An experimental study of vertebrate scavenging behavior in a Northwest European woodland context

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ABSTRACT

Vertebrate scavengers can modify surface deposited human remains which can hinder forensic investigations. The effects of such scavenging vary between species and regions. Published research into the effects of the scavenging of human remains is dominated by work from North America with few studies covering Northwestern Europe. Forensic investigators in Northwestern Europe are often left questioning on a basic level as to which scavengers are active and how they might affect human remains. This paper presents the results of a field study utilizing deer (*Cervus nippon*; *Capreolus capreolus*) as surface deposits observed by motion detection cameras in a British woodland. The most common avian and rodent scavenger species recorded included the buzzard (*buteo buteo*), carrion crow (*Corvus corone*), wood mouse (*Apodemus sylvaticus*) and gray squirrel (*Sciurus carolinensis*). The scavenging behaviors observed were affected by seasonality, rates of decomposition and insect activity. Scavenging by buzzards, unlike carrion crows, was most frequent during fall to winter and prior to insect activity. Overall, avian scavengers modified and scavenged soft tissue. Rodents scavenged both fresh and skeletonised remains with gray squirrels only scavenging skeletal remains. Wood mice were most active in winter and scavenged both soft tissue and bone.

Keywords: forensic science, forensic archaeology, taphonomy, scavenging, vertebrate scavengers, Northwest Europe

Vertebrate scavengers can greatly modify surface deposited human remains through the disarticulation, scattering and removal of soft tissue and skeletal elements, as well as associated personal effects. Scavenging can modify, obscure and remove sites of trauma on both soft tissue and bone which can lead to misinterpretations of the sequence of events that led to the deposition and condition (e.g. rate of decomposition) of the remains (1-5). However, the effects of scavenging on remains will depend on several factors including the environment, scavenger species, weather conditions, main food source, home range size, intra- or inter-specific aggression, condition and deposition of remains, and length of exposure (1-2,6-10). All of these factors will vary at each crime scene and thus must be considered. Despite this, there is limited scavenger species-typical behavior and region-specific studies in a forensic context. The majority of research examining vertebrate scavengers from the point of view of their forensic significance has been based on North American environments and scavenger species, such as coyotes (*Canis latrans*), wolves (*Canis lupus*) and vultures (Cathartidae) (3-4,11-24) with relatively limited forensic research available based on Northwest European vertebrate scavengers and their behaviors (25-28). Previous studies on scavengers in Northwest Europe have generally focused on the main components of their diets, home range sizes and the spread of diseases (29-33). Consequently, less attention has been given to the significance of such scavengers for forensic cases involving human remains. Mustelid and canid scavenging behavior is discussed in detail in Young *et al*. (submitted), subsequently this paper focuses on common avian and rodent scavengers in Northwest Europe.

Forensic investigators questioning what types of scavenging animals are present within Northwest European environments and what those scavengers are capable of doing to human remains are often forced to rely on North American models of scavenging. This situation forces assumptions that Northwest European scavenger species are likely to have similar effects on human remains to those in North America. Providing information on what scavenger species are present within different environments and regions, as well as their species-typical scavenging behaviors aids forensic investigators in the implementation of more efficient and effective search and recovery of scavenged human remains, as well as more accurate interpretations based on those recovered remains. The aim of this paper is to address some of the most commonly asked questions by forensic investigators in Northwest Europe: Which scavenger species are present within a rural and peri-urban environment? What are the effects of scavenging by different scavenger species? Which factors can increase or decrease the frequency of scavenging? What areas on a carcass are different scavengers attracted to and when is such scavenging likely to take place?

