

### Literature Review 3

In the organization of the ten annotated bibliographies, I had organized them linearly by the time of the article, where the oldest article was on top and carried down. I organized it this way because I believed it was interesting to see the information on the spotted hyenas increase as the date increased, as more information was gathered, and newer literature using the articles before as a reference.

#### **The Ten Annotated Bibliographies**

##### Primary Article:

**Tilson, R., Von Blottnitz, F., Henschel, J. (1980). Prey selection by spotted hyaena (*Crocuta crocuta*) in the Namib Desert. *Madoqua*, 1980(1), 41-49.  
[https://hdl.handle.net/10520/AJA10115498\\_227](https://hdl.handle.net/10520/AJA10115498_227)**

**Summary:** It was seen that spotted hyenas (*Crocuta crocuta*) acquire most of their food from hunting, even though early literature deemed them as mostly scavengers. Tilson (1980) studied the overall diet of the *Crocuta crocuta* as well studied the impact of age and sex on the prey rate of being hunted. The research was in the Namib Desert of Southwest Africa, where three different regions were studied over 12 months. Three groups of spotted hyenas were observed, with a total of 13 adults and 4 offsprings, and 595 samples of prey hairs were collected, studied, and compared to reference hair collections. The age and sex of the prey of gemsbok and mountain zebra consumed were determined by the skull of the carcasses, as they were the prey consumed the most. The results in the overall diet showcased that most of the carcasses are consumed, where large bones like skulls, horns, and large vertebrates were left behind or carried to the den. Gemsbok and mountain zebra were consumed the most, indicating that larger prey is preferred. Other methods of feeding were found, such as consuming man-made items like rubber and plastic, and cannibalism was also observed. In the age and sex study, it was found that in the gemsbok carcasses, male gemsbok was killed more, and older prey was hunted more. This was significant as it showcased that spotted hyenas prefer to hunt and feed on older prey, and often kill male gemsbok, as well as having a diverse diet that included hunting, scavenging in the wild and human settlements. It also presented that the behaviour of hunting/scavenging is also influenced by the prey population condition. Research in the future can study how mortality rates in spotted hyena populations affect their hunting and feeding behaviour.

**Article Contribution:** The journal article was an important piece in spotted hyena (*Crocuta crocuta*) research, that showcased the types of feeding and hunting behaviour, and the influences that impact the preferred prey. It also introduced other aspects, such as human settlement influences scavenging, how age and sex impact the prey chosen by spotted hyenas, and how the prey is consumed. It also confirmed previous research that spotted hyenas are majority hunters and scavenge in certain conditions. It would be interesting to research more on the types of conditions that had spotted hyenas to hunt in human settlements.

### Primary Article:

Tilson, R. L., & Hamilton III, W. J. (1984). Social dominance and feeding patterns of spotted hyaenas. *Animal Behaviour*, 32(3), 715-724. [https://doi.org/10.1016/S0003-3472\(84\)80147-5](https://doi.org/10.1016/S0003-3472(84)80147-5)

**Summary:** In past studies, it was discovered that spotted hyenas (*Crocuta Crocuta*) have a hierarchical social organization in clans, that is important in their social dominance and expression. Tilson (1984) article explored how hierarchical organization relates to their feeding behaviour. The article also hypothesized that there is differing prey consumption due to the prey densities in the Namib Desert. To determine the relation, the study was conducted in Namib-Naukluft Park, Namibia, and East African Parks for comparison, each with prey populations of Gemsbok (*Oryx gazella*) and springbok (*Antidorcas marsupialis*). Three clans of spotted hyenas were studied, each with three to five individuals, including a female and their cubs, an adult male, and two to three subadult males. To study the hierarchical organization impact on feeding behaviour, four large carcasses and three small carcasses were set out, and observations of the matriarchal clans where feeding rates were classified as uninterrupted intervals of feeding. Scats of spotted hyenas were observed to determine the more hunted prey to address the hypothesis. The results showcased that in the Namib Desert, Gemsbok was found the most in scats remain. There is a linear relationship between the hierarchal structure of spotted hyenas and feeding behaviour, wherein Namib Park, the spotted hyenas that would feed fast were female adults and cubs, as well as adults, had more reign to the food hunted than the subadults and unrelated males as they would have shorter eating periods. In East Africa, consumption of carcasses was done side by side, while Namib spotted hyenas would eat in individually coordinated replacements through the night. This was significant as it shows that spotted hyenas feeding behaviour are impacted by the social organization within the clans. This also purposes further study on the impact of various environments on spotted hyenas feeding behaviour.

