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Animals and the Economy of Medieval Ireland: A Zooarchaeological Analysis of the Faunal Remains from Caherconnell Cashel, Co Clare

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(Volume 1)

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Abstract

Animals were central to the economy of early (400–1100 AD) and late (1100–1550 AD) medieval Ireland, and were particularly vital to the food economy, farming practices, and social status of a settlement and its occupants. With the Anglo-Normans dominating the archaeology of the later period, there is a significant gap of knowledge surrounding Gaelic sites of this period, which ultimately raises the question as to the influence of the former on the economy of those settlements. This research aims to gain a better understanding of the agricultural economy of Gaelic sites during these periods through the zooarchaeological analysis of the animal bone assemblage from Caherconnell Cashel, a drystone ringfort located in the Burren, County Clare. Recent excavations recovered a large assemblage, with an estimated 40,830 recordable bones, that displays a high level of preservation. Excavations at Caherconnell also yielded evidence of multiple phases of high-status activity, domestic structures, various artefacts, assemblages of other bio-environmental remains, and contextual and dating information. This project is part of a major inter-disciplinary study of Caherconnell, involving a collaboration with University of Galway with excavations directed by Dr Michelle Comber of the Caherconnell Archaeology Field School.

The central research question of this zooarchaeological study is to gain a better understanding of the agricultural economy of rural medieval Gaelic Ireland with a focus on Caherconnell Cashel in north-west Clare. The aims of this analysis have a focus on the role of animal husbandry, hunting, and fishing at medieval Gaelic settlements in western Ireland; identifying changes in livestock farming between the early and late medieval periods to assess potential impacts associated with the arrival of the Anglo-Normans; and detecting any status implications of different animal species at Gaelic medieval settlements. The Caherconnell assemblage provides evidence of a self-sufficient producer-consumer mixed farming economy throughout the early and late medieval periods. The three main domesticates, cattle, sheep, and pig, appear to be bred and slaughtered on-site or nearby, with cattle dominating the assemblage, followed by sheep and then pig. The sites economy shows an emphasis on dairying with the particular dominance of cows, as well as the production of beef, lamb/mutton, and pork, and other products such as wool. The remaining domesticates, horse, dog, cat, and domestic fowl, would have played various roles including working animals, pets, and the production of food stuffs. Hunting, fowling, fishing, and bone working were among the activities undertaken at

Caherconnell. The results of this analysis follow the previously established trends from other early medieval sites in Ireland and due to Caherconnell being situated in a landscape controlled by Gaelic lords in the west of Ireland, it is not surprising that this pattern continued into the later period with the site appearing to be unaffected by the arrival of the Anglo-Normans and the overall continuation of native tradition at Caherconnell.

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Part 1: Research Background

Chapter 1

Introduction

This project aims to gain a better understanding of the food economy and farming practices of early (400–1100 AD) and late (1100–1500 AD) medieval Ireland. There is a significant gap of knowledge surrounding Gaelic settlements of the latter period, raising questions on whether the arrival of the Anglo-Normans caused significant changes in farming economy. This research involves the zooarchaeological analysis of an animal bone assemblage from Caherconnell Cashel, a drystone ringfort located in the townland of Caherconnell, in the Burren of north-west Co. Clare. The assemblage displays a unique level of preservation and high quality contextual and dating information, producing an estimated 40,830 recordable bones, all of which were analysed for this study. Caherconnell was a rural settlement of high status with occupation spanning the early and late medieval periods. Agriculture was the basis of the site economy, with evidence of hunting, craftworking and other activities.

This project aims to understand the agricultural economy of Gaelic settlements in medieval Ireland through an analysis of the Caherconnell faunal assemblage. The research explores the agricultural economy of this and comparable Gaelic settlements, to investigate the role of animal husbandry, hunting, and fishing, as well as the status implications of those activities. The assemblage dates to the early and late medieval periods in Ireland, spanning the period from the 10th to 16th century AD. This broad chronology and the quality of preservation provides a unique opportunity to analyse developments in the agricultural economy during that period. The study contributes to the existing research undertaken on Caherconnell and its surrounding landscape as well as zooarchaeological research of the medieval periods.

1.1 The economy of the Irish ringfort; an archaeological perspective

Our understanding of the early and late medieval periods in Ireland comes from the extensive literary sources and archaeological material. Early medieval settlement was predominantly rural, centred largely on ringfort enclosures of the earthen (rath) and stone-built (cashel) variety (O'Sullivan *et al.* 2008, 48, 53). These sites generally acted as residential farmsteads located in areas suitable for grazing and cultivation (Comber 2005, 51; Downham 2017, 26). Agriculture played a central role in early medieval society with various social structures, status,

and roles organised around land-use and agricultural labour (O'Sullivan *et al.* 2008, 190). Farming and land ownership was one way of determining an individual's social status in the hierarchical society of that period, something that is evident in structured settlement landscapes such as that of Caherconnell (Charles-Edwards 2000, 125).

The first urban settlements in medieval Ireland appear with the foundation of Viking trading ports in the 9th and 10th centuries some of which were further developed into towns with the arrival of the Anglo-Normans in the 12th century (Downham 2017, 184). There is a survival of Gaelic rural settlement in western Ireland, including the use of ringforts as late as the 17th century, including the site of Caherconnell Cashel (Horning 2012, 177; Comber 2019, 60). Caherconnell is one of c.450 enclosed settlements located in the Burren landscape, with the majority of these being cashels, due to the thin soil cover and abundant supply of limestone (FitzPatrick 2012, 3). The Caherconnell settlement seems to have been unaffected by the arrival of the Anglo-Normans compared to other areas in Ireland with evidence suggesting a 'deliberate effort to assert their native tradition' (Comber 2019, 61). Written sources confirm that various Gaelic families retained control over the territories of this landscape throughout the early and late medieval periods.

1.2 Contribution of zooarchaeology to medieval studies

Animals, particularly the domesticates, played an important role in the economy of early medieval Ireland, which is often described as a self-sufficient, mixed, farming economy centred around cattle, sheep, pig, and cereals (Kelly 1988, 3). That economy was impacted by the arrival of the Vikings and the Anglo-Normans in the later medieval period, with evidence of urban consumer sites (McCormick 2014, 122), as well as changes in agricultural practices and the introduction of new species. There is potential to detect these developments in the zooarchaeological record at settlements such as Caherconnell that span both periods. Cattle feature predominantly in the medieval texts as they were a unit of wealth connected to social status (Lucas 1989, 3–4; O'Sullivan *et al.* 2008, 194). Their dominance is apparent at Caherconnell, during both periods, with evidence also indicating that the site's farming economy focused on dairying, a central feature of rural Irish economy. With historical records of a trade of cow hides and calfskins in the later period (O'Neill 1987, 77), zooarchaeological analysis has the potential to detect evidence of this in the faunal material, with a particular focus on whether this was an urban phenomenon or was also present at rural sites.

It is evident from written sources that sheep were used for both primary and secondary products in medieval Ireland, including wool, meat, skins, milk, and horns, with a particular focus on their wool in the later sources (Kelly 1997, 72–4; Denham 2007, 117). Pigs had a similar value, although these were mainly single purpose animals, kept for meat, as well as by-products of butchery such as their bones for craft working. Sheep and pigs feature as the second and third most dominant domesticates in medieval assemblages from Ireland, and provide evidence for the production and exploitation of these primary and secondary products. Other domesticates, such as horse, dog, cat, and domestic fowl, also appear in the written sources, mostly related to their value and role in the medieval economy (Kelly 1997, 89–104, 114–22). They appear in low frequencies in the faunal assemblages compared to the previously mentioned domesticates, but this is not necessarily a reflection of their low importance in the economy of a settlement or the medieval period in general. Wild species also appear in sources, particularly with reference to activities such as hunting, fowling, and fishing (*ibid.* 272). The zooarchaeological potential to analyse these species in an assemblage provides insight into the role these activities played during these periods at a particular settlement, as well as their potential contribution to aspects such as diet or craft working. This analysis can also play a role in assessing the status of the site as some activities, such as deer hunting, were associated with royalty (*ibid.* 273).

1.3 Caherconnell and its faunal assemblage

Caherconnell is a drystone ringfort situated in the townland of Caherconnell, Kilcorney parish, in the barony of Burren, in north-west Co. Clare (Figure 2.1). Caherconnell Cashel is the largest of four cashel enclosures in the townland, three of which are closely grouped, and one of these is a sub-square enclosure (Comber 2008, 9, 31). The Caherconnell landscape encompasses a range of other structures, including small enclosures which likely served as animal pens or dwellings for herdsmen, boulder burials, and a sub-circular barrow, the latter two likely of a prehistoric date (*ibid.* 43–4; Comber 2019, 6). Comber has undertaken various research in the landscape, including a regional study in 2005–2008 which highlighted the archaeological potential of the area, both prehistoric and historic (Comber 2005, 4). Further work involved excavations at Caherconnell, and at the nearby doline and square enclosure (Comber 2016a, 2019, 4–6) which further revealed the archaeological significance of this landscape. The excavations at Caherconnell Cashel itself revealed multiple phases of activity, including pre-cashel (6th/7th century), early and late medieval high status occupation (10th–16th century), and

post-occupation activity (17th–20th century). Various domestic structures were uncovered, along with 'domestic, agricultural and craft-working implements, higher-status personal ornaments, weapons, and imported items' (Comber 2018a, 6). The excavations yielded assemblages of bio-environmental remains including various materials such as animal bone, coprolite, charcoal, hazelnut shells, marine shells, seeds/grain, and slag.

The faunal assemblage from Caherconnell Cashel comprises a total of 40,830 recordable bones, all of which were analysed in this study. This material was recovered from four phases of activity (Phase 4–7) with a date range of 10th–16th century, which spans the early and late medieval periods in Ireland. The assemblage displays high levels of preservation and varying levels of fragmentation.

1.4 Research question and aims

The central research question of this study is to gain a better understanding of the agricultural economy of rural medieval Gaelic Ireland, with a focus on the Caherconnell settlement in north-west Clare. As a rural Gaelic settlement situated in a rural landscape with limited Anglo-Norman influence, Caherconnell provides an opportunity to examine a self-sufficient mixed farming economy into the late medieval period.

This research question will be addressed by fulfilling three research aims:

1. To examine the role of animal husbandry, hunting and fishing at medieval Gaelic settlements in western Ireland;
2. To identify changes in livestock farming between the early and late medieval period and assess potential impacts associated with the arrival of the Anglo-Normans;
3. To identify the status implications of different animal species at Gaelic medieval settlements.

Literary sources suggest the economy of the early medieval period was a self-sufficient mixed farming economy (Kelly 1988, 3), with the archaeological record revealing much variability at a site level. An economy focused on meat production will yield an assemblage dominated by animals being killed once maturity is reached, while one centred around secondary products, such as milk or wool, will produce a dominance of older animals being exploited, with a dairying economy represented by the dominance of adult cows and the slaughter of male calves

(Davis 1987, 158; McCormick 1992, 201; O'Connor 2003, 157). The other domesticates which feature in medieval assemblages include horse, dog, cat, and domestic fowl, and overall would have played a minor role in the farming economy of the site. The presence of wild species in the assemblage, namely deer and hare, give insight into the role hunting played at the site. The presence of horse and dog can also give insight into these hunting activities as they may have played a role in these practices, something which features in the literary sources but not always visible in the faunal material. Although the importance of fishing is regularly discussed in the written texts (Kelly 1997, 285), this is not always visible in the archaeological record. Although taphonomic factors are one possible reason for this, their low occurrence in some medieval collections is not surprising as the economy was largely agricultural (McCormick and Murray 2017, 209).

With a date range spanning the 10th to 16th centuries AD, the Caherconnell assemblage provides the opportunity to analyse the economy of the site between the early and late medieval periods in Ireland. As previously mentioned, agriculture and livestock farming played a central role in economy of early medieval, including the social status and roles of all members of society (O'Sullivan *et al.* 2014, 179). With trade and urbanisation on the rise, changes are seen in this economy in the later medieval period, some associated with the arrival of the Anglo-Normans, such as the introduction of cash rent (McCormick 1991b, 46). These changes are sometimes reflected in the late medieval faunal record, for example, the decline in the socio-economic role of the cattle may be evident when comparing results to early medieval assemblages (*ibid*). Assemblages from rural Gaelic sites such as Caherconnell offer potential to identify whether these changes are isolated to Anglo-Norman sites such as urban settlements, or whether the influence stretches further into sites such as Caherconnell. Overall, the majority of faunal assemblages from the later period are from urban and castle sites, with an even further concentration in the east of Ireland and specifically coastal towns (McCormick and Murray 2017, 201). The analysis of the Caherconnell faunal material allows the opportunity to contribute to previous research of the animal economy of medieval Ireland through a rural perspective of western Ireland.

The status of a settlement can be reflected in different ways, including the animal bone record and its historical background. The material culture of Caherconnell Cashel, namely the variety and abundance of artefacts, also indicate the site was one of high status (Comber 2019, 52). The historical background and literary sources suggest an association with a smaller number of Gaelic chiefdoms over time, such as the *Dál Cais*, and so it is likely that the residents of Caherconnell played an important role in the politics of its surrounding landscape (Comber

2018a, 6). The faunal material has the potential to further support this narrative. The agricultural economy of the early medieval period played a role in the social status of individuals and likely carried into certain late medieval sites (O'Sullivan *et al.* 2014, 179). As previously mentioned, certain species and their associated activities are linked to high status; for example, cattle being a unit of wealth or the high status activities of deer hunting (Kelly 1997, 273; McCormick 2014, 122).

As faunal assemblages tend to comprise of animal remains which were consumed by people, a central focus of zooarchaeological studies has been the dietary contribution of each species (Sykes 2015, 167). Sykes (*ibid.*) has highlighted that this often results in the limited focus given to the analysis of food culture, such as 'meat preferences, avoidances, and distribution methods' as well as other human-animal relationships. Following the practices of Grahame Clark, a founder of palaeoeconomical thought, this study has taken into account not only ecological terms, but also economic terms, to describe the role of animals in a rural medieval Gaelic society (Clark 1952; Trigger 2002, 270). Doing so presents the data in the context of a settlement rather than as an uncontextualized set of ecofacts. Clark's student Eric Higgs, helped to develop palaeoeconomy 'a school of archaeological thought…which focused on the long-term determinants of human behaviour resulting from the relationships between people and their environment' (Darvill 2009). Higgs' approach utilises site catchment analysis in looking at the local vicinity to document and analyse what plants and animals may have been readily available for the occupants of the settlement (Higgs 1972, 1975; Trigger 2002, 270). This approach was applied throughout this study specifically by determining what species were likely present in the area, with the aim of gaining a better understanding of the agricultural economy at Caherconnell Cashel and further placing this in the context of a rural medieval Gaelic society. To this end, several data sources were utilised including the Caherconnell material, comparative assemblages and their associated relevant literature, and historical documents.

1.5 Thesis structure

This thesis is divided into three parts, each part containing three chapters. The first section includes this introduction (Chapter 1) and research background, as well as a chapter discussing the site of Caherconnell Cashel (Chapter 2) and one on its historical background (Chapter 3). The Caherconnell chapter begins with a discussion of the surrounding landscape and nearby sites, to provide context to the settlement location, followed by a more focused discussion of

its morphology, excavation record, chronology and phasing. The historical background chapter involves an overview of medieval Ireland through discussion of the economy of the Irish ringfort and the animals of medieval Ireland. This is then followed by regional discussion of the historical landscape of the Burren and of Caherconnell Cashel.

The second part of the thesis present a detailed analysis of the faunal assemblage and explores the methodologies used and results obtained in the study. The methodology chapter (Chapter 4) begins with a brief overview of the assemblage details and then discusses the approach to recording and the various methodologies employed throughout the stages of data collection and analysis. The chapters that follow present the results (Chapter 5 and 6) from the early medieval assemblage and those from the late medieval assemblage. These results are then further divided by categories and species, the categories being quantification, age at death, biometry, sexing, taphonomic processes: butchery and burning, and palaeopathology.

The final part of the thesis includes a discussion of the zooarchaeological results from Caherconnell, and their significance for an understanding on the site occupation from the early to late medieval periods. The chapter on the faunal results (Chapter 7) is divided into three sections, to address the original research aims of the study, looking at the role of animal husbandry, hunting, and fishing, the changes in agricultural practices between early and late medieval periods at Caherconnell, and the status implication of the assemblage. The Caherconnell in context chapter (Chapter 8) compares the results and overall pattern from this assemblage to those from early medieval and late medieval sites, which is then followed by the conclusion chapter (Chapter 9).

Chapter 2

Caherconnell Cashel

This chapter will review the site of Caherconnell Cashel through a discussion of its landscape setting, site description, excavation summaries, and chronology and phasing. Excavations at Caherconnell revealed multiple phases of activity: pre-cashel, high status occupation, and post human-activity, as well as domestic structures, and artefacts including 'domestic, agricultural and craft-working implements, higher-status personal ornaments, weapons, and imported items' (Comber 2018a, 6). The sub-section, chronology and phasing, includes a discussion of the radiocarbon dates obtained during this study as well as the subsequent Bayesian analysis undertaken on these dates and the existing dates from the excavations.

2.1 Landscape setting

Caherconnell Cashel is situated in the townland of Caherconnell, Kilcorney parish, in the barony of Burren, in north-west Co. Clare. The site is located within the well-known karst limestone landscape of the Burren (Comber 2019, 1) (Figure 2.1). The name, *an Boireann or*

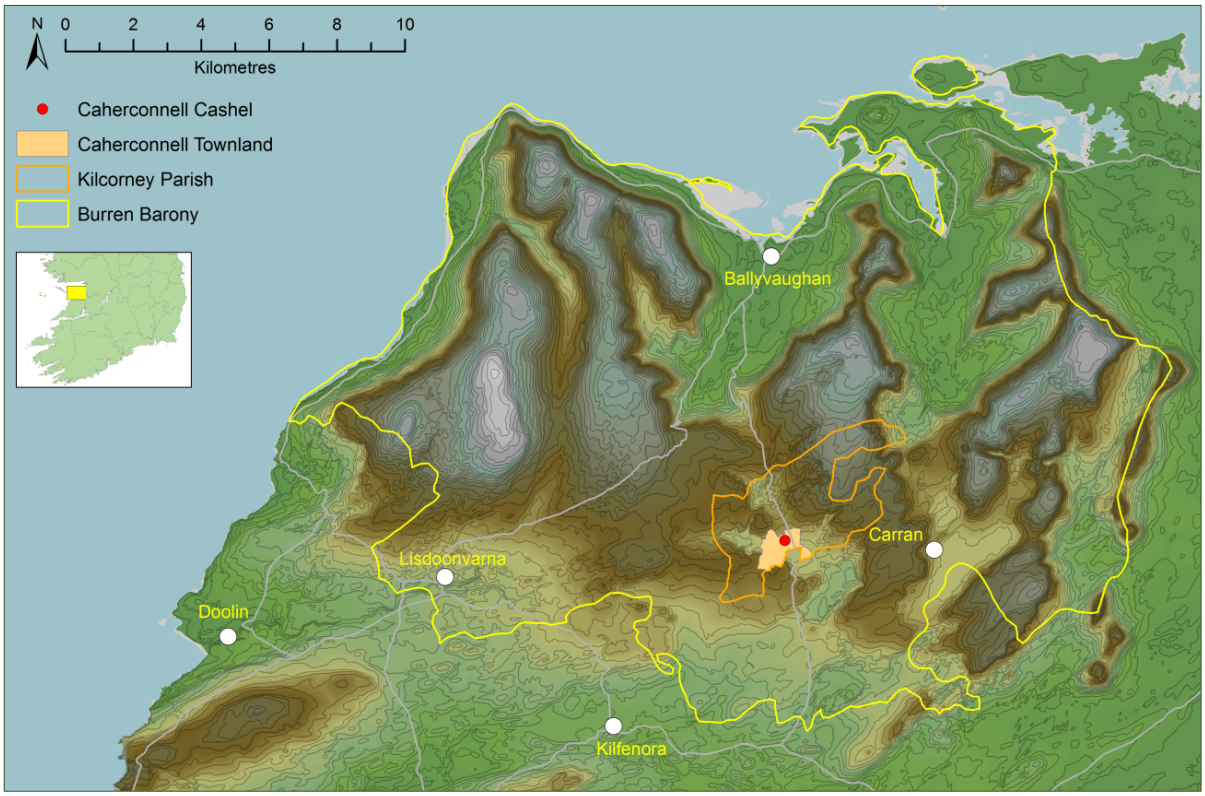

Figure 2.1: Location of Caherconnell Cashel, Caherconnell Townland, Kilcorney Parish, and Burren Barony (Comber 2019. 2).

'rocky place', derives from the abundance of exposed limestone (Comber 2005, 4). The site sits on high land which give it a 'commanding view of its immediate landscape' (Comber 2018a, 4). A regional study undertaken by Comber highlights not only the unique preservation of archaeological sites in this landscape due to the absence of modern agricultural activities, but also the potential to study these as a distinctive cultural landscape (Comber 2005, 4). Her study undertaken in 2005–2008 emphasized the range of archaeological sites within the landscape, from both the prehistoric and historic periods. The early historical landscape is evident through a high volume of cashels, as well as other sites such as other secular sites, unenclosed souterrains, ecclesiastical remains, and field systems (*ibid.* 29). The concentration of settlement in this landscape appears unevenly distributed with clusters of sites, one example being Caherconnell, where agriculture seems to be the central focus (Comber 2018a, 8).