Materials and Methods

Fresh deer carcasses (*Cervus nippon*; *Capreolus capreolus*) were used as human proxies. In contrast to North America (4,11,34-36), human cadavers are not as readily available for scavenging studies within the U.K. due to ethical, planning, and legislative restrictions (37-38). Human cadavers are instead donated to medical research in the U.K. and tend to be from the elderly and frail (39), as well as potentially embalmed, thus limiting the ability of forensic studies to research different crime scene scenarios. Animal analogues are commonly used in forensic studies, both in the U.K. and North America, to recreate and analyze crime scene scenarios (13-14,16,23-24,40-41). Pigs (*Sus scrofa*) are regularly used as human proxies in forensic studies of scavenging (16,23) primarily due to the comparative qualities of the skin and fat contents. However, the Department for Environment, Food and Rural Affairs (DEFRA) prohibits the deposition of pigs on the ground surface in the U. K. for the prevention of the spread of diseases amongst domestic livestock (42). The surface deposition of deer in the U.K. is not restricted by DEFRA because as wildlife they do not pose a threat in the spread of disease to domestic livestock. Deer were chosen as suitable human analogues in this research because the focus of this study is the scavenging, disarticulation and scattering of surface deposited remains rather than the analysis of soft tissue loss, decomposition chemistry, or microbial activity.

Separate deer legs were also used as baits within the experiment. The deer and baits were obtained from an unrelated culling operation which is part of the humane management of wild deer populations within the region. Deer, all of which were aged about 2 years and included both males and females, died as the result of a gunshot wound (.308-calibre; c. 30 mm to 50 mm soft tissue wound) on the right side of the thorax and were surface deposited as fresh for this study with the site of trauma exposed.

The surface deposition of deer legs as baits and whole deer carcasses within a woodland environment located at Bovington, Dorset, U.K. (Figure 1), c. 450 m x 550 m, was conducted from November 2010 to July 2011 and utilized 12 baits and five deer carcasses (see Young *et al*. submitted) (Table 1). Baits were used as a pilot study to gain an understanding of the field site prior to the deposition of whole deer. The first set of six baits did not include hides or hooves but the second set of six did. Baits were deer legs severed at the femur and humerus. The baits and deer were neither covered nor fenced off from the surrounding environment, this allowed for unrestricted exposure to weather conditions, flora, and fauna. Baits in set A (weighing 2 kg) were placed an average 25.2 m apart (Figure 1). Baits in set B (weighing 6 kg) were placed an average 21.6 m (Figure 1). Whole deer (weighing 23 kg – 59 kg) were surface deposited at an average distance of 94 m between each deer (see Young *et al*. submitted) (Table 1; Figure 1).

Baits in set A remained within the site until all baits were scavenged and removed by scavengers. After the removal of set A, baits in set B were deposited and remained on site until removed by scavengers. After both sets of baits were scavenged and removed, Deer 1 (59 kg) was deposited in December and remained on site for the total 210 days of the experiments (Table 1). In February, Deer 2 and 3 (24 kg) were deposited c. 100 m apart. After Deer 2 and 3 were scavenged, scattered and removed by scavengers, Deer 4 (23 kg) and 5 (34 kg) were deposited at the same time in March and were placed c. 135 m apart (Table 1). Maps were created using ESRI *ArcGIS* 10.

Avian and rodent scavenging activities at baits and deer were recorded using SPYPOINT IR-7 infrared cameras fastened to trees at a height of approximately 55 cm above the ground surface and at a distance of about 1 m from each bait (one camera) and deer at the head and hind (two cameras) (see Young *et al*. submitted). Cameras were active during all hours of the experiment in order to record 30 seconds long videos of any motion detected at a vertical angle of 30˚ and up to a distance of 50 ft (see Young *et al*. submitted). Recordings were retrieved from cameras during each site visit and were analyzed for the presence of scavenger species and their scavenging behaviors during different stages of each deer's exposure and decomposition (see Young *et al*. submitted). The decomposition of each deer was identified according to Galloway *et al*.'s (43) four stages of decomposition of human remains. The state of decomposition and level of scavenging for each carcass were observed and recorded during each weekly site visit. Additionally, photographic recordings were taken of insect activity and evidence of scavengers (e.g. scat, paw prints) at or near deer. Daily temperatures were obtained from the Meteorological Office's Hurn, U.K., weather station (44).