**Article Contribution:** The research article was important as it explored the influence of hierarchy in matriarchal clans and its impact on the feeding behaviour in spotted hyenas (*Crocuta crocuta*). It provided more information on how they are social hunters and how it influences their eating. This was important as it showcased another influence on feeding behaviour and provided more insight into how feeding is organized, which is significant in my review. It also brought forward more questions to research, such as how does hierarchy and being social hunters influence the hunting behaviour in spotted hyenas.

### Primary Article:

Cooper, S. M. (1990). The hunting behaviour of spotted hyaenas (*Crocuta crocuta*) in a region containing both sedentary and migratory populations of herbivores. *African Journal of Ecology*, 28(2), 131-141. <https://doi.org/10.1111/j.1365-2028.1990.tb01145.x>

**Summary:** In the previous literature, spotted hyenas (*Crocuta crocuta*) have been determined as successful African predators. Cooper (1990) article studied the hunting behaviour of the *Crocuta crocuta*, by assessing how they affect the population of large mammals in their region, and how they hunt as well as the prey selected. To investigate, the spotted hyenas hunting, and foraging behaviour was observed in the Savuti region of the Chobe National Park in northeastern Botswana. Five clans of spotted hyenas within the study area were observed, that contained on average 50 hyenas each, where adult female hyena from each clan was radiotelemetry collared to be tracked. Over the span of two years, the clans were followed and observed, recording relevant observations. The results gathered that spotted hyenas often hunt medium-sized prey, but are also opportunistic hunters, that will hunt large prey, especially those that are injured, and kill the occasional small prey if given the opportunity. In their hunting behaviour, spotted hyenas hunt in small groups or alone, often at night, where they catch bigger prey when in larger groups. They hunt most of their diets, by using the hunting technique of fan formation, where they rush a herd, pause to locate, and observe a suitable prey, then swiftly attack, making the hunts brief. This was significant as the study of spotted hyenas in Savuti primarily hunting their food agreed with previous studies in other areas of them being hunters, but also scavengers who successfully hunt and gather in daylight and night. It also showcased that spotted hyenas are also affected by annual migrations and are what support the presence of spotted hyenas in the area. Proposed future research should study more on how the numbers of other predators in the region, affect the feeding selection of prey in the region.

**Article Contributions:** The journal article indicated and proved that previous literature of spotted hyenas (*Crocuta crocuta*) are primarily hunters, who hunt medium to large-sized herbivores as true. Though, the article gave more information on how the spotted hyenas hunt (the hunting style), as well as how spotted hyenas are opportunistic hunters, and classified mainly as scavengers. It was important as it provided more information on the hunting behaviour hunting styles but also feeding behaviours. It would be interesting to study how the hunting techniques and feeding behaviour is affected by the time of day.

### Primary Article:

Henschel, J. R., & Skinner, J. D. (1990). The diet of the spotted hyaenas *Crocuta crocuta* in Kruger National Park. *African Journal of Ecology*, 28(1), 69-82.  
<https://doi.org/10.1111/j.1365-2028.1990.tb01138.x>

**Summary:** In studies done in the past, it was determined that spotted hyenas (*Crocuta crocuta*) have a diverse diet as a carnivore's species, that feed in socially organized clans, with the ability to hunt prey 10X their size. Henschel (1990) studied and replicated numerous studies that spotted hyenas, and how their feeding behaviour is done and influenced. The study spanned over a course of two years, in the central district of Kruger National Park, South Africa, where seventeen spotted hyenas with radio collars were observed, eleven from the Mavumbye clan, and the rest from other areas of the park for comparison. Feeding times at each carcass were recorded, as well as the feeding times (in minutes), prey size, food quality, meat, skin, and bones consumed, and quantity needed to be full. Scats and hair were also collected and cross-sectioned with reference hair from Transvaal Museum, Pretoria. The results showcased that the spotted hyenas would hunt and kill more ungulates themselves, but also consumed carcasses killed by lions and leopards, and partake in scavenging. It was found that there was a large selection for buffalo, then wildebeest, zebra, kudu, and impala. Spotted hyenas would consume more food to be full when they kill the prey themselves. Females would spend more time eating meat than the males, and the males would eat more of less quality food such as skin and bones. This was significant as it cemented previous research that spotted hyenas diets are related to the prey size, the abundance of the prey, and prey's availability. It also mentioned how rank influences feeding, and how females differ in hunting and feeding of prey, with a better net energy economy than the males. Future research could study how seasons affect the ratio of feeding between male and female hyenas.