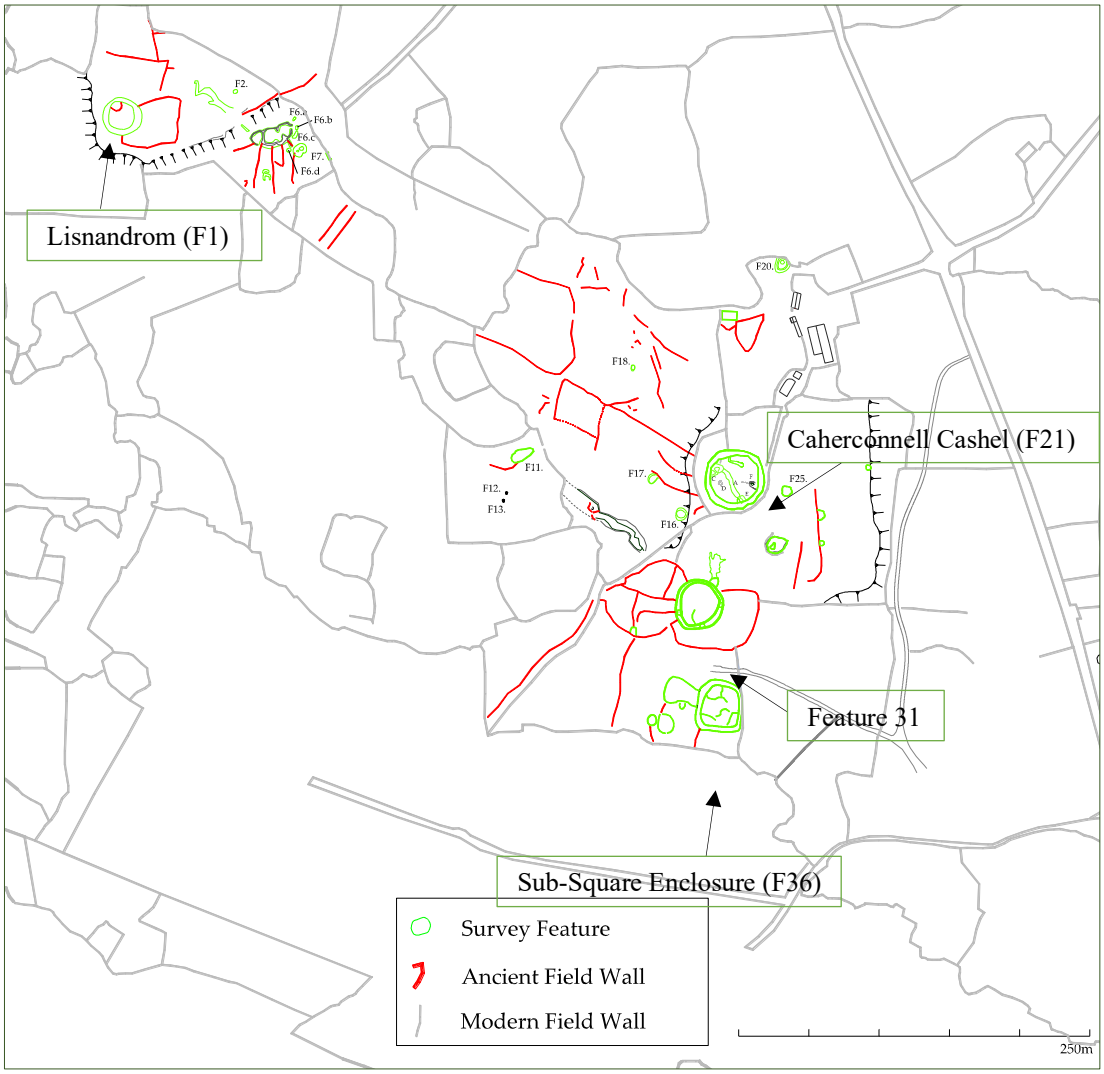

Figure 2.2: Survey of Caherconnell townland (Survey by Liam Hickey) (Comber 2019, 9).

The best known of these is Cahercommaun excavated in 1934, a trivallate stone fort located not far from Caherconnell (Hencken 1938, 3). The landscape also contains many bivallate stone forts, with one example in Tullycommon and another in Ballybaun (Comber 2005, 36). Similar to Caherconnell Cashel, the majority of stone forts in this landscape are univallate. Caherconnell (F21) is the largest of four cashels (F1, F31, and F36) located in the townland of Caherconnell and are 'strategically positioned near the intersection of two natural routeways through the uplands' (Figure 2.2) (Comber 2008, 6, 9). Three of the drystone wall enclosures are closely grouped (F21, F31, and F36), and one is a sub-square enclosure (F36) (*ibid.* 31). A number of smaller enclosures located close to these four enclosures may have been used as animal pens or dwellings for herdsman (*ibid.* 43–4).

As well as the four enclosures, there are other features and structures in the Caherconnell townland and surrounding area of Caherconnell Cashel. These include two potential boulder burials, a cairn and a sub-circular barrow, all of likely prehistoric date (Comber 2019, 6). Also nearby is a doline, where a test excavation in 2008–9 uncovered a rectangular house with an internal stone-lined hearth dating to the early Bronze Age (*ibid.* 5). This excavation also further revealed a stone circular chamber and associated medieval finds, and it is suggested it was used by the nearby cashel inhabitants as a store (*ibid.*). Disarticulated human remains representing a minimum three individuals dating to the 15th/16th century were recovered in this medieval structure and were likely redeposited in the doline (*ibid.* 5–6).

2.1.1 Caherconnell sub-square enclosure

The square enclosure, on a narrow level shelf *c.*50m south of Caherconnell Cashel, was the subject of excavation in 2010–2012 (Comber 2016a, 3–4). This drystone structure is sub-square or slightly D-shaped, measuring 34m by 37m with visible internal and external features (*ibid.* 5). Compared to the typical circular drystone cashels found in the Burren, this sub-square enclosure is distinctive, not only morphologically but also as it is 'of slightly above-average status and is in a strategic location' and is suggested to have provided a 'specific service to the surrounding population' (Comber 2018a, 7, 9). The excavation involved ten cuttings, one of which was located outside of the enclosure across an adjacent field wall (Figure 2.3) (Comber 2016a, 11, 14). The excavation uncovered six phases of activity, with a range of structures and features (Figure 2.4) (*ibid.* 15–40). Radiocarbon dates indicate the site was in use during the early medieval period between the 7th and 9th century, which overlaps with the date of the

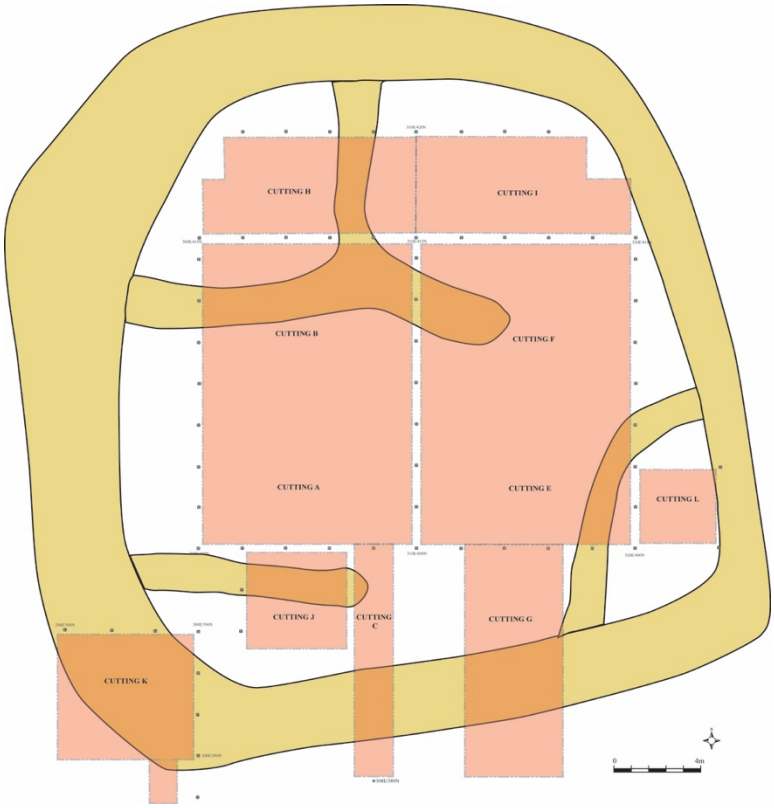

Figure 2.3: Location of excavation cuttings 2010–2012 (Comber 2016a, 13).

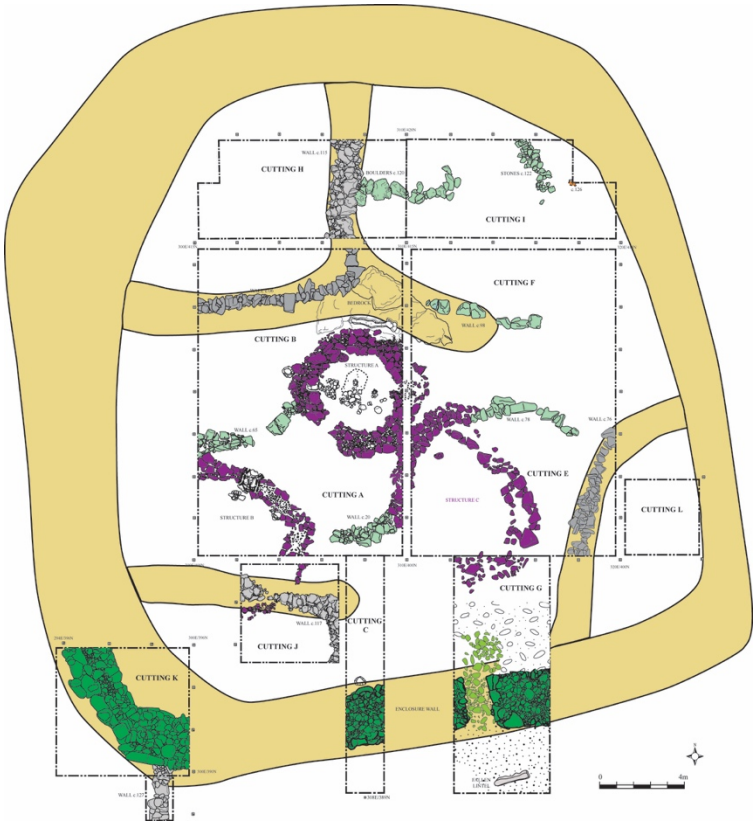

Figure 2.4: Plan of main features, overlying pre-excavation survey (Comber 2016a, 17).

burials under the wall of Caherconnell Cashel (*ibid.* 235). There are later dates of the 10th, 11th and 13th centuries for post-occupation dumping, which is a similar date range to when Caherconnell Cashel was constructed (*ibid.*).

Phase 1 involved the levelling of the areas surface before the construction of the square enclosure which took place in Phase 2, as well as the earliest occupation surface (*ibid.* 15–6). As mentioned, the construction of the enclosure took place in Phase 2, with the enclosure wall built on top of levelling material from Phase 1 (*ibid.* 19). The enclosing wall measures 2.6m in width and 1.6m in height, but based on the volume of wall tumble is likely to have been higher (*ibid.*). An unexcavated field wall that abuts the external face of the south wall is likely to have been built from that tumble at a much later date as its construction does not appear early medieval in style (*ibid.* 21). The entrance of the square enclosure is in the south wall, facing the fertile Kilcorney valley (*ibid.*).

Evidence of three structures, a possible structure, and multiple yard walls were uncovered during excavation (*ibid.* 24, 29). Structure A is a drystone, sub-circular, enclosure that produced a glass bead and a fragment of a rotary quern, both likely to be early medieval, as well as charcoal, animal bone, and slag (*ibid.* 24–5). Structure B is another drystone enclosure, this time rectangular/sub-oval in shape, which produced similar materials, including animal bone, slag, chert, and iron (*ibid.* 26). Structure C is a sub-circular drystone enclosure (*ibid.* 28). All three structures are suggested to represent domestic houses, and the other possible structure likely being an out-house (*ibid.* 232). The later part of Phase 2, and Phase 3 produced early medieval fragments of a double-sided decorated bone comb as well as the artefacts from Structure A (*ibid.* 34–5). Phase 4 was marked by the dumping of material in the entrance of the enclosure which partially blocked the entrance (*ibid.* 35).

Phase 5 marks the abandonment of the enclosure with the possibility of stone being reused for the construction of a nearby cashel which sits in between the square enclosure and Caherconnell Cashel (*ibid.* 36). The final phase, Phase 6, involved the construction of multiple internal stone walls, some likely built from stone from earlier structures (*ibid.*). Fragments of a clay-pipe were recovered from the enclosure and may represent an early modern day for this later activity (*ibid.* 38). A range of artefacts were recovered throughout the excavation of this square enclosure, some previously mentioned, and include objects of stone, iron, bronze, bone, clay, and glass (*ibid.* 40). Based on the results from the excavation of the square enclosure, it is suggested that the inhabitants were of high status, possibly a *bóaire*/strong farmer or lower grade of *aire*/lord, and that it was a domestic settlement with an agricultural economy (*ibid.* 234, 242). As previously mentioned, one of the cuttings from this excavation targeted a field wall, which revealed the levelling of the surrounding surface prior to construction, however it was not evident if this wall and the enclosure were contemporary (*ibid.* 40).

2.2 Caherconnell Cashel

2.2.1 Site description and excavation summaries

Caherconnell Cashel is a circular drystone ringfort, 42m in external diameter, with walls constructed from local limestone up to 3m wide and up to 3.6m high. Tumbled stone suggests the walls were originally higher (Comber 2019, 2). The internal features of the cashel include a dividing wall and two visible features, Structure A and Structure B. All three are late in date,

with the wall probably contemporary with Structure A which was built and occupied between the early 15th and early 17th centuries (Comber and Hull 2010, 138; Comber 2019, 3). The 1–1.3m wide wall divided the interior of the cashel in two (*ibid.* 3). Structure A is a free-standing rectangular structure with an internal measurement of 10m by 5m, and is located inside the north wall of the cashel (*ibid.*). Unlike Structure A, Structure B is not free-standing and is built up against the west wall of the cashel, This is a sub-triangular structure divided in two by a drystone wall and measures 8m by 6.5m (*ibid.*).

A test trench in 2007 at Caherconnell Cashel revealed its archaeological potential with the recovery of 88 artefacts and other archaeological material such as animal bone (Comber and Hull 2008, 10). Following the test excavation, seasonal excavations were undertaken between 2010 and 2019 by the Caherconnell Archaeological Field School (Figure 2.5). Those excavations produced an estimated 1700 artefacts, including items of amber, antler, bone, bronze, clay, copper-alloy, glass, gold, iron, lead, quartz, silver, and stone. The cashel entrance and immediate internal area to the south-west were the focus of the 2010 (Cutting A) and 2011 (Cutting B) excavations. This revealed evidence of re-modelling the entrance when a later path was constructed as well as external and internal door sills, spud-stones, door stops, with evidence suggesting there were two sets of doors (Comber and Hull 2011, 9–10; Comber 2019,

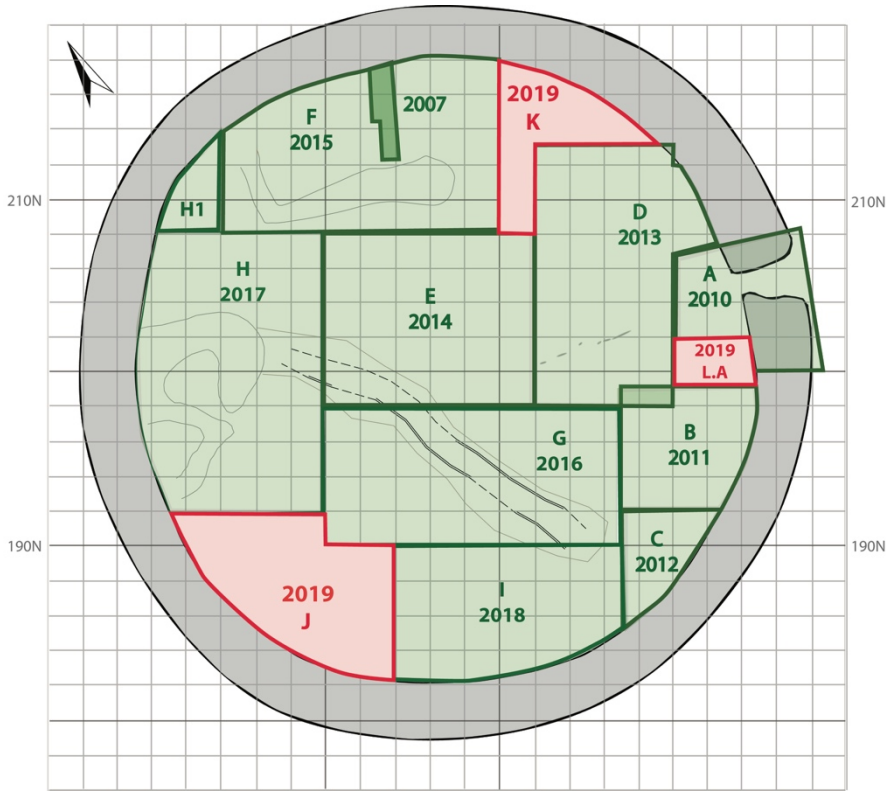

Figure 2.5: Survey of Caherconnell and trench cuttings from 2007 test trench and 2010–2019 excavations (Comber 2009, 4).

10). Cutting C, located south and adjacent to Cutting B, was the focus of the 2012 excavation and this area had 'grassed-over possible structural remains visible prior to the excavation' (*ibid.* 10). The focus of the 2013 excavations was Cutting D (Cuttings D1 and D2) located west of Cutting A with the aim was to investigate a feature uncovered in 2010, a slab pathway, as well as a flat open area which had no evident features prior to excavation (*ibid.* 11). The 2014 excavation of Cutting E, located west of Cutting D, further exposed the previously mentioned slab pathway, as well as uncovering the continuation of another slab pathway, the dividing wall, a circular structure, and a rectangular structure (*ibid.*). Cutting F was the focus of the 2015 excavation and targeted a house structure which was originally explored during the 2007 test trench excavation, as well as part of the 15th/16th century sub-rectangular structure uncovered during the 2014 excavation (*ibid.*). This house structure revealed evidence of a central hearth, lime-mortal floor, stone-built oven, as well as the remains of a metalworking furnace or hearth which pre-dated the structure (*ibid.*).

The 2016 excavations included Cutting G located next to Cutting B and E, and further exposed the circular structure seen in Cutting E, as well as a contemporary metal workshop area and the continuation of the 15th/16th century dividing wall (*ibid.*). Cutting H and H1 were the focus of the 2017 excavation, Cutting H was located west of Cutting E and G, and Cutting H1 was the area between Cutting F, H and the cashel wall (*ibid.*). These excavated areas investigated the visible structure, Structure B, and its relationship with features of the same or earlier and later date, as well as the more of the rectangular structure exposed in Cuttings E and F (*ibid.*). Located between Cutting G and the cashel wall, Cutting I was the focus of the 2018 excavation, and uncovered more of the structure from the 2016 excavation as well as other features including an early midden, a pit, and outdoor hearths (*ibid.* 11–2). The final year of excavation in 2019 involved multiple cuttings, J, K, and L.A and completed the excavation of the cashel interior (*ibid.* 12). Cutting J and L.A produced examples of steps, the example from L.A suggested to provided access between the wall ledge and the upper levels of the wall (*ibid.* 18). Cutting K produced evidence of a range of features, including a cereal-drying kiln, a stone-built drain, a rectangular drystone structure, and a semi-circular structure (*ibid.* 22, 27, 31).

The artefacts recovered during these excavations provide insight into the range of on-site activities occurring on-site, both domestic and those of high status. Metalworking, both ironworking and non-ferrous, is represented by the presence of pieces of slag, whetstones, probable furnace lining, silver-ingot fragment, crucible fragments, awls, hammerstones, anvil stones, a piece of possible ore, a possible tuyère, and mould fragments (Comber 2016b, 48,

2017, 50, 2019, 51). The recovery of these artefacts suggests the probability of these metal objects being manufactured on-site at Caherconnell (*ibid.* 51). Examples of non-ferrous metalworking include a stick-pin and a silver ring, both displaying similar decoration to suggest they were made by either the same person or workshop, and even possibly at Caherconnell (Comber 2015, 37, 2019, 51). Woodworking is evident through the presence of objects such as iron nails, possible drawknives/small saws, punch-like implements, and a small iron axehead (Comber 2013, 28, 2014, 31). It is suggested that the objects made of stone were made locally however there is not much definite evidence of this, however the recovery of a circular shale core may be waste material from the manufacturing of shale bracelets (Comber 2019, 51).