Results

Baits

Baits 1A-6A were surface deposited to test the positioning of cameras on trees and as only one camera recorded scavenging (Bait 3A; scavenging by a buzzard (*Buteo buteo*) was visible) cameras were repositioned. Cameras detected a wider variety of scavenging of Baits 1B-6B which consisted primarily of scavenging by buzzards during daylight and red foxes (*Vulpes vulpes*) at night (see Young *et al*. submitted). Areas of soft tissue on Baits A and B scavenged by buzzards had a string-like appearance, which was consistent with Asamura *et al*.'s (5) description of crow scavenging of charred human remains in Japan but was more prominent in the deer legs deposited without a hide (Figure 2). No other scavenger species were observed at baits.

Deer Case Studies

In total, avian scavengers were observed and recorded at or near deer in 214 video recordings and rodent scavengers in 52 recordings. Wood mice were observed scavenging at a carcass when it was still in the early stages of decomposition (57.89% of all wood mouse scavenging events) prior to bloating but were also recorded scavenging when the carcass had become skeletonized (42.11%) (Table 2). Wood mice scavenging activities were nocturnal (Table 3) and recorded as occurring all over the carcass but were concentrated at the gunshot wound (GSW) located at the thorax (29.03%) (Table 4). Wood mice scavenged deer during all seasons but scavenged more frequently during colder seasons.

Gray squirrels were only recorded during daylight (Table 3) and scavenging at later stages of decomposition when remains were skeletonized (Table 2). Gray squirrels were observed scavenging and travelling through deposit sites during all seasons that deer were deposited. Scavenging by gray squirrels was evenly spread across the head (28.57%), neck (28.57%) and thorax (28.57%) but was also observed at the hind end (14.29%) of the deer (Table 4).

Avian scavenging predominantly involved buzzard and carrion crow but other species, such as jay (*Garrulus glandarius*) and robin (*Erithacus rubecula*), were observed at the carcass deposit site following the removal of the remains by larger scavengers. The robin was observed searching the soil underneath where the deer had been deposited so it was recorded as having scavenged because it had the potential to remove either fur or insects related to the deer. The two instances where a jay was recorded it was stationary near a deer's deposit site (at least 4 m) so it was not identified as scavenging.

Buzzard scavenging was only observed in daylight hours (Table 3) and was primarily concentrated at the site of trauma (79.66%) for the removal of soft tissue but was also observed at the head (8.47%) of deer (Table 4). Additionally, buzzards were only present in the early stages of decomposition prior to any bloating of the carcass and before increased insect activity (Table 2). In contrast to buzzards, scavenging by carrion crows was observed for all months in which deer were deposited and during all stages of decomposition but did increase in warmer months and when deer were in an advanced stage of decomposition (49.01%) (Table 2). Similarly to buzzards, scavenging by carrion crows was limited to daylight hours (Table 3). Carrion crows not only removed soft tissue from the head (6.47%), GSW (14.39%), hind end (18.35%) and limbs (36.69%) of deer (Table 4) but also plucked fur from around the gunshot wounds on Deer 4 and 5 (Figure 3).

Sika deer (*Cervus nippon*) were also observed present near all of the deposited deer carcasses and occasionally walking through deposit sites. All live deer were observed eating vegetation near carcasses and sniffing the soil surface near the deposit site (within 2 m). Deer were not observed scavenging from the carcasses.

Deer 1

Scavenging of Deer 1 occurred only when the deer was in a fresh stage of decomposition and skeletonization. Wood mice were observed scavenging in 90.48% of recordings of Deer 1; gray squirrels in 33.33%; buzzards in 95.92%; and carrion crows in 66.67% of videos. Overall, buzzards (63.51%, *n* = 47) were the most frequent scavenger of Deer 1 other than foxes (see Young *et al*. submitted) (Table 5). Wood mice scavenged when the deer was both fresh (57.89%) and skeletonized (42.10%). Gray squirrels and carrion crows only scavenged when the deer was skeletonized, whereas buzzards only scavenged when the deer was fresh.