**Article Contribution:** The journal article was presenting past research of spotted hyenas (*Crocuta crocuta*) being a carnivorous species, that thrives on hunting as well as scavenging for other hunted prey. It also showcased that the rank and sex of the spotted hyenas influence its diet and hunting. It was important to my research because it also introduced new items such as season and migration influence on the diet, and showcased information not previously mentioned, such as cannibalism (very rare). It would be interesting to further study the rare hunting and feeding styles, such as cannibalism and scavenging human settlements.

### Primary Article:

Gasaway, W. C., Mossestad, K. T., & Standers, P. E. (1991). Food acquisition by spotted hyaenas in Etosha National Park, Namibia: Predation versus scavenging. *African Journal of Ecology*, 29(1), 64-75 <https://doi.org/10.1111/j.1365-2028.1991.tb00821.x>

**Summary:** The spotted hyenas (*Crocuta crocuta*) were previously thought of as foragers until studies discovered that their main food source is from predation rather than scavenging. Gasaway (1991) set out to further define the spotted hyena's diet, determining where if the majority is from either predation or scavenging, as well as whether they are major predators for zebra in the study region. The study was conducted in Etosha National Park in an area filled with diverse large prey populations, where seven hyenas were radio-collared and tracked day and night and three uncollared hyenas were studied each night as well. Spotted hyenas activity and group size were recorded, such as scavenging, travel times for kills, hunting, feeding, and amount killed. The mean encounter of prey hyenas consuming fresh kills or already killed prey was also recorded and radio estimated. The results determined that spotted hyenas prefer to hunt, where 75% of their diets are from the prey, they killed themselves, and the meals were larger in amount than those that were scavenged. They preferred consuming fresh meat over desiccated prey, and used larger hunting groups for hunting larger prey, such as zebra, over smaller prey. In investigating zebra predation, it was not conducted as much, where lions were determined as their leading predator. It was also seen that spotted hyenas forage mostly at night where foraging groups were smaller than the clans themselves. It was significant because it showcased that their diet is primarily from predation, which confirmed the studies before, as well as showcased the preference spotted hyenas have in feeding on prey are the ones killed themselves, specifically large prey, rather than those that were already killed and desiccating. Future studies could see how seasons affect the rates in scavenging and hunting, and the type of items scavenged.

**Article Contribution:** The journal article researched the main source of hunting by spotted hyenas (*Crocuta crocuta*), determining which was most preferred and had the highest amount of food. This was important to my research as it significantly showcased out of the feeding styles, scavenging and hunting, which was used most which was hunting/predation. It was also displayed that fresh kills were favoured over already killed meals, which is important as hyenas are often thought to just eat leftovers. It would be interesting to research spotted hyenas had evolved to consume dissected leftovers when presented the chance.

### **Primary Article:**

**Holekamp, K. E., Smale, L., Berg, R., & Cooper, S. M. (1997). Hunting rates and hunting success in the spotted hyena (*Crocuta crocuta*). *Journal of Zoology*, 242(1), 1-15.  
<https://doi.org/10.1111/j.1469-7998.1997.tb02925.x>**

**Summary:** It was previously studied that spotted hyenas (*Crocuta crocuta*) differ from the rest of the Hyaenidae family, by preying on ungulate species based on their abundance relative to the hunting group size and preferring to hunt in a group and hunting large prey. Holekamp (1997) studied the effects of social rank, sex, and age on the hunting rates and the influences on success in the hunts. The study was in the Masai Mara National Reserve, Kenya, where a clan of 65 *Crocuta crocuta* was analyzed. They were observed in hunts, where a successful hunt was one or more hyenas, with hunting group size determined at the end of the chase. The abundance of ungulate species was estimated as well as recorded for the type hunted the most. Hourly hunting rate of individual spotted hyenas was calculated, as well as relating it to hunting group size, abundance, hunters age, and hunters' social rank. The results concurred solo hunts were most frequent unless the prey were large, then group hunting was chosen, and the hunting success increased with age. Social rank influenced hunting style and rates, where high-rank females hunt mostly in groups, where the amount of intake and quality of food was affected by hunting group size and rank, where higher rank eat more in the group. Hunting success also increased when more spotted hyenas were added to the group. It was significant as it reinforced the idea that hyenas are sociality hunters, who depend on the hierarchy in feeding and hunting, as well as the abundance, season, and migratory of the prey affects the hunting group and the prey itself, as gazelles were the most eaten and most abundant. Future research could study how social rank affect the prey hunted as a solo hunter versus in a group.

**Article Contribution:** The research article was a great study on what influences the hunting and feeding rates and styles of the spotted hyena (*Crocuta crocuta*). There was also more detail of how specifically spotted hyenas conduct their hunting in groups, where they rush to a prey group, observe its behaviour, select a target, and chase it until killed. I found the article significant as it not only explained the specific hunting style but also explained the influences on hunting and feeding behaviour. I would want more study on how the hunting style adapts/changes to each prey it hunts.