It is likely that the crafting of bone objects was undertaken on-site due to the large supply of raw material available, the presence of worked fragments, as well as tools and finished items such as bone combs, pins, spindle-whorls, beads, gaming-pieces, points, and needles (Comber 2019, 51). Although of smaller quantities, the same can be said for antler working due to the presence of worked antler and the volume of artefacts such as bone-combs where antler would be used in its crafting (Comber 2014, 31). Some of the bone artefacts, such as the spindle-whorls, points/awls and sewing needles, can reflect other crafts such as textiles. Textile and leather-working is further represented by objects such as a probably weaving sword, a stone needle punch, drawknives, as well as the large supply of raw material (Comber and Hull 2011, 11; Comber 2016b, 49, 2018b, 43–4, 2019, 52). Activities such as food harvesting and processing in reflected through the presence of quern fragments, sickle, smaller curved blades, and charred grains (Comber 2018b, 44, 2019, 52).

Objects such as bodkin/armour-piercing arrowheads, barbed arrowheads, a long spike-like arrowhead harp-pegs, gaming pieces, slate pencil, and a bone and bonze pen, also indicate high status activities (Comber and Hull 2011, 12; Comber 2013, 28, 2015, 37, 2016b, 48, 2017, 50. 52, 2018b, 43, 2019, 39). Trade is also evident within the Caherconnell artefact assemblage through the recovery of coins, bronze, silver, glass, and amber (*ibid.* 52). Possible evidence of trade the depiction of a ship on a whetstone (*ibid.*). A red, white, and blue bead with late 15th or 16th century origins in Venice, a 10th century Baltic amber bead, and a clear melon bead and an amber stud which both likely have Scandinavian origins, are clear evidence of trade at Caherconnell (Comber 2016b, 50, 2017, 52, 2018b, 46, 2019, 52). As well as these artefacts, other bio-environmental remains include marine shells, animal bone, coprolite, charcoal, seeds/grains, hazelnut shells, and slag, all of which are currently being analysed by specialists.

2.2.2 Chronology and phasing

The excavation of Caherconnell Cashel uncovered 300 contexts and eight phases of activity dating to the early, late, and post medieval periods (Table 2.1) (*ibid.* 15). The chronology of site activity has been analysed through the stratigraphic sequence, as well as both relative and absolute dating, with further dates still being produced (*ibid.*) (Table A2.1). Phase 1 represents the early medieval pre-cashel activity, which was first revealed during the 2013 excavation of Cutting D1 that uncovered a low burial mound with two cists under the cashel wall. These contained the skeletal remains of two infants and an elderly woman dated to the late 6th/early 7th century AD (Comber 2013, 13, 2019, 16). The cists were likely constructed at the same time and then covered with cairn material (Comber 2013, 16). It is suggested that the construction of the cashel wall directly over these burials was done with a sense of 'claiming these ''ancestors'' (*ibid.*). This pre-cashel (Phase 1) burial mound is the earliest activity at Caherconnell cashel (Comber 2019, 55).

Phase 2 represents another phase of early medieval pre-cashel activity and dates to the second half of the 7th century AD (*ibid.* 16). This phase was first identified in Cutting B during the 2011 excavation, represented by a rock-cut fire-pit with associated evidence of 'oxidisation and cracking of the bedrock' and charcoal-rich ash, possibly a timber or metal (Comber 2013, 7, 2019, 16). As they are close in date, there is a possibility of an overlap between the activity in Phase 1 and Phase 2 (*ibid.* 55). Phase 3 involved the levelling of the area and construction of the cashel, with several cuttings revealing the cashel wall was constructed directly on the limestone bedrock (Comber and Hull 2011, 7; Comber 2012, 13, 2015, 15, 2017, 15, 2018b,

Phase of Activity	Date Range	Brief Description
Phase 1	6th/7th century AD	Pre-cashel activity: burial mound
Phase 2	7th century AD	Pre-cashel activity: rock-cut fire-pit
Phase 3	late 10th century AD	Cashel construction
Phase 4	10th/11th century AD	Early occupation
Phase 5	10th/11th century AD	Middle occupation
Phase 6	11th–14th century AD	Late occupation
Phase 7	15th–16th century AD	Final occupation
Phase 8	17th–20th century AD	Post human-occupation

Table 2.1: Summary of phases of activity, date ranges, and brief description, for the chronology of Caherconnell Cashel.

16, 2019, 17). Exceptions to this were seen in Cutting D1 with the previously discussed burial mound as well as other areas where shallow grykes were filled with small stones before constructing the wall on top (*ibid.* 17). A ledge along the lower part on the inner cashel wall was identified in several cuttings, possibly associated with the walls construction (Comber and Hull 2011, 2; Comber 2015, 16, 2018b, 16, 2019, 17). Another feature in the cashel wall are the two sets of steps from Cutting J and L.A, as previously discussed.

The next phase of activity, Phase 4, marks the early occupation of the cashel during the late 10th/early 11th century AD. This phase is represented by a levelling layer and an early occupation layer, as well as features such as structures, pits, a cereal-drying kiln, a refuse midden, metalworking furnace, hearth, post holes and settings, and deposits of burnt material (Comber 2013, 17, 2014, 15, 2015, 17, 2016b, 19–20, 2017, 19–20, 2018b, 17–9, 2019, 20–2). These features provide some insight into the activities occurring during this phase of activity, such as the midden from Cutting I which produced evidence of bone-working and leather-working (Comber 2018b, 19). Another example comes from a structure uncovered in Cutting H and a furnace in Cutting F, with evidence suggesting they were associated with metalworking, possibly non-ferrous (Comber 2017, 20). Further evidence of metalworking during this period is seen in Cutting G through a rock-cut fire-pit, a metalworking furnace, and a possibly associates house structure (Comber 2016b, 19). The early occupation is followed by Phase 5, the middle occupation and also dates to the early medieval period with a date range of late 10th/early 11th century AD. This phase commenced with the laying of a slab surface across areas of the cashel constructed from local limestone slabs(Comber 2019, 24). Similarly to the earlier period, an occupation layer was identified overlying that slab surface (Comber 2013, 18, 22). Features from Phase 5 include a wall base, house structures, an ancillary structure, post holes and settings, cut feature, hearths including some stone-lined hearths, a metalworking area, burnt deposit, drain, pathways, possible yard/shelter walls, fire-pit, linear stone deposit (Comber 2012, 15, 2013, 20–1, 2014, 17, 2015, 23, 2016b, 21, 2017, 26, 2018b, 21–2). There is also a possibility of the cereal-drying kiln from Phase 4 was still in use during Phase 5 (Comber 2019, 55).

Similar to Phase 5, the late occupation (Phase 6) began with the laying of a second slab surface on top of the previous occupation layer (*ibid.* 27). The reason for constructing another slab surface may have been due to the interior surface becoming muddy over time (*ibid.* 56). This phase began with late medieval activity during the 11th–14th centuries AD. Once again, features associated with this phase of activity include charcoal rich burnt material, a rectangular

drystone structure, stone-built drains/box-drains, slab/stone pathways, fire remains, wall structure, linear stone feature, stone-lined hearth, stone-built post-setting, and rock-cut pit (Comber 2013, 22–4, 2014, 23, 2017, 28–30, 2018b, 26, 2019, 27–9). Some features were not covered by the slab surface, including a path and a wall/structure, which suggests they were possibly in continued use from the previous phase, as was a central house structure (Comber 2016b, 29). On top of the slab surface was an occupation layer, once again similar to the previous phases of activity (Comber 2019, 27). Phase 6 was followed by the final occupation, Phase 7, which has a date range of 15th–16th century. Phase 7 is marked by the reconstruction of the cashel entrance, the construction of a rectangular house, and the dividing drystone wall (*ibid.* 31). Other features from this final phase of occupation include an occupation layer, a semi-circular structure, burnt material, drystone wall, lime-mortar flooring, and stone-built linear features (Comber 2014, 26, 2018b, 28–9, 2019, 31). A house structure from earlier Phase 6 activity appears to have been demolished at the beginning of Phase 7 and likely suppling the material to construct the wall and a new sub-rectangular house in Cutting F (Comber 2015, 27, 2017, 33). This house structure revealed many features including a hearth and a stone-built oven (Comber 2015, 31).

Phase 8 represents the abandonment of the site for human occupation and its continued use as an animal enclosure up into the 20th century. This is represented by areas of collapse in the cashel wall, areas of digging, and evidence of demolition and/or accidental knocking (Comber 2019, 34). The construction of newer structures such as animal pens resulted in the clearing of areas of the cashel interior and exposing the limestone bedrock; for example, an animal pen in Cutting J probably built at least 100 years ago (*ibid.*). Other examples in Cutting H were a sub-triangular stone structure and drystone wall, possibly built with material from the clearance of earlier structures (Comber 2017, 33).A rock-cut pit from Cutting G is likely to be modern as it produced a fragment of an early modern iron cooking pot, possibly a failed attempt for an animal burial or a water contained for domestic geese which is a regional practice (Comber 2016b, 37). This span of activity produced a range of modern finds including animal carcasses, a. clay pipe stem, 19th/20th century glass bottle fragments, a 19th/20th century iron pot, and a 20th-century metal button (Comber 2013, 36, 2015, 35, 2017, 35, 2018b, 30, 2019, 34). This post human-occupation activity resulted in the disturbance or loss of earlier features and structures; for example, the doorway of a house structure in Cutting F contained a modern animal burial and stone tumble which lead to any pre-existing features being destroyed (Comber 2015, 35).

2.2.3 Additional radiocarbon dates

Five addition radiocarbon dates were produced in this study through the Archaeology Radiocarbon Dates Scheme provided by the Royal Irish Academy in association with Queen's University Belfast with results displayed in Table A2.2. There are four phases of activity at Caherconnell which involve human occupation and therefore relate to the faunal assemblage. Out of these phases, Phase 5 and Phase 7 are less chronologically defined because of fewer dates. Two faunal samples provided additional dates from Phase 5 and 7, which strengthen the existing chronology of the site and contribute to the Bayesian model. These two samples are ideal for dating as they are both unfused phalanges with the unfused epiphyses present, which indicates that the bones went into the ground soon after the death of the animal and should accurately date the context in question as post-depositional movement is minimal (Hamilton and Krus 2018, 194). The Bayesian analysis provides statistically-backed prior density estimates for various events in the span of site activity. The additional well sources samples allowed for the construction of a robust Bayesian Model which generates empirically-based chronological estimates for specific events occurring at Caherconnell. Three further samples were dated, which not only contributed to the Bayesian Model but to assess dog breeding patterns at the site of Caherconnell Cashel.

2.2.4 Bayesian analysis

After acquiring the additional radiocarbon dates, Bayesian Analysis was undertaken with the assistance of Ben Spillane. The nature of the archaeological evidence at Caherconnell, as well as the scope of the excavation and numerous rounds of radiocarbon dating make it an ideal candidate for Bayesian Chronological modelling. The site has a clear stratigraphic sequence of deposition indicative of several phases of human activity, distinguishable from each other through specific stratigraphic events. Because of this clear sequence, and the radiocarbon dates derived from the excavation, a complex chronological model can be constructed, that can produce accurate estimates for specific events throughout the history of the site. This section will outline a basic overview of the principles of Bayesian modelling, the sequence of deposition and the model structure employed, a review of the dates incorporated, and provide the results of the model.

After the numerous seasons of excavation, a consistent stratigraphic sequence was visible, with 30 radiocarbon dated contexts from the eight cuttings (Table A2.3 and Figure A2.1). Bayesian chronologies are based on the idea that the construction of a chronology through the acquisition of radiocarbon dates as an act in itself is 'sterile' (Bayliss *et al.* 2007, 2). Individual radiocarbon dates are simply accurate temporal estimates of the death of samples. Archaeologists are primarily interested in the date of events represented by those samples such as the beginning and end of activity at a site, or the duration of human activity across a landscape. Bayesian chronological modelling provides an interpretative framework in which dating information can be incorporated with existing archaeological knowledge to provide empirically-based estimates for these specific events, some of which may not be directly datable. The Bayesian approach follows the basic principle laid out by Bayes rule, which is:

Posterior Beliefs = Standardised Likelihoods X Prior Beliefs

This equation provides the parameters for estimating the probability of a belief after the collection of data to test that belief. In an archaeological sense, the standardised likelihoods refer to the new data/solid evidence about a problem or question. These are the set of radiocarbon dates derived from an excavation. The prior beliefs refer to existing knowledge about that problem or question. They are divided into informative and uninformative prior beliefs. Informative prior beliefs in this case are the archaeological context and stratigraphy from which the dates were derived. Uninformative prior beliefs are the assumptions about the distribution of the archaeological events in the phase of activity from which the dates are derived (*ibid.* 5). Imposing such a distribution is necessary in order to counteract the statistical scatter of calibrated radiocarbon measurements, which occur because of the standard deviation or 'error' that comes with a date. This can cause a proportion of the of the probability distributions of the calibrated date to be earlier or later than the calendar span of that phase and if not taken into consideration, a model could produce estimates for specific events that were earlier or later than was actually the case. Implementing Bayes' rule using the online software provided by OxCal version 4.4.4, which applies a form of Markov Chain Monte Carlo sampling, facilities a combination of this information to produce realistic estimates for dates of archaeological interest (*posterior estimates*), some of which are not directly datable. These *posterior* beliefs are not final but rather interpretative estimates that will change as new data is added by future researchers (Bayes 1763; Bayliss et al. 2007, 4–5; Hamilton and Krus 2018, 189–92). Descriptions of the algorithms used in OxCal and the mathematical processes carried

out by the software are available in Bronk Ramsey (1995; 1998; 2001; 2009b) or from the online manual.

The model was intended to address three principal questions:

1. When did activity at the site begin, when was the Cashel built and when did activity end?
2. When did distinct stratigraphic phases of activity begin and end, and how long did they last.
3. How long did the intervals between phases of activity last (i.e. was the site repurposed immediately or was it abandoned periodically before being re-used?).

The model structure employed was to organise the radiocarbon dates into five 'bounded phases' within an overall site sequence. The 'bounded phase' structure applies a uniform prior to the dates and assumes that the associated activity began, occurred over a period of time with an unknown duration and then ended. It also assumes that the available dates were randomly selected from a uniform distribution of possible material. This structure is appropriate, because although the overall stratigraphic sequence of the site is clear, the exact sequence of deposition for each radiocarbon dated sample within each phase is not. The bounded phase structure produces *posterior density estimates* for the beginning and end of the depositional activity of that phase. In addition, the **`Span`** and **`Interval`** commands were also utilised, the former of which measures the temporal span of the radiocarbon dates within the phase, and the latter measures the span of time between the two posterior density estimates (the start and end boundaries). These 'bounded phases' are placed within an overall **`Sequence`**, which acts as an informative prior, because the broad sequence of deposition (i.e. the main stratigraphic phases) is known. It acts as a building block, informing the model that one bounded phase occurred before the other, and adjust the calibration of the dates accordingly. Because there were events that stratigraphically separate the depositional phases (the cashel wall construction and the slab surfaces, the **`Date()`** command was inserted between phases 1, 2 and 3 to derive a *posterior density estimate* for these events, that are not directly datable in and of themselves. (Buck *et al.* 1992; Hamilton and Krus 2018, 197). During modelling, the radiocarbon uncertainties and the calibration process produce dates that will cluster around the points of archaeological interest and the uniform prior applied to the dates helps to counter-act their statistical scatter.

In order to determine if the site was periodically abandoned in between the stratigraphic phases or continually occupied and repurposed, the **`Difference`** query was utilised. This query estimates the amount of time that elapsed between two *posteriors* derived from the model. Six difference queries were derived: 1: the time between the Cashel construction and the start of Phase 2, 2: the end of Phase 2 and the laying down of slab surface 33, 3: the laying down of slab surface 33 and the start of Phase 3, 4: the end of Phase 3 and the laying down of slab surface 28, 5: the laying down of slab surface 28 and the start of Phase 4, 6: the end of Phase 4 and the start of Phase 5.

A crucial aspect of the Bayesian process is to ensure as much as possible that there is a direct connection between the dated event and the target event. The dated event refers to the death of the sample that was subject to radiocarbon dating, and the target event refers to the specific archaeological event that that sample is related to (i.e. the formation of the archaeological context, the date of deposition or related human activity). All of the dates included in the model were AMS measurements derived from bone collagen, two from human remains and the remaining from animal remains, specifically pastoral animals from all phases of human occupation. These samples have a strong functional relationship with human activity, given that they represent the death of a human individual, or of an animal that was related to pastoral activity. Bone collagen is minimally affected by age offsets, meaning that there is minimal likelihood of the dates being affected by old carbon. The main issue with some of the samples is whether they have remained in the context in which they were originally deposited or whether they have been subject to post-depositional taphonomic movement. This is certainly a possibility, given the evidence of multiple reuses of the site, including reworking of previous occupation layers which could lead to the redeposition of earlier material. There are several cases where the dated animal bones are either too early or too late for the phase in which they were found established through a very low level of agreement with the overall model. Although the possibility of a potential offset within the model itself should not be discounted, the most likely explanation is that they have been subject to taphonomic movement. Because these animal bone samples have a strong connection to human pastoral activity, even if not the context from which they were derived, they were included in the model either as *TPQs* or *TAQs* using the **`Before`** or **`After`** commands. Three samples (Table A2.3) were excluded from the modelling, all of which were derived from charred hazelnut shells. One of these samples, UBA-8565 was found in a loose, dark blackish brown silty clay with frequent inclusions of limestone chips derived from the bedrock with infrequent bone and charcoal was recovered.

The deposit was probably partly naturally and partly formed. The deposit continued under the cashel wall and stratigraphically pre-dated the cashel construction. However, the date itself calibrated to the late medieval period. This very small sample is open to significant post-depositional movement and disturbance, and the loose nature of the deposit, as well as the overlying deposits indicate that it could represent residual material. Therefore, it is not considered stratigraphically intact, and was therefore excluded from the analysis. Because this was also a possibility for the other samples with this material, they were also excluded.

- *Results*

This section provides the results of the Bayesian chronological model of Caherconnell (Figure A2.2). Analysis of the Bayesian model results was again undertaken with the assistance of Ben Spillane. The *posterior density estimates* produced by the model, specifically for phases with the most radiocarbon dates, are quite precise. For the earliest and latest phases which contained the least amount of samples, the 95% *posteriors* are not as precise, but are still considered robust, and the shorter 68% *posteriors* provide the most probable estimate for the dated events (Noble and Brophy 2017, 226; Hamilton and Krus 2018, 194).

The model shows good agreement between the radiocarbon dates and the assumption that the dated material is from relatively continuous phases of activity (^{A}model = 80%) (Figure A2.2 and A2.4). Table A2.5 summarises the Bayesian Model phases (Phases 1–5) and the associated Caherconnell Cashel phases of activity (Phases 1–7), the former phases are what are used in the section, tables (A2.3 and A2.4), and figures (A2.1 and A2.2) which relate to the Bayesian analysis. The model estimates that Phase 1 began in *cal AD 170–650* (95.4% Probability), probably in *cal AD 490–630* (68.3% Probability). Phase 1 ended in *cal AD 660–880* (95.4% Probability), probably *cal AD 680–780* (68.3% Probability). The span of dated activity in Phase 1 was *33–203 years* (95.4% Probability), probably *68–148 years* (68.3% Probability). The interval between the start and end of Phase 1 was *40–630 years* (95.4% Probability), probably *86–288 years* (68.3% Probability).

The *posterior density estimate* for the construction of the Cashel wall dates this event to *cal AD 720–980* (95.4% Probability), probably in *cal AD 790–960* (68.3% Probability). The earliest activity within the Cashel during Phase 2 began in *cal AD 890–1000* (95.4% Probability), probably in *cal AD 950–1000* (68.3% Probability). Phase 2 ended in *cal AD 900–*

1040 (95.4% Probability), probably in *cal AD 990–1020* (68.3% Probability). The span of dated activity in Phase 2 was *0–87 years* (95.4% Probability), probably *0–37 years* (68.3% Probability). The interval between the start and end of Phase 2 was *0–112 years* (95.4% Probability), probably *0–48 years* (68.3% Probability).

The *posterior density estimate* for the laying down of slab surface 33 dates this event to *cal AD 970–1100* (95.4% Probability), probably in *cal AD 990–1040* (68.3% Probability). Phase 3 began in *cal AD 1000–1120* (95.4% Probability), probably in *cal AD 1010–1050* (68.3% Probability). Phase 3 ended in *cal AD 1030–1120* (95.4% Probability), probably *cal AD 1030–1100* (68.3% Probability). The span of dated activity in Phase 3 was *0–61 years* (95.4% Probability), probably *0–31 years* (68.3% Probability). The interval between the start and end of Phase 3 is *0–77 years* (95.4% Probability), probably *0–41 years* (68.3% Probability).

The *posterior density estimate* for the laying down of slab surface 28 dated this event to *cal AD 1030–1140 (95.4% Probability), probably cal AD 1050–1120 (68.3% Probability).* Phase 4 began in *cal AD 1060–1150* (95.4% Probability), probably in *cal AD 1090–1140* (68.3% Probability). Phase 4 ended in *cal AD 1280–1450* (95.4% Probability), probably *cal AD 1290–1380* (68.3% Probability). The span of dated activity in Phase 4 was *77–168 years* (95.4% Probability), probably *95–145 years* (68.3% Probability). The interval between the start and end of Phase 4 was *158–348 years* (95.4% Probability), probably *178–280 years* (68.3% Probability).