After a time of exposure of approximately 33 hours, a wood mouse (*Apodemus sylvaticus*) was recorded biting and removing soft tissue from the GSW area (Figure 4). Scavenging by wood mice at the GSW was recorded on three subsequent days of exposure prior to the arrival of a buzzard (*Buteo buteo*) on the 8th day of exposure, around midday, which perched on top of the thorax of the carcass and removed soft tissue from the GSW (Figure 5). Additional scavenging by wood mice was observed at night on the 10th day and was followed on the 11th by scavenging of the deer by a buzzard during daylight. As Deer 1 was exposed for a total of 210 days, additional scavenging by carrion crow (*Corvus corone*), wood mouse, and gray squirrel (*Sciurus carolinensis*) was observed during later stages of decomposition, in particular, once skeletonized. A jay and robin were recorded, separately, at the deposit site but were not recorded pecking at the carcass. The final scavenger observed at Deer 1 was a gray squirrel scavenging the skeletonized innominates on the 128th day of exposure.

Deer 2

No avian or rodent scavengers were recorded at Deer 2. The scavenging, disarticulation, scattering and removal of the deer only involved fox activity (see Young *et al*. submitted).

Deer 3

There were no observations of rodent scavengers at Deer 3 prior to the scavenging, disarticulation, scattering and removal of the deer on its seventh day of exposure within a 24 hour period by a fox (see Young *et al*. submitted). Scavenging of Deer 3 only occurred whilst the deer was in a fresh stage of decomposition. All recordings from Deer 3 of buzzards showed them scavenging from the deer. Carrion crows were observed scavenging in 25.00% of videos of carrion crows at or near the deer.

On Deer 3's second day of exposure, a buzzard was recorded for c. 15 minutes scavenging the GSW located on the thorax of the deer but was not observed scavenging at any other point in the deer's exposure. Scavengers, such as carrion crows and gray squirrels were observed investigating the soil surface of the deposit site after the removal of the deer by the aforementioned fox.

Deer 4

Carrion crows were recorded in 41 videos as present at Deer 4 but were only observed scavenging in 89.13% of videos. Carrion crows only scavenged whilst the deer was in an advanced stage of decomposition. No buzzards were observed at the deer. The only rodent scavengers recorded were gray squirrels but they did not scavenge the deer.

On the 7th day of exposure, a carrion crow was observed at the deer but did not scavenge. Scavenging by carrion crows did not begin until the 22nd day and was focused primarily at the hind end and hind legs of the deer which had soft tissue trauma previously caused by a fox (see Young *et al*. submitted). Scavenging by carrion crows also occurred at the exposed soft tissue at the abdominal cavity which was also caused by fox scavenging (see Young *et al*. submitted). Carrion crows were recorded removing soft tissue and maggots from the abdominal cavity prior to the desiccation of the deer (Figure 3). On the 45th day of exposure, carrion crows were recorded scavenging from the head of the deer. The final observation of carrion crows scavenging from Deer 4 was on the 56th day and was concentrated at the desiccated remains of the ribcage and head (Figure 6).

Deer 5

Carrion crows, gray squirrels and wood mice were observed at or near Deer 5 but not all were recorded scavenging. No buzzards were observed at the deer. There was only one video showing a gray squirrel and one video showing a wood mouse near the deposit site. Carrion crows were recorded scavenging in 69.03% of videos when the deer was fresh (36.45%), in an early stage of decomposition (38.32%), and skeletonized (25.23%) (Table 2).

Scavenging by carrion crows began on the 3rd day of exposure and involved one carrion crow scavenging at the hind legs, front legs, and head of the deer whilst another carrion crow searched the ground surface near the deer. The head of the deer was further scavenged by carrion crows on the 5th day and included the removal of the eyes and part of the tongue (Figure 7). From the 6th day onwards, carrion crows were recorded scavenging and removing fur, soft tissue, and maggots from the GSW area, as well as searching the soil near the deer (Figure 8). On the 28th day, carrion crows were also observed scavenging from the dorsal side of the deer where additional insect larvae were located. The final recording of carrion crow scavenging was on the 41st day. On the 84th day, a jay was recorded near Deer 5 but was not scavenging from the deer.

