hyaena in the wild

During focal group discussions, elderly residents said they were frightened of encountering striped hyaenas in the wild for two reasons. First, their fear arose because striped hyaenas are large carnivores that can kill people. Second, stories told by their own elders had described striped hyaenas as bad and fearsome animals. A 52 year-old male from Kafarmatta explained why people feared striped hyaenas, as follows:

"Fear of striped hyaenas is inherited. In places where high levels of illiteracy persist, traditional stories portraying animals as beasts will result in raising fear of these animals. Moreover, this fear is transmitted from parents to their children".

During interviews, respondents who were frightened of encountering a striped hyaena in the wild gave two reasons for their fear, namely the bad reputation of striped hyaenas, and because striped hyaenas were wild carnivores. Most (50.1%) respondents said they feared encountering a striped hyaena in the wild because of its bad reputation, while fewer (27.2%) said that they feared encountering a striped hyaena because it is a wild carnivore, and slightly fewer (22.7%) for both reasons combined.

8.3.7 Reaction of people to a striped hyaena in the wild

During focal group discussions, elderly residents across the different study sites explained how they would react upon encountering a striped hyaena in the wild. Some informants were more frank than others in expressing their fear and said they would run away. A 56 year-old male from Chnaniir noted as follows:

> *"striped hyaenas are more powerful than man; they are wild carnivores and we know nothing about their behaviour so the best way is to avoid facing them".*

Other elderly residents, however, noted they would react by killing the striped hyaena. They also described how they would shoot the striped hyaena dead or kill it with an axe or with their walking stick. In contrast, others said that striped hyaenas are like dogs, which if you run in front of them, they will run after you, while if you stand still they will run away.

During interviews, respondents expressed three reactions to encountering striped hyaenas in the wild. These reactions included: running away, trying to kill striped hyaena, or standing still. Most (44.7%) respondents said they would react to encountering a striped hyaena in the wild by running away, fewer (33.5%) would react by trying to kill the striped hyaena, and even fewer (14.4%) would react by standing still, while 7.4% of respondents had no idea how they would react.

To further clarify the attitudes of respondents towards striped hyaenas, the answers of respondents were pooled into those that resulted in lethal and non-lethal outcomes for the hyaena. Reactions that included running away and standing still were pooled under non-lethal outcomes, while responses noting killing the striped hyaena were regarded as lethal reactions. During interviews, most (84.5%) respondents overall said they would react in a non-lethal manner to encountering striped hyaena in the wild. The overall model for factors that might have determined the answers of respondents to encountering striped hyaena explained 84.5% of the variance, with an ROC value of 0.667 indicating a satisfactory fit to the model. Gender, age and the number of stories they knew that portrayed a negative image of striped hyaenas, played the most important role in determining their response to encountering striped hyaenas in the wild (Table 8.5). Hence, female respondents were most likely to react in a non-lethal manner to encountering a striped hyaena in the wild (Figure 8.5a). Moreover, younger respondents <35 years of age were most likely to react in a non-lethal manner (Figure 8.5b). Finally, respondents who knew increasing numbers of stories that portrayed a negative image of striped hyaenas were much more likely to react in a non-lethal manner (Figure 8.5c).

Table 8.5. Factors determining answers of respondents on how they would react to encountering striped hyaenas, based on logistic regression.

Variables	B	S.E.	Wald	df	Significance
Gender (male)	-0.661	0.273	5.871	1	0.015
Age group			9.596	4	0.048
<24 yrs	0.429	0.337	1.620	1	0.203
25<yrs<34	0.517	0.334	2.391	1	0.122
35<yrs<44	-0.199	0.304	0.429	1	0.512
45<yrs<54	-0.344	0.343	1.002	1	0.317
<55 yrs	0	-	-	0	-
Number negative image stories			16.198	4	0.006
No stories	-2.111	1.042	4.107	1	0.043
One story	-2.461	1.029	5.717	1	0.017
Two stories	-1.972	1.036	3.619	1	0.057
Three stories	-1.412	1.074	1.727	1	0.189
Four stories	-0.798	1.254	0.405		0.525
> four stories	0	-	-	0	-
Constant	4.153	1.060	15.341	1	0.000

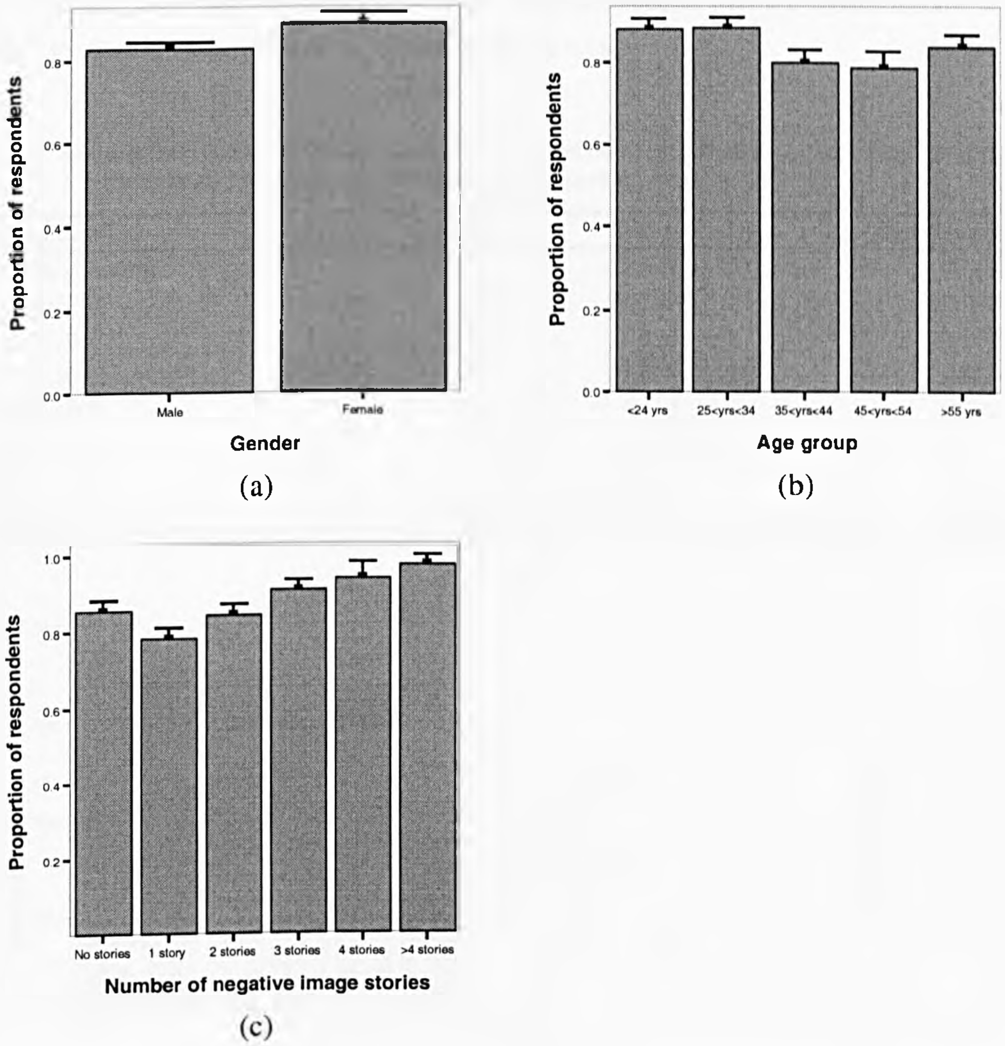


Figure 8.5. The importance of (a) gender, (b) age, and (c) number of stories that portrayed a negative image of striped hyaena known to respondents, in explaining the proportion of respondents who would react in a non-lethal manner to encountering a striped hyaena in the wild, based on logistic regression.

8.3.8 Is the striped hyaena a dangerous animal?

During focal group discussions, many elderly residents across the different study sites reported that striped hyaenas are the most dangerous animal found in Lebanon.

During interviews, most (84.8%) respondents also viewed the striped hyaena as a dangerous animal. The overall model for factors that might have determined whether or not respondents considered the striped hyaena as dangerous explained 84.8% of the variance, with a ROC value of 0.651, which indicates a satisfactory fit to the model. Only monthly income of the respondents appeared to play any important role in explaining their attitudes (Table 8.6). Hence, fewer respondents with the highest income levels were likely to consider striped hyaenas as dangerous (Figure 8.6).

Table 8.6. Factors determining the attitudes of respondents to whether or not they consider striped hyaenas as dangerous, based on logistic regression.

Variables	B	S.E.	Wald	Df	Significance
Monthly income			35.423	5	0.000
US$ 0	2.239	0.455	24.259	1	0.000
<US$ 200	1.806	0.545	11.013	1	0.001
<US$ 500	1.678	0.432	15.066	1	0.000
<US$ 1000	0.935	0.437	4.584	1	0.032
<US$ 1500	1.495	0.627	5.680	1	0.017
>US$ 1500	0	-	-	0	-
Constant	0.154	0.393	0.154	1	0.695

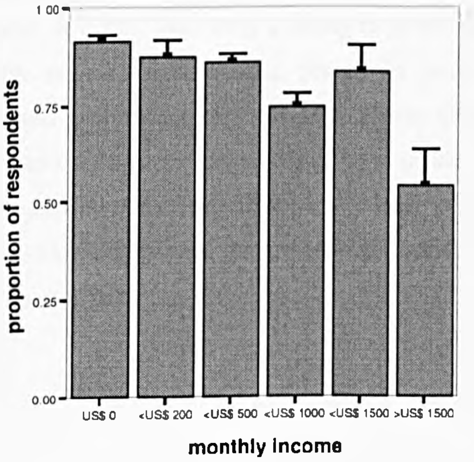


Figure 8.6. The importance of monthly income level in explaining the proportion of respondents who considered striped hyaenas as dangerous animals, based on logistic regression.

8.3.9 Reasons for considering the striped hyaena as a dangerous animal

During focal group discussions, elderly residents said they considered striped hyaenas as dangerous because they can fatally threaten human lives. Informants differentiated between *harmful* and *dangerous*, when noting that any carnivore, from the smallest to the largest, could cause non-fatal harm to people, to their domestic animals, or to their crops. In contrast, striped hyaenas were considered dangerous, and possibly fatally so, to human lives. However, informants' perceptions of the danger of striped hyaenas stemmed mostly from stories told by their own elders, rather than on their own direct experience. When informants discussed the dangers of striped hyaenas, they often said as follows:

"we heard from our elders... or our elders told us..."

During interviews, respondents who considered striped hyaenas as dangerous gave two reasons for their attitudes, namely that an elder had told them, or through their own knowledge and experience. Most (49.7%) respondents considered striped hyaenas as dangerous because an elder had told them. In contrast, fewer respondents considered the striped hyaena as dangerous through their own knowledge and experience (23.6%), or for both reasons combined (26.4%).

8.3.10 Is the striped hyaena a beneficial carnivore?

During focal group discussions, some elders recognised the positive role of striped hyaenas in the environment. During interviews, many (41.9%) respondents overall considered striped hyaenas as beneficial for the environment. The overall model for factors that might have determined whether or not respondents considered the striped hyaena as beneficial explained 67.8% of the variance, with an ROC value of 0.724, indicating a strong fit to the model. Study site, education level, occupation and claims to have seen a striped hyaena, played the most important role in determining their attitudes (Table 8.7). Hence, respondents from Horch Ehden (Figure 8.7a), and increasingly better-educated respondents (Figure 8.7b) were more likely to consider striped hyaenas as beneficial. In contrast, self-employed respondents were least likely to consider striped hyaenas as beneficial (Figure 8.7c), while respondents who claimed to have seen a striped hyaena were most likely to consider striped hyaena as beneficial (Figure 8.7d).

Table 8.7. Factors determining attitudes among respondents on whether or not they considered striped hyaena as beneficial, based on logistic regression.

Variables	B	S.E.	Wald	df	Significance
Study site			22.475	5	0.000
Berqayel	0.193	0.266	0.526	1	0.468
Horch Ehden	0.982	0.347	8.024	1	0.005
Bnachii	-0.362	0.322	1.263	1	0.261
Chnaniir	0.779	0.329	5.614	1	0.018
Kafarmatta	0.531	0.297	3.197	1	0.074
Al-Shouf Cedar	0	-	-	0	-
Education level			27.326	4	0.000
Illiterate	-1.855	0.396	21.939	1	0.000
Elementary	-1.170	0.346	11.459	1	0.001
Intermediate	-0.587	0.289	1.119	1	0.042
Secondary	-0.289	0.275	1.140	1	0.293
University	0	-	-	0	-
Occupation			20.541	6	0.002
Unemployed	-0.611	0.440	1.930	1	0.165
Student	-0.377	0.411	0.842	1	0.359
Farmer	-0.250	0.462	0.293	1	0.588
Self-employed	-0.909	0.438	4.298	1	0.038
Army	0.426	0.503	0.716	1	0.397
Employee	-0.074	0.391	0.036	1	0.849
Professional	0	-	-	0	-
Seen a striped hyaena	-0.373	0.186	4.032	1	0.045
Constant	0.526	0.389	1.831	1	0.176

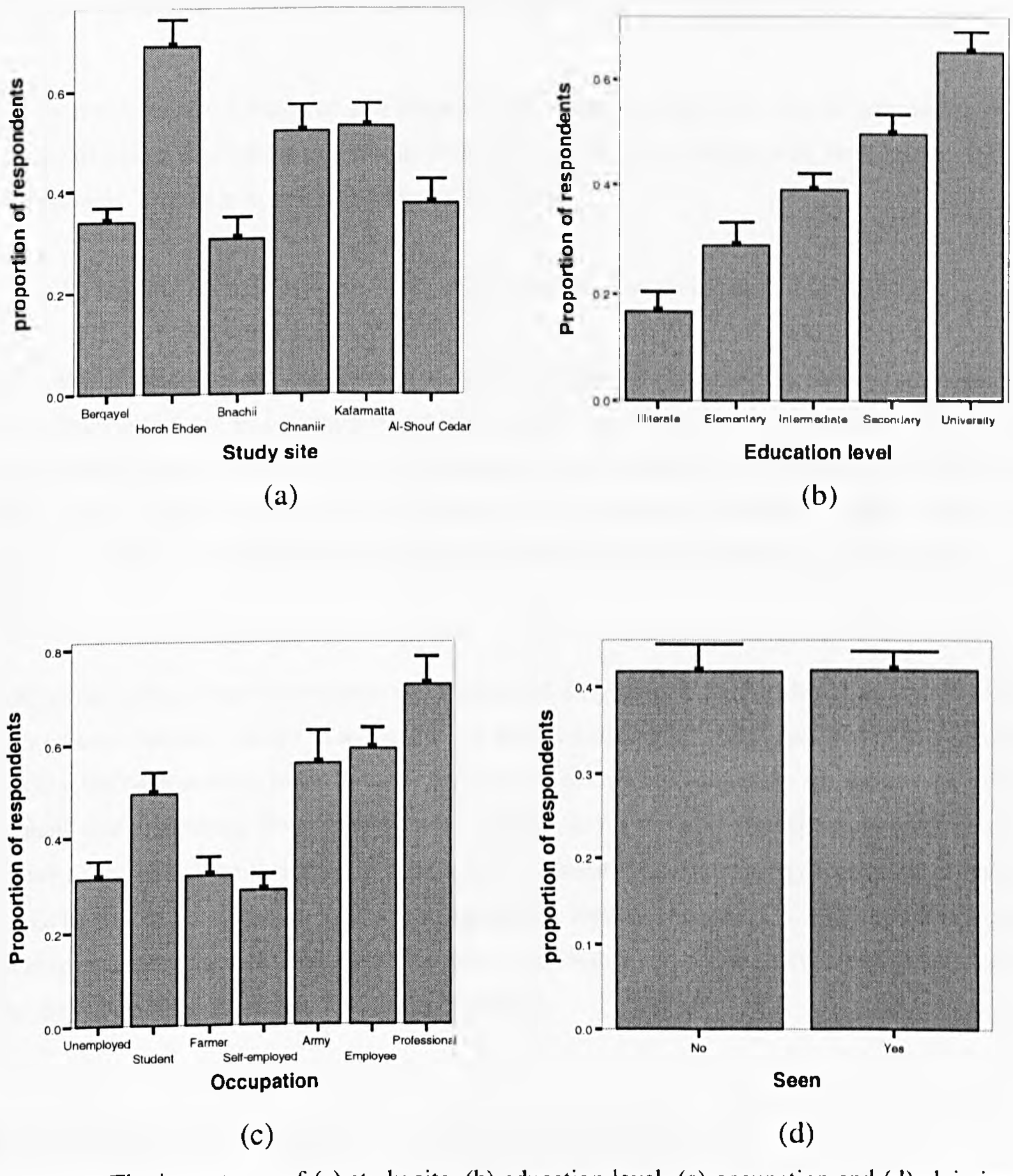


Figure 8.7. The importance of (a) study site, (b) education level, (c) occupation and (d) claiming to have seen a striped hyaena, in explaining the proportion of respondents who considered striped hyaenas as beneficial, based on logistic regression.

8.3.11 Reasons for considering the striped hyaena as a beneficial carnivore

During focal group discussions, elderly respondents who considered striped hyaenas as beneficial reported that the existence of striped hyaenas is vital to the ecosystem. They eat dead animals and so prevent the spread of diseases, and they are important in controlling agricultural pests like wild boars. Only one informant mentioned the medicinal importance of the body parts of striped hyaenas.

Elderly residents also considered that striped hyaenas play an important role in maintaining the natural balance of native ecosystems as a whole, without mentioning any specific role for hyaenas. For example, a 68 year-old informant from Berqayel noted as follows:

> "*if they did not have any role in the environment they might not have been created*".

Other elders mentioned the contribution of striped hyaenas to agriculture by feeding on rodents, insects and wild boar that are increasingly becoming a problem in Lebanon. Furthermore, most elders reported the important role of striped hyaena in cleaning the environment. They said that, with the increase of refuse and garbage dumps and no coherent waste management strategies, striped hyaenas play an important role in cleaning the environment by feeding on garbage, leftovers, domestic waste and dead animals.

During interviews, those respondents who considered the striped hyaena as beneficial attributed this role to three main factors, namely in maintaining a natural balance, for their contribution to agriculture, and cleaning the environment. Many (44.3%) respondents overall considered the striped hyaena as beneficial for their role in cleaning the environment. In contrast, fewer (27.5%) respondents considered the striped hyaena as beneficial for their role in maintaining a natural balance, and very few (4.5%) considered the striped hyaena as beneficial for their role in agriculture. However, several (18.3%) respondents considered the striped hyaena as beneficial for all its roles combined, while a few (5.4%) respondents had no idea why they considered the striped hyaenas as beneficial.

8.3.12 Support for conserving the striped hyaena

During focal group discussions, some elderly residents across the different study sites reported that striped hyaenas have a positive role in the environment and should be conserved. Even those who feared striped hyaenas and considered them as dangerous also showed some support for their conservation. For example, a 75 year-old male from Berqayel noted as follows:

> "*We are afraid of the hyaena since we were raised to fear them but at the same time we were raised to protect wild animals and preserve the natural balance. We know that these animals should have a certain role in nature and eating garbage and dead animals might be one such role*".

During interviews, respondents were evenly divided overall in their support for striped hyaena conservation. The overall model for factors that might have determined whether or not respondents supported striped hyaena conservation explained 63.7% of the variance, with an ROC value of 0.709 indicating a strong fit to the model. Age group, education level and claiming to have seen a striped hyaena played the most important role in determining their support (Table 8.8). Hence, respondents between 35-44 years of age (Figure 8.8a), respondents who were increasingly well educated (Figure 8.8b), and respondents who claimed to have seen a striped hyaena (Figure 8.8c), were all more likely to support the conservation of striped hyaenas.

Table 8.8. Factors determining support among respondents for conserving the striped hyaena, based on logistic regression.

Variables	B	S.E.	Wald	df	Significance
Age Group			15.993	4	0.003
< 24 yrs	-0.058	0.261	0.049	1	0.824
25<yrs<34	0.247	0.254	0.945	1	0.331
35<yrs<44	0.794	0.254	9.727	1	0.002
45<yrs<54	0.323	0.281	1.324	1	0.250
> 55 yrs	0	-	-	0	-
Education level			65.617	4	0.000
Illiterate	-2.270	0.334	46.264	1	0.000
Elementary	-1.785	0.279	40.832	1	0.000
Intermediate	-1.120	0.223	25.133	1	0.000
Secondary	-0.568	0.238	5.686	1	0.017
University	0	-	-	0	-
Seen a striped hyaena	0.416	0.170	6.029	1	0.014
Constant	0.136	0.276	6.874	1	0.009

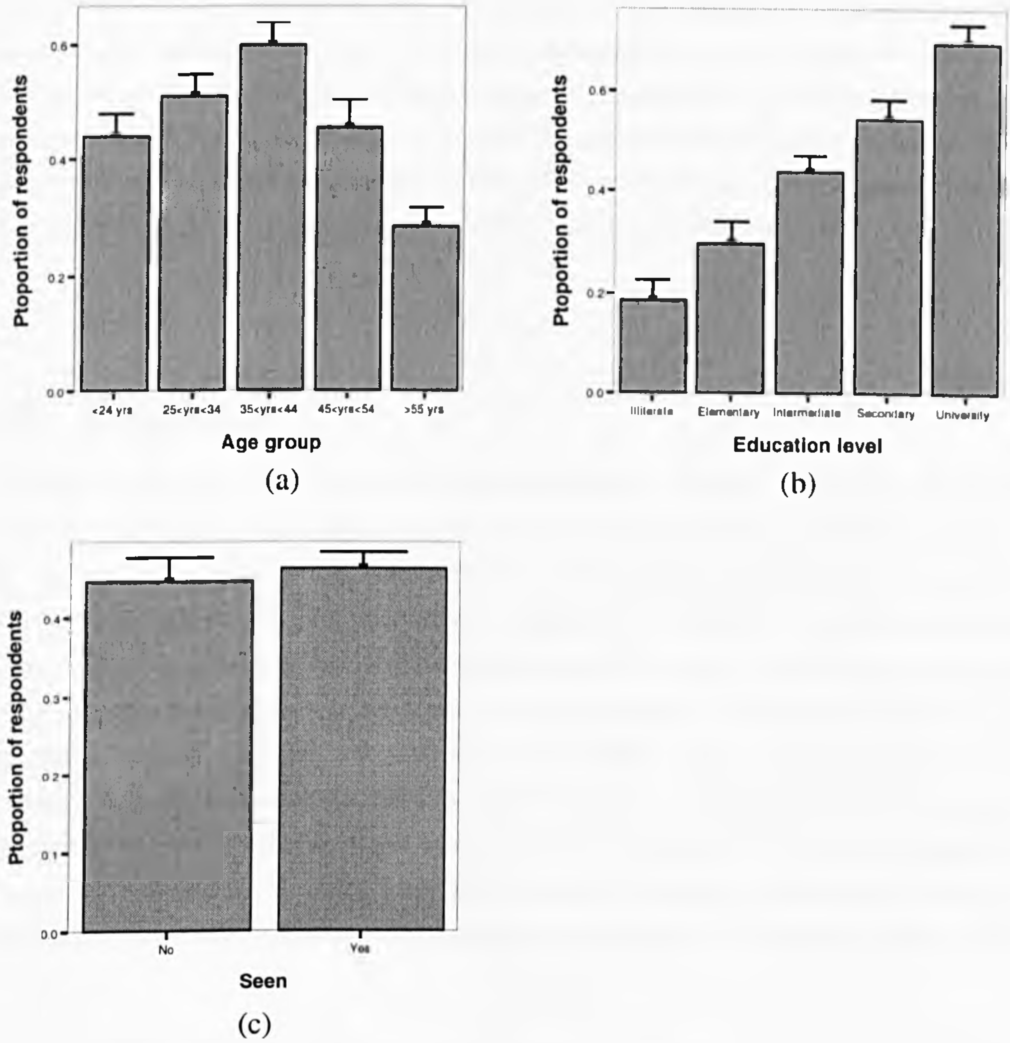


Figure 8.8. The importance of (a) age, (b) education level and (c) claiming to have seen a striped hyaena in explaining the proportion of respondents who supported striped hyaena conservation, based on logistic regression.

8.3.13 Approaches for conserving the striped hyaena

During focal group discussions, elderly residents were asked how they would recommend that striped hyaenas should best be conserved across different study sites. Most elderly residents considered that promoting public awareness would prove more effective in conserving striped hyaenas than protected areas. They noted that, while the law may protect the striped hyaenas inside protected areas, they would be killed as soon as they leave the protected areas. So, while protected areas might help in conserving striped hyaenas, public awareness is far more important. Moreover, elders suggested that public awareness might be effective in breaking fear, and stopping persecution, so leading to conservation of the species.

During interviews, respondents who supported conserving the striped hyaena suggested three approaches, namely: improved public awareness; establishing protected areas; and stopping the killing of striped hyaenas. Most (32.5%) respondents overall suggested a combination of all three approaches as the best way to conserve the striped hyaena. In contrast, few respondents suggested public awareness alone (25.3%) or stopping the killing alone (25.6%) to be the best approaches. Fewer suggested protected areas alone (14.7%), as the best approaches and very few (3.2%) respondents had no idea.

8.4 Discussion

Conflicts between carnivores and people are widespread wherever the two seek to co-exist (Kruuk 2002, Ogada et al. 2003). Such conflicts are complex and require an understanding of different aspects of culture, and of social and political factors, both to achieve a full understanding of this growing problem, and to achieve better solutions for the conservation of carnivores. The attitudes of local people towards many species of carnivores have been widely studied throughout their range. However, studies of the attitudes of local people towards hyaenas are scarce. Moreover, attitudes towards striped hyaenas in human-dominated landscapes are not well understood. The results of this study showed that local people generally held negative attitudes towards striped hyaenas, for several and varied reasons. Most respondents feared encountering striped hyaenas in the wild and noted their different possible reactions towards such encounters. However, many local people did not neglect the beneficial role that striped hyaenas play in the environment and they showed a reasonable degree of support for their conservation.

8.4.1 Negative attitudes towards striped hyaena

Most respondents across the different study sites held negative attitudes toward striped hyaenas and considered them as harmful animals. Likewise, people hold intense feelings towards other species of large carnivore. Several studies have documented the negative attitudes of local people towards carnivores across their ranges within Europe, the Americas, Africa, and Asia. For example, brown bears (*Ursus arctos*), wolves (*Canis lupus*) and lynx (*Lynx lynx*) in the Alps (Breitenmoser 1998), wolves in Norway, Sweden and the USA (Kellert 1985, Bath and Bushanan 1989, Kaltenborn and Bjerke 2002, Williams et al. 2002, Ericsson and Heberlein 2003); brown bears in Slovenia (Kaczensky et al. 2004); lions (*Panthera leo*) in India (Saberwal et al. 1994), snow leopards (*Panthera uncia*) in Ladakh, India, China, Pakistan and Nepal (Mallon 1984, Schaller et al. 1988, Oli et al. 1994, Mishra 1997, Hussain 2003), and wild dogs (*Lycaon pictus*) in Zimbabwe (Davies and du Toit 2004), are all the subject of strongly held negative attitudes among local people.

Modelling the responses using logistic regression indicated that female respondents were most likely to consider striped hyaenas as harmful (Figure 8.1a). Thus, Treves and Naughton-Treves (1999) stated that females are more at risk of being killed by carnivores than males, and so develop more strongly held negative attitudes through considerations for their safety. In contrast, less well-educated respondents were most likely to consider striped hyaenas as harmful (Figure 8.1c). Education may broaden perspectives about carnivores and their conservation, resulting in less strongly held negative attitudes towards striped hyaenas. These results for striped hyaenas in Lebanon mirror previous studies conducted on bears and wolves in Norway (Bjerke et al. 1998, Roskaft et al. 2003, Kleiven et al. 2004) and in USA (Williams et al. 2002, Naughton-Treves et al. 2003), on brown bears in Slovenia (Kaczensky et al. 2004), and on jaguars (*Panthera onca*) and pumas (*Puma concolor*) in Brazil (Conforti et al. 2003), that have shown that females and less well educated people held more strongly negative attitudes toward carnivores.

More interestingly, perhaps, was that knowledge of stories that portrayed a positive image of striped hyaenas played an important role in determining attitudes towards striped hyaenas. Thus, residents who knew of such stories were less likely to consider striped hyaenas as harmful (Figure 8.1d). In these stories (Chapter 7), striped hyaenas were not portrayed as a vicious carnivore that attacks people. Instead, such stories describe striped hyaenas as docile animals seeking help and appreciating those who in turn helped them.

Various factors contributed to respondents holding negative attitudes towards striped hyaenas and considering them as harmful. Attacks on people were the major reason for such attitudes (Section 8.3.2). As the largest carnivore in Lebanon, and as the subject of many other myths and stories that portray them in a negative light, respondents considered that striped hyaenas were more harmful to people than to livestock. In contrast, studies on other species of carnivores, such as jaguars in Brazil, have considered large carnivores to be more harmful to livestock than to people (Zimmermann et al. 2005).

Few respondents, nevertheless, claimed to know of attacks on people by striped hyaenas. Those respondents who claimed to know of such incidents had been told by their elders, who in turn had been told by their elders, while neither they nor their elders had ever witnessed any such attacks. More respondents claimed to know of such attacks from Berqayel, a very rural site, with very low levels of education and of monthly income (Chapter 3). Residents living in such rural areas still appreciate the power and ferocity of wild carnivores, and any reports or rumours of such attacks will lead to a lengthy consideration on their part.

Another possibly equally interesting result was that knowledge of stories that portrayed a negative image of striped hyaenas increased claims among respondents of attacks by striped hyaenas (Figure 8.2d). The greater the number of negative stories that people knew, the more they claim that hyaenas attack people. Moreover, respondents who claimed to know of such attacks had only been told of them from their elders. This underscores how important might be the role that the stories play in determining local attitudes towards carnivores. People who knew stories portraying a good image of striped hyaenas, generally held more positive attitudes towards striped hyaenas and their conservation. In contrast, knowledge of stories that portrayed a negative image of striped hyaenas was associated with more negative attitudes towards striped hyaenas. The role of such stories in determining the attitudes of people towards striped hyaenas, or towards other carnivores, does not appear to have been so clearly shown before.

