

- Chapter 8 -

Summary and conclusions

The Mustelidae is the largest and most diverse family of the Carnivora and while a great deal is known about certain members of the family, others are virtually unstudied (McDonald & King, 2000; Bright, 2000). Despite its formidable reputation, extensive distribution and “vulnerable” conservation status, there was a lack of even fundamental biological information on the honey badger *Mellivora capensis*. The objective of this study was therefore to describe the diet, foraging behaviour and social organization of the honey badger and to compare its behaviour with that of other mustelid species. This was achieved through a combination of radio telemetry, spoor tracking and, most importantly, direct observations of habituated individuals. This chapter summarizes the answers to the key questions (section 1.2.4) and in so doing provides an overview of honey badger behaviour in the southern Kalahari.

8.1 What does the honey badger eat and are there sexual and seasonal differences in diet and foraging behaviour?

A recent analysis of interspecific variation and allometry in all the mustelids for which data were available (Johnson *et al.*, 2000), supported the hypothesis that local ecological conditions dictate animal density and spatial organisation, and hence determine social behaviour. The first step was therefore to investigate diet and foraging behaviour as a basis for understanding spatial and social organisation (Macdonald, 1983; Kruuk, 1995).

In the southern Kalahari, the honey badger is a generalist, solitary carnivore with a diverse diet characterized by marked seasonal differences but no sexual differences. In support of optimal diet theory, the honey badger appears to switch between alternative prey species

depending on which are currently the most abundant on a daily and seasonal level. In addition there is an increase in dietary diversity in the lean season (cold-dry) in response to a decrease in the availability of preferred prey species. Decreased consumption rates in the cold-dry season are countered by an increase in the time spent foraging with the result that there are no significant seasonal differences in the biomass ingested per kg of body weight in either sex.

In this wilderness area, the honey badger shows a strong seasonal shift from predominantly nocturnal activity in the hot-wet and hot-dry seasons to more diurnal activity in the cold dry season. While the factors affecting the activity patterns of the honey badger are undoubtedly complex and interrelated, this seasonal shift in the timing of activity appears to be primarily due to the honey badger avoiding extreme temperatures by taking refuge in a hole, and not due to a seasonal shift in prey activity.

8.2 How does the honey badger interact with other species, with particular reference to the reported foraging associations?

Interspecific interactions between the honey badger and other mammalian and avian predators were common and included intraguild predation and interspecific feeding associations with seven other species (two mammals and five birds). The most common foraging associations were between the pale chanting-goshawk *Melierax canorus* and the black-backed jackal *Canis mesomelas*. These associations appeared to be facultative commensalism with the associating species benefiting directly through increased intake rate and increased hunting opportunities provided by the rodents and reptiles that escape while the honey badger is digging. The associations did not appear to be either beneficial or detrimental to the honey badger.

Aggressive interactions between sympatric mammalian carnivores could largely be predicted by relative body size. The adults and juveniles of the smaller carnivores (< 1 kg) are all prey of the honey badger, as are the young of medium sized carnivores (1 –12 kg). In turn, the honey badger is killed by lion *Panthera leo*, leopard *Panthera pardus* and possibly spotted hyaena *Crocuta crocuta*. It generally avoids confrontation but when surprised at close quarters it utilizes a formidable and frequently successful threat display to dissuade potential predators, including the release of scent from the anal scent glands, a rattling-roar and rushing movements towards the aggressor.

8.3 Does the honey badger support the typical mustelid pattern of intra-sexual territoriality (Powell, 1979)?

It is generally agreed that in solitary carnivores, the limiting resource for females is food while the limiting resource for males is receptive females. Female home ranges were extensive (138 km²) and well beyond the upper confidence limits described by the regression of female body mass and home range area for all non social mustelids (Johnson *et al.*, 2000). Home range size has been found to be inversely proportional to available prey biomass, and it is likely that the extensive home ranges of female honey badgers are largely a consequence of low prey availability in this semi-arid environment. Since females are accompanied by dependent young for an extended period (12 –16 months), home range area may also reflect the area required to support a “group mass” of a mother and her large cub (12 – 14 kg) rather than just an adult female alone (6 kg).

While neighbouring female home ranges overlap an average of 25 %, females appear to avoid each other temporally through scent marking (token urination), and home range centers are more regular spaced than random. The female spacing pattern therefore resembles a form of intrasexual territoriality although the extensive ranges are not actively defended.

The intersexual difference in home range size is larger than predicted from body size and metabolic considerations alone and adult males appear to be limited by receptive females, as has been found in most carnivores. Adult males have extensive overlapping home ranges (548 km²) that encompass the home ranges of at least 13 females and do not support the typical mustelid pattern of intra-sexual territoriality.