Discussion

Buzzard, carrion crow, wood mouse and gray squirrel were the only observed avian and rodent scavengers of deer remains. These scavengers' behavior and patterns were affected by seasonality, insect activity, decomposition, and trauma. Colder temperatures may have affected the availability of main food sources for scavengers and as a result caused an increase in the frequency of scavenging by those seeking an alternative food source such as carrion (46-48). Moreover, colder temperatures will have hindered insect activity and slowed the rate of decomposition of carcasses (34-35,40-41,43,49-51) which may have provided certain scavenger species with a more desirable fresh carcass. Warmer temperatures contributed to an increased level of insect activity and thus increased rates of decomposition at carcasses (35,40,43,52). These increased rates limited the time available to some scavengers to obtain a fresh carcass but also provided other scavengers with an insect rich carcass.

There was no overall pattern observed as to when scavenging began at each carcass nor did the onset of scavenging appear to have an effect on the length of time a single scavenger spent actively scavenging a carcass (Table1). Interestingly, during this study there was never more than one species of scavenger present at the carcass at a single time. Likewise, the maximum number of scavengers simultaneously scavenging from a carcass did not exceed two throughout the entire study. Possible reasons for this limited number at the carcass may be inter-specific aggression (29,53-55). The avian and rodent scavengers in this region caused both soft tissue and skeletal damage but did not cause widespread scattering and removal of skeletal elements. Avian scavenging exposed a greater proportion of soft tissue than rodent scavenging and contributed to increased insect activity and rates of decomposition, which affected the scavenging behavior of other scavengers.

Rodent Scavenging

Previous studies that have focused on rodent scavenging at earlier stages of decomposition have failed to identify the scavenging activities and effects of wood mice on remains (3-4,18,56-57). In contrast to previous studies that have examined wood mice diet (58-60), the results from this study using deer have shown the presence of large size carrion in the wood mice diet. Wood mice proved to be amongst the first scavengers present at the carcass after deposition, prior to any bloating. It is important to note that wood mouse activity was also observed when deer were skeletonized but this was not as frequent as in the earlier stages of decomposition. Results of wood mice from this field study are consistent with baiting studies conducted by Jonathan Reynolds (personal communication March 02, 2011), Game and Wildlife Conservation Trust 2011, in which wood mice were observed as the first scavengers present at sites of lamb carrion prior to any avian scavenging. Rodent scavenging of soft tissue is characterized by even wound margins, crenulated edges, and parallel lacerations produced by the incisors of rodents (56-57). In addition to these characteristics, rodent scavenging is often identified by the presence of rodent fur or faeces, however, the larger the size of the rodent the easier it is to identify such characteristics. The wood mouse is a relatively small rodent in comparison to the more commonly studied scavenging of rats, thus the absence of easily identified evidence of rodent scavenging such as soft tissue damage (e.g. crenulated edges), faeces and fur of the wood mouse has the potential to lead to misinterpretations of trauma obscured by wood mouse scavenging. Scavenging at the site of trauma by a wood mouse can modify the size of the trauma, for example widening a gunshot wound or stab wound, or, in contrast, create a site of trauma in soft tissue. The identification of wood mouse scavenging can assist in more accurate interpretations of trauma but aids in the interpretation of deposit sites (e.g. indoor vs. outdoor; rural vs. urban) and how the body was deposited (e.g. trauma exposed or not exposed; surface vs. buried; textiles or larger item prohibiting access by small scavengers).

Scavenging by rodents at later stages of decomposition was observed and is consistent with a number of studies that have researched the effects of rodent scavenging on human remains (3-4,15,61-62) (Table 2). The interest of rodents, and in particular, gray squirrels, in skeletal remains has been attributed to the necessity of rodents to wear down their incisors and to obtain nutrients (3,61).

Avian Scavenging

Within North American forensic studies of avian scavenging, the predominant avian scavengers discussed are vultures (11,13). Griffon vultures (*Gyps fulvus*), Egyptian vultures (*Neophron percnopterus*), and Cinereous vultures (*Aegypius monachus*) inhabit Mediterranean and Eastern Europe regions, as well as Asia, whereas within Northwest Europe buzzards are amongst the more common larger avian scavengers (46,63-64). Despite this, the species-typical scavenging behavior and effects of buzzard scavenging on a set of remains have yet to be examined.