Most (74.2%) residents thought that striped hyaenas would react negatively to encountering people. Because large carnivores hunt and kill of other animals, people will harbour such thoughts uppermost in their minds, and especially urban residents who are less exposed to, and less experienced with, wild animals. Hence, they will be more likely to think that hyaena will react negatively to encountering people, and especially among women and children who are even less exposed to wild animals (Zimmermann et al. 2001).

On the same basis, it is also likely that seeing a striped hyaena could change peoples' attitudes and improve the image of the imaginary beast that they only know from mythical stories, many of which describe hyaenas as an incredible beast that is eager for human flesh. During individual interviews, some respondents described the size of striped hyaenas as being as big as a calf or a foal, based on the imaginary stories of which they had heard. When shown a photograph of a striped hyaena, many said:

"Is that the beast that they are making us afraid of? It looks like a dog!!"

Fear is an important factor in determining attitudes towards the conservation of carnivores (Kanzaki et al. 1996, Kaczensky et al. 2004, Wilson 2004). Many people consider large carnivores as fearsome, particularly among those people who have not been exposed to large carnivores (Diamond 1993). Respondents from the urban site of Chnaniir spend little time on outdoor activities, are rarely exposed to wildlife, and so held more fear of striped hyaenas than other respondents (Figure 8.4a). Likewise, Norwegians living in areas where carnivores are present and taking part in outdoor activities expressed less fear of large carnivores than people who live in areas where carnivores are absent (Roskaft et al. 2003). In contrast, rural people in south-eastern Norway expressed greater fear of carnivores than urban groups that are not affected by conflicts with carnivores (Bjerke et al. 2001).

Several previous studies have noted the role of gender in determining attitudes towards carnivores (Kellert et al. 1996, Arrindell et al. 1999, Bjerke et al. 2001, Kleiven et al. 2004). In Lebanon, females expressed more fear of striped hyaenas than males. Indeed, Hawkes et al. (1991) hypothesised an "environment of evolutionary adaptedness" which recognises that men are born hunters and so are better adapted to face more dangerous animals, while females remain closer to their camps and their duty was raise and care for their children. Furthermore, females are often encouraged to show their emotions and so may more easily admit their fear compared to males (Bjerke 1992, Roskaft et al. 2003).

Some previous studies have shown that fear of animals declines with age (Kirkpatrick 1984, Davey 1994). Indeed, in Lebanon, younger respondents <24 years of age expressed more fear of striped hyaenas than older respondents. Thus, older people have had time to build up knowledge and experience, as was reported among young Swedish people over their fear towards snakes and spiders (Fredrikson et al. 1996). In contrast, Roskaft et al. (2003) reported that older Norwegians showed more fear towards wolves and bears than younger people, based on the past bad experiences with these animals.

The bad reputation of striped hyaenas was the major cause of peoples' fear, and many stories and myths underpin their bad reputation. Striped hyaenas have a weird laughing cry, a reputation as a grave robber and have long been objects of hatred and superstition (Harrison and Bates 1991, Lewis et al. 1968). Therefore, much of the fear of striped hyaenas arises because of their bad reputation rather than through direct experience, as has also been suggested for other large carnivores including wolves in Norway (Bjerke et al. 2001).

Very few respondents, however, referred their fear of striped hyaenas to them being wild carnivores that potentially threaten lives and livelihoods (Treves and Naughton-Treves 1999, Leo and Roskaft 2004). Norwegians feared large carnivores like bears and wolves more than smaller carnivores like lynx and wolverines because they threaten human lives (Roskaft et al. 2003, Kaczensky et al. 2004).

The bad reputation of striped hyaenas, and the negative attitudes they engender, appeared very obvious in the stated reactions of people to encountering striped hyaenas. Although most respondents said they would react in a non-lethal manner, this does not mean that they are more likely to support conserving striped hyaenas. In contrast, their responses more likely arose from their fear of striped hyaenas, rather than from positive attitudes towards the species, as the following quote from a 51 year-old male from Kafarmatta suggests:

> "*...if I have the courage I will kill it...*"

Or as 33 year-old male from Al-Shouf Cedar said:

> "*Sure I will fly away or should I let him eat me. Don't you know how strong it is? It can crush bones, mesmerize people and drag them to its cave and eat them*".

Furthermore, the results show no effect of the numbers of negative stories that respondents knew, relative to their support for conserving striped hyaenas. By contrast, many more female and younger respondents said they would react in a non-lethal manner. There was also a clear effect of the numbers of stories that portrayed a negative image upon the stated reactions to encountering a striped hyaena (Figure 8.5c). People who knew more stories that portrayed a negative image of striped hyaenas were more likely to react in a non-lethal manner. Therefore, stories have a role in raising human fear of striped hyaenas, and may promote non-lethal reactions that in turn could reduce persecution killings upon encountering a striped hyaena.

Most respondents (84.8%) considered striped hyaenas as dangerous animals, and most particularly those people with no or very low incomes (Figure 8.6). Monthly income levels were strongly inter-correlated with all the explanatory variables (Appendix VI). Hence most people with no income came from Chnaniir, were females, were young in age (<24 years of age), were less well educated, and were either unemployed, students and farmers. Similar results have been reported in several previous studies on attitudes towards large carnivores (Williams et al. 2002, Kleiven et al. 2004).

The case of striped hyaenas is, however, different from other large carnivores like wolves, lions or bears that pose a real threat to human lives. However, in the case of striped hyaenas, people have built their negative attitudes on elders' knowledge rather than on their own experience. Similarly, jaguars were considered as a risk to human life in Brazil (Conforti et al. 2003) and in Bolivia (Almeida 1990), because of perceived rather than real risks to people. Moreover, such attitudes may persist among young people who are told negative stories by their elders or friends yet do not have the chance to see these striped hyaenas for themselves. For example, attitudes toward wolves that are established early in life are deep rooted and persist (Wilson 1997, Bjerke et al. 1998, Knight 2000).

8.4.2 Positive attitudes towards striped hyaenas

Even though most respondents considered striped hyaenas as harmful, many recognised their beneficial role in the environment. Many respondents from Horch Ehden NR considered striped hyaenas as beneficial for the environment (Figure 8.7a), but residents of this area are better-educated than those from other sites (Appendix VI). In contrast, less well-educated respondents, as well as unemployed and self-employed respondents, were less positive towards striped hyaenas, as found previously in studies of attitudes towards other large carnivores (Kellert 1980, 1986, Kellert 1991, Williams et al. 2002). For example, better-educated Norwegians (Kaltenborn et al. 1999, Kaltenborn and Bjerke 2002, Kleiven et al. 2004), Swedes (Ericsson and Heberlein 2003), and Americans (Hook and Robinson 1982, Bath 1987, Naughton-Treves et al. 2003) all held more positive attitudes towards wolves.

Many Lebanese considered striped hyaenas as beneficial because of their major role in cleaning the environment by eating leftovers and refuse, and for their role in maintaining a natural balance. However, some were not clear of what that role actually entailed, as the following comment from a 69 year-old male from Berqayel shows:

> *"if it does not have a role in nature, God might not have created it. We don't know of the specific role in nature, but they should be beneficial in some way".*

A remarkable number of people supported the conservation of striped hyaenas, particularly among those of 34-45 years of age. Respondents belonging to this age group are better-educated and more aware of the importance of conserving wildlife. In contrast, less well-educated respondents are less likely to support striped hyaena conservation, as the following comment from a 60 year-old male from Kafarmatta shows:

> *"What are these animals beneficial for? They eat people and put fear in people's heart. Why do we need to conserve them?"*

Likewise, middle-aged North Americans (Williams et al. 2002, Naughton-Treves et al. 2003) and Norwegians (Kaltenborn et al. 1999) who have been to university are most supportive of wolf conservation. Indeed, Skogen and Krange (2003) found that residents of Stor-Elvdal, Norway who identify with academic knowledge and scientific discourse tend to be more positive toward the wolves, even if their direct interest is negatively affected.

In contrast, younger and better-educated people were more supportive of brown bear conservation in Turkey (Can and Togan 2004) and in Europe (Swenson et al. 2000). Indeed, Andersone and Ozolins (2004) reported that younger (<20 years of age) respondents were more supportive of brown bears than older respondents, because of bad experiences that the older less well-educated people had suffered with brown bears.

Those Lebanese supporting the conservation of striped hyaenas thought that different approaches might be effective. However, public awareness was considered a very important approach towards conserving striped hyaena, as the following 51 year-old male resident of Chnaniir suggests:

> *"You cannot blame peoples' ignorance if they kill striped hyaenas or are not willing to support their conservation, particularly if they know nothing about hyaenas."*

Likewise, another 45 year-old male resident of Berqayel said:

"we do not know of any good thing that hyaenas do. All that we know about them is that they mesmerize people, drag them to their caves and eat them. Why do we need to protect these beasts".

Similar comments were made by many other people, and underscore the importance of public awareness to conserve what is left of wildlife in Lebanon.

8.5 Summary

1) Most (82.1%) respondents in the six study sites held negative attitudes towards striped hyaenas. Most of these attitudes arose as a result of misconception and mythical stories about striped hyaenas.
2) Some (41.9%) respondents, however, recognised the positive role of striped hyaenas in the environment, and were supportive of their conservation.
3) Many respondents recognised the importance of public awareness and of exposing people to facts about the behaviour and ecology of striped hyaena for this species as important for conservation.

In the next two chapters, I will examine two approaches to building public awareness, and I will explore their effectiveness in changing attitudes of adults and students towards striped hyaenas.

Chapter 9

FIELD-BASED AND ZOO-BASED AWARENESS PROGRAMMES FOR ADULTS

Attendees of the awareness programme at four different study sites

9.1 Introduction

The environment is facing increasingly more and complex threats (Soulé 1986, Primack 2002). The expanding human population underlies the declines and extinctions of many species that are currently occurring worldwide (Woodroffe 2000, Kaya and Raynal 2001). Large carnivores are very sensitive to the growth of human populations and conservationists have long been concerned about their future survival (Woodroffe and Ginsberg 1998).

Resolving conflicts between people and large carnivores is vital for their future existence. Protected areas can play a role in carnivore conservation, but most protected areas are too small in size to enclose the home ranges of wide-ranging species like large carnivores (Woodroffe and Ginsberg 1998, Harcourt et al. 2001). Hence, once these animals leave protected areas they are likely to be killed. Some studies have shown that access to conservation-related benefits can positively influence the attitudes of local people and help promote carnivore conservation (Infield 1988, Lewis et al. 1990). However, benefits that are perceived to be small in relation to losses may not achieve their gaols (Parry and Campell 1992, Homewood et al. 1997, Gillingham and Lee 1999, Leader-Williams and Hutton 2005)

Equally, public education and awareness programmes have a vital role to play in maintaining a healthy environment, and promoting sustainable development through the conservation of natural resources (Kaya and Raynal 2001). The success of conservation programmes often depends on developing approaches adapted to particular and local cultural circumstances. Moreover, when such programmes are linked to education, their success can be further increased (Primack 2002). Conforti et al. (2003) suggested that an appropriate long-term education programme targeting local people would be one of the most valuable steps for increasing knowledge about carnivores, and consequently for gaining local acceptance that all native species deserve to be preserved. Any such educational programme needs to enforce values and beliefs that have positive effect on nature, while changing values and beliefs that have negative effect on nature (Williams 1979, Tessler and Shaffer 1990, Kellert et al. 1996).

Zoological parks and wildlife centres can play an important role in improving the understanding of human relationships with the natural world, in encouraging positive attitudes, and in promoting environmental actions (Conforti et al. 2003, Miller et al. 2004, Fisman 2005). Some traditional approaches to environmental education in a zoo setting have assumed that a simply passive approach, through which visitors are exposed to wild animals, can result in cognitive gain and improved attitudes towards wildlife. However, this approach has often proven unsuccessful and visitors may leave with misconceptions and, in some cases, the act of simply confining animals can reinforce existing attitudes of human superiority and dominance (Marcellini and Jenssen 1988, Olson and Zanna 1993, Kellert et al. 1996, Mason 2000, Miller et al. 2004). However, exhibits that are presented in a meaningful context, and with the right message, can contribute significantly to improving positive attitudes towards wildlife, so helping to reverse their declining trends (Kellert et al. 1996, Stoinski et al. 2002). An active approach that includes training, talks, and activities related to wildlife and their habitat, can much better educate the public about important conservation issues, stimulate their curiosity about wildlife, offer educational opportunities about nature and gain the support of visitors towards conservation (Kellert 1996, Stoinski et al. 2002, Miller et al. 2004). Furthermore, these programmes should be evaluated constantly to learn from their experience and to improve their performance (Kleiman et al. 2000).

An appropriate educational programme that targets both local people living among wildlife, and younger people who do not have entrenched attitudes would be a very valuable step in increasing knowledge about wildlife in general and carnivores in particular. An earlier chapter has shown that most respondents across the six study sites held negative attitudes towards striped hyaenas and showed only limited support for their conservation (Chapter 8). However, most respondents suggested that public awareness to change attitudes and improve support would prove the most effective means to achieve striped hyaena conservation. Therefore, this chapter aims to examine the effectiveness of two awareness programmes at changing the negative attitudes of adults towards striped hyaenas. The two awareness programmes comprised: running seminars at the six study sites; and a zoo education programme at Animal Encounter encompassing two approaches:

- a passive approach that includes a self-guided tour and information boards; and,
- an active approach that includes a self-guided tour, information boards and an awareness seminar.

Hence, this chapter will seek to answer the following questions:

- can the attitudes of adults across the six study sites, and adults from among the wider Lebanese public, be improved through an awareness raising programme, and what factors are important in changing those attitudes?; and
- what approaches, whether passive or active awareness programmes, are most effective in changing the attitudes of adults, and in gaining more support for conserving striped hyaenas?

9.2 Methods

9.2.1 Awareness seminar at study sites

A seminar to raise awareness of residents living across each of the six study sites was conducted between July and December 2003. The seminar, conducted in Arabic, comprised a slide session, a video film, and an awareness pamphlet that was distributed to all who attended the seminar. The 45-minute slide show included a discussion of: the role of carnivores in general, and striped hyaena in particular, in the ecosystem; the factors affecting their conservation; and, other environmental issues. The 7-minute video film showed scenes of trapping and radio-collaring a striped hyaena. The A4 awareness pamphlet

(Appendix XII) contained information on the scientific description of striped hyaenas, their distribution, their role in the environment, and of the mythical stories told about the species.

In order to test the effectiveness of the awareness seminar, a structured questionnaire interview, modelled on that to determine attitudes at the start of the study (Chapter 8), was administered before and after each seminar, only to those people who attended the entire seminar. People who came in after the start, or who left before the end, of the seminar were excluded. This resulted in a total of 443 interviewees across the six study sites (Appendix VII). As well as serving as the basis for determining the effect of the actual awareness programme on attendees from the study sites, results from the pre-seminar interview could be compared with the results of the initial interviews conducted in March to October 2002, to allow an assessment of the effectiveness of my research project in changing attitudes to striped hyaenas during the previous 15 months.

The pre-seminar interview began with basic questions to obtain demographic and socio-economic data, including site, age, gender, and education level of the visitors. Spaces for recording monthly income and occupation were included in the written questionnaire, to gain answers from attendees who refused to give an answer in public. As a result, they were excluded from the analysis. Moreover, knowledge of stories was also not included because of limited time. These questions were followed by four dichotomous questions to determine the attitudes of respondents towards striped hyaenas. Attitudes sought included whether respondents regarded striped hyaenas as: dangerous; harmful; beneficial, and whether respondents support their conservation.

The post-seminar interview sought answers to the four dichotomous questions on attitudes toward striped hyaenas, as well as to one other dichotomous question on whether respondents had the will to protect striped hyaenas.

9.2.2 Awareness programme at Animal Encounter

An awareness programme was conducted between January 2003 and September 2004, for adults from any part of Lebanon who visited the Animal Encounter as part of their normal weekend activities. Two approaches were compared in this programme:

1) A passive approach, in which visitors were asked to tour the Animal Encounter on their own.
2) An active approach, in which visitors toured the Animal Encounter accompanied by a guide. The guide toured with the visitors, gave information on the animals exhibited, and detailed information about striped hyaenas, including their distribution, mythical stories about them, their role in the environment, threats they are facing, and the ways to conserve them.

In order to test the effectiveness of these different awareness programmes in changing the attitudes of adult visitors to Animal Encounter, a structured questionnaire interview was conducted at two stages, at the entrance to Animal Encounter and on the way out after the tour:

- The interview at the entrance to Animal Encounter began with questions to obtain demographic and socio-economic data on the visitors including: their governorate of origin, gender, age, education level, occupation, and monthly income level. This was followed by four dichotomous questions requiring positive or negative responses regarding attitudes towards striped hyaenas, including whether visitors considered striped hyaenas as dangerous, harmful; or beneficial; and whether visitors supported their conservation. One non-dichotomous question sought to understand reasons why local people held these attitudes. Finally one non-dichotomous question sought to explore the knowledge among visitors from the wider Lebanese public of stories about striped hyaenas.
- On the way out visitors were asked five questions, four of which were the same dichotomous questions that were asked at the entrance and one other non-dichotomous question to understand the reasons why they might have changed their attitudes, including: 1) encountering the animals; 2) information on cages; 3) or guided tour.

A total of 610 visitors, comprising 440 following the active approach, and 170 following the passive approach, were interviewed, and they originated from all five governorates of Lebanon (Appendix VIII, IX).

9.2.3 Statistical analysis

The Statistical Programme for the Social Sciences (SPSS) for Windows version 12.0.1 was used to conduct a statistical analysis to determine which factors might best explain respondents' answers. The statistical data for each response were first analysed using descriptive statistics, and responses were compared using Chi-square test, but these were not shown for reasons of space. Based on the initial tests, multivariate analyses, using logistic regression were then performed to model responses, as these provide a convenient way to undertake categorical data analyses. Forward Wald logistic regression was used to specify the model with a significance of $P<0.05$. Dichotomous questions were given a dummy of 1 if the answer was positive and 0 if the answer was negative, and these responses were taken as the dependent variable. The explanatory variables for the analyses of changes in attitudes among respondents from across the six study sites included: study site, rural or urban landscape, protected status, relative abundance of hyaenas, gender, age, and education level. Furthermore, the explanatory variables for the analyses of changes in attitudes of adult visitors from around Lebanon to Animal Encounter included: governorate, density of striped hyaena across governorate (Chapter 3), whether they claimed to have seen a striped hyaena, gender, age, education level, occupation, monthly income and knowledge of stories. The likelihood ratio goodness of fit test of the model was described using Chi-square goodness of fit statistics. Model performance on the testing sets was evaluated by calculating the area under the curve (AUC) of receiver operation characteristics (ROC) plots. ROC values range from 0.5 to 1.0. Values above 0.7 indicate strong model fit, while those above 0.9 indicate a highly accurate model (Swets 1988).

9.3 Results

9.3.1 Attitudes after 1.5 years of research

The attitudes of respondents towards striped hyaenas appeared to have improved after 1.5 years of research across the different study sites, based on comparing the results of the initial questionnaire survey from March-October 2002 (Chapter 8) with the pre-seminar survey. Fewer respondents considered striped hyaenas as dangerous (χ^2=52.325, df=1, P<0.001) or harmful (χ^2=134.889, df=1, P<0.001) after 1.5 years of research than at the start of the study (Figure 9.1). Furthermore, more respondents considered striped hyaenas as beneficial (χ^2=51.669, df=1, P<0.001) after 1.5 years of research (Figure 9.1). In contrast, there was no difference (χ^2=0.938, df=1, P>0.05) in the support respondents offered towards striped hyaena conservation after 1.5 years of research (Figure 9.1).

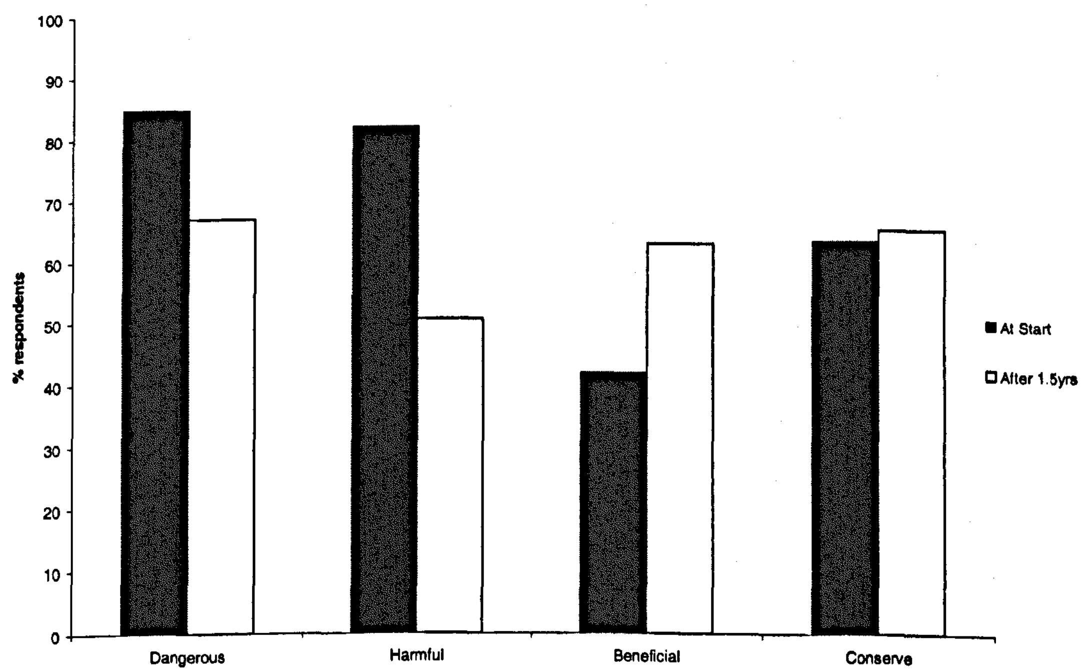


Figure 9.1. Comparison of attitudes among respondents in the study sites towards striped hyaenas at the start of the study (N = 797) and after 1.5 years of research (N = 443).

9.3.2 Effect of seminars on attitudes among adults across six study sites

9.3.2.1 Are striped hyaenas dangerous?

During pre-seminar interviews, most (67.0%) of the 443 respondents considered that striped hyaenas were dangerous animals. The overall model for factors that might have determined whether or not respondents considered striped hyaenas as dangerous explained 67.5% of the variance, with an ROC value of 0.645, indicating a satisfactory fit to the model. The relative abundance of hyaenas across study sites and the gender of attendees played the most important role in determining their attitudes (Table 9.1). Hence, respondents from areas where striped hyaenas are relatively abundant, including (>0.74 and >0.93 signs per km), were most likely to consider striped hyaenas as dangerous (Figure 9.2a). Furthermore, female respondents were most likely to consider striped hyaenas as dangerous (Figure 9.2b).

Table 9.1. Factors determining whether or not attendees interviewed before the seminar considered striped hyaenas as dangerous, based on logistic regression.

Variables	B	S.E.	Wald	df	Significance
Relative Abundance			22.322	5	0.000
0.00	0.694	0.375	3.427	1	0.064
0.06	0.206	0.377	0.298	1	0.585
0.72	0.079	0.383	0.042	1	0.837
0.74	1.264	0.360	12.348	1	0.000
0.93	1.057	0.314	11.370	1	0.001
3.08	0	-	-	0	-
Gender (male)	-0.518	0.222	5.474	1	0.019
Constant	0.392	0.281	1.949	1	0.163

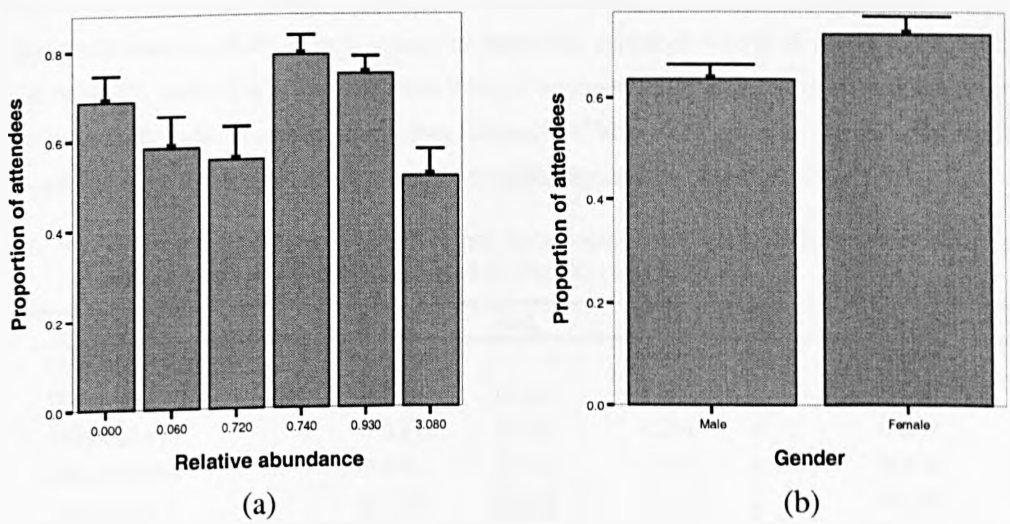


Figure 9.2. The importance of (a) the relative abundance of hyaenas and (b) the gender of respondents before the seminar in explaining the proportion of attendees, who considered striped hyaenas as dangerous, based on logistic regression.

Of the 297 respondents who considered striped hyaenas as dangerous before the seminar, most (82.5%) changed their views after the seminar. The overall model for factors that might have determined whether or not respondents considered striped hyaenas as dangerous after the seminar explained 82.5% of the variance, with an ROC value of 0.597, indicating a poor fit to the model and suggesting that no factor was any more important than another in determining their change in views.

9.3.2.2 Are striped hyaenas harmful?

During pre-seminar interviews, 50.8% of the 443 respondents overall considered striped hyaenas as harmful. The overall model for factors that might have determined whether or not respondents considered the striped hyaena as a harmful animal explained 54.5% of the variance, with an ROC value of 0.546, indicating poor fit to the model and suggesting that no factor was any more important than another in determining their attitude.

Of the 225 respondents who considered striped hyaenas as harmful before the seminar, most (91.6%) changed their views after the seminar. However, none of the explanatory factors played any more important role ($P>0.05$) than any other in changing the views of respondents after the seminar.

9.3.2.3 Are striped hyaenas beneficial?

During pre-seminar interviews, most (63.2%) of the 443 respondents overall considered striped hyaenas as beneficial to the environment. The overall model for factors that might have determined whether or not respondents considered the striped hyaena as beneficial explained 66.6% of the variance, with an ROC value of 0.609, indicating a just satisfactory fit to the model. Education level of respondents played the most important role in determining their attitudes (Table 9.2). Hence, increasingly well-educated respondents were much more likely to consider striped hyaenas as beneficial (Figure 9.3).

Table 9.2. Factors determining whether or not respondents interviewed before the seminar considered striped hyaenas as beneficial, based on logistic regression.

Variables	B	S.E.	Wald	df	Significance
Education levels			20.946	5	0.000
Illiterate	-2.098	0.544	14.892	1	0.000
Elementary	-1.223	0.423	8.354	1	0.004
Intermediate	-0.463	0.259	3.195	1	0.074
Secondary	-0.279	0.265	1.111	1	0.292
University	0	-	-	0	-
Constant	0.935	0.182	26.377	1	0.000

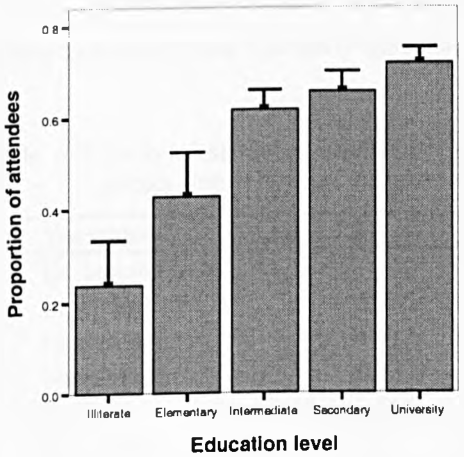


Figure 9.3. The importance of education level in explaining the proportion of respondents interviewed before the seminar who considered striped hyaena as a beneficial animal to the environment, based on logistic regression.

Of the 163 respondents who did not consider striped hyaena as beneficial before the seminar, most (90.8%) changed their thoughts after the seminar. However, none of the explanatory factors played any more important role ($P>0.05$) than any other in changing the views of the respondents after the seminar.

9.3.2.3 Support for striped hyaena conservation

During pre-seminar interviews, 43.6% of the 443 respondents supported the conservation of striped hyaenas. The overall model for factors that might have determined whether or not attendees supported striped hyaena conservation explained 57.8% of the variance, with an ROC value of 0.596, indicating a poor fit to the model, and suggesting that no factor was any more important than another in determining support.

Of the 250 respondents who did not support striped hyaena conservation before the seminar, most (83.6%) supported it after the seminar. However, none of the explanatory factors played a role in determining the support of respondents towards striped hyaena conservation after the seminar.

9.3.2.4 Will to protect striped hyaenas

During pre-seminar interviews, few (34.5%) of the respondents had the will to protect striped hyaenas. The overall model for factors that might have determined whether or not respondents had the will to protect striped hyaenas explained 67.5% of the variance, with an ROC value of 0.615, indicating a just satisfactory fit to the model. Education level of respondents played the most important role in determining their attitudes (Table 9.3). Hence, increasingly well-educated respondents were much more likely to be willing to protect striped hyaenas (Figure 9.4).

Table 9.3. Factors determining whether or not respondents interviewed before the seminar had the will to protect striped hyaenas, based on logistic regression.