Phase 5 began in *cal AD 1330–1620* (95.4% Probability), probably in *cal AD 1390–1500* (68.3% Probability). The span of dated activity in Phase 5 was *0–148 years* (95.4% Probability), probably *0–29 years* (68.3% Probability). The interval between the start and end of Phase 5 is *0–655 years* (95.4% Probability), probably *0–175 years* (68.3% Probability). Phase 5 ended in *cal AD 1440–2000* (95.4% Probability), probably *cal AD 1450–1660* (68.3% Probability).

Use of the difference command showed that *0–236 years* (95.4% Probability), probably *2–144 years* (68.3% Probability) elapsed between the *posterior* for the construction of the cashel wall and the start of deposition associated with Phase 2. The model showed that *0–68 years* (95.4% Probability), probably *0–22 years* (68.3% Probability) elapsed between the *posterior* for the end of deposition associated with Phase 2 and the laying down of slab surface C33. The model showed that *0–68 years* (95.4% Probability), probably *0–22 years* (68.3%

Probability) elapsed between the *posterior* for the laying down of slab surface C33 and the start of deposition associated with Phase 3. The model showed that *0–58 years* (95.4% Probability), probably *0–27 years* (68.3% Probability) elapsed between the *posterior* for the end of deposition associated with Phase 3 and the laying down of slab surface C28. The model showed that *0–58 years* (95.4% Probability), probably *0–27 years* (68.3% Probability) elapsed between the *posterior* for the laying down of slab surface C28 and the start of deposition associated with Phase 4. The model showed that *0–257 years* (95.4% Probability), probably *25–150 years* (68.3% Probability) elapsed between the *posterior* for the end of deposition associated with Phase 4 and the start of deposition associated with Phase 5.

- *Discussion*

The *posterior density estimates* produced by the Bayesian model provide useful empirical estimates for the chronology of the Caherconnell Cashel. The *posteriors* for the end of activity associated with Phase 1 and the construction of the Cashel wall suggest the stone enclosure was likely built during the 9th and mid to late 10th centuries AD, after which the deposition of material related to Phase 2 began during the late 10th to early 11th centuries AD. The Phase 2 activity lasted between the 10th to mid-11th centuries AD and appears to have been quite short-lived, lasting at most just over a century and with less than a century before the slab surface 33 was laid down during the late 9th to early 12th centuries AD. Likewise, there was less than a century between the laying down of slab surface 33 and the start of Phase 3 deposition which lasted less than 80 years between the early 11th to early 12th centuries AD. The slab surface 28 was laid down less than 60 years after the end of Phase 4 during the 11th and 12th centuries AD.

The results from the model indicate that the depositional activity associated with Phases 2 to 4, and the repurposing of the site represented by the laying down of slab surfaces 33 and 28 occurred in relatively quick succession, with Phases 2 and 3 of human occupation being particularly short-lived between a couple of decades to just over a century. It can be concluded that occupation of the Cashel was relatively continuous from the 9th to late 14th centuries AD, with no significant periods of abandonment. It was only after the end of activity associated with Phase 4 that the site may have been abandoned for any significant period of time, at most two and a half centuries before being resettled between the 14th to 16th/early 17th centuries AD. However, the absence of any buried sod layers suggests that this period of abandonment was minimal, perhaps some decades at most.

Chapter 3
Historical Background

This chapter will consider the historical background of Gaelic medieval settlement through a discussion of medieval Ireland, the Burren, and lastly Caherconnell Cashel. In the first section the historical evidence of various aspects of medieval Ireland will be discussed – settlement, landscape, economy, and animals. Secondly, the historical landscape of the Burren, where Caherconnell is located, will be discussed. Finally, the historical background of Caherconnell Cashel will be presented through an exploration of the site, its economy, and the families occupying the site from the 10th to 16th century. As this involves phases of settlement spanning both early (400–1100 AD) and late (1100–1550 AD) medieval periods, the chapter will cover aspects of both periods.

3.1 Medieval Ireland

There are extensive literary sources for the early medieval period (400–1100 AD) in Ireland, such as chronicles, law-texts, and various annals. These provide information on various events and subjects, including climate, settlement and society. Law-texts from the 7th and 8th centuries give insight into the landscape and economy of early medieval Ireland, with a focus on the higher status individuals in regards to wealth and rank (Downham 2017, 23, 69). For example, the *Críth Gablach*, discusses subjects such as the grades of lords, and the roles of elite individuals (*ibid.* 69, 74). Literary sources from the late medieval period (1100–1500 AD) include a combination of Irish and Anglo-Norman texts and also contain discussion of various topics such as settlement, economy, and society. The politics of these periods can be also be reviewed through the literary sources. The genealogies of ruling dynasties and chiefdoms provide the potential to analyse settlements and their encompassing landscapes through a view of hierarchies and power (*ibid.* 81). Legal sources also refer to 'the systems of clientship that existed between lords and farmers', which in general involved loans of cattle or other valued items in return for 'annual food rent, manual labour, and military service' (*ibid.* 31). Cattle played an important role during these periods, particularly in relation to an individual's wealth and status, and therefore featured regularly in the medieval sources. Other animal species are mentioned to a lesser extent.

3.1.1 The economy of the Irish ringfort

Our understanding of settlement during the early medieval period comes from both archaeological and historical records, which suggests this period in Ireland was densely populated between the 6th and 10th centuries AD (O'Sullivan *et al.* 2008, 48). This settlement was essentially rural and included dwelling enclosures such as raths, cashels, and ecclesiastical enclosures, as well as urban settlement and a diverse range of 'unenclosed dwellings, cave occupations, settlements with cemeteries, coastal midden sites and seasonal or temporary habitations in wetlands, uplands, and coastal contexts' (*ibid.*). There were no urban settlements until the foundation of the Viking trading ports in the 10th centuries. The only native centres of population with some of the functions of urban communities were the larger monasteries. Ringforts, the most characteristic settlement type of early medieval Ireland, are earthen field monument comprised of single or multiple arrangements of a stone wall or a bank and ditch combination. (Edwards 1999, 11; O'Sullivan *et al.* 2008, 52). Cashels are stone-walled ringforts and can vary in size, similarly to the earthen ringforts or 'raths' (Edwards 1999, 12; O'Sullivan *et al.* 2008, 53). Ringforts were generally domestic farmsteads, which enclosed 'houses, farm buildings, pens, areas of craft activity or food processing, and rubbish dumps' and were surrounded by 'areas for grazing and cultivation' (Comber 2005, 51; Downham 2017, 26). The majority of ringforts were probably constructed and occupied during the 7th–9th centuries AD with multiple phases of activity (Stout 1997, 24).

The settlement landscape of early medieval Ireland was mostly a rural agricultural environment comprised of farmsteads, fields, and routeways (O'Sullivan *et al.* 2008, 190). Agriculture played a central role in the structure of early Irish society, with kinship and community, social status and gender roles organised around land-use and agricultural labour (*ibid.*). Knowledge of early Irish society comes from a range of sources, including the early Irish law tracts which describe 'land values, social status and cows, labour organisation, aspects of fishing, milling, bee-keeping, etc.' (*ibid.*). The basic territorial unit in early Irish society is the *túath*, which means 'tribe' or 'petty kingdom', each of which had their own ruling king (Kelly 1988, 3–4). As well as a king, a *túath* is also required to have an ecclesiastical scholar, a churchman, and a poet (*ibid.* 4). There were three categories for social relations within the landscape, namely kinship, neighbourhood, or clientship, the first two being strongly influenced by inheritance and land tenure, as well as social standing (Corlett and Potterton 2011, 4). Within the hierarchical society of early medieval Ireland, an individual's social status could be determined through farming/land ownership, craft or scholarship, and ecclesiastical

office (Charles-Edwards 2000, 125). This social hierarchy may be evident in the settlement landscape through the presence of larger, more complex, sites, of which Cahercommaun and Caherconnell are good examples in the Burren, albeit of different form (Downham 2017, 26–7).

The late medieval period saw the development of towns, particularly in areas of the previously established Viking ports (*ibid.* 184). After the arrival of the Anglo-Normans, a pattern of manorial settlement was established in south-east Ireland, whereas patterns of Gaelic rural settlement survived in western Ireland with the continued use of early medieval settlement types such as ringforts, cashels, and crannogs (Horning 2012, 177). As previously said, the majority of evidence for ringforts suggests they were occupied during the 7th–9th centuries, however there is evidence indicating their continued use into the 17th century, with Caherconnell a good example of this survival (*ibid.*; Comber 2019, 60). Some early medieval ringforts were modified into motte castles by the Anglo-Norman in the later period (O'Conor 1998, 89). Ringforts that acted as territorial centres during the early medieval period were sometimes replaced by late medieval settlement types, for example, towerhouses (Comber 2008, 15). It is difficult to interpret the overall picture of ringforts and cashels in the late medieval period as it differed across regions, with only limited sources referring to the use of these settlements during this period (O'Conor 1998, 93)

3.1.2 Animals in medieval Ireland

Cattle

The law-texts refer to many forms of property in medieval Ireland, livestock being very important, referred to as *béodili* or 'living valuables' (Kelly 1988, 99). The economy of early medieval Ireland is described by law-texts as a self-sufficient mixed farming economy centred around cattle, sheep, pigs, as well as cereals (*ibid.* 3). The *Críth Gablach* states that the livestock herd of the *bóaire*, the 'cow-freeman' or ordinary well-off farmer, should include '20 cows, 2 bulls, 6 oxen, 20 pigs, 20 sheep, 4 domestic boars, 2 brood-sows, and a saddle horse' (Binchy, Daniel A. 1941; de Paor and de Paor 1960, 78–9; Kelly 1997, 27). The documentary sources make it clear that cattle played an important role in early medieval Ireland, particularly cows as they were the basic unit of wealth and had influence on an individual's social status (Lucas 1989, 3–4; O'Sullivan *et al.* 2008, 194). The law-texts mainly include discussion of the currency system in regard to cows and young cattle, with less mention of male cattle (Kelly

1997, 58). The milch cow, also referred to as *lulgach* or *bó mlicht*, was the basic unit, followed by the in-calf cow, the *bó inláeg* (Kelly 1988, 113, 1997, 58). After these came various ages of cows, and, lastly, the young bullock which had the lowest value (Kelly 1988, 114). Cattle were also associated with the fertility of land (Edwards 1999, 56). The rural economy of early medieval Ireland had a particular emphasis on dairying, with the by-products of butchery, including meat and hides, of less value (O'Sullivan *et al.* 2008, 194). Cattle would have been kept outside all year and in some places they would have been moved into the uplands during the summer months for seasonal grazing, a practice known as booleying (Edwards 1999, 57). The risk of wolves or cattle raiders meant cattle needed to be protected by herdsmen with references to these animals being herded into pens and corrals, with some suggesting that ringforts would have functioned as an enclosure to protect cattle during raids (McCormick 1995; Edwards 1999, 57; O'Sullivan *et al.* 2008, 195). Cattle were primarily used for their milk, rather than the by-products of butchery, with dairy products predominantly a summer food as cows gave less milk during the winter months and included products such as milk, butter, and cheeses (Edwards 1999, 57). Male cattle would have used for products such as meat, or traction, and were half the value of a cow of the same age, with little economic value after the age of two (McCormick and Murray 2007, 54).

When looking at entries from the Irish annals 1000–1608 AD, cattle feature the most prominently of all species (Denham 2007, 70). There are two peaks within these literary sources, the 12th century and 16th century, but generally references to cattle remains consistent (*ibid.*). The majority refer to military matters; for example, cattle 'taken, destroyed, or driven off for protection in advance of a raid' with the main aim being to seize the enemies cattle to deprive them of their products such as milk and meat (*ibid.* 74, 76). Other references relate to topics such as death, plague, praising wealthy cattle owners, tribute, and weather (*ibid.* 75). Although the annals focus mostly on military engagements, it is also evident that cattle were associated with status and wealth similarly to the early medieval period (*ibid.* 76). The law texts also suggest cattle remained as an important form of currency even after the introduction of coinage (Kelly 1988, 113). During this period, cow hides and calfskins, were some of Ireland's most important exports (O'Neill 1987, 77). Similarly to the annals, cattle feature frequently in Anglo-Norman sources, and the references involve large numbers of cattle, particularly cows, and discuss their value (Denham 2007, 92–3). These sources indicate that cattle were used during the late medieval period for rent, fines, wages and food allowance for soldiers (*ibid.* 94). A notable feature of Anglo-Norman sources is that there is no mention of cattle until AD 1212, which is some 40 years into the records (*ibid.* 92). Dairy products, not

necessarily limited to cattle, are frequently mentioned in Anglo-Norman sources in relation to cheese and butter (*ibid.* 116–7). Wool, hides and animal skins were important during this period, produced from a range of species both domestic and wild (*ibid.* 117).

Sheep

Sheep are frequently referenced in early medieval texts, such as the *Críth Gablach.* These sources, discuss how sheep were grazed in the open all year round and brought into a sheep-pen at night for safety (Kelly 1997, 68). Sheep give birth in Spring, with legal texts recording that children cared for the lambs (*ibid.* 69). Medieval sources place more of an emphasis on the wool rather than mutton or lamb meat. In general, sheep are associated more with women in the texts, possibly due to their role in processing wool (*ibid.* 67). The same sources record that sheep with white fleece were the least common when compared with those with darker coloured fleeces such as brown or black (*ibid.* 70). Due to suitability for dyeing, and scarcity in comparison to the others, sheep with white fleeces had a higher value (*ibid.*). As well as their wool and meat, the texts also reference sheep-skins, milk, and horns (*ibid.* 72–4). Although not on the same scale as cattle, sheep were also used as a unit of currency for small amounts and fines (*ibid.* 75). Similar to cattle, the value of sheep differs based on age and sex, females were higher in value due to their potential for milk and breeding, and were highest in value at the age of two (*ibid.* 76). The medieval texts refer to goats as uncommon and unimportant, with no mention of these animals in the *Críth Gablach* which involves a detailed discussion of early medieval farming (*ibid.* 78). That said, goat milk was worth more than that from sheep based on the evidence of the legal texts (*ibid.* 73).

Unlike cattle, sheep do not feature prominently in the annals of the late medieval period, with the majority of entries relating to military matters. Notably, these only appear well after the arrival of the Anglo-Normans, with references before the 12th century relating to subjects including weather, plague, and tribute (Denham 2007, 77). Similar to the earlier period, references to goats are extremely uncommon within the annals (*ibid.*). Although sheep played an important role the economy of this period, they were not important enough to be recorded to any extent in the annals (*ibid.* 78). That said, wool is mentioned frequently Anglo-Norman sources (*ibid.* 117). Other late medieval sources, such as the 12th century version of *Táin Bó Cúailgne*, involve more general discussion, such as references how sheep grazed on 'greens, lawns, and plains' and are therefore not seen as animals of the hills (Kelly 1997, 68). References to sheep in the Anglo-Norman sources discuss, for example, the theft of sheep, their seizure or levy to pay off debts, and the value of sheep, with references to goats being uncommon

(Denham 2007, 98–100). Similarly to cattle, sheep do not appear in these sources until AD 1212 (*ibid.* 98).

Pig

These animals feature regularly in early medieval law-texts and annals (Kelly 1997, 79). Although kept primarily for meat, pigs could also be used for other by-products of butchery, such as their hides and bones (Edwards 1999, 58). The literary sources suggests that pork, bacon, black and white pudding, and sausages were favoured products during the early medieval period (Lucas 1960, 17; Edwards 1999, 58). Pork products could also be a part of food render (*ibid.* 58). As previously discussed, the *bóaire* was expected to own four domestic boars and two brood-sows, as well as 20 other pigs (Binchy, Daniel A. 1941; de Paor and de Paor 1960, 78–9; Kelly 1997, 85). The *Críth Gablach* also states that the *mruigfer*, the most prosperous grade of *bóaire*, was also expected to own two brood-sows (Binchy, Daniel A. 1941; Kelly 1997, 80). Farrowing happened once a year, and after a sow delivered two or three litters, as well as animals who failed to produce litters, they were killed (Kerr *et al.* 2013, 14). Farrowing occurred in springs and legal texts mention a little which had up to nine piglets (Kelly 1997, 81). The *Cáin Lánamna* discusses how it was the job of the farmer's wife to look after the pig-sties, and feed the pigs, including the runt of the litter which were fattened on milk (*ibid.*; Eska 2010, 159). Pigs would have been kept at the farm until August, where they were then considered able to survive in the woods, sometimes mixed in with herds from other farmers, and most of the time would brought back on-site during the night (Kelly 1997, 81–2). Unlike cattle and sheep, pigs were not used as currency and the value of pigs was comparable to that of sheep of the same age and sex (*ibid.* 86).

The later sources indicate that the importance of pig and its food products carried into the late medieval period; for example, the 11th/12th century *Vision of MacConglinne* has multiple references pork and salted bacon (Lucas 1960, 17; Preston-Matto 2010). Sources from the late medieval period also discuss pigs in urban contexts and the problems associated with keeping them within the city walls, such as damage to gardens (Cantwell 2001, 76). Similar to sheep, pig do not feature regularly in the late medieval annals even though pork was a favoured product during this period. Once again, the references that do exist mostly relate to military matters (Denham 2007, 78). Unlike cattle and sheep, references to pigs in the Anglo-Norman sources appear from the beginning of these texts (*ibid.* 101). These references include discussion of pigs brought on military campaigns, the import of pigs to supply the army in the

late 12th and early 13th centuries, their theft and seizure and use for rents, their value and interaction with humans (*ibid.* 101–3).

Horse

Early medieval texts, such as the *Críth Gablach*, indicate that there were two main types of horses in Ireland during this period, namely the work-pony (*capall fognamo*) and the horse for riding (*ech immrimme*) (Kelly 1997, 89–90). Horses imported from outside of Ireland were described in the law-texts to be of notable value (*ibid.* 90). The value of horses was based on their size, shape, colour, and speed, with those white in colour being the highest in value (*ibid.* 91–2). These sources also discuss the housing and restraint of horses, and their training for tasks such as load-carrying, draught work, riding, and horse-racing (*ibid.* 93–9). After cattle, the horse is the second most frequent species to feature in entries in the Irish annals, with the smallest number dating to the 11th century and increasing over time to the highest during the 16th century overtaking cattle, which may be related to their use in traction (Denham 2007, 70–1). Similarly to the species discussed above, the majority of references are military entries with horses being a valuable asset in battles and so slightly differ from those of cattle with only few mentions to horses taken in a raid or a battle (*ibid.* 79). Some references also hint at the consumption of horse meat, although not a common practice and often a taboo, as well as the use of their skins for curragh boats (*ibid.* 80). Early Irish texts such as *The Irish Penitentials* discuss the penalties associated with the former, stating that 'the penance for eating horse-flesh, four years on bread and water' (Bieler 1975, 161; McCormick 2007, 92). The secular law tract *Bretha Crólige* states that eating horse meat was not entirely forbidden however it was unsuitable for individuals with illness as it could 'stir up sickness in the stomach' (Binchy 1938, 21; McCormick 2007, 93). Although their role differed from that of cattle, horses were clearly regarded as an important and valuable resource or tool during the late medieval period (Denham 2007, 82). Horses are the most frequent species referenced in entries from Anglo-Norman sources (*ibid.* 93). Similar to pigs, horses featured in these sources since the beginning of this period and involve military references such as horses being sent to Ireland to support the army, as domestic references involving palfreys and horse shoes, as well as general references to their appearance and values (*ibid.* 104–5, 108).

Dog

Sources from the early medieval period, such as the law-text on dogs *Conslechtae*, indicate that there were various types of dogs present during this period which included guard-dogs,

hunting dogs, herd dogs, and pet dogs (Kelly 1997, 114–20). Although guard dogs could be small or large in size, sources including the *Táin Bó Cúailnge*, focus more on the larger guard dog, the *árchú* (*ibid.* 115). Early medieval sources describe the hunting of animals such as deer, wild pig, and hares, with the hunting dog, the *mílchú*, playing an important role in this activity which appears frequently within these sources (*ibid.* 117, 274). As well as the *mílchú*, the *gadar*, is another hunting dog referenced in these texts which suggests there was more than one type during this period (*ibid.* 118). The sources also discuss the exportation of dogs from Ireland to Norse countries (*ibid.*). Reference to herd dogs appear frequently in the law-texts and suggest there were three types, namely the herd dog of large livestock (*conbúachaill mórchethrae)*, of calves (*conbúachaill láeg*), and of sheep (*conbúachaill cáerach*) (*ibid.* 119).

Pet dogs, *orcae* or *oirce*, are referenced in the *Críth Gablach* which states the wife of a lord should have a pet dog, other texts associate them with a physician, a harpist, a queen, and a hospitaller, and there are further references of the role of the pet dog to protect a woman while giving birth (*ibid.* 120). References to dogs in the annals are uncommon, those that do exist suggest greyhounds were popular during this period and that it was 'considered an insult to bury a man with a dogs' which implies that either dogs or certain breeds were not well-regarded (Denham 2007, 83). There are also infrequent in the Anglo-Norman sources, little interpretation can be made of their value during this period, and references include discussion of hunting dogs, dogs as state gifts, and the use of dogs for locating a dead body (*ibid.* 110–1). Dog pelts were one of many exports from Youghal in Co. Cork during the mid-16th century (Longfield 1929, 220).