The colder temperatures of winter months, which contributed to a delay in the rate of decomposition of a carcass, provided buzzards with a carcass that remained fresh for a longer period of time in comparison to deer deposited in warmer months, as a result buzzard scavenging activity was observed more frequently in the colder months whilst deer were still in a fresh state. These observations were consistent with ecological studies in Poland on the scavenging of deer, boar, bison and livestock by buzzards (65-66).

In contrast to buzzards observed within this study, carrion crows displayed more variety in their scavenging behaviors. Scavenging by carrion crows occurred at all areas on a deer but was characterized by the initial scavenging of sites of trauma and the head, in particular the eyes and tongue. Interestingly, carrion crows first removed fur from the GSW prior to removing soft tissue. Carrion crows also consumed insects and removed fur from the carcass and soil. Previous studies have identified the removal of hair by birds from a human body for use as nesting material (18,36,67) and within this study the removal of fur from the deer carcass and the soil surface was interpreted as also being used for nesting. Areas of soft tissue on the deer scavenged by buzzards and carrion crows, like the baits, had a string-like appearance, which was consistent with Asamura *et al*.'s (5) description of crow scavenging (Figure 2,9).

The damage to soft tissue and bone by buzzards and carrion crows not only has the potential to remove sites of trauma but to also affect the patterns of decomposition seen on a human body by exposing soft tissue and internal cavities to weather conditions and insects. In contrast to all other scavengers observed during this study, the level of scavenging by carrion crows was not deterred by increased insect activity. Carrion crows were observed eating maggots from the gunshot wound, catching blowflies mid-air, eating insects in the soil, collecting fur and eating soft tissue at all stages of decomposition. The scavenging by carrion crows of Deer 4 and 5 exposed soft tissue, which is known to contribute to an increase in insect activity (4,23,52,68,70). Within this study, insect activity by Calliphoridae appeared to increase once the carrion crows had removed the fur from around the site of trauma, thus giving additional access to the thoracic and abdominal cavities for oviposition. Large maggot masses were observed in both Deer 4 and 5 at the thoracic cavity and specifically at the gunshot wounds at which maggots were visibly exiting (Figure 10). Maggots were observed to a much lesser extent at the hind legs where carrion crows had removed some soft tissue and within the mouth. Cross and Simmons (40) identified blowflies as being primarily attracted to the heads of surface deposited pigs where volatile gases were released and less attracted to sites of trauma (gunshot wounds) for oviposition. The lack of scavenging of the pig carcasses may have influenced the preference of natural orifices for oviposition over gunshot wounds. In contrast, the scavenging of the gunshot wounds on deer in this study by carrion crows appeared to have given blowflies easier access to the thoracic cavity because of the removed fur and exposed soft tissue, thus blowflies were concentrated at the thorax. Oviposition in that location allowed the maggots to use the skin of the deer, like that of human remains (36), as protection against sunlight and other adverse conditions.

Ungulates as Taphonomic Agents

It is important to note that deer are known to scavenge dry bones, a behavior known as osteophagia, caused by a nutritional dysfunction in which an animal is deficient in phosphorous (69). Deer were not observed scavenging bones in this study. There is, however, the potential of modification to surface remains by ungulates due to trampling which can cause movement and fracturing of bones (70-72).

Conclusion

This study found buzzard, carrion crow, wood mouse, and gray squirrel to be the most common avian and rodent scavengers within a British woodland environment. Buzzards and wood mice scavenged a set of remains more frequently when remains were still in a fresh stage of decomposition. Carrion crows were observed scavenging during all stages of decomposition but were observed scavenging more often when deer were in early and advanced stages of decomposition when there was increased insect activity. Gray squirrels were recorded scavenging only when deer remains were skeletonized. The time at which scavenging occurred differed between each scavenger. Buzzards, carrion crows and gray squirrels only scavenged during daylight, whereas wood mice were only recorded scavenging at night.

All of these scavengers displayed different scavenging behaviors, preferring to scavenge at different times of the day, at different stages of decomposition and different weather conditions. The identification of scavengers and their species-typical scavenging behaviors can aid in the search of scavenged remains, as well as interpretations of trauma, condition and deposition of a human body. Studies, such as this, which provide species-typical scavenger behaviors and region specific knowledge are needed in forensic investigations to improve the search, recovery, and interpretation of scavenged remains.