Variables	B	S.E.	Wald	df	Significance
Education levels			19.759	5	0.001
Illiterate	-1.765	0.500	12.482	1	0.000
Elementary	-1.215	0.423	8.252	1	0.004
Intermediate	-0.633	0.262	5.817	1	0.016
Secondary	-0.264	0.273	0.937	1	0.333
University	0	-	-	0	-
Constant	1.072	0.188	32.529	1	0.000

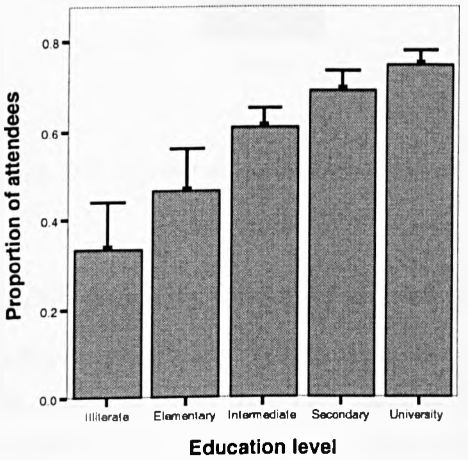


Figure 9.4. The importance of education level in explaining the proportion of attendees interviewed before the seminar that had the will to protect striped hyaena, based on logistic regression.

Of the 290 respondents who did not have the will to protect striped hyaenas before the seminar, all (99.0%) had the will to protect it after the seminar. However, none of the explanatory factors played any more important role (P>0.05) than any other in changing the views of the respondents after the seminar.

9.3.3 Knowledge of stories among the wider Lebanese public

Of the 610 visitors to Animal Encounter who were interviewed, relatively few (32.6%) did not know of any stories about striped hyaenas. However, many visitors knew of at least one or two stories that portrayed a negative image of striped hyaenas (Figure 9.8). In contrast, many fewer visitors knew of the stories either that portrayed a positive image of striped hyaenas or that portrayed a positive image of the bravery of men meeting a striped hyaena (Figure 9.5).

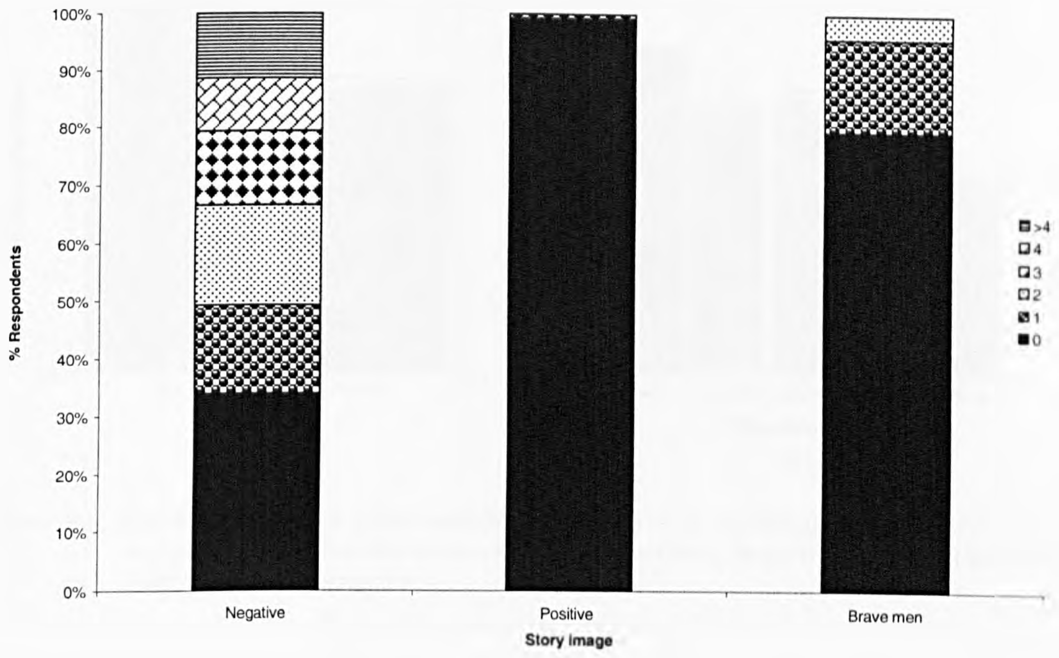


Figure 9.5. Number of stories known by visitors at the Animal Encounter

9.3.3.1 Negative images of striped hyaenas

During interviews, most visitors overall knew stories that portrayed a negative image of striped hyaenas. The overall model for factors that might have determined the likelihood of visitors knowing such stories explained 65.9% of the variance, with an ROC value of 0.674, indicating a satisfactory fit to the model. Gender and education level of visitors played the most important role in determining their knowledge (Table 9.4). Hence, male visitors were most likely to know of such stories (Figure 9.6a), as were less well-educated visitors (Figure 9.6b).

Table 9.4. Factors determining whether or not visitors to Animal Encounter knew of stories that portrayed negative image of striped hyaena, based on logistic regression.

Variables	B	S.E.	Wald	df	Significance
Gender (male)	0.877	0.188	21.853	1	0.000
Education level			22.207	4	0.000
Illiterate	21.006	14030.9	0.000	1	0.999
Elementary	1.110	0.568	3.820	1	0.051
Intermediate	1.324	0.313	17.852	1	0.000
Secondary	0.467	0.231	4.106	1	0.043
University	0	-	-	0	-
Constant	0.014	0.129	0.012	1	0.914

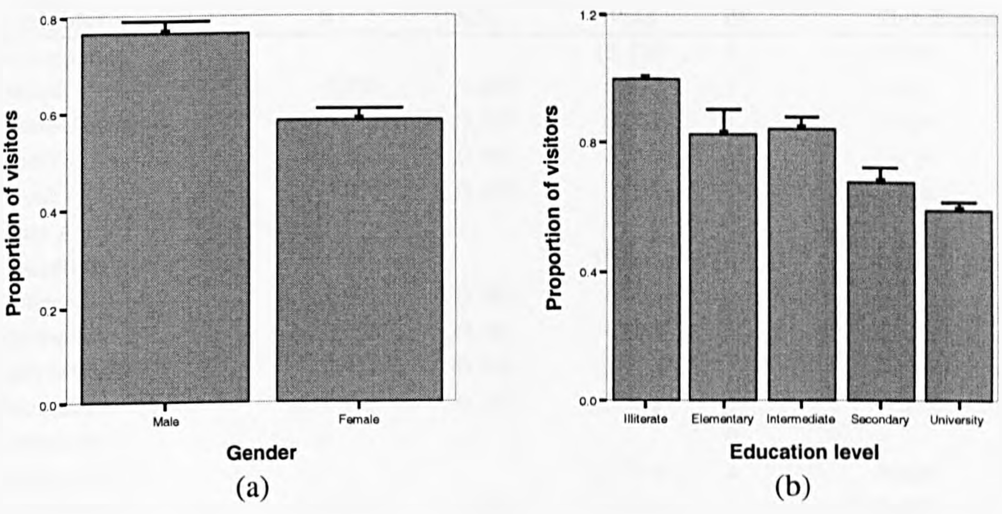


Figure 9.6. The importance of (a) gender and (b) education level in explaining the proportion of visitors to Animal Encounter who knew stories that portrayed a negative image of striped hyaena, based on logistic regression.

9.3.3.2 Men being brave

During interviews, few visitors overall knew of stories that portrayed a positive image of the bravery of men meeting striped hyaenas. The overall model for factors that might have determined the likelihood of visitors knowing such stories explained 80.2% of the variance, with an ROC value of 0.730, indicating a strong fit to the model. Governorate of origin, education level, occupation and monthly income of visitors played the most important role in determining the likelihood of visitors knowing such stories (Table 9.5). Hence, visitors from the South Governorate were least likely to know of such stories (Figure 9.7a). Moreover, less well-educated visitors were more likely to know of such stories (Figure 9.7b). Students were least likely to know of such stories, while self-employed were most likely to know such stories (Figure 9.7c). Finally, monthly income of the visitors was also important, with those on the lowest and highest monthly income levels least likely to know such stories (Figure 9.7d).

Table 9.5. Factors determining whether or not visitors to Animal Encounter knew stories that portrayed a positive image of the bravery of people meeting striped hyaenas, based on logistic regression.

Variables	B	S.E.	Wald	df	Significance
Governorate			15.437	4	0.004
Beirut	-0.988	0.404	5.974	1	0.015
Mount Lebanon	0.017	0.355	0.002	1	0.926
North	-0.974	0.545	3.190	1	0.074
South	-0.075	0.429	0.031	1	0.860
Beqa'a	0	-	-	0	-
Education level			12.490	4	0.014
Illiterate	1.977	0.787	6.313	1	0.012
Elementary	0.558	0.581	0.924	1	0.336
Intermediate	0.986	0.338	8.526	1	0.004
Secondary	0.563	0.307	3.351	1	0.067
University	0	-	-	0	-
Occupation			15.538	4	0.004
Unemployed	-0.173	0.434	0.160	1	0.690
Student	-1.710	0.553	9.551	1	0.002
Self-employed	-0.152	0.506	0.091	1	0.763
Employee	0.327	0.353	0.859	1	0.354
Professional	0	-	-	0	-
Monthly income			9.096	4	0.028
<US$ 500	-0.129	0.453	0.081	1	0.777
<US$ 1000	-0.519	0.419	1.534	1	0.215
<US$ 1500	0.619	0.421	2.158	1	0.142
>US$ 1500	0	-	-	0	-
Constant	-1.169	0.447	6.845	1	0.009

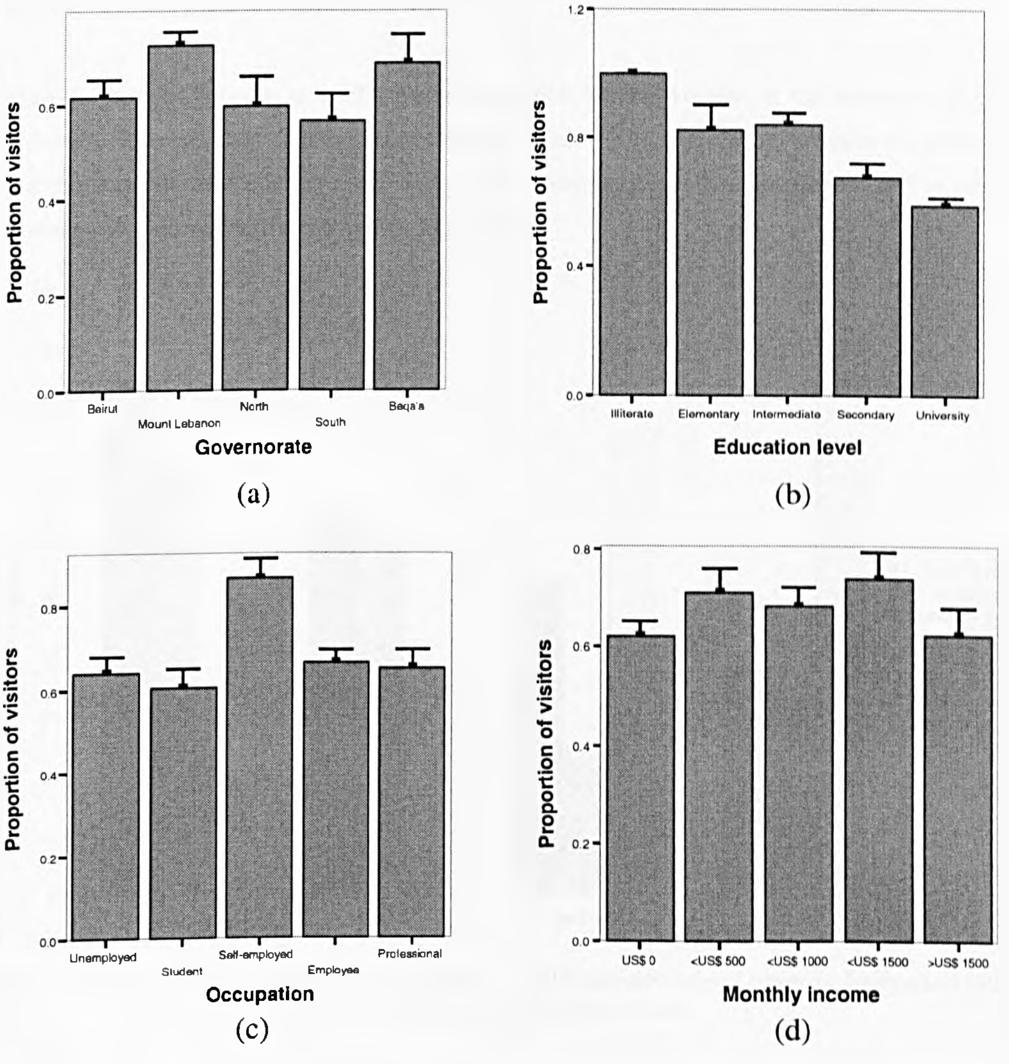


Figure 9.7. The importance of (a) governorate of origin, (b) education level, (c) occupation and (d) monthly income in explaining the proportion of visitors to Animal Encounter who knew stories that portrayed a positive image of the bravery of people meeting striped hyaenas, based on logistic regression.

9.3.4 Effect of visits and seminars at Animal Encounter on attitudes among the wider Lebanese public

9.3.4.1 Attitudes of visitors towards striped hyaenas

At the entrance of the Animal Encounter, there was no difference (P>0.05) among the attitudes of visitors in the two groups that followed passive and active approaches to awareness-raising. Therefore, the data from both groups were pooled together to study the effectiveness of the two approaches on changing attitudes.

Negative attitudes towards striped hyaenas prevailed among visitors at the entrance of the Animal Encounter. However, many visitors recognised the positive role of striped hyaenas in the environment and the importance of their conservation (Figure 9.8). However, the two approaches used in raising public awareness showed very different results (Figure 9.8).

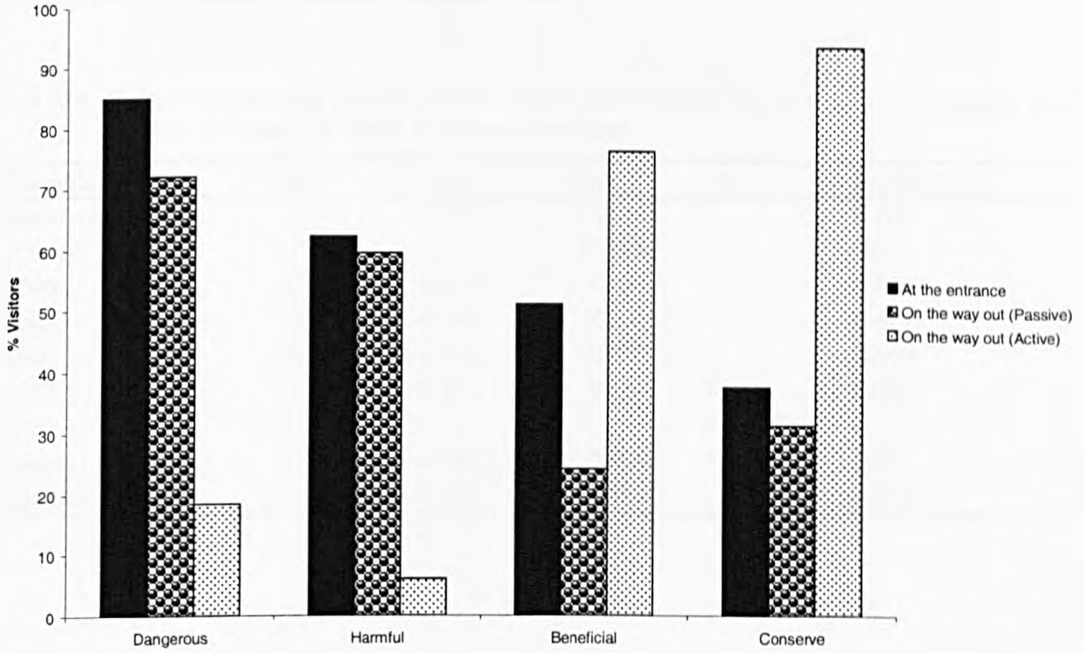


Figure 9.8. Changes in the attitudes of visitors (N = 610) towards striped hyaenas, before and after the two approaches to raising awareness at Animal Encounter.

9.3.4.2 Are striped hyaena dangerous?

Most (84.9%) of the 610 respondents at the entrance to Animal Encounter considered striped hyaenas as dangerous animals (Figure 9.11). Most (79.2%) respondents considered striped hyaenas as dangerous because they had been told stories by elders that portrayed hyaenas in a negative light.

Of the 518 visitors who considered striped hyaenas as dangerous at the entrance, most (66.0%) had changed their views on the way out. However, fewer (25.8%) of the 112 visitors in the passive group had changed their views on the way out (Figure 9.8). In contrast, most (80.1%) of the 367 visitors in the active group had changed their view (Figure 9.8).

The overall model for the factors that might have determined any change in respondents views on the danger of striped hyaenas explained 79.0% of the variance, with an ROC value of 0.799, indicating a strong fit to the model. The approach of their awareness programme, the density of striped hyaenas across their governorate of origin, and their gender played the most important role in determining the change in their views (Table 9.6). Hence, on the way out, visitors who were in the active group were most likely to change their views (Figure 9.9a). Moreover, visitors originating from a governorate where a high density (0.017 hyaena per km^2) of striped hyaena is present (Figure 9.9b), and male visitors (Figure 9.9c) were most likely to have changed their views on the way out.

Table 9.6. Factors determining whether or not visitors interviewed on the way out considered striped hyaenas as dangerous, based on logistic regression.

Variables	B	S.E.	Wald	df	Significance
Approach (active)	-2.615	0.243	115.668	1	0.000
Density			12.316	5	0.015
0.000	0.128	0.267	0.231	1	0.631
0.005	0.171	0.345	0.245	1	0.621
0.007	-0.208	0.396	0.277	1	0.599
0.017	-1.359	0.433	9.854	1	0.002
0.022	0	-	-	0	-
Gender (male)	-0.648	0.230	7.909	1	0.005
Constant	1.509	0.265	32.318	1	0.000

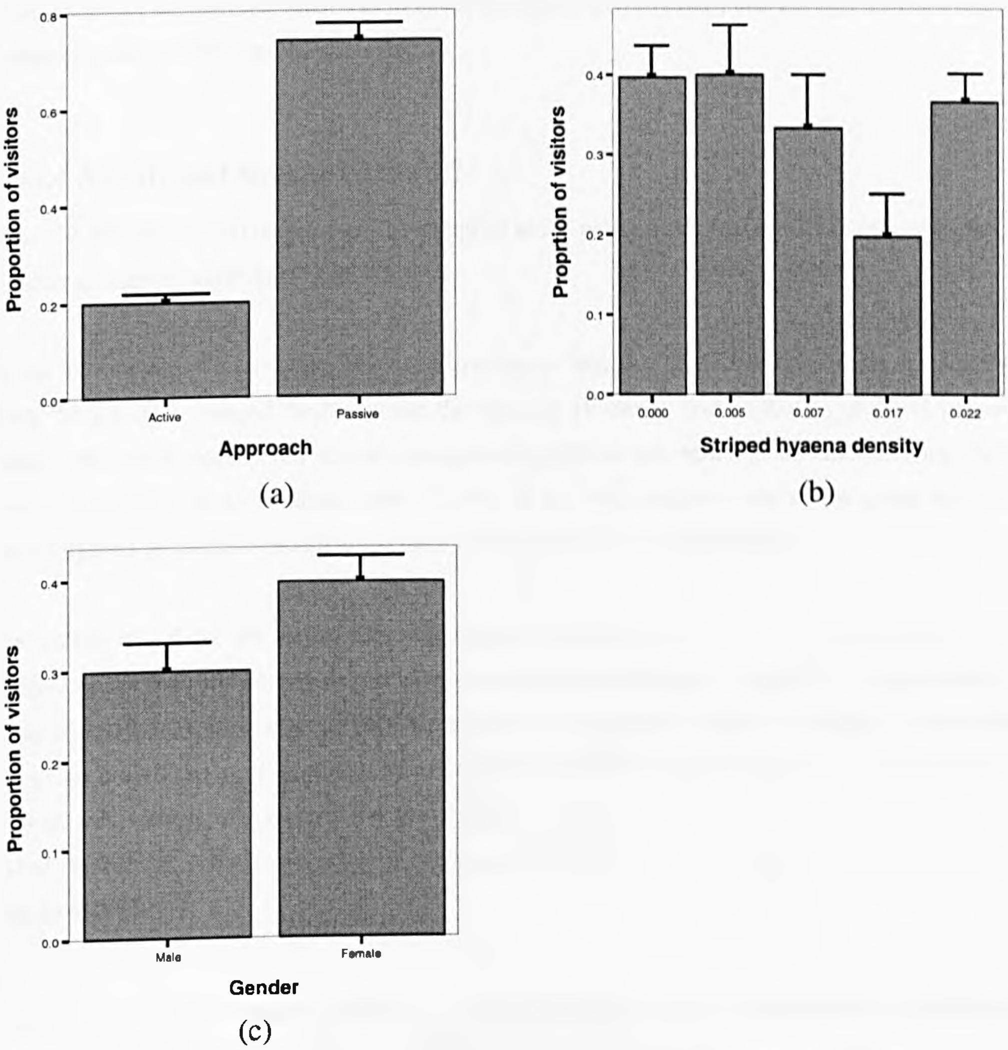


Figure 9.9. The importance of (a) the approach of the awareness programme, (b) striped hyaena density across governorate and (c) gender in explaining the proportion of visitors interviewed on the way out who considered striped hyaena as a dangerous animal, based on logistic regression.

9.3.4.3 What affects visitors' views on the way out?

Visitors in the passive group who changed their mind (N=39) gave two reasons for the change in their view of the danger of striped hyaenas: 1) information on cages; and 2) encountering striped hyaenas. Most (56.4%) visitors attributed their change in view to encountering striped hyaenas, while fewer visitors attributed this to information on the cages (30.8%), or to both reasons combined (12.8%).

However, visitors in the active group who changed their mind (N=294) gave two reasons for their views on the danger of hyaenas on the way out: 1) information given by the guide; and, 2) encountering striped hyaenas. Most (42.2%) visitors attributed their changing views to the information given by the guide, while 28.2% of visitors attributed this to encountering striped hyaenas, and another 29.6% attributed their changing views to both reasons combined.

9.3.4.4 Are striped hyaena harmful?

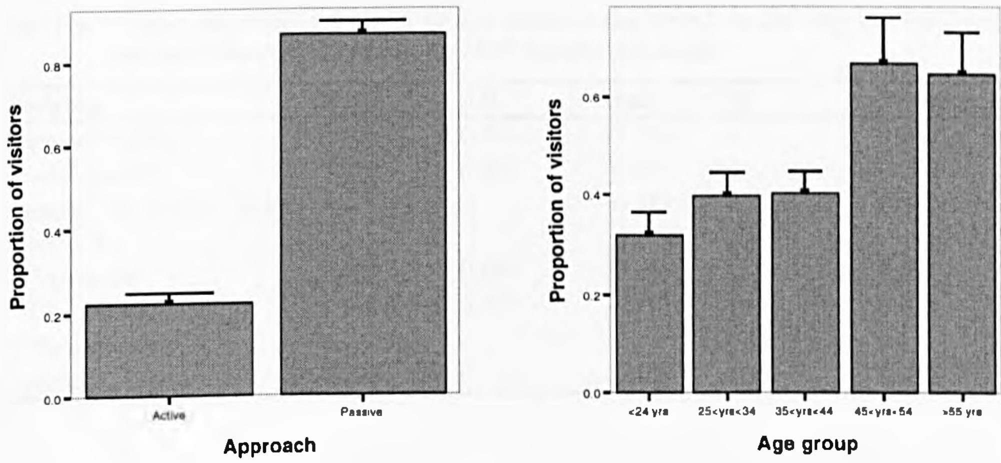
Most (62.3%) of the 610 respondents interviewed at the entrance to Animal Encounter considered striped hyaenas as harmful animals (Figure 9.8).

Of the 380 visitors who considered striped hyaenas as harmful at the entrance to the Animal Encounter, many (58.2%) had changed their views on the way out. However, fewer (40.4%) of the 114 visitors in the passive group who considered striped hyaenas as harmful at the entrance had changed their views on the way out (Figure 9.8). In contrast, more (77.4%) of the 266 visitors in the active group who considered striped hyaena as harmful had changed their views on the way out (Figure 9.8).

The overall model for the factors that might have determined any change in respondents views towards whether or not they considered striped hyaenas as harmful explained 80.3% of the variance, with an ROC value of 0.812, indicating a strong fit to the model. The approach of their awareness programme and their age group played the most important role in determining the change in their views (Table 9.7). Hence, on the way out, visitors who were in the active group were most likely to have changed their views (Figure 9.10a). Moreover, visitors <45 years of age were most likely to have changed their views on the way out (Figure 9.10b).

Table 9.7. Factors determining whether or not visitors interviewed on the way out considered striped hyaenas as harmful animals, based on logistic regression.

Variables	B	S.E.	Wald	df	Significance
Approach (active)	-3.126	0.322	94.152	1	0.000
Age groups			10.237	4	0.037
< 24 yrs	-1.104	0.489	5.099	1	0.024
25<yrs<34	-1.248	0.498	6.280	1	0.012
35<yrs<44	-1.145	0.489	5.473	1	0.019
45<yrs<54	-0.104	0.649	0.026	1	0.872
> 55 yrs	0	-	-	0	-
Constant	-2.874	0.507	32.150	1	0.000



(a) (b)

Figure 9.10. The importance of (a) the approach of the awareness programme and (b) gender in explaining the proportion of visitors interviewed on the way out who considered striped hyaenas as harmful animals, based on logistic regression.

9.3.4.5 Positive attitudes towards striped hyaenas

Thoughts of respondents were fairly evenly divided over the positive role of striped hyaenas in nature (51.1% vs. 48.9%) at the entrance to the Animal Encounter (Figure 9.8).

Of the 298 respondents who did not consider striped hyaenas as beneficial at the entrance to Animal Encounter, most (65.4%) had changed their views on the way out. However, fewer (24.2%) of the 62 visitors in the passive group who did not consider striped hyaenas as beneficial at the entrance to Animal Encounter had changed their views on the way out (Figure 9.8). In contrast, most (76.3%) of the 236 visitors in the active group who did not consider striped hyaenas as beneficial at the entrance had changed their views on the way out (Figure 9.8).

The overall model for the factors that might have determined the change in their views towards whether or not they considered striped hyaenas as beneficial explained 75.2% of the variance, with an ROC value of 0.773, indicating a strong fit to the model. The approach of their awareness programme, their gender, and the number of stories that portrayed man in a brave light when encountering hyaenas, played the most important role in determining the change in their views (Table 9.8). Hence, on the way out, visitors who were in the active group were most likely to change their attitudes (Figure 9.11a), as were male visitors (Figure 9.11b). Furthermore, the number of stories that portrayed man in a brave light known to visitors had an overall effect upon their attitudes with no clear cut among stories, although the proportion of visitors who knew two such stories were least to change their attitudes (Figure 9.11c).

Table 9.8. Factors determining whether or not visitors interviewed on the way out considered striped hyaenas as beneficial animals, based on logistic regression.

Variables	B	S.E.	Wald	df	Significance
Approach (active)	2.703	0.394	47.086	1	0.000
Gender (male)	0.898	0.325	7.641	1	0.006
Number of stories about brave men			6.342	2	0.042
No stories	0.472	0.699	0.457	1	0.599
One story	1.518	0.787	3.717	1	0.054
Two stories	0	-	-	0	-
Constant	-2.330	0.752	9.603	1	0.002

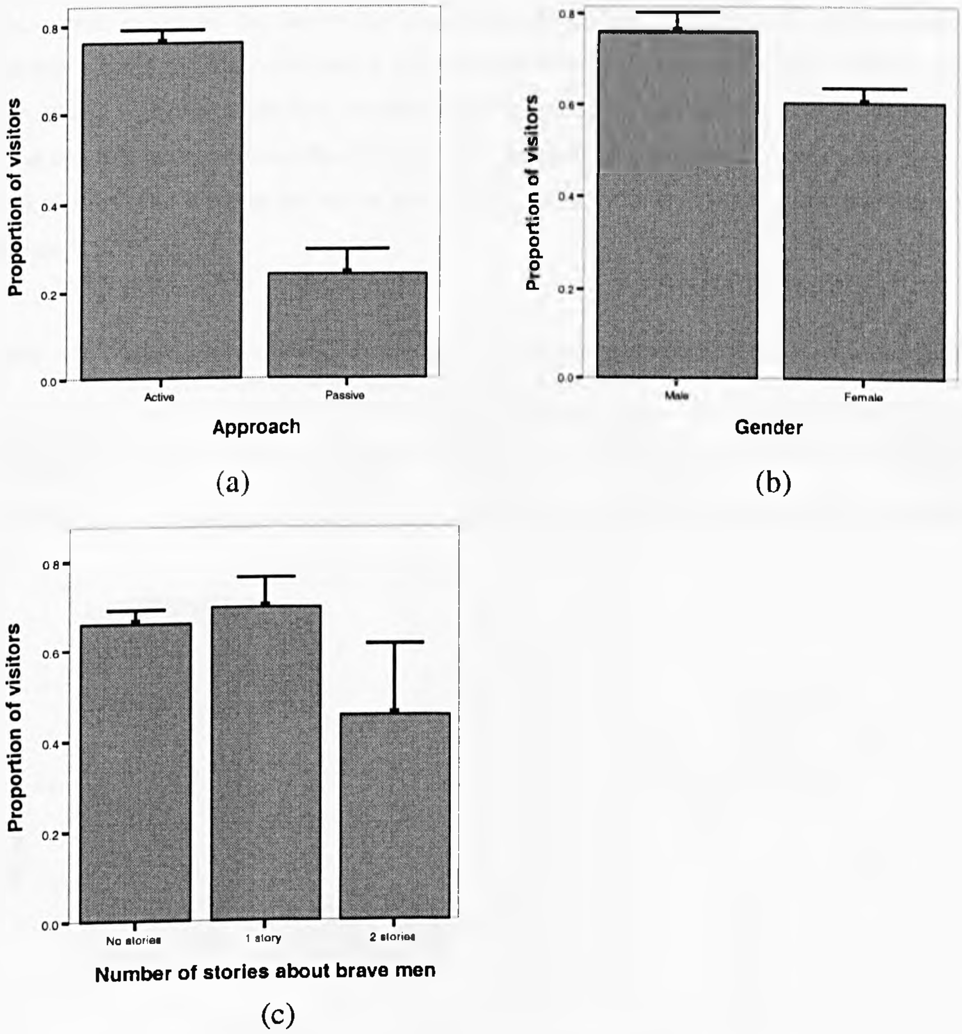


Figure 9.11. The importance of (a) the approach of the awareness programme, (b) gender and (c) the number of stories that portrayed man in a brave light known to respondents in explaining the proportion of respondents who considered striped hyaenas as beneficial on the way out, based on logistic regression.