8.4 How is the spacing pattern maintained?

As has been found in other solitary carnivores, scent marking is an important form of communication in the honey badger, with urine, faeces and secretions from the anal gland regularly used to mark objects in the environment. Both sexes were observed to scent mark frequently but in significantly different ways with adult males predominantly marking at latrines and females and young males using token urination with irregular latrine visits.

Since token urination occur in holes along the foraging path, it is likely that the recipients are intensively foraging honey badgers. It is suggested that token urination allows female and young male honey badgers to partition resource utilization and mediate spatio-temporal separation. The function of latrine visits in females appears to be to advertise their receptive status to males and to gain information on the males in the area (possibly through scent matching; Gosling, 1982). Males use latrines to find females and to advertise their status to other males through scent matching. The “scent matching” hypothesis (Gosling, 1982) suggests that subordinates are able to make an olfactory association between the dominant individual and marking frequency, and this allows the subordinate to identify the dominant individual when they meet and thereby avoid potentially costly aggressive interactions.

8.5 What is the mating system of the honey badger?

As suggested by the spacing patterns, sexual size dimorphism and lack of parental care in males, the honey badger shows a polygynous mating system in common with the majority of the smaller mustelids (Johnson *et al.*, 2000). In contrast to the classical view of polygynous systems, females also appear to play an active role in mate choice, and there is some evidence to suggest that females mate with more than one male in a single receptive period (promiscuous).

Asynchronous breeding and the long interbirth interval result in a skewed operational sex ratio with fewer receptive females than males at any time. For males, receptive females are therefore an unpredictable and scarce resource in space (large home ranges, moving targets) and time (no breeding season), with a long time to renewal. As a result, males adopt a roaming rather than a staying tactic, and instead of territoriality males compete directly for each mating opportunity.

Direct interactions are characterized by ritualized intimidation and appeasement postures, and since individuals retained their intimidation or appeasement roles towards each other on subsequent encounters, there appears to be a non-linear dominance hierarchy loosely based on age, mass and testes size. The dominance hierarchy appears to be maintained through direct interactions and regular scent marking events. In addition to dominance and aggressive display, there is also some evidence that less obvious forms of sexual selection might be important i.e. competitive searching, sperm competition (mate guarding, frequent copulation and sequestering) and infanticide.

8.6 Does the honey badger show sexual size dimorphism and to what extent?

In common with most mustelids the honey badger shows marked sexual size dimorphism, with males a third larger than females with no overlap. Two main theories have been suggested to account for this. The first claims that dimorphism reduces intersexual competition for food by enabling the sexes to exploit different prey, while the second suggests that in polygynous species the large size of males is due to sexual selection either through male-male competition or female choice (Weckerley, 1998). Detailed analysis of diet and feeding behaviour provided little evidence for the first hypothesis as the sexes did not differ in prey type, prey size or foraging behavior. There is, however, some support for the sexual selection hypothesis as males compete directly through a dominance hierarchy, where heavier males are frequently dominant over lighter males, and indirectly through competitive mate searching, where larger size may confer an advantage of increased mobility (longer legs).

8.7 Conclusions

While the honey badger occupies a unique position as the single extant species in its own genus and subfamily *Mellivorinae*, little information has been available, until now, to compare the behaviour of the honey badger with the other mustelids. At least in the southern Kalahari, the honey badger is non social with marked sexual size dimorphism and a polygynous or promiscuous mating system. In common with the European otter *Lutra lutra*, the honey badger appears to be a relatively “k-selected” species within the Mustelidae, with a small litter size, extended period of cub dependence, increased maternal investment and a relatively short life span. An important factor affecting honey badger spacing and mating patterns is this long period of cub dependence as it results in non seasonal breeding, which in turn affects male spacing and movement patterns and therefore social behaviour.

Numerous studies have reported extensive intraspecific variation in spacing patterns between study sites, years, social status and individuals (Johnson *et al.*, 2000) supporting the hypothesis that the mating system for a species may be entirely study dependent. It is likely that the future research on the honey badger in a different area will reveal a different pattern, particularly since the honey badger is found in such a wide variety of habitats. Will the home ranges of honey badgers be smaller in more mesic environments? Does the honey badger have more than one cub in more productive environments or does the long period of cub dependency preclude this? These questions have important consequences for conservation as they relate to the minimum area requirements needed to support a viable population and reproductive output.

It is hoped that this study will provide a basis for comparison for future studies of the honey badger in other habitats and that it provides baseline data that can be used in comparison with other mustelids. I firmly believe that knowledge of a species' behaviour is the key to successful conservation efforts while ignorance of behaviour can lead to conservation failures.

8.8 References

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