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Tables

Table 1. Month and year of deposition for baits and each deer and the average temperature during the total number of days of exposure (adapted from Young *et al*. submitted).

Deer #	Weight (kg)	Deposit Month & Year	Total Exposure (Days)	Average Temperature (˚C)
Baits 1A-6A	2	November '10	6	6.13
Baits 1B-6B	6	December '10	6	2.57
1	59	December '10	210	9.51
2	24	February '11	44	7.17
3	24	February '11	8	8.10
4	23	March '11	103	12.58
5	34	March '11	103	12.58
Average	24.57		68.57	
Minimum	2		6	
Maximum	59		210	

Table 2. Percentage of scavenging events per scavenger species during each stage of decomposition for all deer. Stages of decomposition based on Galloway *et al*. (43).

Stages of Decomposition	Wood Mouse	Gray Squirrel	Robin	Crow	Buzzard	Total scavenging events
1.Fresh	57.89% (n=11)	0	0	25.83% (n=39)	100% (n=54)	45.22% (n=104)
2. Early Decomposition (e.g. discolouration and bloating; maggot activity)	0	0	0	23.84% (n=36)	0	15.65% (n=36)
3. Advanced Decomposition (e.g. moist soft tissue decomposition; some bone exposure and mummification)	0	0	0	49.01% (n=74)	0	32.17% (n=74)
4. Skeletonization	42.11% (8)	100% (n=5)	100% (n=1)	1.32% (n=2)	0	6.69% (n=16)
5. Extreme decomposition	0	0	0	0	0	0
Total count of scavenging events	19	5	1	151	54	230

Table 3. Percentage of recorded scavenging events that occurred during day and night per scavenger species. Sunrise and sunset times for each day deer were exposed were obtained from Time and Date AS (45).

Animal Species	Scavenging events after sunrise	Scavenging events after sunset
Crow	100% (n=151)	0
Buzzard	100% (n=54)	0
Wood Mouse	0	100% (n=19)
Gray Squirrel	100% (n=5)	0
Total scavenging events of all scavengers observed	91.70% (n=210)	8.30% (n=19)

Table 4. Percentage of scavenging events according to different locations on the whole deer.

Animal Species	Site of Trauma (GSW)	Head	Neck	Front Limbs	Thorax	Abdominal Cavity	Hind End	Hind legs	Total for all locations
Crow	14.39% (n=40)	6.47% (n=18)	7.19% (n=20)	10.43% (n=29)	3.96% (n=11)	12.95% (n=36)	18.35% (n=51)	26.26% (n=73)	278
Buzzard	79.66% (n=47)	8.47% (n=5)	0	0	10.17% (n=6)	1.69% (n=1)	0	0	59
Wood Mouse	16.13% (n=5)	12.90% (n=4)	16.13% (n=5)	9.68% (n=3)	29.03% (n=9)	6.45% (n=2)	3.23% (n=1)	6.45% (n=31)	31
Grey Squirrel	0	28.57% (n=2)	28.57% (n=2)	0	28.57% (n=2)	0	14.29% (n=1)	0	7
Total for all scavengers	24.53% (n=92)	7.73% (n=29)	7.20% (n=27)	8.53% (n=32)	7.47% (n=28)	10.40% (n=39)	14.13% (n=53)	27.73% (n=104)	375

Table 5. Percentage of scavenging events by each observed scavenger species per deer.

Animal Species	Deer 1	Deer 2	Deer 3	Deer 4	Deer 5	Total percentage of scavenging events for all deer
Crow	2.70% (n=2)	0	12.50% (n=1)	100.00% (n=41)	100.00% (n=107)	65.65% (n=151)
Buzzard	63.51% (n=47)	0	87.50% (n=7)	0	0	23.48% (n=54)
Wood Mouse	25.68% (n=19)	0	0	0	0	8.26% (n=19)
Gray Squirrel	6.76% (n=5)	0	0	0	0	2.17% (n=5)
Robin	1.35% (n=1)	0	0	0	0	0.43% (n=1)
Total Count	n=74	n=0	n=8	n=41	n=107	n=230