9.3.4.6 Support towards conservation of striped hyaenas

Relatively few (37.4%) of the 610 visitors interviewed at the entrance to Animal Encounter, supported the conservation of striped hyaenas (Figure 9.8).

Of the 382 visitors who did not support striped hyaena conservation at the entrance, most (72.3%) supported their conservation on the way out. However, fewer (17.4%) of the 115 visitors in the passive group who did not support striped hyaena conservation at the entrance to Animal Encounter supported their conservation on the way out (Figure 9.8). In contrast, most (95.9%) of the 267 visitors in the active group who did not support striped hyaena conservation at the entrance supported their conservation on the way out (Figure 9.11).

The overall model for the factors that might have determined any change in the support of respondents towards striped hyaena conservation explained 91.9% of the variance, with an ROC value of 0.912, indicating a highly accurate fit to the model. The approach of their awareness programme played the most important role in determining the change in their support towards striped hyaena conservation (Table 9.9), with visitors who were in the active group most likely to have changed their attitudes on the way out (Figure 9.12).

Table 9.9. Factors determining whether or not visitors interviewed on the way out supported striped hyaena conservation, based on logistic regression.

Variables	B	S.E.	Wald	df	Significance
Approach (active)	4.705	0.394	142.531	1	0.000
Constant	-1.558	0.246	40.112	1	0.000

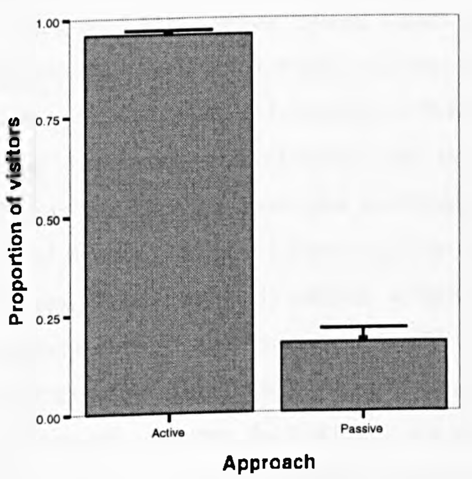


Figure 9.12. The importance of the approach of the awareness programme in explaining the proportion of visitors interviewed on the way out who supported striped hyaena conservation, based on logistic regression.

9.4 Discussion

This the first study to compare the effectiveness of different approaches, whether passive or active, to raising awareness, in order to improving attitudes towards striped hyaenas. Indeed, this study is probably of considerably broader interest for zoological collections more generally, given a recent study that has shown for zoological collections more generally that approaches to raising awareness through passive means are largely ineffective (Balmford et al. in press).

Attitudes of respondents across the six study sites had become considerably more positive towards striped hyaenas after 1.5 years of research. Moreover, a seminar to raise public awareness towards striped hyaenas was very effective in changing views of respondents across the six study sites towards striped hyaenas, with the result that more respondents supported the conservation of striped hyaenas.

The awareness programme run at Animal Encounter was also effective in changing the views of the wider Lebanese public to striped hyaenas. However, the active approach that included a guided tour was much more effective in changing views than the simply passive approach that depended on seeing the animals and their associated information boards (Figure 9.11).

9.4.1 Changing attitudes after 1.5 years of research

Within 1.5 years of starting my research on striped hyaenas, the attitudes of respondents across the six study sites had greatly improved towards striped hyaenas (Figure 9.1). This change in attitudes probably arose from my frequent presence in these sites, through explaining the purpose of my research to local people and clarifying for them the impact of striped hyaenas and their role in the environment. Working on an animal like a striped hyaena, which suffers from a bad reputation (Chapter 7) and the negative attitudes that people hold towards it (Chapter 8) will raise their curiosity to learn more about it. During my visits to the study sites, and especially to those sites in rural areas, people often gathered to see what I was doing in their village. Furthermore, they started asking questions about my research and about striped hyaenas that I spent a much time answering, in order to help them gain knowledge and experience of striped hyaenas. Indeed, I covered my four-wheel drive vehicle with photos and messages about striped hyaenas, thereby indirectly seeking to raise awareness. People often stopped me on the road to ask questions about striped hyaenas, or to tell me information or stories about them. Brewer (2002) also reported that working closely with local communities can help introduce people to what a scientist does, and how and why they do it, while at the same time, a scientist can learn from local people about the threats that face species and habitats, and how local people relate to them.

Another factor that probably helped to change attitudes after 1.5 years of my research was the use of local assistants and volunteers who helped me in the field. At each site, I was helped by local assistants and volunteers who introduced me to people or walked with me during the transect surveys. On such occasions, I answered their questions about wildlife in general and about striped hyaenas in particular. Such conversations helped to raise their knowledge of striped hyaenas that, in turn, they started to spread among their friends. Furthermore, on more than one occasion at different sites, I was walking with an assistant when we met people along the way who stopped us and questioned what we were doing, why we cared about hyaenas, while expressing their own negative attitudes towards the species. Then, instead of me explaining about the role of striped hyaenas in the environment and about the work that I was doing, the local assistant began to explain without being asked, which proved much more convincing for those people. Furthermore, I found that training active and well connected members of the community was very successful in raising awareness. Local people living in the same environment, and using the same language, can understand and convince each other much more than any outsider trying to convince them. Similarly, local volunteers promoted a much better understanding of the conservation needs of marine and fresh water ecosystems in Vancouver Public Aquarium (Marliave et al. 1999) and in Baltimore Zoo (Wisnieski and Poole 1999).

9.4.2 Changing attitudes of local people pre-and post-seminar

Pre-seminar, most local people held negative attitudes towards striped hyaenas. However, many fewer people recognized their positive role in the environment, but even fewer people supported their conservation or had the will to protect them. As with an earlier study attitudes of local people in the study sites before any research began (Chapter 8), the negative attitudes of the seminar attendees were mainly determined by their gender (Figure 9.2b, 9.3), and by the relative abundance of striped hyaenas across study sites (Figure 9.2a), while the positive attitudes of respondents, and their will to protect striped hyaenas, were largely determined by their education levels (Figure 9.5).

Furthermore, respondents' support towards the conservation of striped hyaenas was determined by the relative abundance of striped hyaenas in their study site (Figure 9.6). Least support was shown towards striped hyaena conservation by local people who reside in sites where the relative abundance of striped hyaenas is relatively high (0.74 hyaenas per km^2). Seeing an animal may create the impression for local residents that this species is abundant and has no likelihood of becoming extinct, in turn suggesting that conservation measures are unnecessary. Equally, this relationship is possibly more complex than it appears at first sight, because a high relative abundance of striped hyaenas does not always equate to a high sightability of hyaenas by local residents. For example, residents from Chnaniir, where striped hyaenas were most abundant (Chapter 3), were less likely to have claimed to have seen striped hyaenas, while in Bnachii where striped hyaenas were less abundant, yet more people claimed to have seen them (Chapter 6).

The seminar was very effective in changing the views of local people towards striped hyaenas, in the immediate short term at least. Most (>80%) respondents had changed their negative views after the seminar and none of the explanatory factors played any more important role than any other in changing the views of attendees after the seminar. A lack of knowledge about striped hyaenas and their bad reputation were the main causes of any negative attitudes. The effectiveness of the seminar was also triangulated in several ways. Informal conversations with attendees after the seminar (Plate 9.1) showed their interest and eagerness to learn more about the topic, and several people commented that if they had known these facts about striped hyaena beforehand, they might not have killed any of them.

Plate 9.1. Informal conversation with people after the seminar.

This change in views was also confirmed over the longer term by local field assistants from across the study sites, who reported a change in the behaviour of local people towards striped hyaena after the seminar. Moreover, I was asked by local people in the study sites, and by those living in other villages surrounding the study sites who had attended the seminar, to repeat it again in their villages. These qualitative results showed the importance of the awareness seminar in changing the views of local people, and improving the image of striped hyaenas. Moreover, showing the video of how a striped hyaena had behaved while it was trapped and was being radio collared was very effective in changing attendees' views.

9.4.4 Awareness at the Animal Encounter

Attitudes towards striped hyaenas also appeared to be generally negative among most of the wider Lebanese public who visited Animal Encounter. However, some visitors to Animal Encounter knew of the positive role of striped hyaenas in the environment, but such knowledge did not bring much support for its conservation. The awareness programmes were very effective overall in changing the views of visitors. However, the active approach was very much more effective in changing visitors' views than the passive approach (Figure 9.11). Likewise, it was reported that an active approach was more effective in changing attitudes of visitors to Zoo Atlanta (Swanagan 2000) and North Carolina (Barney et al. 2005), while passive approaches have been shown to be largely ineffective (Balmford et al. in press).

For example, Dunlap and Kellert (1989) found that awareness programmes were largely ineffective when restricted to animal appearance and behaviour, and several factors might be at play here. Wildlife centres are a major visitor attraction and are more visited than any other type of museum collection (Kotler and Kotler 1998). For example, Berlin Zoo received over 2 million visitors per year (Shackley 1996), Mexico City Zoo received over 12 million visitors per year, Beijing Zoo averaged 11 million visitors per year, and San Diego Zoo received 3.3 million visitors per year (van Linge 1992). However, many such visits to zoos may be made to spend some time outside the house or the office, or to occupy and entertain children, rather than to learn about the animal exhibits (Bostock 1993). In the case of visitors to Animal Encounter, many considered their visit to be part of their normal weekend activities, while some were visiting Animal Encounter just to see a particular animal. As some of the visitors said:

> *"We are just coming to see the hyaena or the bear... and leave. We don't need the guided tour ...."*

In such situations, any exposure by the visitors to the information boards will be short and they may only pay attention to the behaviour of the animal that attracted them, so the information boards will be either missed or ignored. Indeed, Bitgood et al. (1988) reported that animal behaviour can distract the attention of zoo visitors from the ecological and conservation message. Added to this, adults may be pre-occupied looking after their children (Balmford et al. in press). Hence, social interactions between visitors during their visit may further increase the chance of missing the information boards and even missing the animals. This was very obvious as some visitors, asked on the way out, noted:

"you do not have wolves, foxes or buzzards...."

Their names, however, are written on the cages, and these species are very visibly displayed, such that they should not easily be missed, given their size and the consequent area of their exhibit.

Furthermore, some social interactions might also affect visitors' attitudes negatively (Bitgood et al. 1988), as was regularly observed at Animal Encounter. Most visitors at the hyaena exhibit start describing the power of striped hyaenas, how it mesmerizes and kills people, and some stories about it, to other visitors including their family, friends, or other visitors that they had just met at Animal Encounter. Such social interactions could result in perpetuating negative attitudes towards striped hyaenas that will not benefit their conservation. Therefore, for many reasons, a passive approach using signs may be less successful than an active approach (Marcellini and Jenssen 1988, Kellert et al. 1996), since visitors may spend very little time at an exhibit, and may leave with misconceptions. Furthermore, passive approaches to zoo education can be negatively affected by selective memory, as well as by message clarity and accuracy, and by the frequency of receiving the message (Williams 1979, Tessler and Shaffer 1990, Kellert et al. 1996).

On the other hand, active outreach programmes that educate people are more efficient at creating awareness (Kellert 1996). Similarly, the active approach at Animal Encounter was more reliable and effective in changing negative attitudes towards striped hyaena (Figure 9.11). This approach ensures that most visitors gain important information about striped hyaenas, allowing a better understanding of their behaviour and ecology through the interaction between the visitors and the guides. Similarly Swanagan (2000) reported that an active experience with the elephant show at Zoo Atlanta was more effective than the passive experience of seeing the animal and reading the accompanying graphics. Lectures involving live rattlesnakes in Houston Zoo were also very effective in increasing public awareness (Mays 2001). Moreover, educational outputs like textbooks, CD-ROMs, and talks will increase the levels of knowledge, and understanding about conservation issues, as well as strengthen commitment to biodiversity, and enhance the achievement of conservational goals (Olson and Zanna 1993, Fien et al. 2001, Main 2004, Miller et al. 2004).

9.5 Summary

1) Using questionnaire interviews, awareness programmes, comprising seminars at the study sites and an active approach at Animal Encounter, have been shown to be very effective at changing the views of adult towards striped hyaenas, and to improve their support for striped hyaena conservation.
2) One key factor that affected the negative attitudes of visitors from among the wide Lebanese public was the number of stories that portrayed an image of the bravery of men when

encountering a striped hyaena. Visitors who knew both such stories did not consider striped hyaenas as beneficial to the environment, and saw no reason why they should not be killed.

3) Such results show the need for paying more attention to the need to raise awareness among adults through different kinds of approaches. Indeed, Miller et al. (2004) recommended that adult education requires sensitivity and preparation, since most adults have an economic stake in the policies that affect conservation issue.

The next chapter will evaluate the effectiveness of Animal Encounter programmes, and the passive and active awareness approaches, to improving pupils' and teachers' attitudes towards striped hyaena.

Chapter 10

A ZOO-BASED AWARENESS PROGRAMME FOR STUDENTS AND THEIR TEACHERS

A poster drawn by Wissam Sleiman a 12 year-old student after his visit to Animal Encounter

10.1 Introduction

Collections and displays of exotic animals were once reserved to be seen only by royalty. However, zoological collections were later established for the wider public to see some of the exciting, exotic, and endangered species of the world, and for scientists to promote taxonomic and other studies (Schaaf 1994). However, most zoological collections today have almost entirely changed their missions, from merely being viewing sites of the exotic and research institutions, into more coherent institutions that deal with conservation education, breeding of endangered species and field research, in support of *in situ* conservation (Eluned et al. 1994, Schaaf 1994, Norton et al. 1995, Swanagan 2000).

It is imperative in today's society that the rate of extinction is slowed down and that endangered species are preserved, and conservation education can help bring this about. Zoological collections can play an important role in changing the attitudes of human society towards wildlife, environment, and the promotion of environmental actions, by providing the zoo-visiting public with an awareness of animals and their habitats, that leads to public participation in wider conservation efforts (de White and Jacobson 1994, Kruse and Card 2004). Indeed, a key role for modern zoos is to educate the public on the importance of biodiversity and its conservation using "hands on" techniques based on an effectively displayed animal collection (Whitehead 1995, Lindemann-Matthies 2001). Moreover, the idea behind these conservation programmes is to educate young people on the importance of conserving wildlife and their habitats, so that young people can serve as advocates of conservation, both during their youth and later as adults (Serrell 1981). Attitudes can be acquired and formed at a young age, and may be carried into adulthood (Eagles and Muffitt 1990, Basile 2000), so conservation education should begin at a young age and continue throughout adulthood. Such education, when effectively delivered, may improve negative attitudes towards the environment, which in turn may affect conservation efforts positively (Marshydole et al. 1982, Pomerantz 1991).

Knowledge of conservation can be increased through conservation education and awareness programmes, and those run outside the classroom have a greater impact than those more traditional classroom programmes (Shepard and Speelman 1986, Dettmann-Easler and Pease 1999). For example, when an animal husbandry component was added to a more traditional zoo conservation education programme in Cali, Colombia, young people reported gaining more knowledge, more positive attitudes, and greater behavioural intent to act in an environmentally responsible manner than they had previously (de White and Jacobson 1994).

In order to more fully establish the effectiveness of conservation awareness programmes, more research is needed on how behaviour, attitudes and knowledge are affected over time by conservation education, and how previous conservation education experience can be related to attitudinal and behavioural change (de White and Jacobson 1994; Shepard and Speelman 1986). It has already been suggested that more active awareness programmes are more effective than the passive ones relying on displays and passive information only (Kellert 1996, Miller et al. 2004). However, more research is needed to document attitudes before the public participate in an awareness programme, to compare any change in attitudes that may occur after participation in passive and active awareness programmes. Therefore, this chapter aims to examine the effectiveness of zoo education in changing the negative attitudes of students and their teachers towards striped hyaena using the two previous approaches (Chapter 9) of a passive programme including seeing the animals and information boards: and, an active programme that included an awareness seminar. Therefore, this chapter will seek to answer the following questions:

- what are the attitudes of students and their teachers visiting Animal Encounter towards striped hyaenas, and what factors are important in determining those attitudes?
- what approaches, whether passive or active awareness programmes, are most effective in changing the attitudes of those students and teachers, and in gaining more support for conserving striped hyaenas?

10.2 Methods

An awareness programme relating to striped hyaenas was conducted for students aged from 11 years to less than 22 years, and their teachers, between January 2003 and September 2004. The programme comprised a tour of the animal exhibits, and a seminar on striped hyaenas.

1- On their arrival, students and teachers followed a self-guided tour of Animal Encounter, which gave them the opportunity to see the animal exhibits, on the cages of which were attached boards displaying information in the three languages of Arabic, English, and French, about each exhibited animal (Plate 10.1);
2- After finishing the tour, students attended a seminar (see Chapter 9), during which an awareness pamphlet was distributed to them all.

Plate 10.1. Students at the Animal Encounter looking at the striped hyaena exhibit with its live animals and information boards.

In order to test the effectiveness of different components of this awareness programme in changing the attitudes of students, a structured questionnaire interview was administered at three stages in the programme: at the entrance to Animal Encounter; after the tour; and, after the seminar. In contrast, the structured questionnaire interview was administered to teachers only at two stages in the programme: at the entrance to Animal Encounter; and, after the seminar. The post-tour stage was omitted for teachers, as they were too busy supervising the students, and so could spend little time looking at the animal exhibits and their associated information boards.

- The interview at the entrance to Animal Encounter began with questions to obtain demographic and socio-economic data on the students and their teachers including: their governorate of origin, gender, age, and education level. These questions were followed by five dichotomous questions. One dichotomous question sought to document whether they had previously seen a striped hyaena, whether in the wild or in a zoo, and the other four questions sought to determine their attitudes towards striped hyaenas, including whether respondents considered striped hyaenas as dangerous, harmful or beneficial; and whether they supported striped hyaena conservation. A further three non-dichotomous questions administered only to students sought to understand which of four sources of information to which they might have been exposed had most determined their knowledge and attitudes, comprising: 1) through their own learning; 2) because they had been told by their parents; 3) or had been told by their teacher; or 4) had learned from watching television programmes.

- The interviews after the tour and after the seminar, only sought answers to the same four dichotomous questions on attitudes towards striped hyaenas.

A total of 349 students and 233 teachers were interviewed from across the five governorates of Lebanon.

10.2.1 Statistical analysis

The Statistical Programme for the Social Sciences (SPSS) for Windows version 12.0.1 was used to conduct a statistical analysis to determine which factors might explain the responses of students. The statistical data for each question were first analysed using descriptive statistics, and responses were compared using Chi-square test, but these are not shown for reasons of space. Based on the initial tests, multivariate analyses, using logistic regression were then performed to model responses, as these provide a convenient way to undertake categorical data analyses. Forward Wald logistic regression was used to specify the model with a significance $P<0.05$. Dichotomous questions were given a dummy of 1 if answers were positive and 0 if answers were negative, and these responses were taken as the dependent variable. The explanatory variables for the analyses included: governorate of origin, density of striped hyaena across governorate (see Chapter 3), having previously seen a striped hyaena, gender, age, and education level and source of knowledge. The likelihood ratio goodness of fit test of the model was described using Chi-square goodness of fit statistics. Model performance on the testing sets was evaluated by calculating the area under the curve (AUC) of receiver operation characteristics (ROC) plots. ROC values range from 0.5 to 1.0. Values above 0.7 indicate strong model fit, while those above 0.9 indicate a highly accurate model (Swets 1988).

General Linear Model (GLM) Repeated Measures in SPSS 12.0.1 for Windows were used to determine the effectiveness of different approaches to changing attitudes of students. GLM Repeated Measures procedure was used because it can handle non-orthogonal designs and mixtures of continuous and categorical explanatory variables. The GLM repeated measures procedure provides analysis of variance when the same measurements are made several times on each subject or case (Vonesh and Chinchilli 1996).

10.3 Results

10.3.1 Attitudes of students

The attitudes of students, who lived outside the study sites, were primarily negative towards striped hyaenas, as were those of adults living in the study sites and among the wider Lebanese public as already described in Chapters 8 and 9. However, their attitudes were dependent on the students' governorates of origin, on whether they had seen a striped hyaena previously, their gender, age and education levels, and their source of information about striped hyaenas.

10.3.1.1 Are striped hyaena dangerous?

Most (81.7%) of the 349 students interviewed at the entrance to Animal Encounter considered striped hyaenas as dangerous animals. Of the 285 students who considered striped hyaena as dangerous, most (42.5%) students referred their attitudes to comments made by their parents. In contrast, 12.7% of students considered striped hyaenas dangerous through their own learning, 17.9% because they had been told by their teachers and 27.0% because of watching television programmes (Figure 10.1). In contrast, 32.8% of the 64 students who did not consider striped hyaenas as dangerous referred their attitudes to watching television programmes, while 25.0% did not consider striped hyaenas as dangerous through their own learning, 28.1% because they had been told by their parents, and 14.1% because they had been told by their teachers (Figure 10.1).

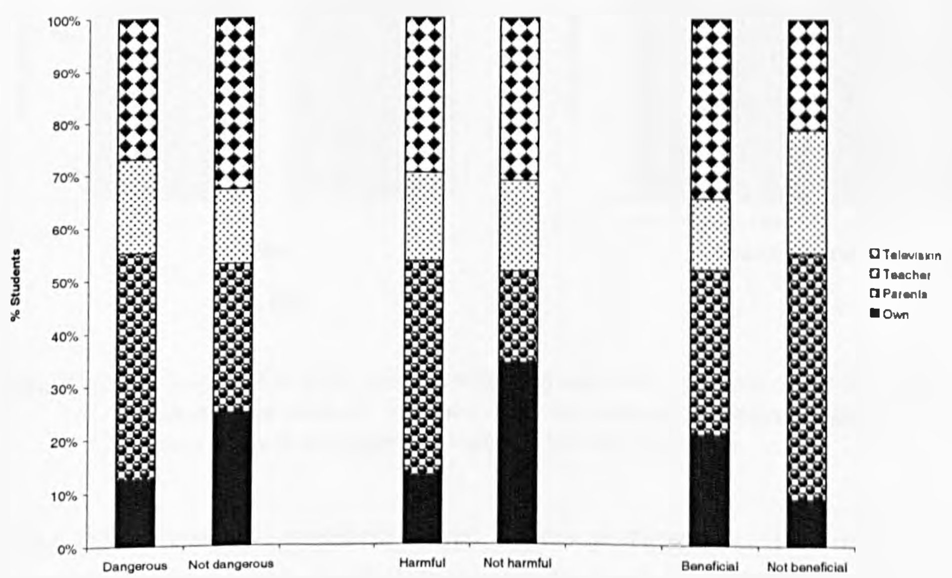
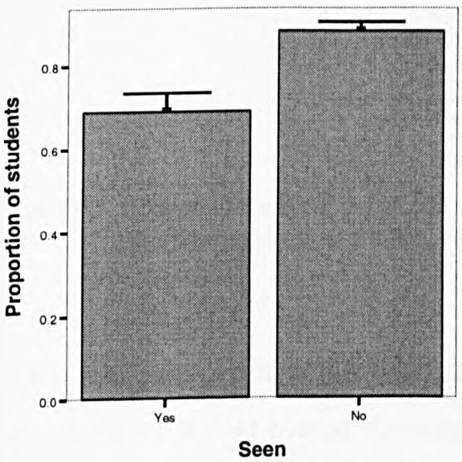


Figure 10.1. The sources of information to which students interviewed at Animal Encounter attributed their attitudes towards striped hyaenas.

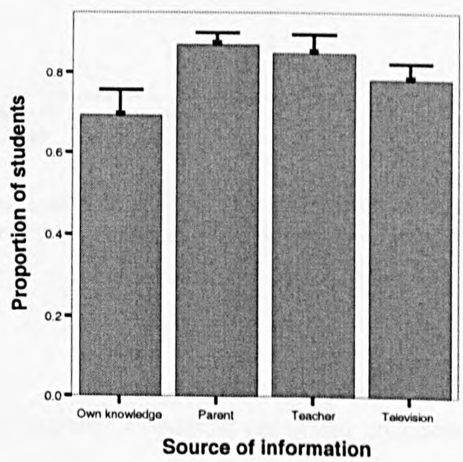
The overall model for factors that might have determined whether or not students considered striped hyaenas as dangerous explained 81.4% of the variance, with an ROC value of 0.706, indicating a strong fit to the model. Having previously seen a striped hyaena and their source of information played the most important role in determining their attitudes, although the latter was only just significant (Table 10.1). Students who had seen a striped hyaena previously were least likely to consider striped hyaenas as dangerous (Figure 10.2a). Furthermore, parents, followed by teachers, were the most likely source of information to affect their attitudes (Figure 10.2b).

Table 10.1. Factors determining whether or not students interviewed at the entrance to Animal Encounter considered striped hyaenas as dangerous, based on logistic regression.

Variables	B	S.E.	Wald	df	Significance
Seen a striped hyaena	-1.216	0.290	17.645	1	0.000
Source of information			0.963	3	0.047
Own learning	-0.421	0.403	1.090	1	0.296
Parent	0.616	0.362	2.886	1	0.089
Teacher	0.537	0.450	1.422	1	0.233
Television	0	-	-	0	-
Constant	1.788	0.289	38.236	1	0.000



(a)



(b)

Figure 10.2. The importance of (a) seeing a striped hyaena and (b) source of information in explaining the proportion of students interviewed at the entrance to Animal Encounter who considered striped hyaenas as dangerous, based on logistic regression.

Of the 285 students who considered striped hyaenas as dangerous at the entrance, only 13.3% had changed their views after their self-guided tour, and none of the explanatory factors played any more important role ($P>0.05$) than any other factor in determining any changes in views of the danger of striped hyaenas. In contrast, of the 247 students who still considered striped hyaenas as dangerous after the tour, most (92.7%) had changed their views after the seminar. Likewise, none of the explanatory factors had played any more important role (P>0.05) than any other factor in changing students' views after the seminar.

Taken together, the combination of the tour and the awareness seminar was more effective overall than the tour alone in changing the views of students to whether they considered striped hyaenas as dangerous ($F=570.373$, df= 2,347, $P<0.001$). There was no significant mean difference (0.034 ± 0.023, $P>0.05$) in views after the tour only, but there was a highly significant mean difference (0.751 ± 0.025, $P<0.001$) after the seminar (Figure 10.3).

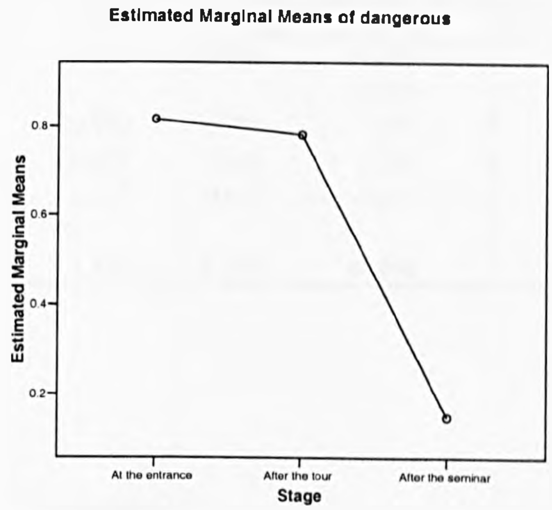


Figure 10.3. Change in the mean proportion of students who considered striped hyaenas as dangerous at the three stages at which they were interviewed, based on GLM Repeated Measures.

10.3.1.2 Are striped hyaenas harmful?

Most (81.7%) of the 349 students interviewed at the entrance to Animal Encounter considered striped hyaenas as harmful animals. Of the 285 students who considered striped hyaenas as harmful, most (40.4%) referred their attitudes to information learned from their parents. In contrast, 13.0% of students considered striped hyaenas harmful through their own learning, 16.8% because they had been told by their teachers, and 29.8% because of watching television programmes (Figure 10.1). In contrast, 34.4% of the 64 students who did not consider striped hyaenas as harmful referred their attitudes through their own knowledge, while 17.2% did not consider striped hyaenas as harmful because they had been told by their parents, 17.2% because they had been told by their teachers, and 31.3% because of watching television programmes (Figure 10.1).

The overall model for the factors that might have determined whether or not students considered striped hyaenas as harmful explained 81.7% of the variance, with an ROC value of 0.722, indicating a strong fit to the model. Having previously seen a striped hyaena, and their source of information played the most important role in determining their attitudes (Table 10.2). Hence students who have previously seen a striped hyaena were least likely to consider striped hyaenas as harmful (Figure 10.4a). Furthermore, information learned from parents was most likely to lead students to considering striped hyaenas as harmful, while their own learning was least likely to lead them to considering striped hyaenas as harmful (Figure 10.4b).

Table 10.2. Factors determining whether or not students interviewed at the entrance to Animal Encounter considered striped hyaenas as harmful, based on logistic regression.