Cat

References to cats appear in early medieval texts, including legal texts and literature, which generally associated them with woman, children, and the kitchen (Kelly 1997, 122). Based on these sources, their value is based on a combination of factors, their ability to purr and to guard the property from mice (*ibid.*). The early Irish texts describe various types of cats, which appear to be based of physical attributes such as fur-patterns and colours, as well other characteristics which make them, for example, a kitchen cat (*cat cuile*) or a barn cat (*Cruibne*) (*ibid.* 123). Similar to dog pelts, cat skins were also an export during the late medieval period (Caulfield 1878, xxvi). The cat in late medieval Ireland still played the role of a pet however its role would have developed through the development of the fur trade, as well as the presence of the black rat (McCormick 1988, 225)

Wild mammals, birds, and fish

Early medieval sources reference activities such as the hunting of wild animals, for example deer, as well as fowling, and fishing. The texts regard deer-hunting as a high status activity associated with royalty and aristocracy (Kelly 1997, 273). There are various forms of deer-hunting, which include the use of hunting dogs, a deer-ambush, driving the deer to a barrier, hidden spikes, deer-pits, and leg traps (*ibid.* 274–80). References to the hunting of wild pig, although not as frequent as those of deer-hunting, appear in the early sources, as well as the hunting of badgers, hare, otter, and wolf (*ibid.* 281–2). Early medieval sources have various references to fowling of game-birds through methods such as trapping, hunting with missiles, and hawking (*ibid.* 298–303). The importance of fishing and the economic importance of fish during this period is reflected in the frequent references in early Irish texts, and discuss types of fishing based on methods and species (*ibid.* 285–96). Marine mammals appear to be a valued source of food and resource, an example is seen in a law-text where it is said 'if a whale is washed up, its highly valued whalebone is divided out among the members of the *túath*' (Kelly 1988, 107, 1997, 282).

References to wild species are not numerous in the annals of the late medieval period. These include descriptions of wild animals feeding on the dead from battles, metaphorical references of wolves, and two references to camels which were brought to Ireland as gifts (Denham 2007, 83–4). References to birds and fish are also uncommon in the annals, which is particularly surprising for fish as they played an important economic role in the late medieval period (*ibid.* 84–5). Similarly to other wild species, birds featured in the annals reference birds of prey and corvids feeding on bodies from battles (*ibid.*). The majority of references featuring fish highlight the importance of inland and coastal fisheries however there are also other less frequent exaggerated descriptions, for example the capture of two mermaids, one in Ossory and the other in Waterford (*ibid.* 85). Wild species appearing in Anglo-Norman sources mostly include discussion of managed species and their habitats, such as deer and deer parks, as well as rabbits and rabbit warrens (*ibid.* 111). Fish are mentioned in the Anglo-Norman sources through references to fisheries, weirs, pools, and the purchasing of large amounts of fish which was likely to feed the army (*ibid.* 114). Birds in these sources feature in the discussion of domestic birds, including domestic fowl, geese, and doves, as well as falconry and game birds (*ibid.* 114–5).

3.2 The historical landscape of the Burren

3.2.1 Burren landscape

The Burren has around 400–500 native enclosed settlements, or ringforts as they are commonly known, from the medieval period. The majority of these are stone circular enclosures known as cashels or cathair, a good example being Caherconnell (FitzPatrick 2012, 3). This landscape did not attract the Anglo-Normans to the same extent to the urban areas on the east of Ireland, which is possibly because it lacked surface rivers and extensive areas of arable land (*ibid.* 5). Because of this, these enclosures remained as principal strongholds of important Gaelic families and generally had little direct Anglo-Norman influence (Comber and Hull 2010; FitzPatrick 2012, 6).

Difficulties can arise when attempting to outline the early history of the Burren as the historical sources for this landscape being rare when compared to other areas in Ireland (Comber 2005, 22). Ptolemy's map, which dates to *c.*150 AD, records that the earliest group in this area are the Auteini, which are the later Uaithne from the nearly bounties of Limerick and Tipperary (*ibid.* 19). After the Auteini, the dominant chiefdom of this landscape were *Corcu Mruad* which was a combination of groups such as *Crecraige* (Byrne 2001, 67) and *Cenél Báeth* (Gibson 1990, 384) (Comber 2005, 19). The territory of *Corcu Mruad* during the early part of this period is suggested to have covered the area between Galway Bay to Ennis, and the Atlantic ocean to the modern Clare/Galway border, with its capital Caherballykinvarga cashel (Jones 2004, 108; Comber 2005, 20). This area makes up what is today the baronies of Corcomroe, Burren, and Inchiquin, and it is suggested that their territory was even larger in the earlier part of the period (Ó Corráin 1975, 21; Comber 2008, 13). They would have paid tribute to various over-kings, such as *Éoganacht Árann* during the 5th and 6th centuries before their decline in the 7th century (Gosling 1991, 78; Comber 2005, 19). The *Eóganacht's* decline may have created an opportunity for Guaire, the king of *Uí Fiachrach Aidne* and Connacht, to expand his control down from Galway and into this landscape, which may have been anticipated with Kilmacduagh, his primary church, being situated on the *Corcu Mruad* border (Byrne 2001, 242–3; Comber 2005, 19–20).

In the 8th century, *Corcu Mruad's* control on their territory began to decline as *Uí Fidgeinti* (affiliated with the *Éoganacht*) and *Déis Tuaisceart* began to encroach which resulted in its borders being pushed back and reducing the area to the modern baronies of Corcomroe and Burren (Ó Corráin 1975, 21; Comber 2005, 20, 2008, 13). The earliest record of this dates

to 705 AD and appears in the annals which documents *Célechair Mac Commáin*, a dynast of *Uí Chormaic* which was part of *Uí Fidgente*, who died in battle against the *Corcu Mruad* (Ó Corráin 1975, 21). Records from the Annals of Ulster document the destruction of the *Corcu Mruad* in 744 AD by the *Déis*, later known as the *Dál Cais*, which likely resulted in the *Dál Cais* establishing themselves in Clare during this time (*ibid.*; Bhreathnach 1999, 87). These annals also record a battle between *Uí Fidgeinti*, *Corcu Mruad*, and *Corcu Baiscinn* who were another chiefdom group in north Clare to the south-west (*ibid.* 87, 90). Despite these events, *Corcu Mruad* survived as a sub-kingdom of Thomond under the rule of *Dál Cais* and in the early 10th century they were under rule of a *Dál Cais* king (Ó Corráin 1975, 21). The *Dál Cais*, originally *Déis Tuaiscirt*, were spreading from Limerick into Clare since the 8th century with their new identity emerged in the 10th century with the kingship of Munster (MacCotter 2008, 187).

Although under the leadership of others, *Corcu Mruad* managed to preserve their territory even after their decline due to being pushed back to north Clare (Sheehan 1982, 30). *Anruadán mac Máel-Gorm* of *Uí Thairdelbaig,* of *Dál Cais*, ruled over *Corcu Mruad* in 925 AD before dying in 934 AD (Gibson 1990, 384; Comber 2008, 14). *Corcu Mruad* kings reclaimed the chiefdom, not only following the death of *Anruadán*, but also due to the *Dál Cais* placing their focus on the Viking attacks in Thomond (*ibid.* 14). This did not last long as by the latter half of the 10th century *Máel Sechnaill*, a *Uí Thoirdelbaig/Dál Cais* king and first cousin of Brian Boru, was ruler of the chiefdom (Gibson 1990, 382; Comber 2008, 14). After the death of *Máel Sechnaill* in 983 AD, *Corcu Mruad* was ruled by *Uí Conchobar* and *Uí Lochlainn*, descendants of his nephew *Conchobar* and his son *Lochlainn,* with both families alternating kingship (Ó Corráin 1975, 21; Sheehan 1982, 29–30; Ní Ghabhláin 1995a, 62; Comber 2008, 14). In the late 12th and 13th centuries, ecclesiastical parishes were established within the existing secular territories, and by the 14th century the *Corcu Mruad* chiefdom split into two distinct territories, Corcomroe East and Corcomroe West, with the *Conchobar* descendants the O'Connors ruling the western half (the modern barony of Corcomroe) and the *Lochlainn* descendants the O'Loughlins ruled the eastern half (the modern Burren barony) (Frost 1893, 14–7, 93–5; Hogan 1929, 232; Ní Ghabhláin 1995a, 62; Comber 2008, 14–5).

The *Uí Fidgeinti* branch *Uí Chormaic* may have acted as agents for the territorial ruler between the 7th and 10th centuries, who are also suggested to be associated with Cahercommaun and its territory which sits on the eastern edge of *Corcu Mruad* land (Bhreathnach 1999, 90; Comber 2008, 14). Cahercommaun is located in the townland of Tullycommon and both place-names share a similar element, *Commán* or *Cumann*, and it is suggested that *Commán Mac*

Maínaich of *Uí Chormaic*, father of the previously mentioned *Célechair*, lent is name to both the townland and site (Bhreathnach 1999, 83, 89–90). The inland cliff-top trivallate cashel of Cahercommaun may have acted as a territorial capital, possibly in competition with Ballykinvarga stone fort (Comber 2005, 51). An area with less settlement evidence is suggested to be the border zone between *Corcu Mruad* and *Uí Chormaic*/*Dál Cais* (*ibid.* 52).

As previously mentioned, ecclesiastical parishes were established in the late 12th/13th century, for example Kilcorney parish in which Caherconnell is situated (Comber 2008, 13). The parish church in Kilcorney is situated south-west of Caherconnell cashel and has a possible earliest date of late 11th/12th century with later additions dating to the 13th and 15th/16th centuries (Ní Ghabhláin 1995a, 440–2). Evidence of a monastic enclosure of earlier date is located in the nearby area and it is suggested that the O'Loughlin lord, who likely lived close by, provided patronage to develop the stone church in order to gain parish-church status (Comber 2008, 15). It is highly possible that Caherconnell was a likely settlement of the O'Loughlins due to its 'strategic location, impressive morphology, and excavated economic evidence' (*ibid.*). As discussed previously, the two distinct territories of O'Connor and O'Loughlin were well established by the 14th century, and then further divided into smaller territorial areas which were overall under the O'Briens of Thomond who were of *Uí Thoirdelbaig* descent (*ibid.*).

In the 15th century, many of the leading families were moving from cashels to towerhouses, with the O'Loughlins moving north from Caherconnell to Glensleade to establish their new capital by building the only towerhouse in the parish (*ibid.*). The baronies of Clare were established in the 16th century, such as Corcomroe and Burren, which as previously mentioned mirror the O'Connor and O'Loughlin territories (*ibid.* 16). The O'Briens took over ownership of most of the O'Connor land and the O'Loughlins kept their lands while paying tribute to the O'Briens, however land ownership in the Burren barony changed in the 17th century (Ní Ghabhláin 1995b, 31–2; Comber 2008, 16). This change is seen in the Kilcorney Parish, which was mostly under O'Loughlin rule but was transferred to their O'Brien overlords (Gibson 1990, 101–2; Comber 2008, 16). Further changes in ownership occurred in the later part of the 17th century with 'Karconnell' being forfeited by Donogh O'Brien to transplanted Catholics John and Laurence Comyn, which is documented in the *Books of Survey and Distribution* (1636–1703) (Simmington and MacGiolla Choile 1967; Comber 2008, 16). Towards the end of the 17th and the 18th century, the O'Davoren family were gradually re-establishing in their native parish of Rathbourney which is west of Kilcorney, and by the 19th century the majority of the Caherconnell townland was under their ownership, including Caherconnell Cashel which remains in Davoren ownership today (*ibid.* 16).

3.2.2. Caherconnell in its historical landscape

Caherconnell Cashel is located in the townland of Caherconnell, Kilcorney parish, diocese of Kilfenora, Burren barony, Co. Clare (*ibid.* 12). The Caherconnell townland is one example of the many townland divisions throughout the Burren, which likely represent the areas of land owned by various noble and ruling families (*ibid.*). As a site of high status, the residents of Caherconnell would have played an important role in the politics of the local landscape, and their connection to the ancestors through burials and activity at the two adjacent early cashels, would have further contributed to the statement Caherconnell made on its surrounding landscape (Comber 2018a, 6). With a likely construction date of the late 10th century, the building of Caherconnell Cashel was probably undertaken by a branch of the *Dál Cais* (*Uí Thoirdelbaig*) who were establishing themselves in the area at this time over the *Corcu Mruad* (Comber 2019, 60). The kings of these ruling chiefdoms would have 'enforced regular tribute from the territory to their overlords and kinsmen' (Comber and Hull 2010, 158). Caherconnell would have been a likely candidate for a settlement which would play an important role in the assertion of power in this landscape (*ibid.*). The historical evidence records Congal as the lord of the native *Corcu Mruad* family and the brother of the imposed *Dál Cais* king *Máel Sechnaill* (Comber 2019, 60). The occurrence of the name Congal in the genealogy of *Dál Cais* coincides with the construction of the cashel. Comber (2019, 60) has suggested a possible link between Congal and the place-name Caherconnell, *Cathair Congal*. An *Uí Thoirdelbaig* king during this time, *Anruadán* or *Máel Sechnaill*, could have utilised Caherconnell to assert their power over *Corcu Mruad* (Comber and Hull 2010, 158). The same could be said for the O'Connor or O'Loughlin descendants who alternated kingship after the death of *Máel Sechnaill* (Ó Corráin 1975, 21; Sheehan 1982, 29–30; Ní Ghabhláin 1995a, 62; Comber 2008, 14).

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Part 2: Assemblage Analysis

Chapter 4

Methodology

This chapter outlines the methodologies used in the collection and analysis of faunal bone data from Caherconnell. The size, composition and phasing of the assemblage is presented, along with the results of a pilot study undertaken to identify the most suitable recording methodology. The methods used in the quantification, aging, sexing, biometrical recording and bone modification are discussed.

4.1 Recording approach

4.1.1 The pilot study

A sampling exercise was undertaken to identify a recording methodology suitable for the Caherconnell animal bone assemblage. The sample size chosen involved four samples from the Phase 4 occupation layer (context 36) dating to the late 10th/early 11th century.

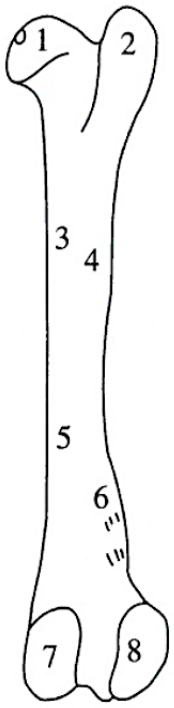


Figure 4.1: Bone zones for Femur (Serjeantson 1996, 196).

The first methodology employed was taken from the publication *Recording an Assemblage* (Hadjikoumis 2019) and comprised several methodologies based on past zooarchaeological work. For mammals and bird bones, this methodology requires the survival of 50% or more of a diagnostic zone of an element in order for it to be classed as recordable. For example, 50% or more of the glenoid cavity must be present for the scapula to be recordable. To include teeth, 50% or more of the occlusal surface must be present. There are also elements which are regarded as non-countable in this methodology. For mammals, these include the proximal end of a humerus, radius, femur, and tibia, antlers and horncores. For bird bones, the non-countable elements include the proximal end of the humerus, femur, and tibia. This methodology follows two measurement guides, namely *A Guide to the Measurements of Animal Bones from Archaeological Sites* (von den Driesch, 1976) and *A Rapid Method for Recording Information about Mammal*

Bones from Archaeological Sites (Davis 1992). Tooth wear analysis used within this methodology is based on *The Use of Tooth Wear as a Guide to the Age of Domestic Ungulates* (Grant 1982). Other zooarchaeological work referenced within this methodology includes *The Saxon and Medieval Animal Bones Excavated 1985-1989 from West Cotton, Northamptonshire* (Albarella and Davis 1994), *Neolithic Pigs from Durrington Walls, Wiltshire, England: a Biometrical Database* (Albarella and Payne 2005), and *Components of Variation in Measurements of Pig Bones and Teeth, and the Use of Measurements to Distinguish Wild from Domestic Pig Remains* (Payne and Bull 1987).

The second methodology used in the pilot study was from the publication *The Animal Bones* (Serjeantson 1996). This approach was used by Dale Serjeantson at Runnymede in Surrey where the 'bone had survived in quantity and in good condition' (*ibid.* 194), similar to the Caherconnell assemblage. This system records the zones present on each bone, once more than 50% of a zone was present. A uniform number of eight zones per bone is used to ensure consistency when calculating the proportion of bone present (Figure 4.1). Zone 1 refers to the medial half of the proximal epiphysis, Zone 2 the lateral half of the proximal epiphysis, Zone 3 the medial half of the proximal shaft, Zone 4 the lateral half of the proximal shaft, Zone 5 the medial half of the distal shaft, Zone 6 the lateral half of the distal shaft, Zone 7 the medial half of the distal epiphysis, and Zone 8 the lateral half of the distal epiphysis. The eight zone system is suitable for the main limbs bones, with the bones for which the fragmentation patterns of most interest (*ibid.* 195). For axial bones such as the vertebrae, zones 1, 3, 5, and 7 are used for the left half and zones 2, 4, 6, and 8 are used for the right half. Bones that are asymmetrical and irregular in shape, such as the scapula, pelvis, ulna, fibula, and ribs, have adapted zones. Not all bones are divided into eight zones, principally due to their size, for example the astragalus and navicular-cuboid. With the majority of zones, it is necessary that over 50% of the zone has to be represented for the bone to be classes as present. For example, Zone 1 (the head) of the humerus or Zone 2 (glenoid) of the scapula. There are also bones which are not zoned, namely the carpals, small tarsals, sesamoids, patella, small phalanges, lateral metapodials, disarticulated parts of skull, isolated teeth, sternum and hyoid.

4.1.2 Results and research aims

After completing zooarchaeological analysis of the four early medieval samples using both methodologies, there was an immediate visible difference in the results. Methodology 1

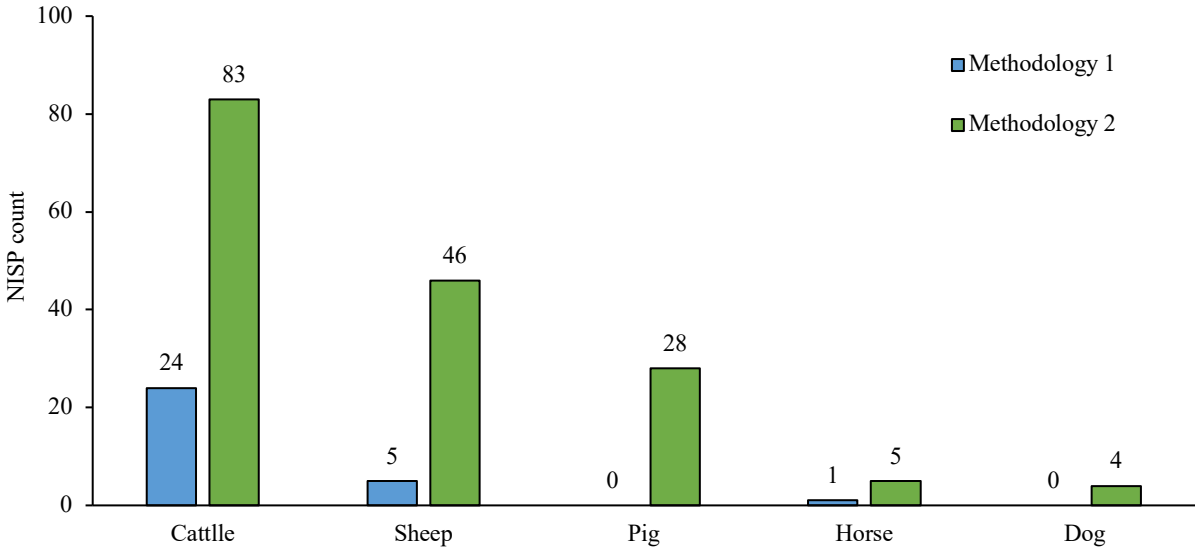


Figure 4.2: NISP counts for domestic species through the use of Methodology 1 and 2 to represent animal husbandry practices at Caherconnell Cashel.

produced 88 recordable bones while Methodology 2 yielded 391, a difference of 303 bones. As Caherconnell is located in a karst landscape and the site has been reused over multiple centuries, the assemblage has a varying level of fragmentation. Due to this degree of fragmentation, the rapid method of Methodology 1 excludes a high amount of material as it requires a diagnostic zone per element to be present. By using that methodology, it limits the material available for recording, which leads to under-representation throughout the assemblage. Methodology 2 is more inclusive as it allows all zones of an element to be recorded under the terms previously mentioned, which is evidently more appropriate for an assemblage of this nature.