## Secondary Article

**Skinner, J. D. (2006). Bone collecting by hyaenas: A review. *Transactions of the Royal Society of South Africa*, 61(1), 4-7. <https://doi.org/10.1080/00359190609519187>**

**Summary:** This review article explores and compares the feeding and hunting behaviour between the three species of hyenas: the spotted hyenas (*Crocuta crocuta*), the striped hyenas (*Hyaena hyaena*), and the brown hyenas (*Parahyaena brunnea*), as it was previously thought that they all hunt the same. To compare the species of hyenas feeding behaviour, they related it to bone collecting to understand the prey taken back to the den, and the differences of bones collected according to the feeding type. The brown hyenas (*Parahyaena brunnea*) and striped hyenas (*Hyaena hyaena*) are smaller nocturnal hunting species, with weaker jaws, that often scavenge and forage for small mammals and reptiles as well as meatless foods such as seeds, fruits, and insects. Since the prey is small, they often scavenge alone. On the other hand, spotted hyenas (*Crocuta crocuta*) are great hunters that hunt for medium to large, hoofed mammals as well as scavenging human settlements. Spotted hyenas are the larger species of hyena, with the strongest jaws in their family with their ability to chew and consume hard prey bones. As previously known, spotted hyenas hunt in clans to be able to catch larger prey and feed where they kill occurred, but they also adapted to consuming a large number of meats and converting it to milk to feed to the young.

When reviewing the feeding behaviour with bones collection, spotted hyenas are often the ones that would eat their food right where they have been killed. It was discovered that young spotted hyenas also bring bones and prey back to their den due to the disturbance of human settlements. It is significant as while mostly scavenging hyenas bring bones home, so does spotted hyenas. A proposed future study could study how affected spotted hyenas hunting style due to human settlements.

**Article Contribution:** This review article summarizes the feeding behaviour of the three species of hyenas. It showcased that hyena species differ in mass and the strength of their jaw which relate to their prey preference. It described the way that spotted hyenas differs from other hyena species in hunting and feeding, as well as the type of prey they hunt, which is significant to my topic. This article is an excellent source on the type of hunting in the spotted hyenas and how it differs from the rest of its family's feeding behaviour.

### **Primary Article:**

**Trinkel, M. (2010). Prey selection and prey preferences of spotted hyenas *Crocuta crocuta* in the Etosha National Park, Namibia. *Ecological Research*, 25(2), 413-417.  
<https://doi.org/10.1007/s11284-009-0669-3>**

**Summary:** In previous research articles, it was determined that spotted hyenas are efficient hunters with the ability to hunt corporately in groups called clans, but their diet was found to be flexible and dependent on prey abundance itself. Trinkel (2010) article studied how the density of spotted hyenas and prey abundance affect the feeding ecology of spotted hyenas and their prey preferences. To determine the spotted hyenas that were first observed in two different study areas: the central Etosha Park and east Etosha Park (with a smaller area). The study focused on five clans of spotted hyenas consisting of subadults and their hunting was studied with the use of infrared sensitive cameras, binoculars, and red filtered spotlights. The species of prey was studied on whether they were migratory and or resident species, and a successful kill was only recorded if a pursuing hyena had done that killing in a chase formation. To investigate the prey preferences as the Jacobs index was a method used to determine the correlation between the kills done by spotted hyenas and the abundance of the prey. The results determined that prey that was larger in weight, had *Crocuta crocuta* hunting in larger clan sizes and it affected their preferences, as those with smaller sized clans preferred to hunt for smaller and more abundant prey. It was discussed that due to *Crocuta crocuta* flexible diet and ability to hunt alone and in groups, the type of prey hunted depended on its availability to the spotted hyena density. This was significant as it provided insight on how *Crocuta crocuta* choose the prey they hunt and explored how territory area (m<sup>2</sup>) and hyena population affect it. It could also propose future studies to explore the hunting techniques used according to the size of the spotted hyena clan.

**Article Contribution:** This journal article indicated how prey density affected the feeding behaviour of *Crocuta crocuta* (spotted hyenas), as well as how it affected the preferences and density of the spotted hyenas. It cemented the previous finding that spotted hyenas have an opportunist behaviour with a diverse prey palette, so the results showcased that the impact on its feeding behaviour was due to prey density and hyena population, which I found important to the topic. It also raises the question for me to explore, the type of hunting skills that are used when influenced by the prey density.