Variables	B	S.E.	Wald	df	Significance
Seen a striped hyaena	-0.986	0.292	11.369	1	0.001
Source of information			18.975	3	0.000
Own learning	-0.902	0.375	5.776	1	0.016
Parent	0.928	0.408	5.187	1	0.023
Teacher	0.062	0.425	0.021	1	0.884
Television	0	-	-	0	-
Constant	1.832	0.287	40.890	1	0.000

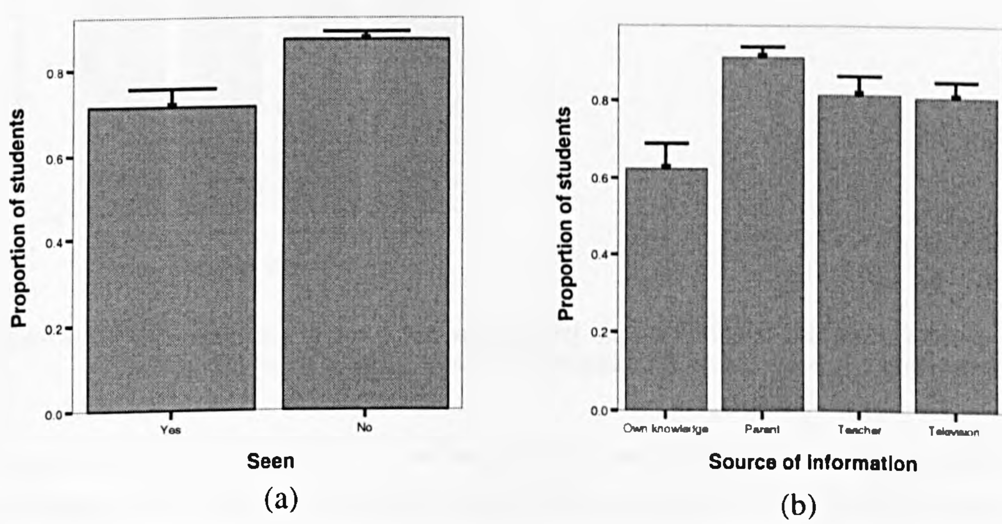


Figure 10.4. The importance of (a) seeing a striped hyaena and (b) source of information in explaining the proportion of students interviewed at the entrance to Animal Encounter who considered striped hyaenas as harmful, based on logistic regression.

Of the 285 students who considered striped hyaenas as harmful at the entrance, only 17.5% had changed their views after their self-guided tour. The overall model for the factors that might have determined whether or not students considered striped hyaenas as harmful after the tour explained 82.5% of the variance, with an ROC value of 0.607, which indicated a just satisfactory fit to the model. The age of students was the only factor that played a role in determining their change of view (Table 10.3). Hence, the older students >18 years of age were least likely to consider striped hyaenas as harmful after the tour (Figure 10.5).

Table 10.3. Factors determining whether or not students interviewed after the self-guided tour considered striped hyaenas as harmful, based on logistic regression.

Variables	B	S.E.	Wald	df	Significance
Age group			8.707	3	0.033
11 yrs	1.429	0.522	7.487	1	0.006
12<yrs<14	0.973	0.454	4.604	1	0.032
15<yrs<17	1.484	0.665	4.983	1	0.026
>18 yrs	0	-	-	0	-
Constant	0.531	0.399	1.773	1	0.183

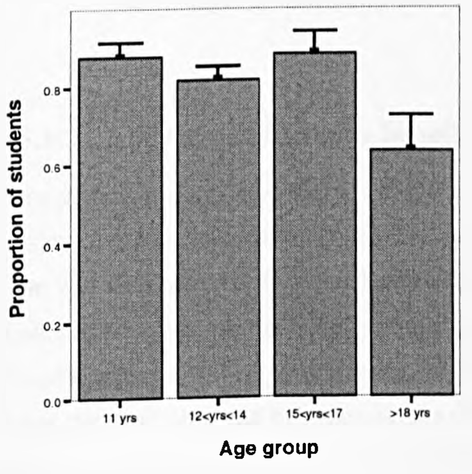


Figure 10.5. The importance of age group in explaining the proportion of students interviewed after the self-guided tour who considered striped hyaenas as harmful, based on logistic regression.

In contrast, of the 235 students who considered striped hyaenas as harmful after the tour, most (83.8%) had changed their views after the seminar, and none of the explanatory factors played any more important role (P>0.05) than any other factor in changing students' views after the seminar.

Taken together, the combination of the tour and the awareness seminar was more effective overall than the tour alone in changing the views of students to whether they considered striped hyaenas as harmful (F=346.788, df= 2,347, P<0.001). There was a slightly significant mean difference (0.069±0.025, P<0.05) in views after the tour only, but there was a highly significant mean difference (0.679±0.028, $P<0.001$) after the seminar (Figure 10.6).

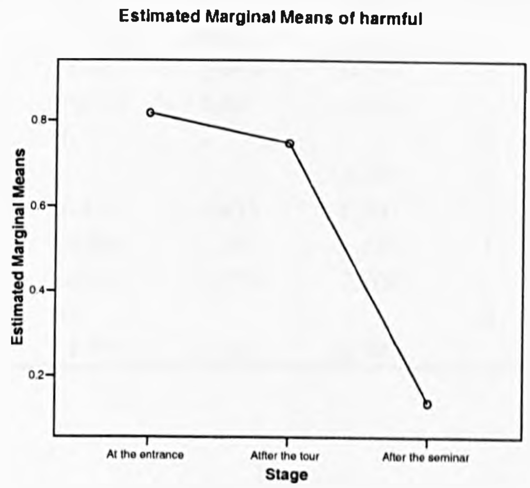


Figure 10.6. Change in the mean proportion of students who considered striped hyaenas as harmful at the three stages at which they were interviewed, based on GLM Repeated Measures.

10.3.1.3 Are striped hyaenas beneficial?

Although most students held negative attitudes towards striped hyaenas, many (67.3%) of the 349 students interviewed at the entrance to Animal Encounter were aware of their beneficial role to the environment. Of the 235 students who considered striped hyaenas as beneficial, most (34.5%) students referred their attitudes to watching television programmes. In contrast, only 20.9% students considered striped hyaenas as beneficial through their own learning, 31.3% because they had been told by their parents and 13.6% because they had been told by their teachers (Figure 10.1). In contrast, 46.5% of the 114 students who did not consider striped hyaenas as beneficial referred their attitudes to comments made by their parents, while 8.8% did not consider striped hyaenas as beneficial through their own learning, 23.7% because they had been told by their teachers, and 21.1% because of watching television programmes (Figure 10.1).

The overall model for the factors that might have determined whether or not students considered striped hyaenas as beneficial explained 71.6% of the variance, with an ROC value of 0.682, indicating a satisfactory fit to the model. Age group and source of information appeared to play the most important role in determining their attitudes (Table 10.4). Hence, parents and teachers were the least likely sources of information to influence the attitudes of students to considering striped hyaenas as beneficial (Figure 10.7a). Moreover, younger students (11 years of age) were least likely to consider striped hyaenas as beneficial (Figure 10.7b).

Table 10.4. Factors determining whether or not students interviewed at the entrance to Animal Encounter considered striped hyaena as beneficial based on logistic regression.

Variables	B	S.E.	Wald	df	Significance
Age group			13.487	3	0.004
11 yrs	-1.265	0.514	6.053	1	0.014
12<yrs<14	-0.417	0.494	0.710	1	0.399
15<yrs<17	-0.163	0.603	0.073	1	0.787
>18 yrs	0	-	-	0	-
Source of information			13.747	3	0.003
Own knowledge	0.196	0.433	0.205	1	0.651
Parent	-0.805	0.301	7.139	1	0.008
Teacher	-0.965	0.359	7.209	1	0.007
Television	0	-	-	0	-
Constant	1.795	0.508	12.502	1	0.000

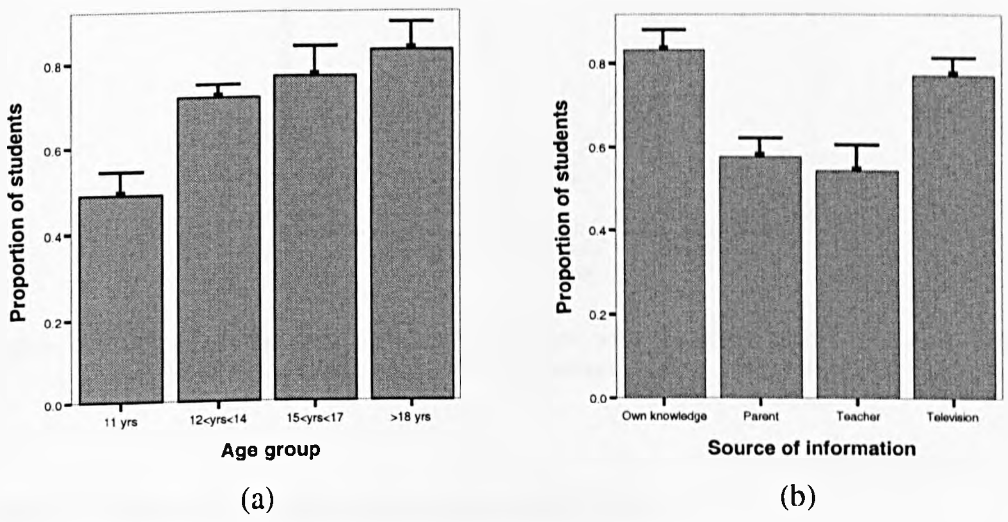


Figure 10.7. The importance of (a) age group and (b) source of information in explaining the proportion of students interviewed at the entrance to Animal Encounter who considered striped hyaenas as beneficial, based on logistic regression.

Of the 114 students who did not consider striped hyaenas as beneficial at the entrance, few (36.0%) changed their views after their self-guided tour, and none of the explanatory factors played any more important role (P>0.05) than any other factor in determining any change of view to the beneficial role of striped hyaenas. In contrast, of the 73 students who still did not consider striped hyaenas as beneficial after the tour, most (71.2%) had changed their views after the seminar. Likewise, none of the explanatory factors played any more important role (P>0.05) than any other factor in changing the views of students after the seminar.

Taken together, the combination of the tour and the awareness seminar was more effective overall than the tour alone in changing the views of students to whether they considered striped hyaenas as beneficial (F=40.353, df= 2,347, P<0.001). There was no significant mean difference (0.00±0.026, P>0.05) in views after the tour only, but there was a highly significant mean difference (-0.206±0.028, P<0.001) after the seminar (Figure 10.9).

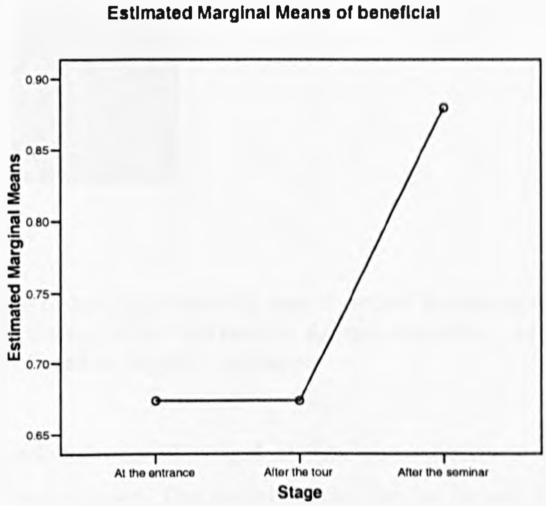


Figure 10.9. Change in the mean proportion of students who considered striped hyaenas as beneficial at the three stages at which they were interviewed, based on GLM Repeated Measures.

10.3.1.4 Support for striped hyaenas conservation

Few (25.2%) of the 349 students interviewed at the entrance to Animal Encounter supported the conservation of striped hyaenas. The overall model for the factors that might have determined whether or not students supported the conservation of striped hyaena explained 74.8% of the variance, with an ROC value of 0.606, which indicated a just satisfactory fit to the model. Having previously seen a striped hyaena played the most important role in determining their support (Table 10.5). Hence, students who have seen a striped hyaena previously were most likely to support its conservation (Figure 10.10).

Table 10.5. Factors determining whether or not students interviewed at the entrance to Animal Encounter supported striped hyaena conservation, based on logistic regression.

Variable	B	S.E.	Wald	df	Significance
Seen a striped hyaena	0.908	0.253	12.857	1	0.000
Constant	-1.442	0.168	73.944	1	0.000

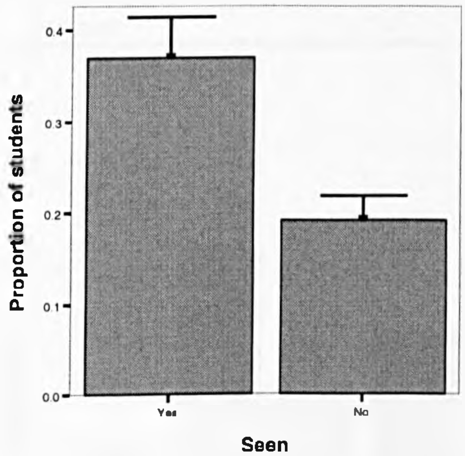


Figure 10.10. The importance of having previously seen a striped hyaena in explaining the proportion of students interviewed at the entrance to Animal encounter, who supported striped hyaena conservation, based on logistic regression.

Of the 261 students who did not support striped hyaena conservation at the entrance, few (25.7%) supported it after their self-guided tour. The overall model for the factors that might have determined whether or not students supported striped hyaena conservation after the tour explained 74.3% of the variance, with an ROC value of 0.619, indicating a satisfactory fit to the model. Education level of students only played the most important role in determining their support (Table 10.6). Hence, education level of students had an overall effect upon support of students towards striped hyaena conservation without any clear effect between different education levels, although students who had elementary education only were least likely to support striped hyaena conservation after the tour (Figure 10.11).

Table 10.6. Factors determining whether or not students interviewed after the self-guided tour support striped hyaena conservation, based on logistic regression.

Variable	B	S.E.	Wald	df	Significance
Education level			10.522	3	0.015
Elementary	-0.973	0.694	1.970	1	0.160
Intermediate	0.485	0.535	0.816	1	0.366
Secondary	-0.434	0.746	0.339	1	0.560
University	0	-	-	0	-
Constant	-1.224	0.509	5.786	1	0.016

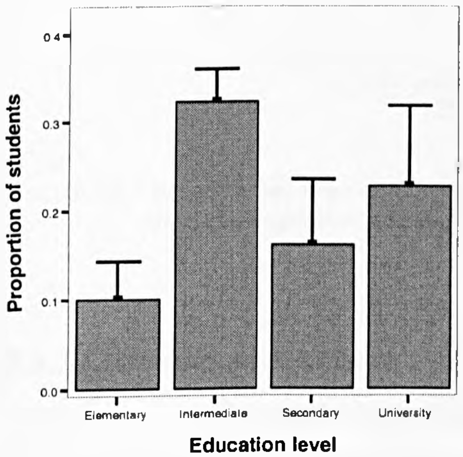


Figure 10.11. The importance of education level in explaining the proportion of students interviewed after the self-guided tour who supported striped hyaena conservation, based on logistic regression.

In contrast, of the 194 students who still did not support the conservation of striped hyaenas after the tour, most (75.3%) supported their conservation after the seminar. However, none of the explanatory factors played any more important role (P>0.05) than any other factor in determining any change in support after the seminar.

Taken together, the combination of the tour and the awareness seminar was more effective overall than the tour alone in changing the levels of support for conservation of striped hyaenas (F=229.507, df= 2,347, P<0.001). There was a significant mean difference (-0.109±0.028, P<0.001) in support towards striped hyaena conservation after the tour only, but there was an even more highly significant mean difference (-0.579±0.028, P<0.001) after the seminar (Figure 10.12).

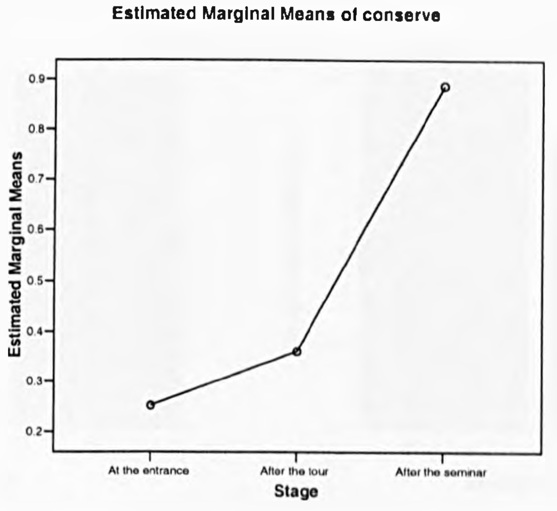


Figure 10.12. Change in the mean proportion of students who supported striped hyaena conservation at the three stages at which they were interviewed, based on GLM Repeated Measures.

10.3.2 Attitudes of teachers

Students in the previous section referred some of their attitudes towards striped hyaenas to information provided by their teachers. Therefore, this section explores the attitudes of teachers towards striped hyaenas and the factors that affect those attitudes.

10.3.2.1 Are striped hyaenas dangerous?

Most (68.2%) of the 233 teachers interviewed at the entrance to Animal Encounter considered striped hyaenas as dangerous animals. The overall model for the factors that might have determined whether or not teachers considered striped hyaenas as dangerous explained 68.2% of the variance, with an ROC value of 0.634, indicating a satisfactory fit to the model. Having previously seen a striped hyaena and education level played the most important role in determining their attitudes (Table 10.7). Hence, teachers who have seen a striped hyaena previously were least likely to consider striped hyaenas as dangerous (Figure 10.13a), as were teachers who had been to university (Figure 10.13b).

Table 10.7. Factors determining whether or not teachers interviewed at the entrance to Animal Encounter considered striped hyaenas as dangerous, based on logistic regression.

Variable	B	S.E.	Wald	Df	Significance
Seen a striped hyaena	-0.871	0.300	8.447	1	0.012
Education level (university)	-0.979	0.390	6.296	1	0.004
Constant	1.860	0.382	23.728	1	0.000

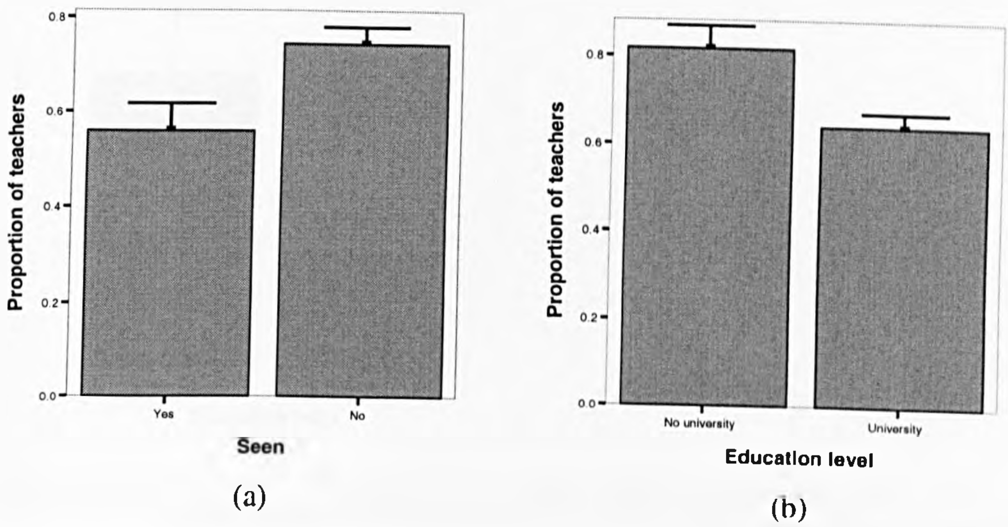


Figure 10.13. The importance of having previously seen a striped hyaena and education level in explaining the proportion of teachers interviewed at the entrance to Animal Encounter who considered striped hyaenas as dangerous, based on logistic regression.

Of the 159 teachers who considered striped hyaenas dangerous at the entrance, most (86.2%) had changed their views after the seminar. The overall model for the factors that might have determined whether or not teachers considered striped hyaenas as dangerous explained 86.2% of the variance, with an ROC value of 0.626, indicating a satisfactory fit to the model. Education level played the most important role in determining their change in views (Table 10.8). Hence, teachers who had been to university were least likely to consider striped hyaena as a dangerous animal after the seminar (Figure 10.14).

Table 10.8. Factors determining whether or not teachers interviewed after the seminar considered striped hyaenas as dangerous, based on logistic regression.

Variable	B	S.E.	Wald	Df	Significance
Education level (university)	-1.108	0.470	5.560	1	0.018
Constant	1.128	0.347	10.584	1	0.001

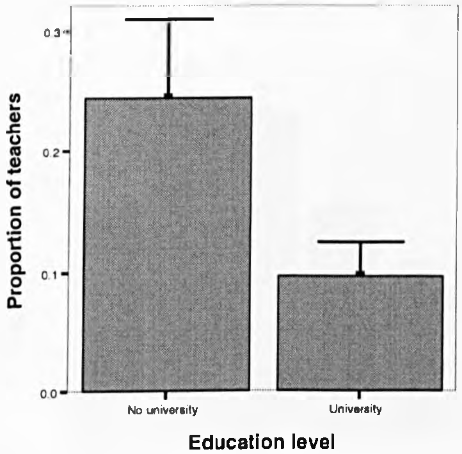


Figure 10.14. The importance of education level in explaining the proportion of teachers interviewed after the seminar who considered striped hyaenas as dangerous, based on logistic regression.

10.3.2.2 Are striped hyaenas harmful?

Teachers were fairly evenly divided over whether or not (45.8% vs. 54.2%) they considered striped hyaenas as harmful at the entrance to Animal Encounter. The overall model for the factors that might have determined whether or not teachers considered striped hyaenas as harmful explained 63.9% of the variance, with an ROC value of 0.710, indicating a strong fit to the model. Striped hyaena density across governorates and education level played the most important role in determining their attitudes (Table 10.9). Hence, teachers who reside in governorates where striped hyaenas are found at low density (0.005 hyaenas/km^2) were most likely to consider striped hyaenas as harmful. In contrast, teachers living in governorates where striped hyaenas are found at higher density (0.022 hyaenas/km^2) were least likely to consider striped hyaenas as harmful (Figure 10.15a). Furthermore, teachers who had been to university were least likely to consider striped hyaenas as harmful (Figure 10.15b).

Table 10.9. Factors determining whether or not teachers interviewed at the entrance to Animal Encounter considered striped hyaenas as harmful, based on logistic regression.

Variable	B	S.E.	Wald	df	Significance
Density			14.442	4	0.006
0	1.081	0.442	5.979	1	0.014
0.005	1.226	0.437	7.853	1	0.005
0.007	1.515	0.438	11.947	1	0.001
0.017	0.922	0.439	4.404	1	0.036
0.022	0	-	-	0	-
Education level (university)	-1.347	0.372	13.074	1	0.000
Constant	0.113	0.430	0.069	1	0.793

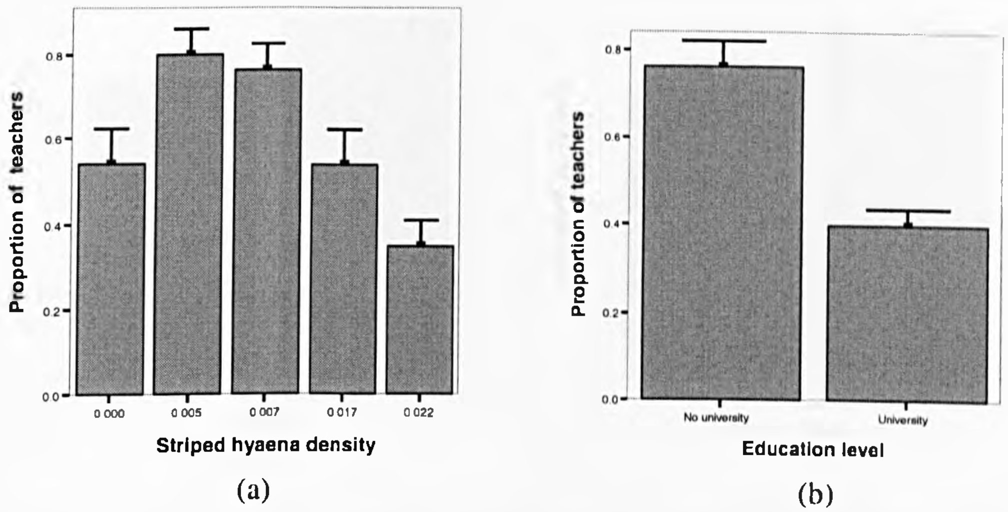


Figure 10.15. The importance of (a) striped hyaena density across governorates and (b) education level in explaining the proportion of teachers interviewed at the entrance to Animal Encounter, based on logistic regression.

Of the 113 teachers who considered striped hyaenas as harmful animal at the entrance, most (91.2%) had changed their views after the seminar, but none of the explanatory factors played any more important role (P>0.05) than any other factor in changing the views of teachers after the seminar.

10.3.2.3 Are striped hyaenas beneficial?

Most (78.5%) of the 233 teachers interviewed at the entrance to Animal Encounter were aware of the beneficial role of striped hyaena to the environment. The overall model for the factors that might have determined whether or not teachers considered striped hyaenas as beneficial explained 78.5% of the variance, with an ROC value of 0.618, indicating a satisfactory fit to the model. Gender and education level played the most important role in determining their attitudes (Table 10.10). Hence, male teachers were least likely to consider striped hyaenas as beneficial (Figure 10.16a) as were teachers who had not been to university (Figure 10.16b).

Table 10.10. Factors determining whether or not teachers interviewed at the entrance to Animal Encounter considered striped hyaenas as beneficial, based on logistic regression.

Variable	B	S.E.	Wald	df	Significance
Gender (male)	-0.769	0.335	5.269	1	0.022
Education level (university)	0.770	0.352	4.774	1	0.029
Constant	-1.007	0.321	9.849	1	0.002

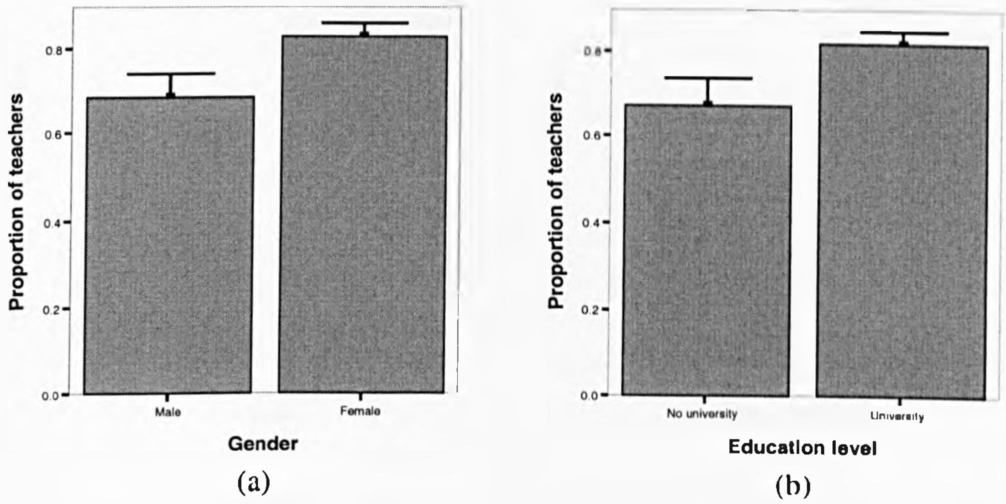


Figure 10.16. The importance of gender and education level in explaining the proportion of teachers interviewed at the entrance to Animal Encounter who considered striped hyaena as beneficial, based on logistic regression.

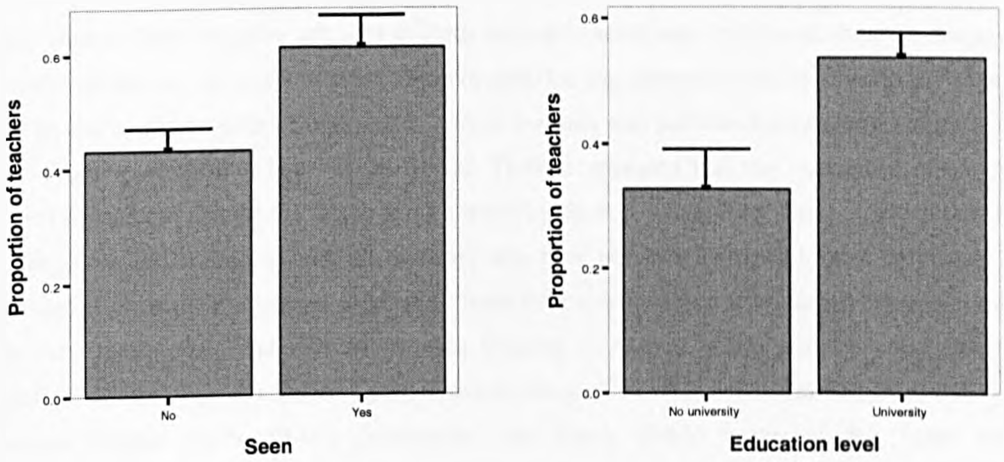
Of the 50 teachers who did not consider striped hyaenas as beneficial at the entrance, most (90.0%) had changed their views after the seminar, and none of the explanatory factors played any more important role ($P>0.05$) than any other factor in changing teachers' views after the seminar.

10.3.2.4 Support for striped hyaenas conservation

Teachers were fairly evenly divided (48.9% vs. 51.1%) on whether or not they supported the conservation of striped hyaenas at the entrance to Animal Encounter. The overall model for the factors that might have determined whether or not teachers supported striped hyaena conservation explained 59.7% of the variance, with an ROC value of 0.631, indicating a satisfactory fit to the model. Having previously seen a striped hyaena and education level played the most important role in determining their support (Table 10.11). Hence, teachers who have seen a striped hyaena previously were most likely to support striped hyaena conservation (Figure 10.17a), as were teachers who had been to university (Figure 10.17b).

Table 10.11. Factors determining whether or not teachers interviewed at the entrance to Animal encounter supported striped hyaena conservation, based on logistic regression.

Variable	B	S.E.	Wald	df	Significance
Seen a striped hyaena	0.923	0.331	7.791	1	0.005
Education level (university)	0.776	0.291	7.121	1	0.008
Constant	1.010	0.314	10.337	1	0.001



(a) (b)

Figure 10.17. The importance of (a) having previously seen a striped hyaena and (b) education level in explaining the proportion of teachers interviewed at the entrance to Animal Encounter who supported striped hyaena conservation, based on logistic regression.

Of the 119 teachers who did not support striped hyaena conservation at the entrance, most (83.2%) supported its conservation after the seminar, and none of the explanatory factors played any more important role (P>0.05) than any other factor in changing teachers' support towards striped hyaena conservation after the seminar.