When examining animal husbandry practices, the most important species are cattle, sheep/goat, and pig. It is also important to look at horse, dog, cat, and domestic fowl, though the latter two are not represented in the pilot sample. When reviewing the pilot study results, the contrast the number of identified specimens (NISP) counts of each taxa varies per method (Figure 4.2). The under-representation and general loss of data caused by the use of Methodology 1 is once again apparent, resulting in lower NISP counts and the absence of certain species, notably pig. At medieval sites pigs are generally one of the dominant domesticates, and therefore this absence is notable. The remaining domesticates are expected to appear in low amounts, a result produced by both methodologies, although dog is absent from Methodology 1.

Deer are of particular importance when analysing the role of hunting, with red deer present in Ireland throughout the early and late medieval periods, fallow and roe deer introduced to Ireland during the latter (Denham 2007, 287). The presence of hare and rabbit can also provide insight into hunting practices, although as burrowing animals, the latter can occasionally be intrusive. When comparing deer and hare/rabbit, the smaller species can sometimes be under-represented in assemblages due to their size (Beglane 2015, 186). That said, on-site sieving during an excavation can help to reduce this retrieval bias. On-site wet sieving was undertaken during the excavations at Caherconnell with 8mm sieves, and those used during post-excavation ranged between 1mm and smaller. In comparison to the briefly mentioned domestic species, wild animals tend to play a minor role in rural medieval assemblages, a trend which is represented in the results from Methodology 2, however absent from those of Methodology 1. The absence of these wild species gives a partial understanding to the role of hunting at Caherconnell and would result in the false conclusion that deer and rabbit/hare were absent at Caherconnell.

Other animal species, both domestic and wild, are associated with high status in various medieval literary sources. This can reflect the status of a settlement and its occupants during the medieval period in Ireland. Cattle were of particular importance, as a unit of wealth connected to an individual's social status (Lucas 1989, 3–4; O'Sullivan *et al.* 2008, 194). Depending on factors such as the age and sex of the cattle, the value of individual animals differed. As the pilot study only involved the identification of species and no further analysis was undertaken, the only conclusion that could be reached is that cattle were the most numerous species in this sample. The same texts confirm that deer-hunting was a high status activity that is associated with royalty (Kelly 1997, 273). This was the case for both the early and late medieval period, with the introduced species of deer being kept in Anglo-Norman deer parks which meant restrictions on who and when they could be hunted (Beglane 2012, 317). Based on the results from the pilot study sample, particularly from Methodology 2, the overall picture at Caherconnell follows the established trend of a rural site of the early and late medieval period in Ireland.

4.2 Data collection

After selecting a suitable recording methodology based on *The Animal Bones* (Serjeantson 1996), further data collection methods were tested for use in the recording, analysis, and

interpretation of these faunal remains. Bone recording involves various stages, such as the identification of taxa and elements, quantification, age at death, biometry, sexing, bone modifications including butchery, burning, and gnawing, and pathology. The data recorded was then analysed and interpreted using various methods.

4.2.1 Primary and secondary data

Identification of taxa and element

As previously mentioned, the overall objective of the identification stages is to place these specimens into taxonomic and anatomical categories (Driver *et al.* 2011, 26). The identification of species and elements in the Caherconnell faunal material was primarily undertaken through the use of the UCC Department of Archaeology animal bone reference collection. This resource allowed for the identification of various mammal, bird, fish, and amphibian species. The bird bone reference collection at the National Museum of Ireland –Natural History collections was used to further identify bird species which were not available in the UCC collection. In addition to these faunal collections, various animal bone atlases were used, including those by Schmid (1972), Pales and Lambert (1971), Cornwall (1956), France (2008), Sisson (1914), and Johnson (2015). When attempting to distinguish sheep and goat bones in the assemblage, Halstead *et al.* (2002), Boessneck (1971), Zeder and Lapham (2010), Salvagno and Albarella (2017), and Prummel and Frisch (1986) were consulted. To further aid in the identification of teeth Hillson (2005) was used. Serjeantson and Cohen (1996) was used for the identification and measurements of bird bones and Cannon (1987) was used for fish. Each recordable element was assigned its own identifying number (Bone ID, Mandibular Tooth ID, or Maxillary Tooth ID) which provides the total count for identifiable specimens.

Quantification

Three methods of quantification were used throughout this study, namely the number of identifiable specimens (NISP), minimum number of individuals (MNI), and minimum number of elements (MNE). The recording methodology used in this analysis (Serjeantson 1996) has many advantages when it comes to undertaking methods of quantification. As a bone zoning method, it records the surviving areas or ‘zones’ of each bone through a uniform number of eight zones. This allows for the calculation of the minimum number of bone elements based on the most frequent zone per element, taking into consideration the side (right, left, or axial). The minimum number of elements is an estimate of the total amount of elements that are

represented in an assemblage based on the survival of certain parts of the bone, in this case the eight bone zones (Reitz and Wing 2008, 226). The number of identified specimens was calculated for each element. The number of identifiable specimens is a basic count where each bone and tooth are recorded individually, a total count was given for each element which were then also sided (axial, right, or left). NISP has its advantages, for example it is an additive calculation undertaken while identifications are done, as well as its disadvantages for example it is affected by taphonomic factors and fragmentation (Lyman 2008, 28–9). The minimum number of individuals was also calculated, based on the overall most frequent element (Serjeantson 1996, 200). This is a method of quantification that produces results of the least possible number of animals present in a faunal assemblage. As an analytical product, these estimates only represent a proportion of the animals which would have been at the site as not would have made it into the assemblage (Reitz and Wing 2008, 206). When compared to NISP, MNI has the advantage of not being affected by fragmentation, however it also has its disadvantages such as overexaggerating the importance of species with low NISP counts (Lyman 2008, 43, 46).

The recording methodology also allows for the surviving proportions of the bones to be calculated consistently and the degree of fragmentation to be quantified (Serjeantson 1996, 195). This is undertaken by summing up the number of zones present for each bone from which the results are calculated as eighths of a bone, 12.5% indicating one zone is present and 100% representing all eight zones or the complete bone. Not only does the uniformity of the eight zones allow for the degree of fragmentation to be calculated, but it also records which area of the bone is present. As an example, zone one represents the medial half of the proximal epiphysis. The frequency of each individual bone zone, survival rates of each element, and the quantities of bones in skeletal areas were also calculated for each species. Total counts and weights were taken for the contents of Box 51 as discussed previously, which provides the estimated ratio of recordable to unrecordable elements. Estimated meat weights for the main domesticates, cattle, sheep, and pig, were calculated. This calculation can be problematic as it can be impacted by the sex, breed, and age of an animal (McCormick and Murray 2007, 41). The estimates for the dressed-out meat weights of the three domesticates were estimated ‘assuming a live animal weight of 450kg for cattle (Legge 1981, 99), 23kg for sheep (Boyd *et al.* 1964, 145), and 80kg for pig ((van Wijngaarden-Bakker 1986, 71), with a dressing-out weight of 50% for cattle and sheep, and 80% for pig’ (McCormick and Murray 2007, 147).

Ageing

Tooth wear analysis is one method of determining the age of an animal. Tooth wear stages (TWS) were recorded following various methodologies appropriate to species. Grant (1982, 92, 94) was used for cattle and pig teeth, both *in situ* and loose mandibular teeth. The upper surface of a tooth is covered in enamel after eruption, and over time this surface begins to wear and leave patterns suitable for analysis (*ibid.* 91). The results from the analysis of tooth wear stages were then assigned to mandibular wear stages (MWS) based on those of O'Connor (1988 and 2003) with age stages ranging from neonatal to elderly. For sheep, tooth wear stages were recorded for both *in situ* and loose dP_4, P_4, M_1, M_2, and M_3 teeth following (Payne 1973, 1987). Tooth eruption stages for horse, dog, and cat were recorded following (Silver 1969, 257, 265–6). The stages of epiphyseal fusion for all domesticates was recorded and ranged from unfused, fusing, to fused. The fusion of the proximal and distal epiphyses differs between species and element. From these recorded stages, the age of fusion for cattle, sheep, pig, horse, and dog were analysed following Silver (1969) and results placed into the fusion categories of Reitz and Wing (2008, 72). The age of fusion for cat was analysed following the methods of Habermehl (1961) and Smith (1969). For the ageing of bird

Table 4.1: List of measurements and standard used for log scaling analysis follow Thomas *et al.* (2013).

Element	Measurement	Cattle	Sheep	Pig
Humerus	GL	301.0	120.2	166.0
	BT[a]	75.5	23.7	38.7
Radius	GL	265.0	129.8	–
	Bd	72.2	23.8	–
Femur	GL	362.0	147.0	186.5
	DC/Dp	46.5	16.6	–
	Bd	103.0	30.8	42.1
Tibia	GL	337.0	178.0	169
	Bd	63.9	21.3	27.5
	Dd	49.7	16.8	24.5
Astragalus	GLl	63.8	23.8	37.9
	Bd	44.9	15.8	22.8
	Dl	35.3	13.5	–
Calcaneum	GL	138.2	48.3	68.8
Metacarpal[b]	GL	185.0	109.6	65.3
	SD	36.6	11.9	–
	Bp	–	–	14.1
	Bd	64.2	20.8	–
Metatarsal[c]	GL	216.0	119.9	70.0
	SD/SC	31.5	9.6	–
	Bp	–	–	14.0
	Bd	59.2	20.1	–

Key

[a] Bd for pigs.

[b] Metacarpal IV for pigs.

[c] Metatarsal III for pigs.

bones (Sadler (1991), Baumel *et al.* (1993), and Serjeantson (1998, 2009) were consulted.

Biometry

Measurements were taken following the methodology of von den Driesch (1976), with abbreviations presented in Table A1. The stature of the domesticates was estimated from this metrical data following various methods. Estimated withers heights (EWH) for cattle, sheep, pig, and horse were calculated by using the multiplication factors of Fock and Matolcsi (quoted in von den Driesch and Boessneck 1974). To further analyse the stature of cattle, sheep, and pig, measurements were compared from the most frequent element, the astragalus. This was done through calculating the count, mean, minimum, maximum, standard deviation (SD), and coefficient of variation (CV). Pearson's coefficient of variation expresses the standard deviation as a percentage of the mean and is used to detect variation between measurements and samples (CV=SD x 100/mean) (Payne and Bull 1987, 29). Length and breadth measurements of the third permanent mandibular molar (M_3) for cattle and pig were also compared to investigate variation throughout the assemblage, and unlike postcranial bones any changes in tooth measurements would be 'highly constrained by genetics rather than environment' (O'Connor 2020, 67). To further analyse the change in size and shape of the three main domesticates throughout time at Caherconnell, the log ratio method was used. This involves 'converting all measurements to base-10 log-arithms by relativising each against a standard' (Thomas *et al.* 2013, 3311). The standards chosen were from Thomas *et al.* (2013), the Chillingham bull (University of Leicester reference collection R625), the Soay ewe (University of Leicester reference collection R159), and the Feral Australian sow (described in (Legge 2009)) (Table 4.1). As Thomas *et al* (2013, 3311), note 'a positive value indicates that the archaeological specimen is larger than the standard, a negative value that it is smaller, while zero indicates that the standard and archaeological specimens are identically sized.' (Thomas *et al.* 2013, 3311). To determine the statistical significance in changes throughout this metrical data over time, non-parametric Mann-Whitney U-tests were undertaken, which demonstrated little statistical difference throughout the data. This also demonstrated that the data was not normally distributed and therefore the undertaking or *t*-tests was not possible.

The estimated withers heights of dogs were calculated in two ways. The first method uses multiplication factors to estimate the withers heights from the total length of long bones, namely the humerus, radius, ulna, femur, and tibia (Harcourt 1974, 154). As this method uses greatest length measurements, it requires the complete long bone to be present. The second method, developed by Clark (1995), involves a formula to determine the estimated withers

heights from metapodial greatest length measurements. Estimated withers height calculations was first devised by Koudelka (1885) and involved a multiplying factor using the GL of long bones, these factors were later updated by Harcourt (1974) (Table A5.61) (Grieve 2012, 82). Clark (1995) developed a similar method where the estimated withers heights are estimated from GL measurements, taken from metapodials (Table A5.62). The estimated shoulder heights for dog were then compared to those of modern dog breeds following the data collected by Grieve (2012). Limb bone comparisons using greatest length (GL) and greatest breadth of the distal end (Bd), the slenderness index (SI) of certain long bones, and other bone and tooth measurements were also compared to the metrical data of the modern breeds. A classification by Hasebe (1952) that groups dogs into size categories, ranging from small to large, was used to investigate the size of dogs at Caherconnell.

Sexing

The biometrical data for cattle metacarpals was used to sex mature individuals, where the distal breadth is plotted and compared with the slenderness index, calculated as SI = SD/GL x 100 (McCormick 1992, 205). A further method was used, following the criteria of McCormick (1997), which states is the distal breadth of the metacarpal is less than 56mm the individual is female, and male if greater than 57.1mm. Pig canines, both mandibular and maxillary, were analysed to distinguish between boars and sows based on their morphological characteristics (Schmid 1972, 81). Certain species have elements which are sexually dimorphic, such as the dog baculum, the red deer antlers, or domestic fowl spurs and medullary bones, and where these were present they were recorded and noted for sexing information.

Bone modifications

Various bone modifications were recorded throughout the analysis, including the preservation of the faunal material, butchery marks, burning, gnawing marks, and pathologies. The bone preservation was recorded throughout the analysis as good, moderate, or poor. For evidence of butchery, the type of mark (e.g. chop or cutmarks) was recorded and a note was made if multiple modifications were present. From this data, butchery patterns can be analysed, to identify practices such as skinning or disarticulation, and the results can be investigated to propose what the animal and the specific butchered bone was used for. Levels of burning were recorded as scorched, charred, and calcined. These different levels can occur because of the bones size and density, the intensity of the fire, and duration of burning (Reitz and Wing 2008, 132). Burnt bone can be a result various activities, such as roasting or the disposal of waste however it is

difficult to conclude the intention of burning the material (*ibid.*). Gnawing was recorded based on the species which created the marks, including canids, cat, or rodent, as each create distinguishable marks such as punctures or pitting (Binford 1981, 44). Gnawing marks indicate the presence of certain animals as well as certain human activities, for example dogs in the settlement with access to waste left behind by the occupants. The identification and interpretation of pathologies was undertaken by following various sources and consulting previous research, including Baker and Brothwell (1980), Bartosiewicz (2008), Craig *et al.* (2016), Dobney and Ervynck (1998) O'Connor (2008), García-González *et al.* (2019), Groot (2005), Holmes *et al.* (2021), Huch *et al.* (1997), Kierdorf *et al.* (2009), Madgwick *et al.* (2013) Rassadnikov (2021), Roberts and Manchester (1995) Ross *et al.* (1945), Thomas *et al.* (2021), and Towle and Irish (2020).

Chapter 5
Presentation of Results: Domestic Mammals

5.1 Introduction

This chapter outlines the results of the zooarchaeological analysis in relation to the domestic species cattle, sheep, pig, horse, dog, and cat. The discussion of domestic fowl will be included in the following chapter with the remaining bird species. The results from each analysis will be discussed in sequence: quantification, age at death, biometry, and sexing. These results are separated into the early medieval and late medieval results, the former comprising of material from Phase 4 (late 10th/early 11th century) and Phase 5 (late 10th/early 11th century), and the latter from Phase 6 (11th–14th century) and Phase 7 (15th–16th century). The final section involves further observations from analysis: estimated weights of cattle, sheep, and pig, taphonomic processes such as butchery, burning, and gnawing, pathology, and the uncountable taphonomy.

5.2 Assemblage details

The faunal remains from Caherconnell display high levels of preservation in a favourable alkaline soil environment. Over 99% of the material from all four phases of activity was well preserved, and less than 1% displaying poor preservation. The assemblage is comprised of 51 boxes (roughly 60L: H33 x W40 x L60cm) of disarticulated bones from various contexts and phases of activity (Table A5.1). This represents a total of 40,830 recordable bones, with total counts ranging 296–1253 per box (Table A5.2). The bones were recovered from the four phases of human activity, the first two (Phases 4 and 5) dating to the early medieval period, while Phases 6 and 7 date to the later medieval period. A total of 17,582 bones (9927 bones, 4133 mandibular teeth, 3522 maxillary teeth) were recovered from Phase 4, with 12103 (6183 bones, 3300 mandibular teeth, 2620 maxillary teeth) from Phase 5. There are 8997 (4316 bones, 2463 mandibular teeth, 2218 maxillary teeth) from Phase 6, and 2148 (1059 bones, 637 mandibular teeth, 452 maxillary teeth) from Phase 7 (Tables A5.3–A5.6). The majority of material was recovered from occupation layers/deposits, 84% from Phase 4, 77% from Phase 5, 84% from Phase 6, and 74% from Phase 7. The remaining smaller amounts were retrieved from other contexts, for example midden deposits or the occupation layers in house structures. As well as

	Species					
	Cattle	Sheep/Goat	Pig	Horse	Dog	Cat
Phase 4	4936	4601	3212	180	72	75
Phase 5	3140	3471	2280	116	42	67
Phase 6	2836	2465	1721	94	22	29
Phase 7	538	735	296	59	11	5
Total	**11450**	**11272**	**7509**	**449**	**147**	**176**

Table 5.1: Total NISP count for domestic species from Caherconnell.

the high volume of countable elements, there is also a large amount of animal bone which highly fragmented and unidentified. Box 51 can be used as an example to display the size of this assemblage. This contained a total of 5864 fragments, 1082 (18.5%) of which were recordable. The Box 51 bone has a total weight of 25.1kg, of which 15.2kg was identifiable. This example demonstrates that the recordable material is significantly larger in size in comparison to the highly fragmented unrecordable material.

5.3 Quantification

Cattle, sheep, and pig are the three main domesticates, with the remaining domesticates occurring in smaller amounts (Table 5.1). Overall, cattle are the dominant species in the assemblage, which is evident through the MNI counts. Sheep are the second most dominant species, and from the NISP counts they are the dominant species in Phase 5.It should be noted that no post-cranial goat bones were positively identified in the Caherconnell assemblage, only some possible horncore fragments from Phase 4, therefore it can be assumed the majority of caprids in the assemblage are sheep. Pig follow sheep as the third most dominant domesticate. The remaining domesticates, horse, dog, and cat, occur in lower amounts and are present throughout the assemblage.

5.3.1 Early medieval results

Cattle

Cattle remains from Phase 4 have a NISP of 4936 (2412 bones, 1312 mandibular teeth, and 1212 maxillary teeth) and an MNI of 80 (Table A5.7), the most frequent element being the astragalus. Phase 5 cattle have a NISP of 3140 (1384 bones, 1000 mandibular teeth, and 756 maxillary teeth) and an MNI of 43 (Table A5.8), once again the astragalus having the highest

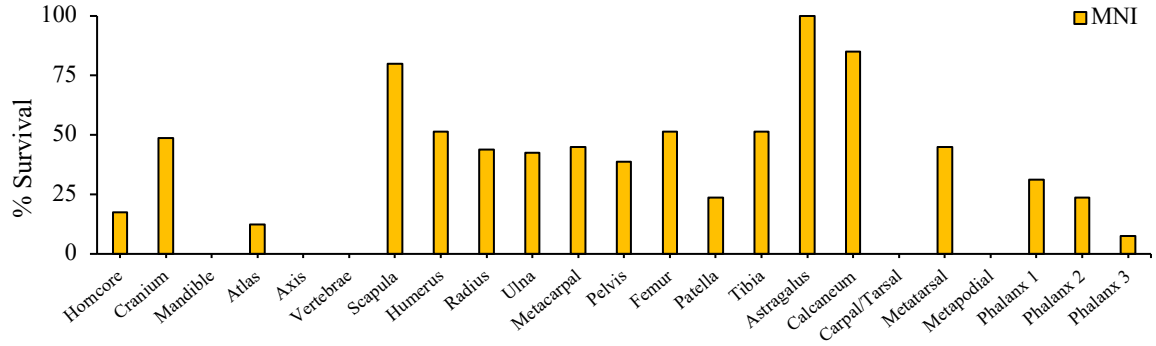


Figure 5.1: Survival of Phase 4 (late 10th/early 11th century) cattle bone from Caherconnell.

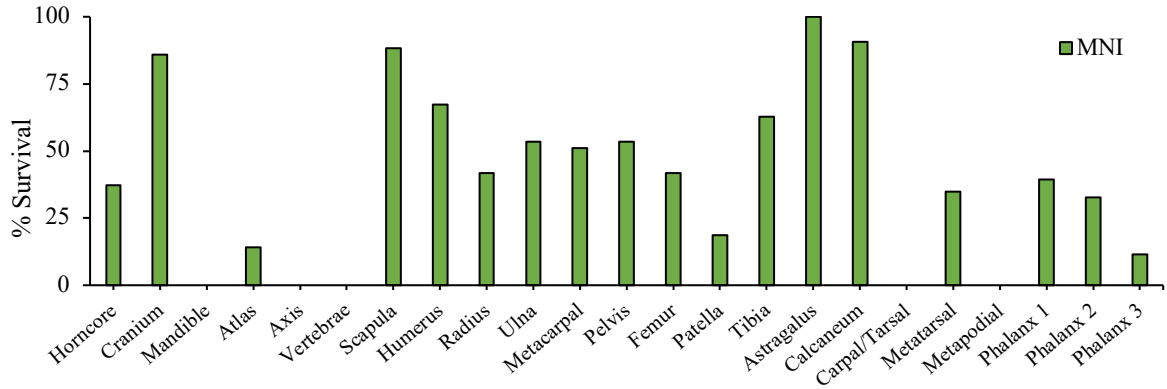


Figure 5.2: Survival of Phase 5 (late 10th/early 11th century) cattle bone from Caherconnell.