### Primary Article:

Yirga, G., De Iongh, H. H., Leirs, H., Gebrehiwot, K., Deckers, J., & Bauer, H. (2015). Food base of the spotted hyena (*Crocuta crocuta*) in Ethiopia. *Wildlife Research*, 42(1), 19-24. <https://doi.org/10.1071/WR14126>

**Summary:** In previous literature on the diet of the spotted hyenas (*Crocuta crocuta*), it was found that spotted hyenas do not have a species preference, mainly feeding on preys most abundant, as well as being adapted to human populations. Yirga (2015) article studied how the main food base of the spotted hyenas as well as their impact on livestock population and its depredation in Ethiopia. To determine the food base, the study was done in Ethiopia, where livestock observation was focused on the highlands, where they recorded the livestock's type of species, age, number, and sex in its losses. The researcher also collected fresh scats from spotted hyenas and prey hair to compare to reference hair collection. They had used Jacob's indices to determine the preference for each prey species to compare to the availability. The results found in the scat analysis, that many livestock are present, as well as human hair, most likely from garbage dumps and cemeteries. This was significant as it showcased that spotted hyenas in Ethiopia are very dependent on livestock and waste from human activity as a food source. It also showcased that in spotted hyena's habitats that are heavily influenced by human settlements, the *Crocuta crocuta* is adapted to these settlements, where they can meet their food requirements using scavenging, becoming attracted to the areas due to their nocturnal and opportunistic foraging/hunting behaviour. It also displayed that spotted hyenas have such a wide variety of diets, that are impacted by numerous influences, which in turn affects their feeding and hunting behaviour, which this paper specifically showcased the influences of human-dominated habitats (and their waste) and livestock on scavenging rates. Further research on how more predation on livestock prey affects the success of hunting prey in the wild, and if the hunting strategies changed.

**Article Contribution:** This article is an important piece that focuses on the less documented area of the influences on the feeding and hunting behaviour of spotted hyenas. Focussing on the impact of human disturbance and livestock. It was significant as it displayed more information on why scavenging became a more well-known aspect of spotted hyenas hunting behaviour and how habitat conditions influence the type of prey chosen, as well as the hunting and feeding behaviour. It would be interesting to have further study on the types of conditions needed to increase livestock predation and instances that increase wild prey predation.

### **Primary Article:**

**Fester, K. S. M., Hockings, G., Vuuren, R. J., & Vuuren, M. (2021). Spotted hyaena *Crocuta crocuta* feeding ecology and selectivity of large herbivorous prey in the Namib desert. *Ecology and Evolution*, 11(9), 3672–3678. <https://doi.org/10.1002/ece3.7302>**

**Summary:** A previous study done in the Namibia Desert by Henschel and Tilson in 1988, found that the spotted hyena (*Crocuta crocuta*) population was not a limiting factor to the prey population. Fester (2021) article aimed to have a more updated report on the spotted hyenas feeding ecology versus the large prey density. The article hypothesized that large herbivorous prey with the most density would be the most found in the scats of spotted hyenas. To investigate, the study was done in the southwest of Namibia, with land surrounded by tourist and livestock farming. The study area is filled with large herbivorous prey of study, specifically the Gemsbok (*Oryx gazella*), Springbok (*Antidorcus marsupialis*), ostrich (*Struthio camelus*), and kudu (*Tragelaphus strepsiceros*). The largest prey density in the study area was determined by Ivlevs Electivity Index. Hikes were conducted twice a week around areas spotted hyenas were observed with motion-sensor cameras to obtain the scats and determine the type and amount of large prey species that were eaten. The results in Ivlevs Electivity Index determined that Gemsbok and Springbok were the largest in abundance density as well as the highest in scats sampled. Though it did not support that spotted hyenas choose the more numerous preys, as the springbok were the largest in density size, but the Gemsbok was the highest selected found in scats. The article reasons that it was due to the hunting size of the spotted hyenas, where hunting size determines the type of prey hunted, as a larger hunting size needs a larger prey to acquire a reward-gain. This was significant as it showed the spotted hyenas have a higher selection for larger sized prey. The article also considers for future study how seasons may affect the prey abundance as well as the prey preference by spotted hyenas.

**Article Contribution:** The journal article had a great significance to the study as it showcased that larger prey is selected. It contradicted my previous article that spotted hyenas (*Crocuta crocuta*) chose prey according to their abundance, but it did showcase that spotted hyenas will hunt according to their hunting clan size and hunt larger prey to ensure there was a gain in reward with the energy spent. I found this important as it showed that spotted hyenas are more intellectual hunters than thought before and raise the question of how evolution led to acquiring the hunting mentality.