10.4 Discussion

The attitudes of students and teachers were similar to those of adult visitors at the entrance to Animal Encounter (Chapter 9). Most students and teachers held negative attitudes towards striped hyaenas but, at the same time, many did not neglect their positive role in the environment, and showed some support for their conservation. Several factors had influenced the attitudes of students towards striped hyaenas, and most of the negative attitudes were influenced by information provided by their parents.

The overall awareness programme comprising both a self-guided tour and an awareness raising seminar, was very effective in changing the views of respondents, both students and their teachers, in the immediate short-term at least. For students, at least, it was possible to show that the combination of the awareness seminar and tour was much more effective overall than the self-guided tour alone, a message that appears very important for other zoo-based conservation programmes.

10.4.1 Negative attitudes among students

Most students held negative attitudes towards striped hyaenas and considered them as dangerous or as harmful. However, the extent of these negative attitudes was affected by having previously seen a striped hyaena and by their source of information. Fewer students who had previously seen a striped hyaena held such negative attitudes (Figure 10.2a, 10.4a). Thus, it appeared that the experience of having seen a striped hyaena can change the image that a student holds of this imaginary beast of which they had heard in fairy tales and stories. In contrast, students who have not seen a striped hyaena previously will only have heard of them from stories originating from their elders, which may portray the species as a beast that eats, mesmerizes, and kills people (see Chapter 7). Indeed, many students noted that they held negative attitudes towards striped hyaenas mostly because of information learned from their parents or teachers (Figure 10.2b, 10.4b). Dimopoulos and Pantis (2003) suggested that home and school environments may not provide information that is of direct value to conservation and protection of large carnivores. In contrast, Eagles and Demare (1999) showed that talking at home about environmental issues improved positive attitudes among Grade Six students in Waterloo-Canada.

Striped hyaenas are large carnivore with a bad reputation (Chapter 7) that in turn can result in negative attitudes (Chapter 8), especially when safety of their children is of primary concern to parents (Kaltenborn and Bjerke 2002). In Lebanon, many parents have modest knowledge, but great fear, of striped hyaenas (Chapters 6 and 8), and this may cause them to build fear in their children's hearts. For example, some parents will warn their children about seeing a wild or domestic animal by saying:

"*Don't get close to it, it will bite you*".

In such cases, the primary goal of the parents is to ensure the safety of their child. However, this may indirectly and unintentionally build up negative attitudes towards animals among their children. Other parents may threaten their children by saying:

"*Do this ... behave or I will let the dog bite you or I will throw you to the hyaena to eat*"

If such statements encourage their children to behave, this may encourage the children to use the sayings, when in turn they become parents and have to raise their own children. Hence, negative attitude may flow and be perpetuated from one generation to another. Furthermore, acquiring attitudes from parents parallels acquiring knowledge and behaviour "*like father... like son*". Knowledge and attitudes can be transmitted from generation to generation. Parents can transmit what they have learned from their own parents to their children. This was evident in Chapter 8 where most respondents said that they considered striped hyaenas as dangerous because they had been told so by their elders. Therefore, it is important for conservationists to raise the awareness of parents, because what children learn at a young age may persist with them until old age (Basile 2000).

Teachers also played a role in influencing the attitudes of students towards striped hyaenas (Figure 10.2b, 10.4b). Environmental education has only been recently introduced to the school curriculum in Lebanon. Teachers had not been previously exposed to such ideas, and their prior knowledge of this topic was still minimal. Similarly, Greek teachers lacked an integrated environmental educational plan, and therefore failed to raise environmental awareness among their students (Goussia-Rizou and Abeliotis 2004). Moreover, Christenson (2004) reported that collaboration with teachers can enhance environmental education in the classroom, thereby promoting conservation action. The influence of teachers on their students is probably related to the stories that were read by their own teachers during their classes.

Watching television programmes was another important factor that influenced the attitudes of students (Figures 10.2b, 10.4b). In the same way that a television programme can make some students love certain animals, it can also make them hate other animals. In this study, students were not asked to state which television programme had caused them to adopt their negative attitudes towards striped hyaenas. However, many students referred to the bad hyaenas in "*The Lion King*".

10.4.2 Positive attitudes among students

Although most students held negative attitudes towards striped hyaenas, some recognised their positive role in the environment. The age of students was an important factor in determining their attitudes (Figure 10.7a). Older students, who have had more chance to further their education, are more knowledgeable about the beneficial role of striped hyaena in the environment. Hence, the negative attitudes of students towards striped hyaenas decreased with age and as students attained higher educational levels (Kellert and Westervelt 1983, Leeming et al. 1993).

Parents and teachers had some affect upon the positive attitudes of students towards striped hyaenas. However, students learning by themselves were a very important factor in determining the extent of positive attitudes towards striped hyaenas (Figure 10.7b). Self-learning is a very important approach for those seeking information about subjects not taught at school. Students interested in wildlife can read more about it, and the increasing ease with which information can be accessed through the internet can help them to enrich their knowledge. It was reported that students from Waterloo, Canada who had read about environmental issues for themselves showed more positive attitudes towards the environment (Eagles and Muffitt 1990, Eagles and Demare 1999). Moreover, Pomerantz (1986) reported that students' environmental learning from environment magazine improved their attitudes towards the environment.

Television programmes may have played a dual role, both positive and negative, in influencing the attitudes of students. However, television programmes were more effective at influencing the positive attitudes of students and were probably good at reinforcing positive attitudes towards wildlife and the environment (Figure 10.7b). Similarly, Eagles and Demare (1999) and Eagles and Muffit (1990) found that watching nature films was correlated with positive attitudes towards the environment. Cable television is becoming very popular in Lebanon due to the increasing numbers of channels, including many wildlife channels, as well as their easy access and low cost. People were always fascinated with wildlife and animal behaviour programmes, and wildlife channels have proven the answer to their curiosity. Furthermore, free access to the ten national television stations that broadcasting in Lebanon for 24 hours a day, 7 days a week, are attracting greater audiences and can play an important role in enhancing knowledge among students. The Lebanese television stations show numerous children's' programmes and are always competing to reach larger audiences through generating new and attractive ideas. Programmes about animals are a very attractive topic for a wide range of audiences, including younger audiences. Indeed, the media have covered Animal Encounter since it was opened, and I have participated in over 100 broadcasts presenting on a wide range of wildlife issues. My broadcasts have included 10 children's programmes on different channels, 20 talk shows, and two series on wildlife issues broadcast on weekly bases for 12 weeks on two of the most popular television stations, namely Future Television (FTV) and Lebanese Broadcasting Cooperation International (LBCI) in 1998 and 2001. These TV spots were important in improving the attitudes of students. Through my conversations with students after the seminar, many referred their knowledge about striped hyaenas to the documentaries that were made at Animal Encounter.

Although a high percentage of students knew about the positive role of striped hyaenas in the environment, many fewer students supported their conservation, probably due to their superimposed negative attitudes. Conforti and Azevedo (2003) found that fear of certain species can cause a more passive response that might affect their conservation negatively. Seeing the striped hyaena was an important factor in improving the support of students towards the conservation of striped hyaenas (Figure 10.10). Students who have seen a striped hyaena probably realise that in reality, it was not the beast that has been portrayed through stories and fairy tales, and so show more support for their conservation.

10.4.3 Attitudes of students after the self-guided tour

Exposure to striped hyaenas resulted in a modest change in the views of (<20% of students (see sections 10.3.1.1, 10.3.1.2). Similarly, de white and Jacobson (1994) found that exposure to wild animals was insufficient to change attitudes of elementary Colombian students visiting Cali Zoo. In contrast, seeing a striped hyaena may have simply reinforced for the students what they already knew of its bad reputation. For example, some were telling each other:

"...have you seen how big it is..., have you seen his canine teeth that can crash iron bars?"

Other students looking at the striped hyaenas repeated what they had been told by their parents, and more than once students were heard to say:

"Take care! Do not get close to the cage as it might "pee" on you" or
"Do not tease him, as he will bite the fence and get you"

Moreover, most students when they knew that they were going to see a striped hyaena were telling each other to pinch their noses since their parents had told them that the hyaenas smelled the worst of all animals.

Such examples might explain why simply just encountering the animal was not so effective in changing students' views of striped hyaenas and may not lead to much support for its conservation. In other words, students were simply looking at the animals and were imagining what they had previously been told or heard about them.

Informational boards were also not very effective in changing attitudes. In part, this could be explained because students were so excited to see the animals that had not seen previously, which in turn may probably have caused them to neglect the information boards. Moreover, most schools do not brief their students about the importance of such trip before they leave, and they consider their visit to Animal Encounter as a day out of school and away from classes, so instead regard it as time for fun rather for than learning facts about conservation.

10.4.4 Views of students after the seminar

Conservation education programmes undertaken outside the classroom have a greater positive attitude change than they would through traditional classroom programmes (Shepard and Speelman 1986, Dettmann-Easler and Pease 1999, Kruse and Card 2004). During the awareness programme, encountering the animals or looking at information boards had a minimal effect on changing the attitudes of students and raising their awareness of the importance of conserving striped hyaenas. However, their views were more effectively changed, in the immediate short term at least, if the visit was accompanied by an active awareness programme. Thus, students visits are considered as an informal and un-graded outing, which means that the students will be more attracted by the animal and its behaviour, and pay less attention to the information boards about which they are not tested or assessed. However, intensive and active awareness programmes like seminars, lectures and workshops, can be more powerful tools if they attract the attention of students. Therefore, giving facts and viewing the 7-minutes video film on how the striped hyaena behaved during trapping and radio-collaring exercises, was very effective in changing student attitudes.

Consequently, the seminars that actively discussed the importance of wildlife in general, and of striped hyaenas in particular, were highly effective in changing the views of students towards striped hyaenas, in the immediate short term at least. Although the information on the information boards was the same as that given during the seminar, the seminar was nevertheless much more effective at changing the views of students. Students will concentrate more, and interact with the lecturer during the talk, rather than being distracted by the animal exhibits. Furthermore, many students had little previous knowledge of wildlife, probably allowing these high levels of change seen at Animal Encounter (Figures 10.3, 10.6, 10.9). Lisowski and Disinger (1991) also found that students with low levels of environmental knowledge and generally poor attitudes towards wildlife are much more in favour of change after an environmental education programme. Moreover, providing conservation education at earlier age is much more effective in changing attitudes (Caro et al. 1994), as is providing outdoor learning experiences that can positively influence the future environmental attitudes of children (Bogner 1998). Thus Rivas and Owens (1999) noted as follows:

> *"Grade-school children are still developing their personalities and they are receptive to new ideas and philosophies.... Seeding a love for nature in today's youth is the best hope we have of ever achieving a world with real respect for the earth instead of a minority of concerned citizens struggling to make the best of a bad job... we can make a more valuable contribution to conservation by diverting a little of the time that we currently devote for research to the simpler yet fruitful task of teaching children".*

10.4.5 Attitudes of teachers before the awareness programme

Like other members of the wider Lebanese public (Chapter 8 and 9), most teachers held negative attitudes towards striped hyaenas. The basis of their attitudes probably arose from the common mis-perceptions held among Lebanese citizens about striped hyaenas. However, some teachers also recognised the positive role of striped hyaenas in the environment and some of them supported their conservation.

The attitudes of teachers were mostly affected by their educational level, and more teachers who had been to university held positive attitudes towards striped hyaenas (Figure 10.16b). In contrast, more teachers who had not been to university held negative attitudes towards striped hyaenas (Figure 10.13b, 10.15b). Therefore, it appears vital that teachers who have not been to university should be offered environmental education, to avoid their wrong information and negative attitudes from misleading younger students. If misleading ideas are implanted in the minds of young children, this may cause negative attitudes towards striped hyaenas to persist until adulthood (Eagles and Muffitt 1990, Basile 2000).

Previously, seeing a striped hyaena positively affected the attitudes of teachers. As mentioned earlier (Chapter 8), seeing a striped hyaena can change the image of this fabled beast that they have heard about from their elders. Moreover, the density of hyaenas across governorates was important in determining whether teachers considered striped hyaenas as harmful animals. In governorates where hyaenas are present at higher densities, teachers probably knew more about them than those teachers living in areas with a low density of striped hyaenas. In the same way that seeing a striped hyaena can change its image, teachers living among hyaenas at a high density have probably gained sufficient experience to know that hyaenas are not harmful, rather than having to rely only on stories told by elders. The presence of Animal Encounter in the Mount Lebanon Governorate, which currently supports the highest relative densities of striped hyaenas (Table 3.2) probably positively affected the attitudes of teachers. However, we did not ask teachers on how many occasions they had visited Animal Encounter previously, to determine its effect upon their attitudes, and this factor will be taken into consideration in future studies.

10.4.6 Views of teachers after the seminar

Lack of knowledge can in part be blamed for the negative attitudes of teachers. The seminar introduced teachers to wildlife in general, and to striped hyaenas in particular, and this was very effective in changing their views. Similarly, de White and Jacobson (1994) found that training workshops for Colombian teachers appeared to be a very effective educational approach in improving their knowledge of conservation-related topics. The lack of environmental education training courses for teachers in Lebanon was very clear in their responses and in the very impressive change in their views after the seminar, when many teachers claimed that most of the information that they took from the seminar was new for them. And others claimed as follows:

> *"If we do not know this information, how we are going to teach it to our students?"*

Taken overall, the results encompassed in the last two chapters show the importance of raising the awareness of both parent and teachers, who spend much time with their children and students, and in turn have a big influence on their attitudes. Indeed, Eagles and Demare (1994) showed that positive attitudes among students were influenced by talking at home about environmental issues. Moreover, de White and Jacobson (1994) found that teachers exposed to appropriate environmental training improved their knowledge of conservation issues.

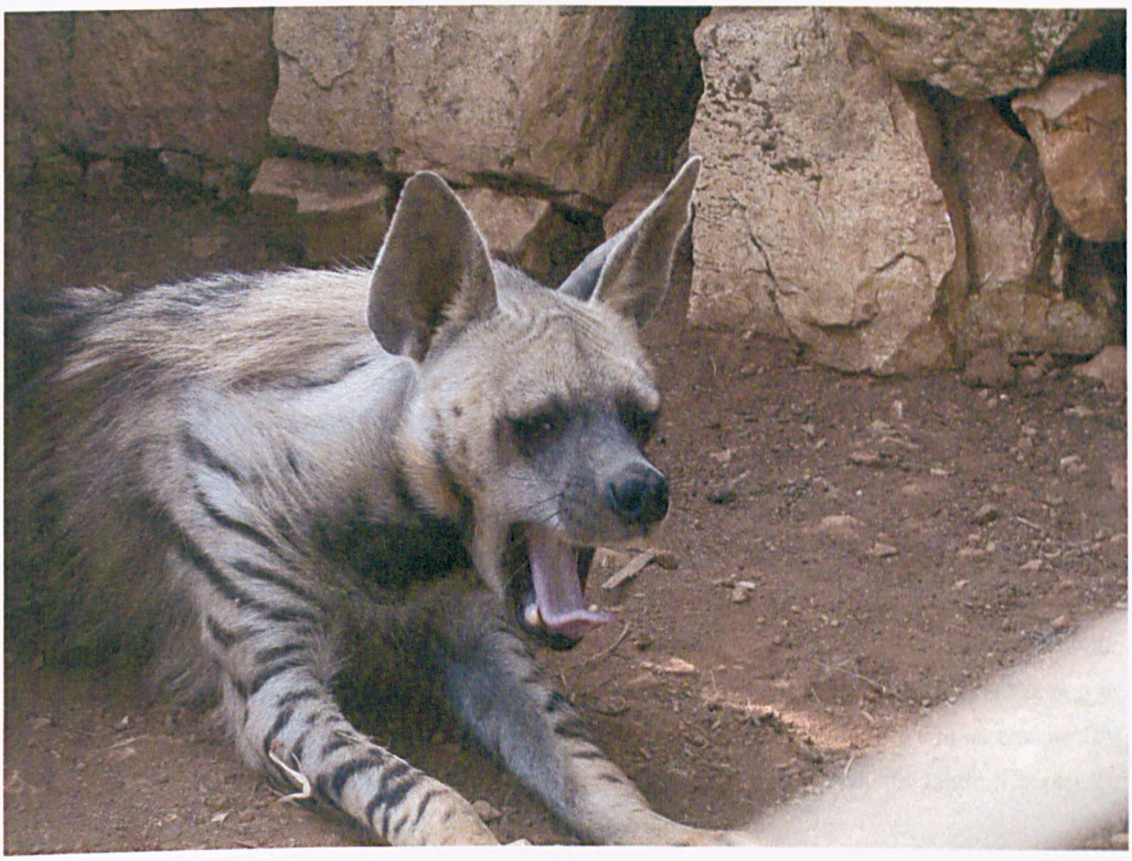
10.5 Summary

1) Using questionnaire interviews, an awareness programme at Animal Encounter, comprising both passive and active approaches, was shown to be very effective in changing students' and teachers' views towards striped hyaenas and to improving their support for their conservation.
2) The negative attitudes of students towards striped hyaenas were influenced mainly by their parents and teachers. In contrast, students who gained their own knowledge were more positive towards striped hyaenas. Moreover, television programmes played a dual role both positive and negative with greater reinforcement of the positive attitudes.
3) Moreover, the negative attitudes of teachers were influenced by their education levels. Teachers who had not been to university held more negative attitudes than those who has been to university.

The next and final chapter seeks to summerise the overall findings of the study, and to draw together the conclusions and recommendations that arise from it.

Chapter 11

Research Findings and Conclusions



11.1 Introduction

Protected areas remain a core activity for conservationists in their efforts to conserve biodiversity (Chape et al. 2005). However, many protected areas across the world are too small to achieve the objective of conserving widely ranging species of large mammals, and in particular of large carnivores at the top of the food chain that require a large home range and an adequate prey base (Lindsey et al. 2004). Furthermore, if efforts to conserve wild ungulate prey within protected areas do not succeed, and when livestock is no longer allowed within such protected areas, this situation can lead large carnivores to range even more widely outside protected areas, and within human settlements, in search of food (Wilcove et al. 1986). In turn, this brings large carnivores into greater conflict with livestock and people, who in turn can hold more deeply negative attitudes towards such carnivores (Bjerke et al. 2000). Furthermore, such negative attitudes can take an even deeper hold when built upon the myths and stories that surround many species of large carnivores (Landa 1993, Bunaian et al. 2001). In turn, this can lead towards more retribution killings of these carnivores, hence further threatening populations of large carnivores.

Striped hyaenas are one of four species that are still extant with the Hyaenidae, one of the nine families of terrestrial carnivores. Striped hyaenas are widely distributed across 50 countries within Africa and Asia (Figure 2.2). The species is near threatened across its range (IUCN 2004), yet is the least researched of the four living species of hyaena. Striped hyaenas are nocturnal and mainly inhabit bushy closed forests throughout their range, but appear highly adaptable to modified habitat in which people predominate (Mills and Hofer 1998). Nevertheless, this adaptability has brought striped hyaenas into conflict with people throughout their range. Indeed, the striped hyaena is the largest species of carnivore remaining in Lebanon, and has been the subject of conflict with people. Misconceptions held of striped hyaenas by local people are worsened by mythical stories that have a long history in the Arabic literature (Chapter 2), and that in turn might have affected their survival across Lebanon.

Lebanon is a Middle Eastern country with a rich biodiversity. However, this biodiversity is currently threatened by deforestation, urban expansion, pollution, over-use of water, over-hunting, and a lack of environmental awareness (Hamadeh et al. 1996). As a result forest and grassland cover has been reduced from 70% of Lebanon's current surface area 100 years ago, to less than 7% in the past 20 years, with especially heavy losses in cover during the war years from 1975 – 1991 (UNEP 1996). Such threats have not only affected forest and grassland cover directly, but also threatened the other species associated with forest and grassland habitats. However, several institutions within Lebanon are now playing a direct or indirect role in trying to address environmental problems. The Lebanese Parliament and the Ministry of Environment are developing a better understanding of the environment. Environmental NGOs are playing an important role in conservation and environment protection, both at the national and the local levels. Considerable efforts have been expended since 1993 to conserve wildlife and their habitats through the establishment of a range of protected areas, which now cover 2.0% of the country's surface area (Ministry of Environment 2002). Nevertheless, all these protected areas are very small, and most species of native antelope are locally extinct within them, while livestock are not allowed to graze within them either. In turn, if large carnivores like striped hyaenas are to survive, they have little option but to range within the human-dominated landscapes outside Lebanon's protected areas.

11.2 Studying striped hyaenas in Lebanon

This is the first detailed study conducted on striped hyaenas living in human-dominated landscape, whether in Lebanon or elsewhere across its range. This study had four aims: to determine the status of striped hyaenas across Lebanon, the threats that they are facing, and to understand the ecological adaptability of striped hyaenas living within different socio-economic landscapes; to characterize the local knowledge of, and attitudes towards, striped hyaenas and to quantify the basis of those attitudes, whether in myth or in reality; to explore ways to solve conflicts between people and striped hyaenas, using novel approaches within a conservation education programme; and, to clarify the implications of these findings for management and conservation, both for striped hyaenas in Lebanon, and for large carnivores more generally. The ultimate aim of this study was to provide practical recommendations that might help inform future measures to conserve striped hyaenas and other species of large carnivore living in human-dominated landscapes, in Lebanon and elsewhere.

11.2.1 The ecology of striped hyaena in Lebanon's human-dominated landscape.

Indirect survey methods, using newspaper and other reports of conflict between hyaenas and people, showed that striped hyaenas were widely distributed across Lebanon (Chapter 3). Based on more detailed surveys of indirect signs within six study areas, the relative abundance of striped hyaenas was higher outside the nature reserves. Indeed, striped hyaenas are particularly abundant in areas of high human disturbance, where the unorganized dumping of refuse provides a continuous supply of food for striped hyaenas, irrespective of the fragmented nature of suitable habitat.

Based on data from camera traps, the feeding habits of striped hyaenas in Lebanon have further demonstrated their adaptability (Chapter 4). Striped hyaenas feed at night throughout their range (Kruuk 1976), and they also started foraging after sunset in Lebanon. Moreover, the peak of feeding activity for striped hyaenas in Lebanon was three hours before dawn, giving them enough time to return to their dens. Striped hyaenas are opportunistic, omnivorous scavengers throughout their range and feed on whatever is available in their area (Kruuk 1976, Leakey et al. 1999), as was also found in Lebanon, based on data from scat analysis and from feeding remains (Chapter 4). Striped hyaenas in Lebanon fed on any available food, from carrion, animal offal, and fruits, to garbage and domestic refuse. Their strong jaws and their stomach, which is rich in hydrochloric acid (MacDonald 2001), allow striped hyaenas to crush and digest big bones, and their faecal remains were indeed high in ash content.

Based on data obtained from a small sample of radio-collared striped hyaenas, their ranging ecology has adapted flexibly to human-modified habitats (Chapter 5). The annual home range size of striped hyaenas living in a rural site was similar to those recorded for striped hyaenas in the Serengeti NP, Tanzania and the Negev Desert, Israel. However, striped hyaenas living in an urban site in Lebanon remained within an annual home range some five times smaller than recorded previously. Striped hyaenas seem tolerant to the presence of people, although they appear to avoid direct interactions. For example, striped hyaenas covered smaller distances when the moon was full than when there was no moon, and this is probably a way of avoiding contact with people. Likewise, no radio-tracking signals were ever recorded before it was dark in the rural site, while signals were always detected before dark in the urban site. This difference probably arose because striped hyaenas sought to avoid contact with rural people who were still working their lands, cutting wood or hunting, until after sunset. In contrast, urban residents rarely enter the un-urbanized habitats at night, so the risks of contact with people are minimal.

Although striped hyaenas are widely distributed across Lebanon, and have adapted to human-dominated landscapes it was nonetheless striking that striped hyaenas were absent from Al-Shouf Cedar and Horch Ehden NRs (Chapter 3). Although protected and not disturbed by people, these areas do not contain either wild ungulate prey or livestock, and therefore provide no suitable sources of food for large scavengers like striped hyaenas that rarely hunt. As a result, striped hyaenas in Lebanon are becoming increasingly urbanised, leading to an increasing likelihood of conflict with people. Therefore, the future conservation of species like the striped hyaena will largely depend on an increase in tolerance, and a reduction in persecution on occasions when striped hyaenas come into contact with people. In turn, this will require an understanding of the attitudes of people towards striped hyaenas.

11.2.2 People and their perceptions of striped hyaenas

Based on focal group discussions and questionnaire interviews, local people living in the six study areas generally had good knowledge of the ecology and status of striped hyaenas (Chapter 6). Local people generally knew about the adaptable foraging time and diet of striped hyaenas. Nevertheless, views on the status of Lebanon's striped hyaena population depended to some extent on the relative abundance of striped hyaenas at each study site. However, most local people thought that the striped hyaena population was decreasing due to habitat destruction and hunting. In contrast, some local people thought that striped hyaenas were increasing in numbers and attributed this to an increase in refuse, to reduced killing, to improved reproduction, and to an increase in forested areas.

Based on focal group discussions, the negative attitudes that people generally held towards striped hyaenas were not built on any firm evidence of the damage that striped hyaenas might cause to human life or livelihoods, but were rather built on stories transmitted across generations by elders to young people (Chapter 7). Most of these stories portrayed a negative image of striped hyaenas, or a positive image of the bravery of men upon meeting a striped hyaena. Based on questionnaire interviews, stories about striped hyaenas were still very widely known among local people at all the study sites, and people mostly knew of stories that portrayed striped hyaenas in a negative light. These stories, some of which originated in ancient Arabic literature, were transmitted from generation to generation. Indeed sometimes the narrator would exaggerate the story to attract more attention as would as the next narrator, which in turn resulted in elevating and spreading of the negative attitudes towards striped hyaenas. Furthermore, the popularity of these mythical stories made people believe that they had happened in reality, as was shown in the responses of local people over their "knowledge" of hyaenas attacking people.

Based on focal group discussions and questionnaire interviews, the images portrayed of striped hyaenas in the different stories had an important effect on the attitudes of local people (Chapter 8). For example, people who knew stories that portrayed a positive image of striped hyaenas considered them less harmful, while those who knew stories that portrayed a negative image of striped hyaenas held negative attitudes towards striped hyaenas, whether judging their own reaction, or the reaction of striped hyaenas, and when encountering each other in the wild. Taken overall, most local people expressed negative attitudes towards striped hyaenas. They considered them harmful, dangerous and feared encountering them in the wild. However, these attitudes were also affected by factors related both to study site and to individual respondents. Female respondents, younger respondents, and illiterate or less well educated respondents held more negative attitudes towards striped hyaenas. In contrast, better educated respondents and those who claimed to have seen a wild hyaena, held more positive attitudes towards striped hyaena and were more supportive of their conservation.

These findings revealed that a key factor in securing the future conservation of striped hyaenas depends on changing the misconceptions that people hold towards striped hyaenas.

11.2.3. Changing attitudes towards striped hyaenas through awareness programmes

Focal group discussions and questionnaire interviews showed that attitudes towards striped hyaenas were to a large extent built upon misconceptions and mythical stories rather than on evidence of actual damage that striped hyaenas had caused to people or their property (Chapter 8). Moreover, the bad reputation of, and negative stories known about, striped hyaenas are still widespread across the wider Lebanese public who visited Animal Encounter from all the governorates of Lebanon (Chapter 9). Hence, local people suggested that exposing people to the correct facts about striped hyaena and trying to change their misconceptions might prove effective in helping to secure their conservation. However, the way that conservation education seeks to convey these facts to people could determine their effectiveness in changing attitudes (Kleimman et al. 2000, Miller et al 2004).

The involvement of local people in, and the contact engendered through, research is possibly one indirect way of changing local attitudes. Working with local people and discussing conservation issues opened the eyes of local people towards several environmental issues that might in turn lead towards the adoption of better conservation practices. After 1.5 years of initiating my field research, my contact with people and involving them in my research appeared to have played an important role in changing their attitudes (Chapter 9).

Adopting a passive approaches to conservation education programmes was, however, not very successful in changing the attitudes of either adults (Chapter 9) or students (Chapter 10) towards striped hyaenas. *Information boards* could be helpful for people who are already aware of environmental problems or are visiting the zoo with conservation in mind. However, many people visit zoos for fun and are more attracted by the behaviour of the exhibited animals than by their conservation. Many fewer people visit zoos with the specific aim of learning about the conservation of animals, especially in countries where people have other more pressing priorities than wildlife conservation. Moreover, even for students, whose visits are supposedly linked to part of their curricular activity, passive approaches to conservation education were less effective in changing their attitudes.

In contrast, an active educational programme, through which people can interact with conservationists or with guides through seminars, talks and guided tours, proved to be more successful (Chapter 9). The awareness seminars to adults living within the different study sites, and to adults and to students visiting the Animal Encounter, proved very successful in changing views towards striped hyaenas, in the immediate short term at least. Students gained their attitudes towards striped hyaenas as a result of both home and school education, and because of television (Chapter 10). Many teachers held negative attitudes towards striped hyaenas, which in turn might have unintentionally influenced the holding of negative attitudes among their students. Furthermore, television played a dual role in determining the attitudes of students, comprising on the one hand a positive role by encouraging conservation and understanding of carnivores through documentary films, and on the other hand, a negative role by giving some carnivores a bad character through cartoons and movies. However, it was not possible to include the attitudes of parents in this study, which it will be important to investigate in future.

These findings suggest that an understanding of the attitudes that people hold towards a certain species of large carnivore and of the basis upon which these attitudes may be held, could allow an appropriate awareness programme to be built accordingly.

11.3 Wider implications for the conservation of carnivores

The results of this study, besides having relevance to the conservation of striped hyaenas in Lebanon, and in other human-dominated landscapes, would appear to have wider implications for carnivore conservation more generally:

- Carnivore behaviour, their physical appearance, and threats that affect the direct interests of people, and sometimes irrational fear, are the main causes for people-carnivore conflict. This conflict is partly related to a lack of knowledge about carnivore ecology. For example, the striped hyaena is a species that appears well-adapted to human modified landscapes, without causing much concern for local people. However, the misconceptions and negative attitudes held by local people towards striped hyaenas, has enhanced perceived conflicts with people, who in turn threaten their survival.