MNE. Cattle are the most dominant species throughout the assemblage, which is displayed in the total MNI%, 39.8% in Phase 4 and 32.8% in Phase 5 (Table A5.31). All body parts of cattle, including peripheral non-meat bearing bones, from these phases are present in the assemblage, which indicates the cattle were slaughtered on-site. The rate of survival for each element is calculated in relation to the MNI (Figures 5.1 and 5.2). As discussed previously, this is undertaken by calculating the MNE for each element and displaying it as a percentage of the highest MNE, or the MNI. Bones that are more robust have a higher chance of survival in comparison to those that are fragile or porous, such as the remains of younger specimens or unfused bones (Lyman 1994, 252, 288). Small elements which are structurally dense have survived in high amounts, for example the first phalanges have a survival rate of 31.3% from Phase 4 and 39.5% from Phase 5. The astragalus, one of the larger tarsal bones, has the highest survival rate for both phases, with the calcaneum not far behind with 85% from Phase 4 and 90.7% from Phase 5. Similarly to phalanges, the high survival rate for these tarsal bones is likely due to the fact they are structurally dense (*ibid.* 215). The high occurrence of the meat-bearing hind-leg bones is already evident through the survival of the long bones. It is possible that the tarsals are producing a higher survival rate as a result of discard after dismemberment instead of being butchered further and exploited for meat. The high amount of cattle scapula,

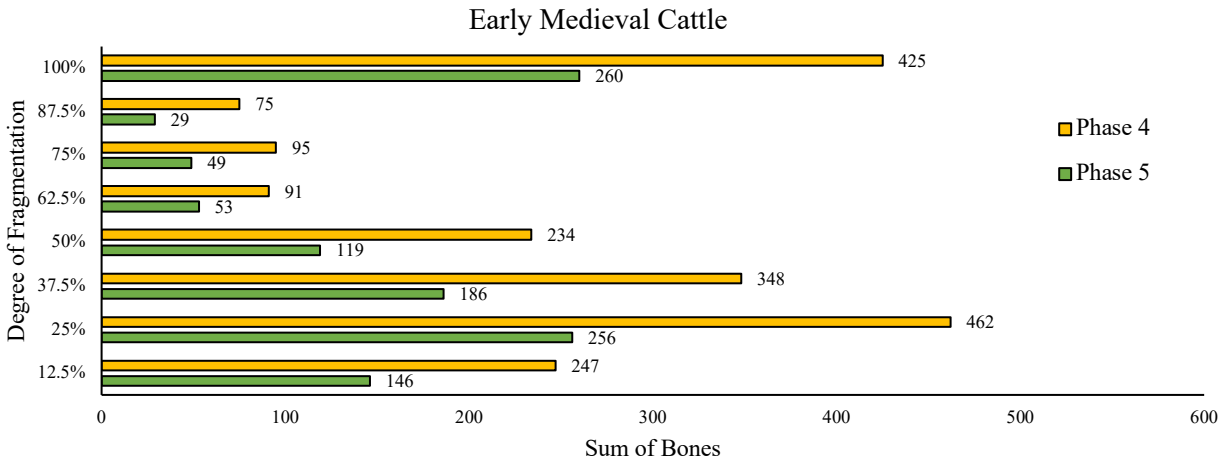


Figure 5.3: Fragmentation of Phase 4 and 5 cattle bones from Caherconnell Cashel.

with a rate of 80% from Phase 4 and 88.4% from Phase 5, is reflective of the primary beef joint of the shoulder. Similarly, the high frequency of fore- and hind-limbs represent other meat-bearing bones, such as the humerus with a rate of 51.3% from Phase 4 and 67.4% from Phase 5. It should also be noted that the scapula and distal end of the humerus are both early fusing which are denser than later fusing bones (Brain 1969, 19; Lyman 1994, 288; Reitz and Wing 2008). Although at a slightly lower survival rate of 38.8% from Phase 4 and 53.5% from Phase 5, the pelvis is representative of another primary beef joint, the rump. The high survival rate of 48.8% from Phase 4, and even higher from Phase 5 with 86% of cranial elements, again suggests that cattle were present and slaughtered on-site. Overall, the early medieval cattle remains from Phase 4 and 5 have produced the same pattern of bone survival rates.

Figure 5.3 displays the degree of fragmentation of the early medieval cattle bones that were zoned. This ranges from 12.5% to 100%, with the former indicating the presence of one zone, while 100% represents the complete bone. The varying level of fragmentation of this is evident, the most frequent are early medieval cattle bones with either two or eight zones

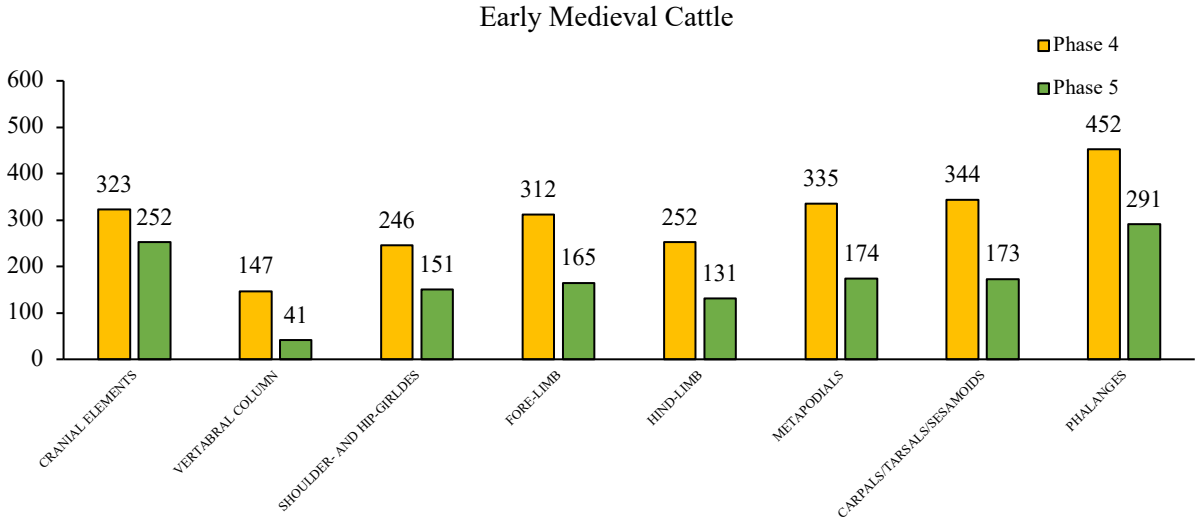


Figure 5.4: Bone elements present in early medieval Phase 4 and 5 in cattle at Caherconnell Cashel.

surviving. Phase 4 bones produced 462 bones with two zones surviving, and 425 bones with all eight zones present. Phase 5 produced 256 bones with two zones and 260 bones with all eight zones surviving. When this is compared with data of bone zone counts, there is no indication of a certain bone zones favouring survival and dominating the assemblage. Each zone has been recorded in a rather uniform amount, with the lowest count of 895 (zone 8) for Phase 4 and 512 (zone 7) for Phase 5, and the highest count being 1114 (zone 3) for Phase 4 and 631 (zone 2) for Phase 5. Figure 5.4 highlights that all parts of the cattle are present at Caherconnell from within the early medieval Phases 4 and 5. Each element has been put within an anatomical grouping, namely cranial elements, vertebral column, shoulder- and hip-girdles, fore-limb, hind-limb, metapodials, carpals/tarsals/sesamoids, and phalanges. The quantities displayed in this graph are NISP counts. The most common element group is the phalanges. This is not surprising as these elements occur more than others with a total of six phalanges in each foot, two first phalanges, two second phalanges, and two third phalanges. The lowest occurring element category is the vertebral column. This low count may not indicate a low presence of cattle vertebrae as many of those bones were not recorded to species level and instead recorded in size groups such as large mammal vertebrae.

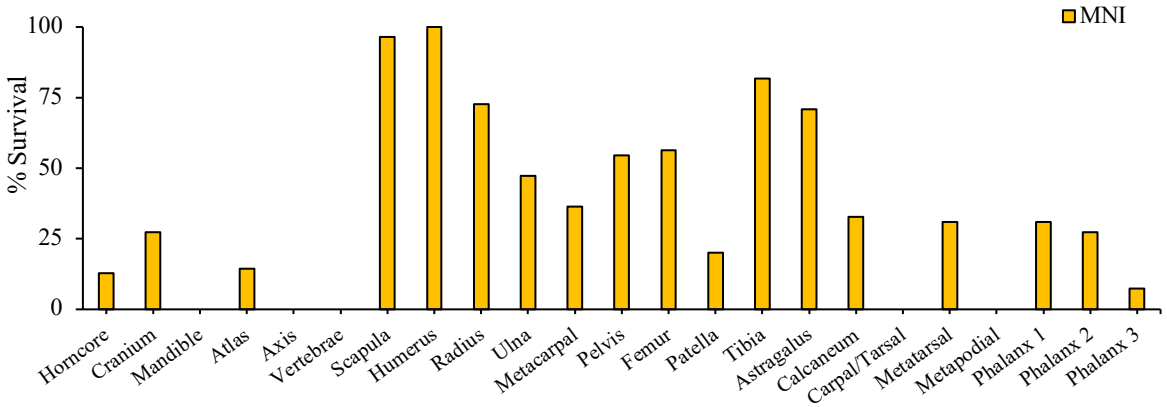


Figure 5.5: Survival of Phase 4 (late 10th/early 11th century) sheep bone from Caherconnell.

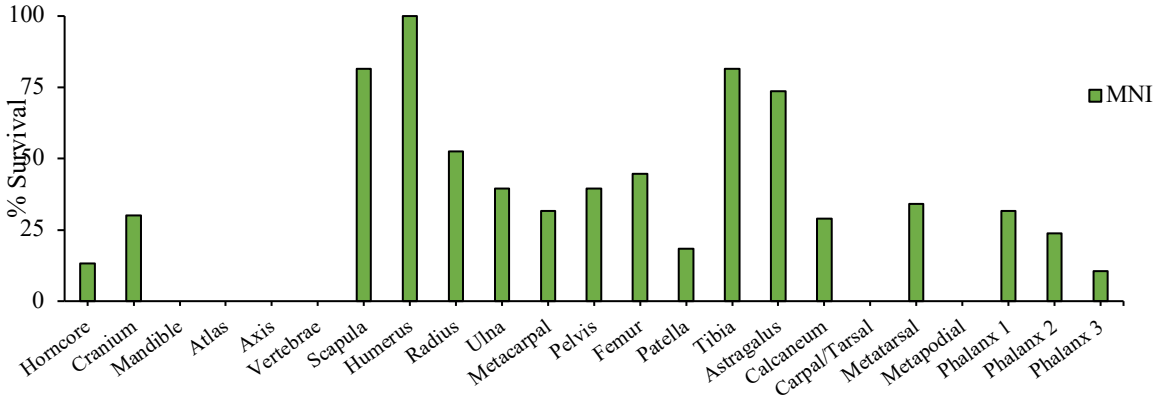


Figure 5.6: Survival of Phase 5 (late 10th/early 11th century) sheep bone from Caherconnell.

Sheep/Goat

Sheep remains from Phase 4 have a NISP of 4601 (1540 bones, 1762 mandibular teeth, and 1299 maxillary teeth) and an MNI of 55 (Table A5.11), the most frequent element being the humerus. Phase 5 sheep have a NISP of 3471 (932 bones, 1469 mandibular teeth, and 1070 maxillary teeth) and an MNI of 38 (Table A5.12), once again the humerus having the highest MNE. Sheep are the second most dominant species throughout the assemblage, which is displayed in the total MNI%, 27.4% in Phase 4 and 29% in Phase 5 (Table A5.31). At least two horn core fragments from Phase 4 were identified as possible goat, and are the only possible goat elements identified throughout the entire assemblage. All body parts of sheep, including peripheral non-meat bearing bones, from these phases are present in the assemblage which indicates the sheep were also slaughtered on-site. The rate of survival for each element is calculated in relation to the MNI (Figures 5.5 and 5.6). The bones of younger individuals, or bones, which are more fragile and porous in general, have a lower chance of survival (Lyman 1994, 252, 288). Small elements which are structurally dense have survived in high amounts, for example the first phalanges have a survival rate of 30.9% from Phase 4 and 31.6% from Phase 5. The astragalus, produced high survival rates of 70.9% from Phase 4 and 73.7% from Phase 5. Similarly to phalanges, the high survival rate for these tarsal bones is likely due to the fact they are structurally dense (*ibid.* 215).The presence of the hind-leg bones is already evident through the high survival rates of these bones and therefore the high levels of the astragalus is reflective of the discarding of certain bones after the dismemberment stage of butchery.

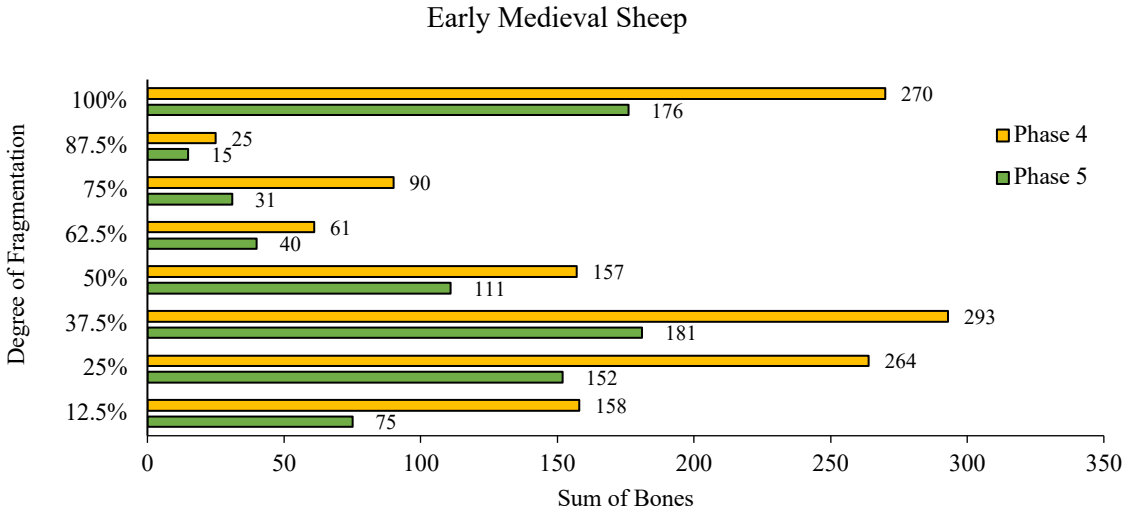


Figure 5.7: Fragmentation of Phase 4 and 5 sheep bones from Caherconnell Cashel.

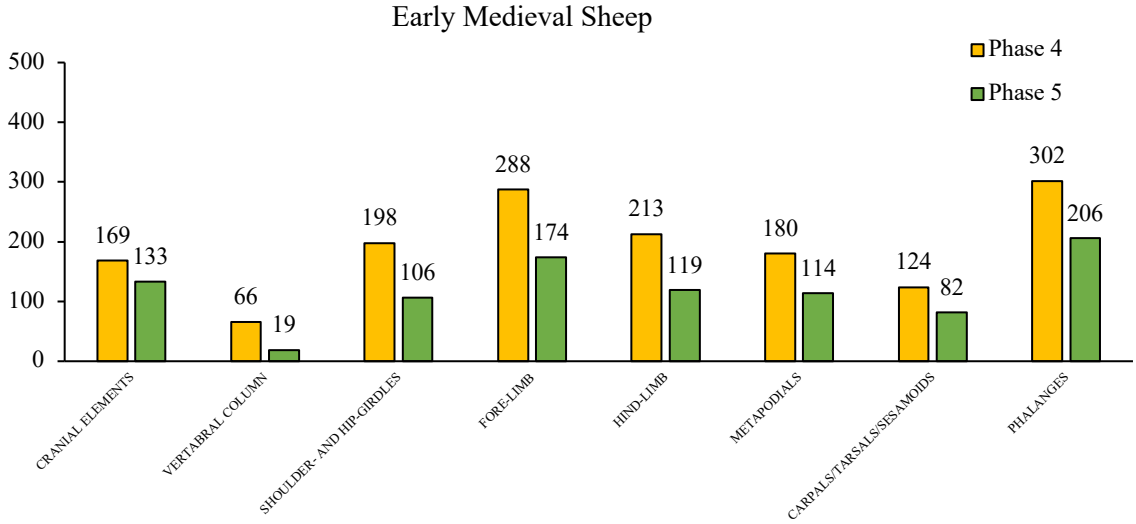


Figure 5.8: Bone elements present in early medieval Phase 4 & 5 in sheep at Caherconnell.

The humerus, one of the fore-limb long bones, has the highest survival rate for both phases, which is expected as it is an early fusing bone which tend to be denser (Brain 1969, 19; Lyman 1994, 288). The other long bones of the fore-limb, the radius and ulna, also have high survival rates, the former with 72.7% from Phase 4 and 52.6% from Phase 5, and the ulna with 47.3% and 39.5%. The hind-leg long bones, the femur and tibia, also have high survival rates. Femur produced 56.4% from Phase 4 and 44.7% from Phase 5, and the tibia produced even higher rates with 81.8% from Phase 4, and 81.6 from Phase 5. The high survival rates of these long bones, as well as the metacarpals and metatarsals, are representative of some of the meat bearing bones. Primary meat-bearing joints are also represented through the scapula and pelvis, both exhibiting high survival rates, particularly the scapula which as an early fusing bone is expected (Brain 1969, 19; Lyman 1994, 288; Reitz and Wing 2008, 72). The scapula have a rate of 96.4% from Phase 4 and 81.6% from Phase 5, while the pelvis are 54.5% from Phase 4 and 39.5% from Phase 5. The presence of bones such as the horncores and cranial elements give further indication to sheep being slaughtered on-site. Overall, the early medieval sheep remains from Phase 4 and 5 have produced the same pattern of bone survival rates.

The degree of fragmentation, ranging from 12.5% to 100%, of the early medieval sheep bones that were zoned is displayed in Figure 5.7. The varying fragmentation of this faunal assemblage is once again evident. The most frequent are early medieval sheep bones, with either three of eight zones surviving. Phase 4 bones produced 293 bones with three zones survival and 270 bones with all eight zones surviving. Phase 5 produced 181 bones with three zones and 176 bones with all eight zones surviving. When compared to the bone zone counts, it is clear that no bone zone favours survival. Each zone has been recorded in a similar amount, with the lowest count of 57 (zone 2) for Phase 4 and 339 (zone 2) for Phase 5, and the highest

count being 723 (zone 5) for Phase 4 and 454 (zone 6) for Phase 5. Figure 5.8 highlights that all parts of the sheep skeleton are present at Caherconnell from within the early medieval Phases of 4 and 5 which may suggest on-site butchery. The quantities displayed in this graph are NISP counts and no further quantification methods were applied. The most common element group is the phalanges, which is not surprising as there is a total of six phalanges in each foot. The lowest occurring element category is the vertebral column, which is likely reflective of the majority of vertebrae not being recorded to species level.

Pig

The remains of this animal from Phase 4 produced a NISP of 3212 (1431 bones, 885 mandibular teeth, 896 maxillary teeth) and an MNI of 45 (Table A5.15), the most frequent element being the scapula. Phase 5 pig have a NISP of 2280 (895 bones, 678 mandibular teeth, 707 maxillary teeth) and an MNI of 33 (Table A5.16), once again the scapula having the highest MNE. Pig are the third most dominant species throughout the assemblage, which is displayed in the total MNI%, 22.4% in Phase 4 and 25.2% in Phase 5 (Table A5.31). All body parts of

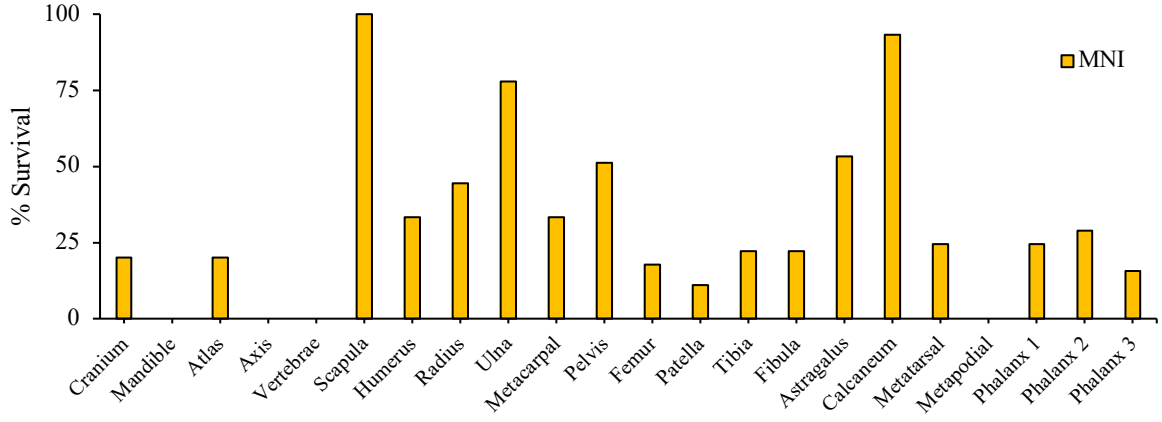


Figure 5.9: Survival of Phase 4 (late 10th/early 11th century) pig bone from Caherconnell.