- Small protected areas containing little to no prey will do little to help the survival of wide-ranging carnivores, and especially of those predators or scavengers which seek out food in human settlements. In turn, this will bring large carnivores into greater conflict with people, creating an edge effect at the borders of protected areas (Woodroffe and Ginsberg 1998). One solution, therefore, is to encourage the reintroduction or restoration of native herbivores to protected areas, both to maintain ecosystem processes such as browsing and grazing, to serve as prey for the predators, and as a spectacle that attracts tourists to protected areas.

- Nevertheless, Mills (1991) suggested that a successful programme for carnivore conservation could be managed outside the protected area network in Africa through public relations campaigns run in rural areas. Hence, ensuring positive attitudes among those living in and around protected areas could enhance the goals behind establishing protected areas, and in helping them conserve wide-ranging species of carnivores, and especially those scavengers whose effect on people and their property is minimal. The results presented in Chapter 9, which focussed on the short-term effectiveness of presenting an active seminar to people living among wildlife in Lebanon, would appear to offer a useful model for carnivores more generally.

- Improving the knowledge of local communities about carnivores and their role in the environment will allow more the understanding of these animals among local community. The future of many threatened species depends on local communities for their protection. Hence, changing local communities' attitudes will reduce people-carnivore conflict and promote their conservation.

- The empowerment of local communities to play a role in conservation could prove very successful for the future of carnivores, when empowered through effective public awareness programmes. Public awareness programme that take into account the socio-economy of the people, their cultural concerns, the causes of negative attitudes, and disseminating facts in a simple understandable language among by the local people will greatly benefit the conservation of the species in question. For example, an awareness programme undertaken through active approaches to environmental education appeared very effective in changing negative views in the short-term at least and could help improve longer-term support towards striped hyaena conservation.

- It is very important for conservationists and environmental educators to target young people. The attitudes that the youth acquires at young age will persist until adulthood, and if they gain the right attitudes they may become the conservation advocates of the future (Serrell 1981, Basile 2000). However, the effectiveness and the success of any environmental education programme will depend on the methods used to disseminate the information. As with the adult awareness programme (Chapter 9), an active approach to awareness raising involving seminars and talks was very effective in changing students' attitudes.

- Television programmes and spots with a conservation message could prove another form of public awareness programme. Television programmes can play an important role in changing attitudes, especially in these days of high technology, high quality of filming, and easy access to different television channels.

- Moreover, television programmes directed towards children can be important in influencing the environmental ideals of young people. Consequently, television programmes could be more animal friendly, with a conservation message, while also taking into consideration the emotional development of the children, as these programmes will be imprinted in their minds and persist until adulthood. Portraying good images of carnivores could encourage positive attitudes towards carnivores, improve their image and support their conservation.

- Moreover, zoos can play an important role in public awareness and education. Zoos can benefit from the huge number of visitors to spread the conservation message. As noted already (Chapter 9 and 10), zoos should put more effort into active approaches, for example through direct contact with visitors via keepers talks and animal shows (Miller et al. 2004; Balmford et al. in press).

Concise, short and straight forward talks, which also give time and encourage people to ask questions, appear more likely to make zoo education programmes more effective.

11.4 Management recommendations

Based on the findings of this study, it is clear that serious conservation measures are needed to prevent the decline and local extinction of striped hyaenas in Lebanon, and in other human-dominated landscapes. The following appear to be key management recommendations arising out of the research for improving the conservation status of striped hyaenas in Lebanon:

- Monitoring of striped hyaenas in rural and urban areas should continue, and future monitoring should take advantage of the extensive coverage by the GSM mobile phone system, to facilitate the retrieval of detailed data. The future use of GPS-GSM collars could result in better documentation of the frequency of visits by striped hyaenas to human settlements, allowing for more effective management of any future conflict with people.

- The creation of more and larger protected areas could be another potential solution to conserving carnivores within Lebanon that would be favoured by many conservationists. At present, Lebanon supports only a small protected area network that covers much less than the recommended 10% of the country's surface area. However, lacking suitable sources of food within protected areas, large carnivores like striped hyaenas will still seek food from livestock and from within human settlements, and so risk being killed. Nevertheless, a successful programme for carnivore conservation could be managed in Lebanon through mounting public relations campaigns that focus on the people living around Lebanon's small protected areas.

- The chance of encounters between people and carnivores could be reduced by better household waste management techniques. For example, the fencing or covering of waste dumps in animal-proof containers could keep scavengers away from human settlements. However, such approaches would first require research to determine the effect of adopting such strategies on the availability of other food supplies for striped hyaena populations.

- Approaches that combine the use of incentives with more effective waste management could also be tested. Simmons (1999) reported that "vulture restaurants" in South Africa were successful as ecotourism opportunities, which in turn generated income for local people and also for local boy scouts who gained some service hours by crushing bones for the vultures, resulting in local people adopting conservation measures for the species. Similar approaches could be applied to mammalian scavengers, where household and butchery waste could be collected at a central tourist viewing point away from the village, but where local people can benefit from offering tourist opportunities. Such an approach might allow tourists to enjoy seeing the animals in a more natural state, to break the wall of fear between people and these animals, and allow conservationists to spread their message. Furthermore, by offering such ecotourism opportunities, income may be generated for local people, which in turn could offer another solution to encouraging local people in rural areas to conserve their wildlife. At the same time, obvious difficulties that need to be recognised in suggesting this approach include incorporating the nocturnal behaviour of striped hyaenas into an ecotourism programme, and the desirability or otherwise of creating a dependence on, and habituation towards, provisioned food (Walpole 2001).

- More research is needed, nevertheless to determine the acceptability of large carnivores to people, and the long-term effectiveness of public awareness techniques carried out in rural areas where people live amongst wildlife. However, research carried out so far shows the potential value of placing more effort in active public awareness campaigns that seek to change the attitudes of people towards striped hyaenas. Indeed, clarifying the origin of, and truth behind, traditional stories that portray striped hyaenas in a negative light might help create greater long-term understanding of the ecology of the species by local people.

- Longer-term research is needed to determine whether the attitudes of people can be improved by a targeted public awareness programme. While it has been shown that active approaches are more effective at changing the views of adults over the short-term, the effectiveness of these programmes still needs to be evaluated over the long term.

- Zoos play an important role in wildlife conservation through public awareness, educating people, and promoting wildlife conservation. However, the success of this role depends on the approach used by the zoos to promote awareness. This needs more research to decide on the suitable effective approach. More research needs to be carried out to investigate the long-term effect of zoos' education programmes on visitors and how frequently these programmes should be repeated for conservation-friendly attitudes to be adapted by people.

- More research is needed to determine whether the attitudes of students can be improved by awareness programmes targeting their parents through flyers that students take home, encouraging students to transfer the conservation message to their parents, television programmes or by invitating parents to attend zoo conseravtion programmes. Another topic that also needs further investigation is an environmental education programmes for teachers, and the effect of such a programme on improving the attitudes of students towards wildlife conservation.

- Finally, the role of non-governmental organizations in Lebanon should be assessed. The growing number of environmental non-governmental organizations and societies with conservation mission, could further help support conservation by placing more emphasis on public education and public awareness, as a possible solution to minimizing the problem and maximizing the chance of recovery of large carnivores, including of the striped hyaenas.

In conclusion, this thesis has shown how a species of large carnivore like the striped hyaena can survive in, and adapt to, the human-dominated landscapes of Lebanon. However, with little suitable food currently available within its protected areas, the future survival of striped hyaenas in Lebanon most probably lies with mounting effective public awareness raising campaigns. The most critical issue appears to be defusing the negative attitudes that arise from traditional stories and myths passed down from generation to generation. The findings of this thesis, and particularly of the role of traditional stories and myths in determining attitudes towards carnivores, and how to change these negative attitudes through active rather than passive public awareness campaigns, appear to hold wider implication for the conservation of large carnivores more generally.

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APPENDICES

Appendix I

Indiviual interview

Ref#:_________________

Village: ________________ Date: __________________

Name	Social Status 1-Single 2-Married 3-Divorced 4-Widow	Gender 1-Male 2-Female	Age	Education Level 1-Illiterate 2-Elementary 3-Intermediate 4-Secondary 5-University 6-Others	Occupation	Monthly Income ($) 1-< 200 2- 250-500 3-550-10000 4-1000-1500 5->1500

Knowledge about striped hyaena

1- Have you seen a wild striped hyaena?

2- What time of the day do striped hyenas forage?

a) From dusk till dawn b) Midnight till dawn c) All day long

d) At night e) During the day f) Don't know

3- What do hyenas feed on?

a) Fruits b) Carcasses c) Live animals e) Others, specify f) Don't know

4- Do you think that striped hyaenas' population is:

a) Decreasing b) Increasing c) Stable d) Don't know

5- Why decreasing?

a) Hunting b) Habitat destruction c) Others d) Don't know

6- Why increasing or stable?

a) Increase in garbage? b) Reduced killing c) Improved reproduction

d) Increase in forested areas e) Don't know

7- Are striped hyaenas threatened?

Stories about striped hyaenas

8- Do you know any story about striped hyaenas?

a- Mesmerizing their victims b- Accompanying their victims c- pushing door open d- Robbing graves e- Finding unburied corpses f- Kidnapping an infant g- Attacking old woman h- Flashing magic eyes i- making hair stand on end j- Smelling bad k- Their effect on animals l- Good animal

m- man riding a striped hyaena n- testing the fear of man

9- Could you tell me about it? Can you narrate the stories you know?

Attitudes towards striped hyaenas

10- Are striped hyaenas harmful? Why?

11- Do you know of any attacks by hyaenas? How did you know?

12- What do you think will be the reaction of striped hyaenas to encountering people?

13- Do you fear encountering a striped hyaena in the wild? Why?

14- What do you think your reaction will be to encountering a striped hyaena in the wild?

15- Are striped hyaenas dangerous animal?

16- Are striped hyaenas beneficial? Why?

17- Do you support striped hyaenas' conservation? If yes how?

Appendix II

Individual Interviews: Awareness seminars at study sites

Pre-Seminar

Ref#: ________________

Village: ________________ Date: ________________

Name	Social Status 1-Single 2-Married 3-Divorced 4-Widow	Gender 1-Male 2-Female	Age	Education Level 1-Illiterate 2-Elementary 3-Intermediate 4-Secondary 5-University 6-Others	Occupation	Monthly Income (US$) 1-< 200 2- 250-500 3-550-10000 4-1050-1500 5->1500

1- Are striped hyaenas dangerous?

2- Are striped hyaenas harmful?

3- Are striped hyaenas beneficial?

4- Do you support striped hyaenas' conservation?

After the Seminar

5- Are striped hyaenas dangerous?

6- Are striped hyaenas harmful?

7- Are striped hyaenas beneficial?

8- Do you support striped hyaenas' conservation?

9- Will you protect striped hyaenas?

Appendix III

Individual Interviews: Adult visitors to Animal Encounter

At the entrance to Animal Encounter

Ref#:________________

Governorate: ________________ Date: ________________

Name	Social Status 1-Single 2-Married 3-Divorced 4-Widow	Gender 1-Male 2-Female	Age	Education Level 1-Illiterate 2-Elementary 3-Intermediate 4-Secondary 5-University 6-Others	Occupation	Monthly Income (US$) 1-< 200 2- 250-500 3-550-10000 4-1050-1500 5->1500

1- Have you seen a wild striped hyaena before?

2- Are striped hyaenas dangerous?

3- Are striped hyaenas harmful?

4- Are striped hyaenas beneficial?

5- Do you support striped hyaenas' conservation?

6- Do you know of any story about striped hyaena?

7- Can you narrate the stories you know?

After the tour/visit of the On the way out of the Animal Encounter

8-Are striped hyaenas dangerous?

9-What made you change your mind?

10- Are striped hyaenas harmful?

11- Are striped hyaenas beneficial?

12- Do you support striped hyaenas' conservation?

Appendix IV

Individual Interviews: Students Awareness Programme at Animal Encounter

At the entrance to Animal Encounter

Ref#:________________ Name: ________________

Governorate: ________________ Date: ________________

Gender: Male Female Age: ______________

Education level: 1-Illiterate 2-Elementary 3-Intermediate 4-Secondary 5-University 6-Others

1. Have you seen a wild striped hyaena before?
2. Are striped hyaenas dangerous?
3. Who told you? a) My parents b) My teacher c) TV d) Own learning
4. Are striped hyaenas harmful?
5. Who told you? a) My parents b) My teacher c) TV d) Own learning
6. Are striped hyaenas beneficial?
7. Who told you? a) My parents b) My teacher c) TV d) Own learning
8. Do you support striped hyaenas' conservation?

After the tour and on the way out of the Animal Encounter

9. Are striped hyaenas dangerous?
10. Are striped hyaenas harmful?
11. Are striped hyaenas beneficial?
12. Do you support striped hyaenas' conservation?

Appendix V

Individual Interviews: Teachers' Awareness Programme at Animal Encounter

At the entrance to Animal Encounter

Ref#:________________ Name: ________________

Governorate: ________________ Date: ________________

Gender: Male Female Age: ______________

Education level: 1-Illiterate 2-Elementary 3-Intermediate 4-Secondary 5-University 6-Others

1- Have you seen a wild striped hyaena before?

2- Are striped hyaenas dangerous?

3- Are striped hyaenas harmful?

4- Are striped hyaenas beneficial?

5- Do you support striped hyaenas' conservation?

On the way out of the Animal Encounter

6- Are striped hyaenas dangerous?

7- Are striped hyaenas harmful?

8- Are striped hyaenas beneficial?

9- Do you support striped hyaenas' conservation?

Appendix VI.

Demographic and Economic patterns of the 800 respondents in the six study sites

The study area comprised six study sites distributed in different areas of Lebanon. A total of 800 people from the six study sites were interviewed (Table VI.1). Most (76.0%) respondents were males, and the majority (56.5%) of them were married.

Table VI.1. Number of respondents interviewed, number of males and marital status in the six study sites.

Study site	N	Males	Married
Berqayel	307	239	195
Horch Ehden	75	53	34
Bnachii	111	77	49
Chnaniir	83	49	57
Kafarmatta	119	94	64
Al-Shouf Cedar	105	96	53
Total	800	608	452

The ages of respondents ranged from 18 to 85 years with the following distribution: (21.4%) respondents were ≤ 24 years of age; 22.8% of the respondents were 25-34 years of age; 20.6% respondents were 35-44 years of age; 12.9% respondents were 45-54 years of age; and 22.4% respondents were >55 years of age. Age groups of respondents differed (χ^2=46.508, df =20, P<0.01) across study sites (Figure VI.1). Most respondents who were ≤24 years of age (29.7%) or 45-54 years of age (16.2%) were from Bnachii, while most respondents who were 25-44 years of age were from Horch Ehden NR. Most (38.6%) respondents who were >55 years of age were from Chnaniir. However, age group of the respondents did not differ (χ^2=9.051, df=4, P>0.05) among sexes.

Education levels of respondents ranged from illiterate to university level. Many (30.5%) respondents had intermediate education. In contrast, 13.4% respondents were illiterate; 15.6% respondents had received only elementary education; 20.6% secondary education; and 19.9% had been to university. Education level of respondents differed (χ^2=220.673, df =20, P<0.001) across study sites. Most (74.8%) illiterate respondents were from Berqayel site, while most (27%) respondents who had been to university were from Horch Ehden NR (Figure VI.1).

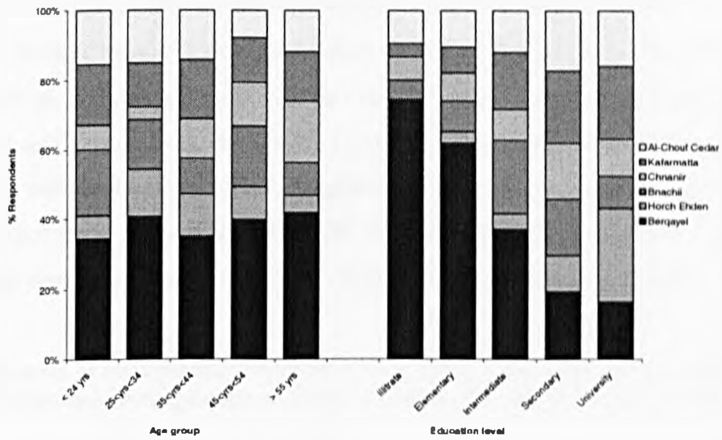


Figure VI.1. Distribution of age groups and education level of the 800 respondents among study sites.

Gender of the respondents differed (χ^2=21.862, df =4, P<0.001) among their education levels (Figure VI.2). Most respondents who were illiterate or had higher education level (secondary to university) were females, while most respondents who had elementary or intermediate education were males. The ages of respondents also differed (χ^2=227.817, df =16, P<0.001) among the education levels (Figure VI.2). Most respondents who were illiterate (39.7%) or had elementary (26.3%) education were >55 years of age, while most respondents who had higher education were of younger age.

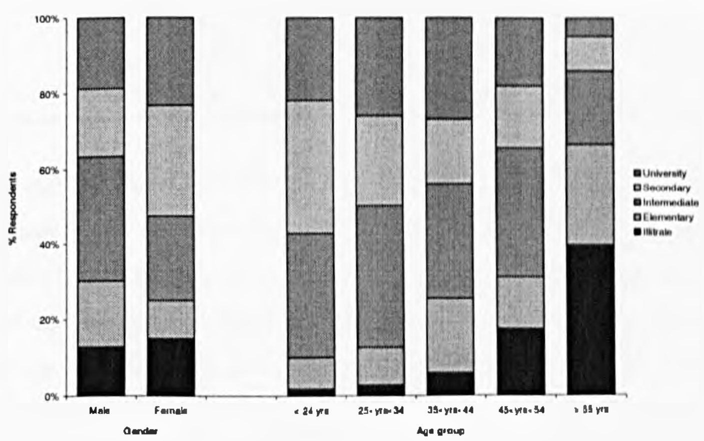


Figure VI.2. Education level of respondents among their gender and age groups.

The occupation of the respondents in the six sites was divided into six criteria. a) Unemployed; b) Students; c) Farmers, involved in livestock and agriculture; d) Self-employed, never been to university and having their own small private business; d) Employee, employees of companies or government; e) army; and f) Professional, those who had been to university and having their own business. Many (22.6%) respondents were self-employed. In contrast 18.5% respondents were unemployed; 13.8% respondents were students; 16.4% respondents were farmers; 6.5% respondents were in military forces; 15.5%

respondents were employee; and 6.8% respondents were professional. Most (37.3%) unemployed respondents were from Chnaniir site (χ^2=210.062, df =30, P<0.001); while most (20.2%) student respondents were from Kafarmatta, most (26.5%) farmers respondents were from Berqayel, most self-employed (30.5%) and respondents in military forces (14.3%) were from Al-Shouf Cedar NR. Most employee (26.7%) and professional (28%) respondents were from Horch Ehden NR (Table VI.2). Occupation of respondents differed (χ^2=314.728, df =6, P<0.001) among their gender. Among all occupations, female respondents were only more unemployed than male respondents (Table VI.2).

Table VI.2. Occupations of respondents among their sites and gender. Key: a= unemployed; b= student; c= farmer; d=self-employed; e= army; f= employee; and g= professional.

Variable	N	Occupation (%)						
		(a)	(b)	(c)	(d)	(e)	(f)	(g)
Study site								
Berqayel	307	21.5	9.4	26.4	21.5	9.8	10.4	1.0
Horch Ehden	75	9.3	14.7	6.7	14.7	0.0	26.7	28.0
Bnachii	111	19.8	17.1	22.5	20.7	1.8	15.3	2.7
Chnaniir	83	37.3	12.0	1.2	22.9	1.2	15.7	9.6
Kafarmatta	119	12.6	20.2	5.0	25.2	3.4	23.5	10.1
Al-Shouf Cedar	105	6.7	16.2	12.4	30.5	14.3	13.3	6.7
Gender								
Male	608	6.1	12.5	21.4	28.6	8.6	15.0	7.9
Female	192	57.8	17.7	0.5	3.6	0.0	17.2	3.1
Total	800	18.5	13.8	16.4	22.6	6.5	15.5	6.8

Occupation of respondents differed (χ^2=463.964, df =24, P<0.001) according to age group (Figure VI.3). Most (59.6%) respondents who were students were ≤24 years of age, while most unemployed (24.6%) and farmers (29.6%) were >55 years of age. Most self-employed (27.3%) and employee (26.1%) respondents were 35-44 years of age, while most respondents in military forces (11.7%) and professionals (11.7%) were 45-55 years of age. Occupation of the respondents differed (χ^2=553.227, df =24, P<0.001) according to education level (Figure VI.3). Most unemployed (34.6%) and farmers (39.3%) respondents were illiterate, while most (29.9%) student respondents had received secondary education. Most self-employed (37.7%) and military forces (9%) respondents had received intermediate education, while most employee (35%) and professional (33.8%) respondents had been to university

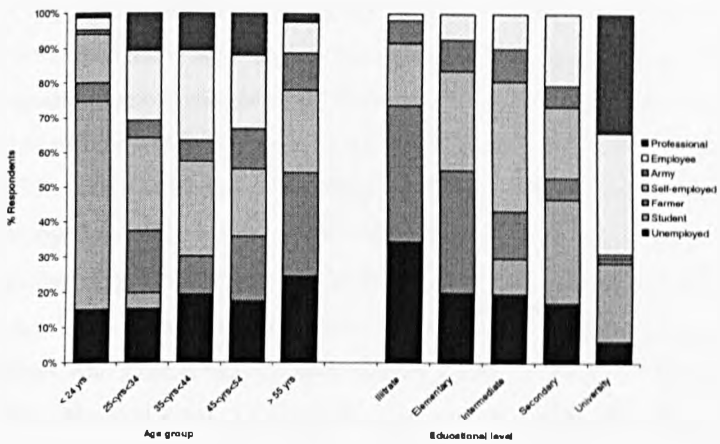


Figure VI.3. Occupations of respondents among their age groups and education level.

Many (33.4%) respondents enjoyed monthly income <US$ 500; In contrast 32.4% respondents had no income; 8.3% respondents enjoyed monthly income <US$ 200; 18.4% respondents enjoyed monthly income <US$ 1000; 4.0% respondents enjoyed monthly income <US$ 1500; and 3.6% respondents enjoyed monthly income >US$ 1500. Monthly income differed (χ^2=181.658, df =25, P<0.001) across study sites (Table VI.3). Most respondents who had no income or enjoyed monthly income >US$ 1500 were from Chnaniir, while most respondents who enjoyed monthly income <US$ 200 were from Berqayel. Most respondents who enjoyed monthly income <US$ 500 or <US$ 1000 were from Al-Shouf Cedar NR; and most respondents who enjoyed monthly income <US$ 1500 were from Horch Ehden NR. Most male respondents enjoyed a better income (χ^2=220.931, df =5, P<0.001) than female respondents (Table VI.3).

Table VI.3. Monthly income of respondents among their sites and gender.

Variable	**N**	**Monthly income (US$) (%)**					
		0	**<200**	**<500**	**<1000**	**<1500**	**>1500**
Study site							
Berqayel	307	30.9	18.2	36.8	12.7	0.7	6.9
Horch Ehden	75	24.0	0.0	21.3	28.0	16.0	10.7
Bnachii	111	36.9	1.8	38.7	18.0	3.6	0.9
Chnaniir	83	49.4	1.2	19.3	12.0	6.0	12.0
Kafarmatta	119	33.6	4.2	30.3	22.7	3.4	5.9
Al-Shouf Cedar	105	22.9	1.9	41.0	28.6	4.8	1.0
Gender							
Male	608	18.6	10.0	39.8	22.5	4.9	4.1
Female	192	76.0	2.6	13.0	5.2	1.0	2.1
Total	800	32.4	8.3	33.4	18.4	4.0	3.6

Monthly income of respondents differed (χ^2=233.241, df =20, P<0.001) according to age groups (Figure VI.4). Most (74.9%) respondents who had no income were ≤24 years of age, while most (15.1%) respondents who enjoyed monthly income <US$ 200 were >55 years of age. Most (48.4%) respondents who enjoyed monthly income <US$ 500 were 25-34 years of age, while most respondents who enjoyed monthly income <US$ 1000 (34%) and >US$ 1500 (6.8%) were 44-55 years of age and most (6.7%) respondents who enjoyed monthly income <US$ 1500 were 35-44 years of age. Monthly income of respondents was associated (χ^2=190.203, df =20, p<0.001) with their education level (Figure VI.4). Most respondents who were less well-educated (illiterate – intermediate) enjoyed monthly income <US$ 500, while most respondents who were better educated enjoyed monthly income >US$ 500. Monthly income differed (χ^2=1037.984, df =30, P<0.001) according to occupation (Figure VI.4). All student respondents had no income. Most (33.6%) respondents enjoyed monthly income <US$ 200 were farmers, while most (60.2%) who enjoyed monthly income <US$ 500 were self-employed. Most (51.9%) respondents who enjoyed monthly income <US$ 1000 were in military forces, while most respondents enjoyed monthly who enjoyed monthly income <US$ 1500 (18.5%) or >US$ 1500 (22.2%) were professionals.

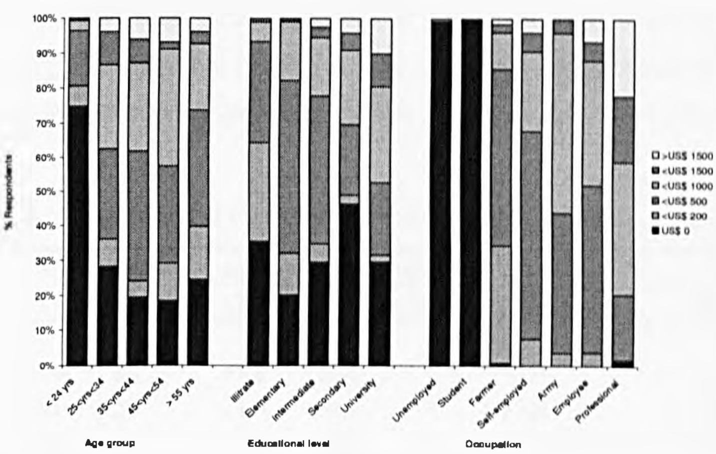


Figure VI.4. Monthly income of respondents among their age groups, their education level and their occupation.

Appendix VII

Demography of respondents who attended the seminar at the six study sites

Of the 443 respondents, most (61.0%) were males (Table VII.1).

The ages of respondents ranged from 18 to 85 years of age. Most (43.3%) respondents were ≤24 years of age; 18.7% were 25-34 years of age; 16.5% were 35-44 years of age; 12.4% were 45-54 years of age; and 9% were ≥55 years of age. The ages of respondents differed (χ^2=51.915, df=20, P<0.001) across study sites (Table VII.2). Most respondents of ≤24 years of age were from Chnaniir, while most respondents of 25-34 years of age were from Bnachii. Most respondents of 35-44 years of age and 45-54 years of age were from Horch Ehden NR, while most respondents of ≥55 of age were from Kafarmatta. The age of respondents differed (χ^2=11.888, df=4, P<0.05) according to gender. Most respondents of <44 years of age were females, while most respondents of >45 years of age were males (Table VII.1).

Table VII.1. Numbers of respondents at each study sites, according to sex and age class.

Variable	N	Male	Age group (years) (%)				
			≤24	25<yrs<34	35<yrs<44	45<yrs<54	≥55
Study site							
Berqayel	134	92	47.8	19.4	11.9	11.9	9.0
Horch Ehden	50	26	24.0	20.0	36.0	18.0	2.0
Bnachii	85	53	40.0	24.7	14.1	11.8	9.4
Chnaniir	70	45	64.3	5.7	8.6	11.4	10.0
Kafarmatta	47	23	27.2	23.4	17.9	17.0	17.0
Al-Shouf Cedar	57	33	42.1	19.3	24.6	7.0	7.0
Gender							
Male	272	-	40.8	18.8	14.3	14.0	12.1
Female	171	-	47.4	48.7	19.9	9.9	4.1
Total	443	272	43.3	18.7	16.5	12.4	9.0

Education levels of respondents ranged from illiterate to university level. Many (33.6%) respondents had been to university, and some had received secondary (27.1%) or intermediate (28.2%) education. In contrast, 4.7% respondents were illiterate and 6.3% had received only elementary education. Education levels of respondents differed (χ^2=80.39, df=20, P<0.001) across study sites. Most illiterate respondents were from Berqayel, while most respondents who had been to university were from Horch Ehden NR (Table VII.2).

Education levels of respondents differed (χ^2=19.897, df=5, P<0.001) according to gender. Male respondents were less well educated than female respondents (Figure VII.1). Education levels of respondents differed (χ^2=79.13, df=16, P<0.001) according to age group. Most (47.6%) illiterate respondents were >55 years of age (Figure VII.1) while most (50.6%) respondents who had been to university were 25-34 years of age.

Table VII.2. Levels of education of respondents across the six study sites.

Variable	N	Education level (%)				
		Illiterate	Elementary	Intermediate	Secondary	University
Study site						
Berqayel	134	9.7	12.7	42.5	23.1	11.9
Horch Ehden	50	2.0	2.0	16.0	26.0	54.0
Bnachii	85	7.1	3.5	30.6	25.9	32.9
Chnaniir	70	1.4	2.9	21.4	30.0	44.3
Kafarmatta	47	0.0	8.5	17.0	34.0	40.4
Al-Shouf Cedar	57	0.0	1.8	19.3	29.8	49.1
Total	443	4.7	6.3	28.2	27.1	33.6

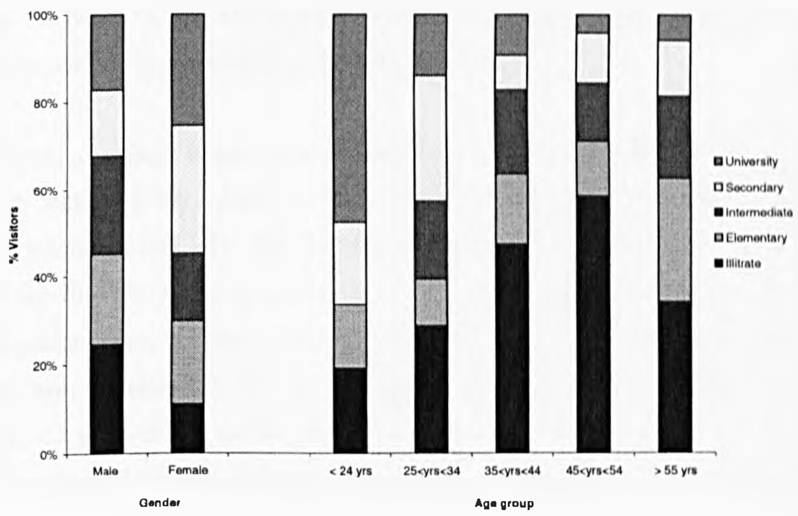


Figure VII.1. Education level distribution among the 443 interviewed attendee among their gender and age groups.

Appendix VIII.

Demography of Visitors to the Animal Encounter Without Guide

A total of 170 visitors from the five Lebanese governorates were interviewed upon their visit to the Animal Encounter. Male (42.9%) visitors interviewed were less than female visitors (Table VIII.1).

Table VIII.1. Number of visitors interviewed, and number of males from the five Lebanese governorates.

	Beirut	Mount Lebanon	North	South	Beqa'a	Total
N	50	63	19	20	18	170
Males	9	33	8	7	6	73

The ages of visitors ranged from 18 to 73 years of age. Most (33.5%) visitors were 25-34 years of age; while 13.5% were ≤24 years of age; 31.5% were 35-44 years of age; 11.2% were 45-54 years of age; and 10.6% were ≥55 years of age. The ages of visitors did not differ across governorate (χ^2=17.271, df=16, P>0.05), nor according to gender (χ^2=8.216, df=4, P>0.05).

Education levels of visitors ranged from illiterate to university level. Most (59.4%) visitors had been to university. In contrast, 1.2% visitors were illiterate; 5.3% had received elementary education; 14.1% had intermediate education and 20% had secondary education. Education levels of visitors did not differ (χ^2=15.229, df=16, P>0.05) across governorates, nor according to gender (χ^2=1.655, df=4, P>0.05). In contrast, education levels of visitors differed (χ^2=41.813, df=16, P<0.001) according to age group. Most visitors who were illiterate (11.1%), had elementary education (44.4%) or had intermediate education (27.8%)were ≥55 years of age, while most (26.1%) visitors who had secondary education were ≤24 years of age and most (61.4%) visitors who had been to university were 25-34 years of age (Figure VIII.1).

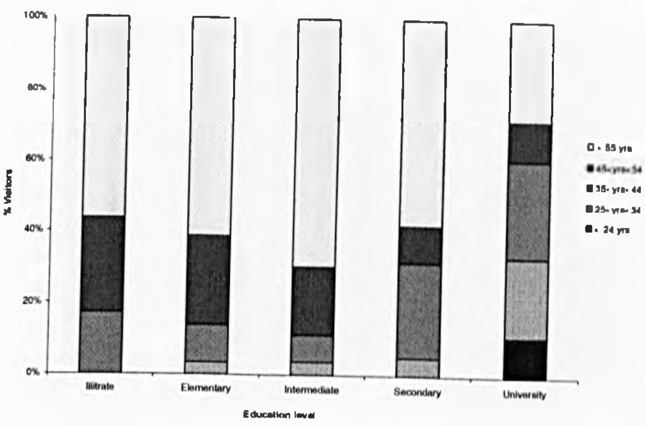


Figure VIII.1. Education level distribution of the 170 visitors among their age groups.

Visitors were distributed into six occupation criteria. a) Unemployed; b) Students; c) Self-employed, never been to university and having their own small private business; d) Employee, employees of companies or government; and e) Professional, those who had been to university and having their own business. Many (34.1%) respondents were employee. In contrast 31.2% respondents were unemployed; 2.9% respondents were students; 7.6% respondents were self-employed; and 24.1% respondents were professional. Occupation of visitors did not differ (χ^2=10.744, df =16, P>0.05) across governorates; Occupation of respondents differed (χ^2=58.550, df =4, P<0.001) according to gender. Most self-employed (15.1%), employee (46.6%) and professionals (35.6%) were males while most unemployed (53.6%), and students (4.1%) were females (Figure VIII.2).

Occupation of respondents differed (χ^2=57.402, df =16, P<0.001) according to age group (Figure VIII.2). Most (21.7%) student visitors were ≤24 years of age, while most unemployed (61.1%) and self-employed (16.7%) were >55 years of age and most employee (42.1%) and professionals were 45-55 years of age. Occupation of the respondents differed (χ^2=88.368, df =16, P<0.001) according to education level (Figure VIII.2). The two illiterate visitors were unemployed, while most student (14.7%) and employee (35.3%) visitors had secondary education. Moreover, most (37.4%) self-employed visitors had intermediate education, while most (39.6%) professional visitors had been to university.

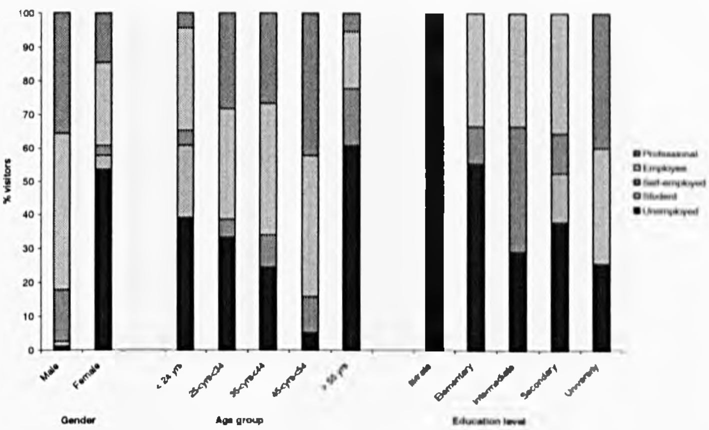


Figure VIII.2. Occupations of respondents among their gender, age groups and education level.

Many (34.1%) respondents had no income. In contrast 9.4% enjoyed monthly income <US$ 500; 27.6% respondents enjoyed monthly income <US$ 1000; 18.2% respondents enjoyed monthly income <US$ 1500; and 10.6% respondents enjoyed monthly income >US$ 1500. Monthly income did not differ (χ^2=16.505, df =16, P>0.05) across governorates. However, most male visitors enjoyed a better income (χ^2=62.017, df =4, P<0.001) than female visitors (Figure VIII.3).

Monthly income of visitors differed (χ^2=44.301, df =16, P<0.001) according to age group (Figure VIII.3). Most visitors who had no income (61.1%) or enjoyed monthly income <US$ 1500 (22.2%) were >55 years of age, while most (17.4%) who enjoyed monthly income <US$ 500 were ≤24 years of age and most who enjoyed monthly income <US$ 1000 (42.1%) and >US$ 1500 (31.6%) were 45-54 years of age. Monthly income of visitors differed (χ^2=46.553, df =16, p<0.001) according to education level (Figure VIII.3). The two visitors who had no income were illiterate. In contrast, most (44.4%) visitors who enjoyed monthly income <US$ 500 had elementary education, while most (37.5%) visitors who enjoyed monthly income <US$ 1000 had intermediate education and most who enjoyed monthly income <US$ 1500 (23.8%) or >US$ 1500 (17.8%) had been to university. Monthly income of visitors differed (χ^2=214.171, df =16, P<0.001) according to occupation (Figure VIII.3). All unemployed and student respondents had no income, while most (28.6%) visitors who enjoyed monthly income <US$ 500 were self-employed. Most (53.4%) visitors in who enjoyed monthly income <US$ 1000 were employee, while most visitors who enjoyed monthly income <US$ 1500 (40%) and >US$ 1500 (32.5%) were professionals.

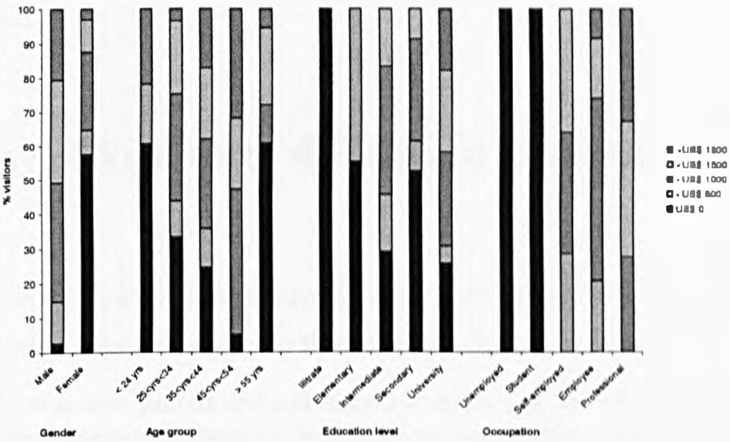


Figure VIII.3. Monthly income of visitors among their gender, age groups, education level and occupation.

Appendix IX.

Demography of Visitors to the Animal Encounter With Guide

A total of 440 visitors from the five Lebanese governorates were interviewed upon their visit to the Animal Encounter. Most (58.4%) visitors were females (Table IX.1).

Table IX.1. Number of visitors interviewed, and number of males from the five Lebanese governorates.

	Beirut	**Mount Lebanon**	**North**	**South**	**Beqa'a**	**Total**
N	117	181	43	56	43	440
Males	58	69	19	21	16	183

The ages of visitors ranged from 18 to 73 years of age. Most (32.0%) visitors were ≤24 years of age; 28.6% were 25-34 years of age; 26.8% were 35-44 years of age; 6.1% were 45-54 years of age; and 6.4% were ≥55 years of age. The Ages of visitors did not differ according to governorate (χ^2=26.179, df=16, P>0.05), but they differed according to gender (χ^2=27.379, df=4, P<0.001). Most visitors who were 35-44 years of age were males.

Education levels of visitors ranged from illiterate to university level. Most (62%) visitors had been to university, very few were illiterate (1.4%) or had received elementary education (3.2%); some had received intermediate education (15%) or secondary education (18.4%). Education levels of visitors differed (χ^2=28.217, df=16, P<0.05) across governorates (Figure IX.1). Most (3.3%) illiterate visitors were from Mount Lebanon, while most (72.9%) visitors who had been to university were from Beirut. In contrast education level of respondents did not differ according to gender (χ^2=8.296, df=4, P>0.05). However, education levels of respondents differed (χ^2=106.909, df=16, P<0.001) according to age group. Most (21.4%) illiterate visitors were >55 years of age, while most (72.2%) visitors who had been to university were 25-34 years of age (Figure IX.1).

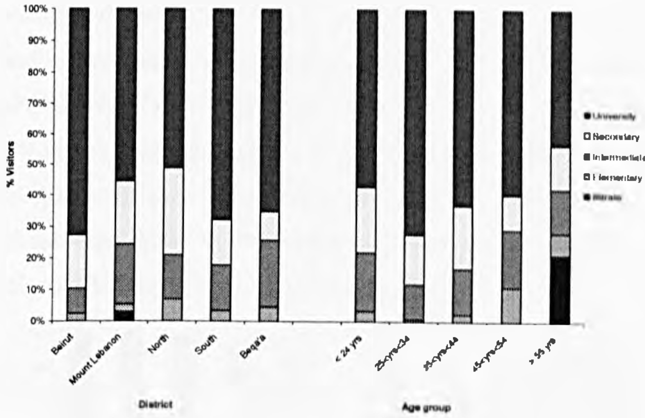


Figure IX.1. Education level distribution among visitors' governorates and age groups.

Visitors were distributed into six occupation criteria. a) Unemployed; b) Students; d) Self-employed, never been to university and having their own small private business; f) Employee, employees of companies or government; and g) Professional, those who had been to university and having their own business. Many (31.6%) respondents were employee. In contrast, 19.3% respondents were unemployed; 25.2% respondents were students; 8.4% respondents were self-employed; and 15.5% respondents were professional. Occupation of visitors differed (χ^2=53.250, df =16, P<0.001) across governorates. Most unemployed and professional visitors were from the South, while most students were from the North. Most self-employed visitors were from Mount Lebanon and most employees were from Beirut. Occupation of respondents differed (χ^2=118.898, df =4, P<0.001) according to gender. Most self-employed, employee and professionals were males while most unemployed and students were females (Table IX.2).

Table IX.2. Occupations of respondents across their governorates and among their gender. Key: Key: a= unemployed; b= student; d=self-employed; f= employee; and g= professional.

Variable	N	Occupation (%)				
		(a)	(b)	(d)	(f)	(g)
Governorate						
Beirut	117	28.2	15.3	18.9	32.4	35.3
Mount Lebanon	181	16.0	26.0	12.7	35.4	9.9
North	43	7.0	51.2	7.0	20.9	14.0
South	56	33.9	21.4	3.6	16.1	25.0
Beqa'a	43	23.3	30.2	4.7	27.9	14.0
Gender						
Male	183	2.7	16.4	18.0	35.5	27.3
Female	257	31.1	31.5	1.6	28.8	7.0
Total	440	19.3	25.2	8.4	31.6	15.5

Occupation of respondents differed (χ^2=349.861, df =16, P<0.001) according to age group (Figure IX.3). Most (78.0%) student visitors were ≤24 years of age, while most (50.0%) unemployed were >55 years of age. Most self-employed (16.9%) and professionals (26.3%) were 35-44 years of age, while most (51.6%) employee were 25-34 years of age. Occupation of the respondents differed (χ^2=146.819, df =16, P<0.001) according to education level (Figure IX.3). Most (66.7%) unemployed visitors were illiterate, while most student (35.7%) and self-employed (35.7%) visitors had secondary education. Moreover, most employee (37.7%) and professional (24.9%) visitors had been to university.

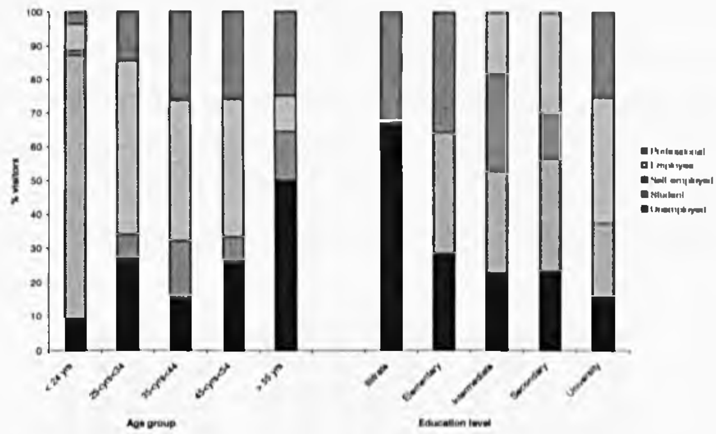


Figure IX.2. Occupations of visitors among age groups and education level.

The majority (44.5%) of visitors had no income. In contrast 15.2% enjoyed monthly income <US$ 500; 20% respondents enjoyed monthly income <US$ 1000; 6.8% respondents enjoyed monthly income <US$ 1500; and 13.4% respondents enjoyed monthly income >US$ 1500. Monthly income differed (χ^2=52.057, df =16, P<0.001) across governorates (Table IX.3). Most visitors who had no income were from the North, while most visitors who enjoyed monthly income <US$ 500 or <US$ 1000 were from Mount Lebanon. Most visitors who enjoyed monthly income <US$ 1500 or >US$ 1500 were from Beirut. Most male visitors enjoyed a better income (χ^2=105.856, df =4, P<0.001) than female visitors (Table IX.3).

Table IX.3. Monthly income of respondents among their Governorates and gender.

Variable	N	Monthly income (US$) (%)				
		0	<500	<1000	<1500	>1500
Governorate						
Beirut	117	35.0	8.5	21.4	10.3	24.8
Mount Lebanon	181	42.0	23.2	23.2	5.0	6.6
North	43	58.1	9.3	16.3	7.0	9.3
South	56	55.4	5.4	12.5	5.4	21.4
Beqa'a	43	53.5	18.6	16.3	7.0	4.7
Gender						
Male	183	19.1	14.2	30.6	9.8	26.2
Female	257	62.6	16.0	12.5	4.7	4.3
Total	440	44.5	15.2	20.0	6.8	13.4

Monthly income of respondents differed (χ^2=192.698, df =16, P<0.001) according to age group (Figure IX.4). Most (87.2%) visitors who had no income were ≤24 years of age, while most visitors who enjoyed monthly income <US$ 500 (22.2%) and <US$ 1000 (35.7%) were 25-34 years of age. Most (14.4%) visitors who enjoyed monthly income <US$ 1500 were 35-44 years of age, while most (33.3%) who enjoyed monthly income >US$ 1500 were 45-54 years of age. Monthly income of visitors differed (χ^2=52.150, df =16, p<0.001) according to education level (Figure IX.4). Most visitors who had no income (66.7%) or enjoyed monthly income <US$ 1000 (33.3%) were illiterate, while most (24.2%) visitors who enjoyed monthly income <US$ 500 had intermediate education and most visitors who enjoyed monthly income <US$ 1500 (9.2%) or >US$ 1500 (20.1%) had been to university. Monthly income of visitors differed (χ^2=550.744, df =16, P<0.001) according to occupation (Figure IX.4). All unemployed and student respondents had no income, while most (36%) visitors who enjoyed monthly income <US$ 500 were employees. Most (51.4%) visitors who enjoyed monthly income <US$ 1000 were self-employed, while most visitors who enjoyed monthly income <US$ 1500 (14.7%) and >US$ 1500 (55.9%) were professionals.

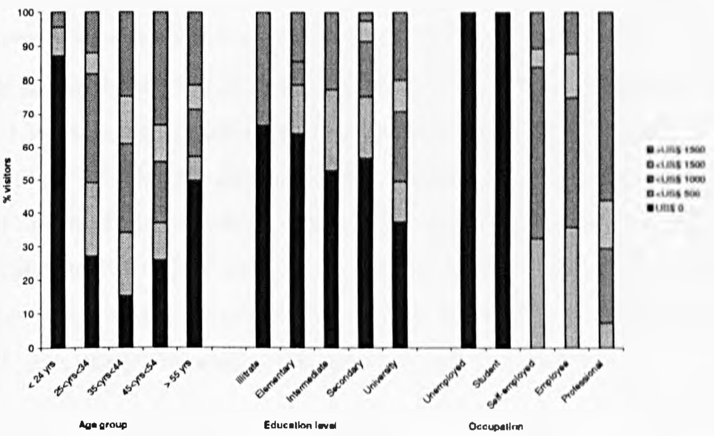


Figure IX.3. Monthly income of visitors among their age groups, education level and occupation.

Appendix X.

Demography of the Students Interviewed at the Animal Encounter

Of the 349 students least (46.1%) were males (Table X.1).

Table X.1. Number of students interviewed, and number of males among the respondents from the five Lebanese governorates.

	Beirut	Mount Lebanon	North	South	Beqa'a	Total
N	83	65	25	70	106	349
Males	44	32	13	31	41	161

The ages of students ranged from 11 to 22 years of age. Most (52.4%) students were 12-14 years of age, while 26.4% were 11 years of age; 11.2% were 15-17 years of age; and 10% were >18 years of age. The ages of students differed (χ^2=25.873, df=12, P<0.05) across to their governorates (Table X.2). Most students who were 11 years of age were from Beirut, while most students between 12-14 years were from the North. Most students between 15-17 years of age were from Beqa'a, while most students >18 years of age were from Mount Lebanon. Age of students differed (χ^2=11.888, df=4, P<0.05) according to gender. Younger males (<14 years of age) were more than younger females (Table X.2).

Table X.2. Age of students interviewed among their governorates and gender.

Variable	N	Age group (%)			
		11 yrs	12<yrs<14	15<yrs<17	>18 yrs
Governorate					
Beirut	83	41.0	41.0	12.0	6.0
Mount Lebanon	65	20.0	53.8	10.8	15.4
North	25	16.0	72.0	8.0	4.0
South	70	12.9	62.9	10.0	14.3
Beqa'a	106	30.2	49.1	12.3	8.5
Gender					
Male	161	34.8	54.7	4.3	6.2
Female	188	19.1	50.5	17.0	13.3
Total	349	26.4	52.4	11.2	10.0

Education levels of students ranged from elementary to university level. Most (62.2%) students had received intermediate education, In contrast 17.2% had received elementary education, 10.6% secondary education, and 10% had been to university. Education levels of students did not differ (χ^2=20.963, df=12, P>0.05) across governorates. However, education levels of students differed (χ^2=24.724, df=3, P<0.001) according to gender. Female students had better education than males (Figure X.1). Education levels were positively associated (χ^2=637.675, df=9, P<0.001) with age group. Younger students had lower education level than older students (Figure X.1).

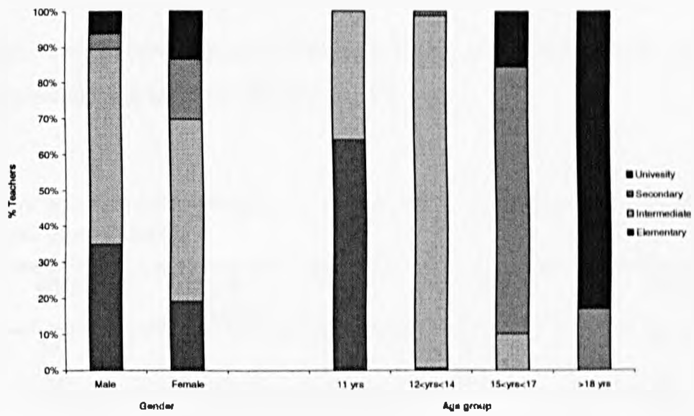


Figure X.1. Education level distribution among the 349 interviewed students among their gender and age groups.

Appendix XI.

Demography of the teachers Interviewed at the Animal Encounter

A total of 233 teachers were interviewed upon their visit to the Animal Encounter (Table XI.1). Male teachers (30%) interviewed were less than female teachers.

Table XI.1. Number of teachers interviewed, and number of males among the respondents from the five Lebanese governorates.

	Beirut	Mount Lebanon	North	South	Beqa'a	Total
N	37	66	39	45	46	233
Males	8	25	7	15	15	70

The ages of teachers ranged from 24 to 55 years of age. Many (38.2%) teachers were 25-34 years of age; In contrast, 21.9% were ≤24 years of age; 26.6% were 35-44 years of age; and 13.3% were >45 years of age. The ages of teachers differed (χ^2=47.118, df=12, P<0.001) across their governorates (Table XI.2). Most teachers ≤24 years of age were from Beqa'a, while most teachers >45 years of age were from the North. The age of teachers differed (χ^2=11.839, df=3, P<0.01) according to gender. Most teachers between 25-44 years of age were males, while most teachers ≤24 or >44 years of age were females (Table XI.2).

Table XI.2. Age of teachers interviewed among their governorates and gender.

Variable	N	Age group (%)			
		≤24 yrs	25<yrs<34	35<yrs<44	44<yrs<55
Governorate					
Beirut	37	29.7	37.8	21.6	10.8
Mount Lebanon	66	9.1	50.0	33.3	7.6
North	39	5.1	25.6	33.3	35.9
South	45	28.9	33.3	26.7	11.1
Beqa'a	46	41.3	37.0	15.2	6.5
Gender					
Male	70	8.6	50.0	27.1	14.3
Female	163	27.6	33.1	26.4	12.9
Total	233	21.9	38.2	26.6	13.3

Education levels of teachers were grouped under two categories: 1) had been to university; and 2) had not been to university. Most (76.4%) teachers had been to university. Education levels of teachers differed (χ^2=26.116, df=4, P<0.001) across governorates. Most (91.9%) teachers who had been to university were from Beirut, while most (57.8%) teachers who had not been to university were from the South. However, education levels of teachers did not differ according to gender (χ^2=0.694, df=1, P>0.05), nor according to age groups (χ^2=6.233, df=3, P>0.05).

Appendix XII

Stories and Myths about Hyaenas:

Many myths are told about the hyaenas. They are considered as vicious animals having shining eyes that glow at night to frighten people. Hyaenas are also thought to feed on human flesh and attack people and livestock on cold winter days. What is the truth behind these myths?

1. Do hyaenas really mesmerize people?

Striped hyaenas are shy and fearful animals. In spite of all these mysterious stories about them, no one has confirmed, in all of the Lebanese regions where hyaenas are found, that they have killed anyone. The truth is that the sight of the hyaena at night will shock people. Hyaenas wouldn't attack humans unless directly threatened.

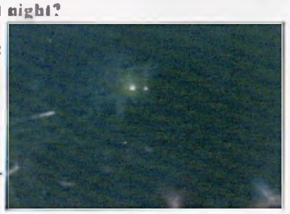
2. Tales describe hyaenas as huge beasts, is that true?

No. The size of the hyaena is a little bigger than a shepherd dog. But when it is frightened, it will increase its size by erecting its mane, fur and tail, similar to a frightened cat, to intimidate the enemy.

3. Is it a grave robber?

This is possible, since they feed on carcasses. To prevent hyaenas from rubbing graves, people got into the habit of covering burial sites with cement or flat rocks.

4. Do hyaenas' eyes shine at night?



No. The hyaena's eyes reflect light and do not shine. The eyes of nocturnal animals have a reflective surface in the back of their eyes to condense incoming light in order to enhance night vision.

5. Do hyaenas attack livestock?

Contrary to what is commonly believed about hyaenas attacking livestock herds, studies and shepherds' experiences reveal that they do not attack livestock, and some shepherds even proclaim that hyaenas pass through their herds without harming them.

How can you help?

IUCN's Red List 2000 characterizes the striped hyaena as Near Threatened species. Since striped hyaenas play an important role in biodiversity and nature, this induces many international organizations to support efforts for their conservation. We too can and should have a role in their conservation through different activities:

1- Public Awareness
2- Hyaenas are not your enemy. If you encounter them, don't kill them.
3- Poisoning dead animals kills a lot of carnivores. Save hyaenas by not poisoning the dead animals, their food source.
4- Striped hyaenas don't attack people unless threatened. Whenever you encounter a hyaena stand still. Since hyaenas are like dogs, they retreat if you stand still and run after you if you run away.
5- Protect their habitat. Stop deforestation and cave destruction.
6- Put garbage in closed containers and keep dead animals away from houses. This will keep hyaenas at a safe distance for them and you, away from houses.

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The Striped Hyaena
Hyaena hyaena syriaca

- **Life span: 25 years.**
- **Mating season: occurs throughout the year.**
- **Gestation period: 3 months.**
- **Litter size: 1-4 cubs a year.**
- **Weight: males weigh up to 55kg. Height: 65-80cm. Length 1m.**
- **Feeding: mainly on carcasses, leftovers and refuse.**

Lebanese wild mammals:

Lebanon is characterized by a rich biodiversity of fauna and flora. It hosts a wide variety of wild animals that play an important role in the ecological balance. Up to a century ago, Lebanon still had numerous kinds of wild mammals. Most of these mammals, such as fallow deer, bears, and caracals, are now extinct,



while others are seriously endangered due to the destruction of their natural habitats, deforestation, urbanization and hunting, in spite of their essential role and importance to the environment and man. Such endangered species include wolves, wild cats, badgers and striped hyaenas.



Types of hyaenas:

Hyaenas are carnivorous animals, belonging to the Hyaenidae family, closer to the feline family than to the canine one. There are four types of hyaenas:

1. **Striped hyaena:** (found in Lebanon)
   Found in Africa and Asia.

2. **Spotted hyaena:**
   Found in Africa. Lives in groups that hunt animals, but also feeds on leftovers of hunted prey and carcasses.

3. **Brown hyaena:**
   Found in Africa. Feeds on leftovers, invertebrates and fruits.

4. **Aardwolf:**
   Found in Africa. Feeds exclusively on termite, its favorite food.

THE STRIPED HYAENA

Distribution:

The geographic distribution of the striped hyaena extends throughout Africa from Morocco to Kenya and Tanzania. In Asia, it is found in Iran, Afghanistan, India, Nepal and the Middle East. Historically, hyaenas were widely distributed in various regions of Lebanon including the coastal hills, Mount Lebanon and the Bekaa Valley. However, with the spread of urbanization, their natural habitat was reduced and they became more exposed to hunting. This led to a steady decrease in their population, and this species might soon be on the verge of extinction.

Description:

1. The coat color of the striped hyaena is gray with dark brown to black stripes on the body and legs.
2. It has a well-developed mane from neck to tail, which is erected to enlarge the hyaena's size whenever it feels threatened.
3. The hyaena's rear legs are less developed than the front ones giving it the appearance of backward inclination.
4. The striped hyaena, like the rest of the Hyaenidea family, has the strongest jaws among all mammals. These jaws help it crush bones, its favourite food.
5. Its weight ranges between 25 and 55 kgs; its height from 65 to 80 cm; and measures approximately 1m in length.
6. Life span: 25 years.
7. The female matures at 2 years of age with a gestation period of three months, and the litter size is 1 to 4 cubs a year.
8. The striped hyaena breeds throughout the year.

Habitat and Food:

In contrast to the spotted hyaenas, which live in groups, striped hyaenas are solitary animals that live in bushy forests and rocky areas, where caves are abundant. This is probably due to the fact that living in groups in such areas can hinder their access to sufficient food to sustain the group. Striped hyaenas are nocturnal animals, that travel long distances, from sunset to dawn, searching for food. They are scavengers that feed on dead animals, garbage and fallen fruits.

Hyaenas are essential to the environment, beneficial to man:

Despite their bad reputation, hyaenas play an important role in nature and are considered as friends of the environment and essential to its good health.

1. Hyaenas play an important role in cleaning the environment by scavenging on dead animals and leftovers. Hyaenas prevent the spread of diseases by ingesting dead infested animals that are otherwise contagious to other animals and humans.

2. The striped hyaena is the farmer's friend. The bones of dead animals that have high calcium content would turn into stones if not degraded. However, as mentioned previously, hyaenas crush the bones using their strong jaws. Their stomach, rich with hydrochloric acid (HCl), converts these bones into a readily available source of calcium for plants after defecation.

3. Striped hyaenas play an important role in conserving the natural balance. They do so by feeding on insects, rodents and wild boar populations, which threaten the natural balance if their numbers increase.