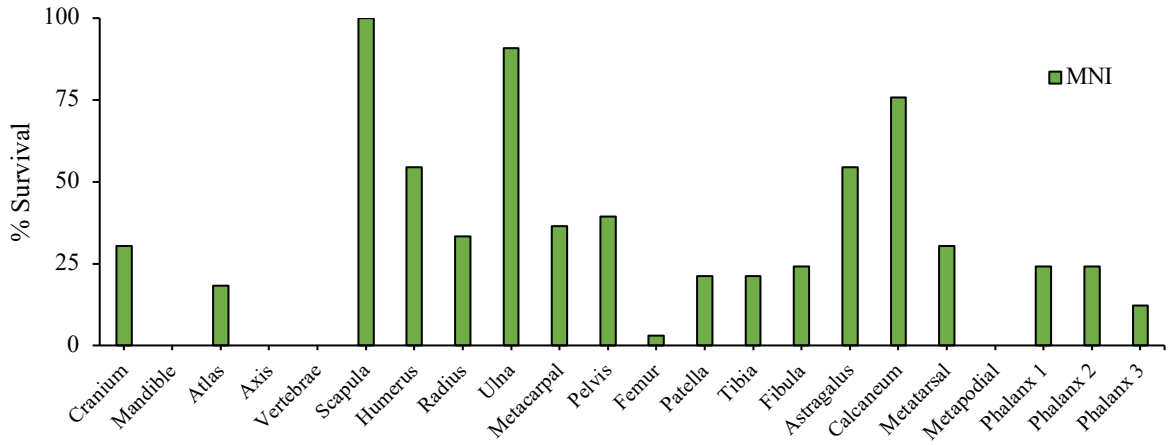


Figure 5.10: Survival of Phase 5 (late 10th/early 11th century) pig bone from Caherconnell.

the pig from these phases, including non-meat bearing bones, are present in the assemblage, which indicates that pig were also slaughtered on-site. The rate of survival for each element is calculated in relation to the MNI (Figures 5.9–5.10). Bones that are more robust have a higher chance of survival in comparison to those that are fragile and porous, such as the remains of younger specimens or unfused bones (Lyman 1994, 252, 288). Smaller elements appear to have high survival rates, for example the second phalanges have a survival rate of 28.9% from Phase 4 and 24.2% from Phase 5. The astragalus and calcaneum, two of the larger tarsal bones, have also produced high survival rates. Phase 4 produced 53.3% for the astragalus and 93.3% for the calcaneum, and Phase 5 produce 54.5% for the astragalus and 75.8% for the calcaneum. Similarly to trends seen for the other domesticates, the high survival rates of these tarsal bones is likely because these elements are structurally dense (*ibid.* 215). The astragalus, one of the

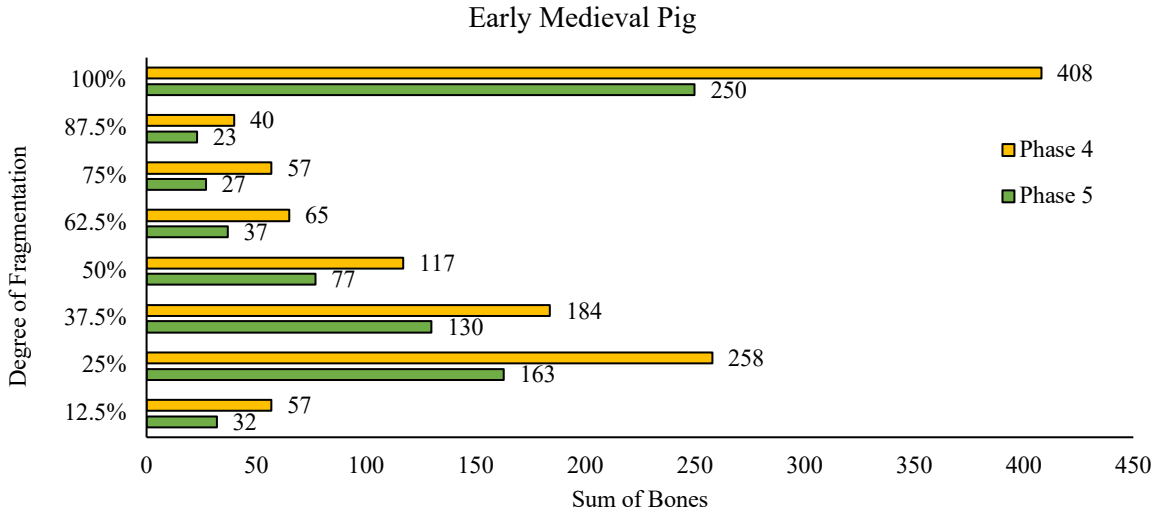


Figure 5.11: Fragmentation of Phase 4 and 5 pig bones from Caherconnell Cashel.

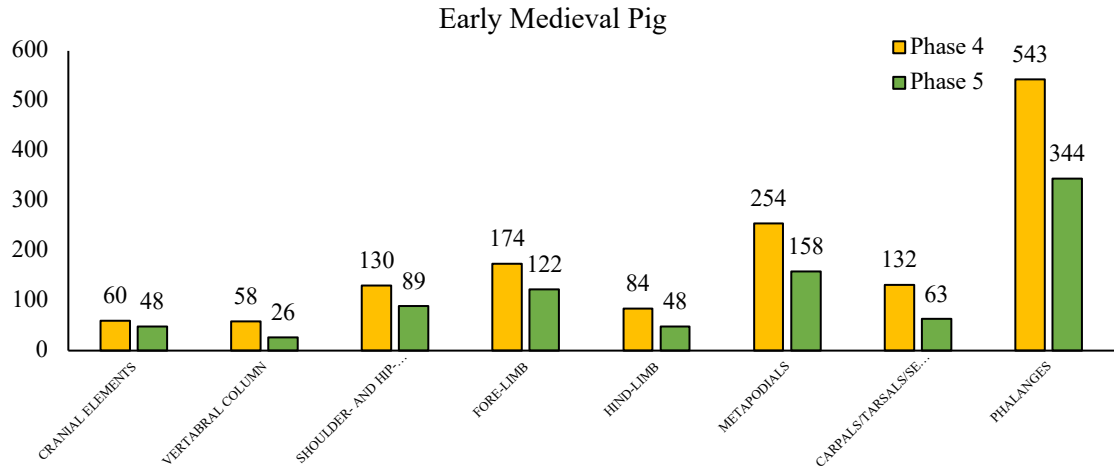


Figure 5.12: Bone elements present in early medieval Phase 4 and 5 in pigs at Caherconnell Cashel.

larger tarsal bones, has the highest survival rate for both phases, with the calcaneum not far behind with 85% from Phase 4 and 90.7% from Phase 5.

As previously mentioned, the scapula has the highest survival rate for both phases. This is because this bone is from one of the primary meat joints and are also an early fusing bone (Brain 1969, 19; Lyman 1994, 288; Reitz and Wing 2008, 72). The high amount of pig pelvis also represents a primary meat joint, with a rate of 51.1% from Phase 4 and 39.4% from Phase 5. The high frequency of the fore-limbs represent some of the meat-bearing bones, with the ulna producing the highest of those rates with 77.8% from Phase 4 and 90.9% from Phase 5. The meat-bearing bones of the hind-limbs are also represented although at lower rates compared to the fore-limb. The survival rate of 20% from Phase 4, and 30.3% from Phase 5 for cranial elements again guests that pig were present and slaughtered on-site. Overall, the early medieval pig remains from Phase 4 and Phase 5 have produced the same pattern of bone survival rates.

Figure 5.11 displays the degree of fragmentation of the early medieval pig bones that were zoned, with 12.5% indicating the presence of one zone and 100% represents the complete bone. The high quality of bone preservation and the varying level of fragmentation of this

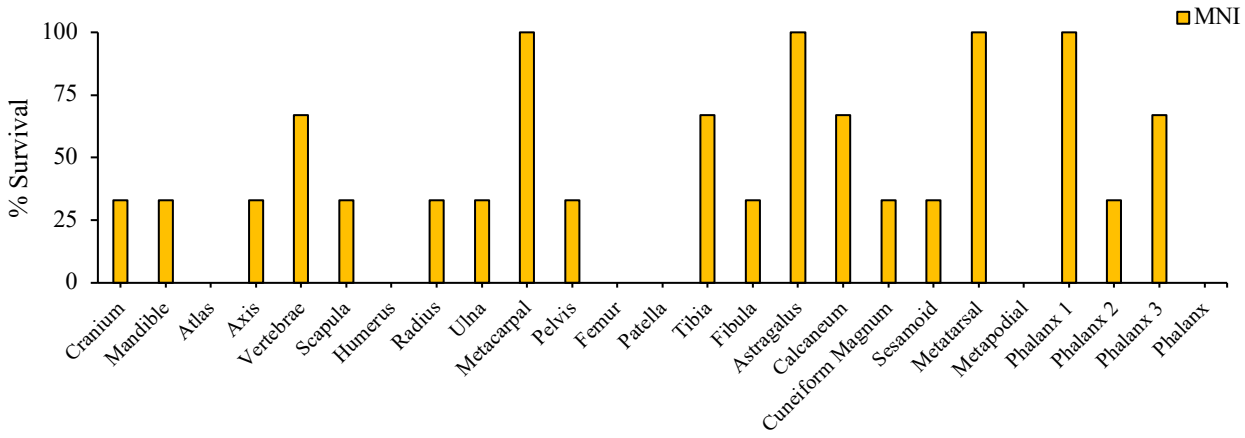


Figure 5.13: Survival of Phase 4 (late 10th/early 11th century) horse bone at Caherconnell.

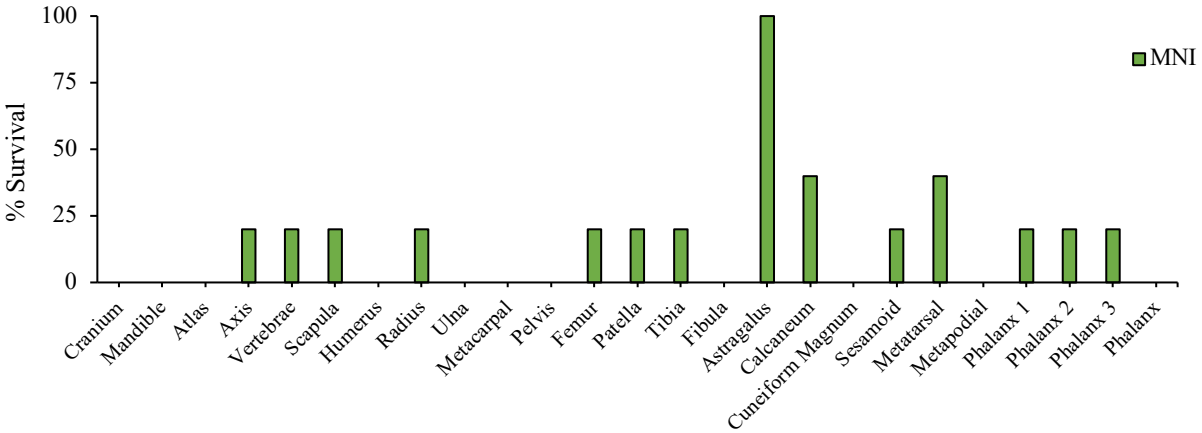


Figure 5.14: Survival of Phase 5 (late 10th/early 11th century) horse bone at Caherconnell.

assemblage is once again evident. The most frequent are early medieval pig bones with either two or eight zones surviving, the same as the cattle bones. Phase 4 bones produced 258 bones with two zones surviving, and 408 ones with all eight zones surviving. Phase 5 produced 163 bones with two zones and 250 bones with all eight zones surviving. When compared to the bone zone counts, there is no pattern of certain bone zones favouring survival. Each zone has been recorded in a rather unform amount, with the lowest count of 663 (zone 6) for Phase 4 and 399 (zone 8) for Phase 5, and the highest count being 787 (zone 3) for Phase 4 and 506 (zone 3) for Phase 5.

Figure 5.12 highlights that all parts of the pig are present at Caherconnell from within early medieval Phases 4 and 5. The quantities displayed in this graph are NISP counts and no further quantification methods were applied. Similarly to cattle, the most common element present is the phalanges. When compared with other domesticates such as cattle and sheep, pig

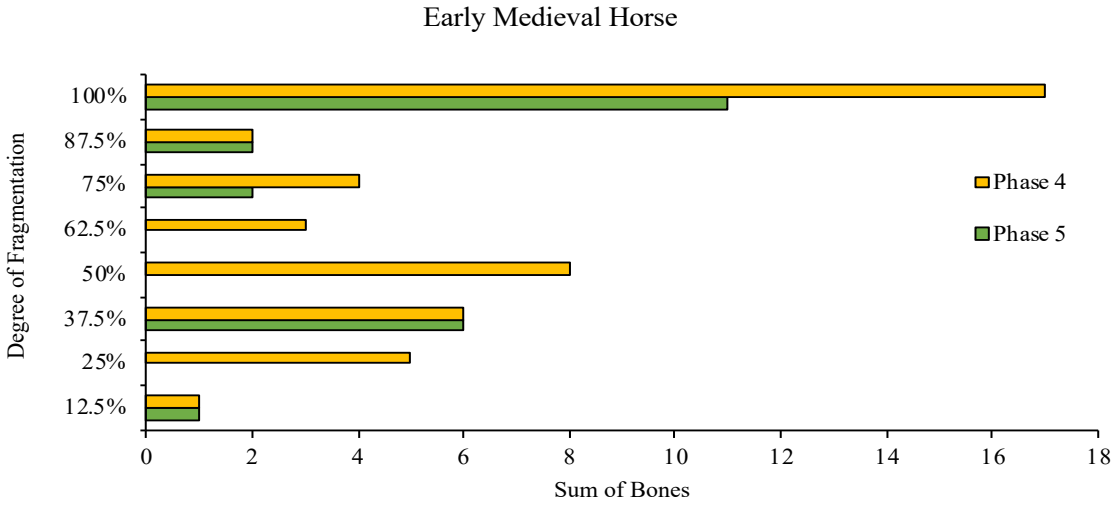


Figure 5.15: Fragmentation of Phase 4 and 5 horse bones at Caherconnell.

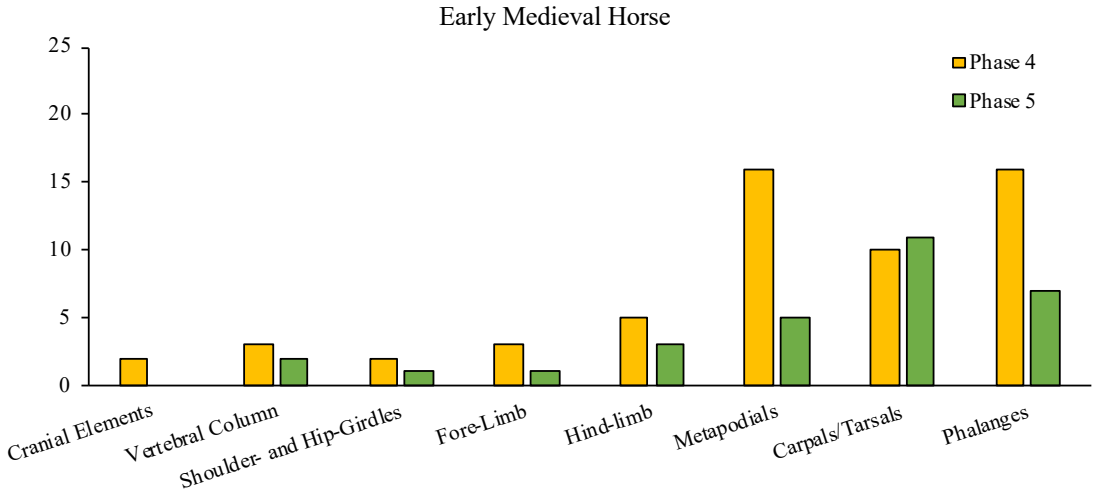


Figure 5.16: Bone elements present in early medieval Phase 4 and 5 horses at Caherconnell.

have an even higher number of phalanges per foot, and therefore it is not surprising that they are not only the most frequent element group, but that pig phalanges occur even more than the phalanges of other animals. The vertebral column is once again the lowest occurring element group, and as discussed before this low count is likely down to the fact that the majority of vertebrae bones were only recorded to size group and not to species level.

Horse

Horse remains from Phase 4 at Caherconnell have a NISP of 180 (57 bones, 61 mandibular teeth, and 62 maxillary teeth) and an MNI of 3, with metacarpal, astragalus, metatarsal, and 1st phalanx the most common elements (Table A5.19). Phase 5 horse at Caherconnell have a NISP of 116 (30 bones, 46 mandibular teeth, and 40 maxillary teeth) and an MNI of 5, with the astragalus the most common element (Table A5.20). Horse are generally the most common animal in medieval faunal assemblages after the three main domesticates . That said, they usually do not exceed 2% of NISP counts, and the sites that usually produce higher amounts are secular settlements (McCormick, Finbar 2007, 92). This is seen at Caherconnell where they are the fourth most dominant species throughout the assemblage, which is displayed in the total MNI%, 1.5% in Phase 4 and 3.8% in Phase 5 (Table A5.31). Not all bone elements of the horse are present during the early medieval period. The rate of survival for each element is calculated

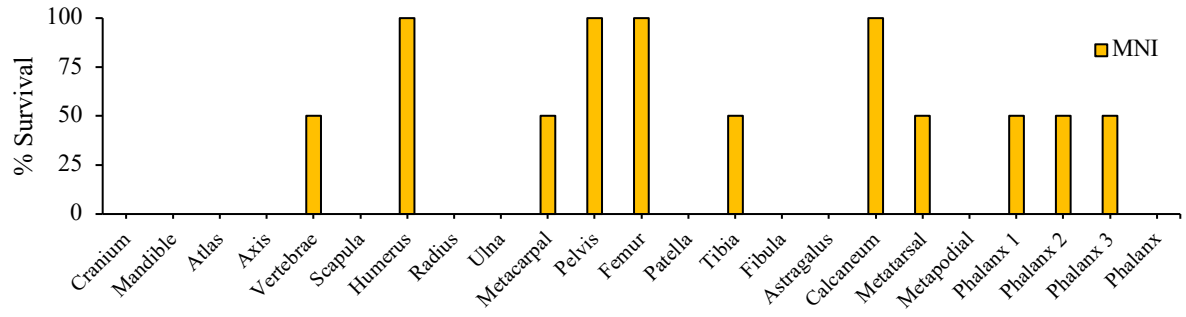


Figure 5.17: Survival of Phase 4 (late 10th/early 11th century) dog bone from Caherconnell.

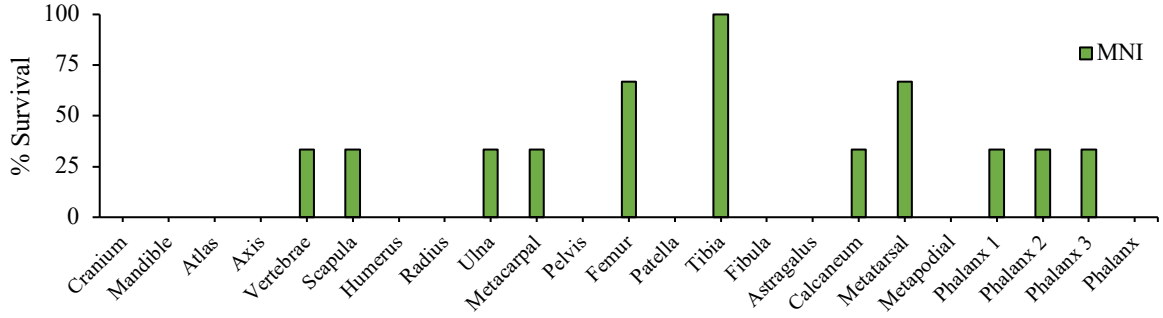


Figure 5.18: Survival of Phase 5 (late 10th/early 11th century) dog bone from Caherconnell.

in relation to the MNI (Figures 5.13 and 5.14). As both phases of activity produced low MNIs, little interpretation can be made.

The presence of certain horse elements does not give an insight into the role horses played at Caherconnell. This will be discussed later when data from other sections is compared. This is further evident through the degree of fragmentation of the surviving horse remains, as the majority are complete with all eight bone zones surviving (Figure 5.15). Figure 5.16 also demonstrates that all parts of the horse skeleton were present within the assemblage. The most common element groups are the metapodials, carpals/tarsals, and phalanges which are expected to occur in high numbers as their structurally dense (Lyman 1994, 215). The frequency displayed are basic NISP counts and no other methods of quantification were used.

Dog

Dog remains from Phase 4 have a NISP of 72 (41 bones, 24 mandibular teeth, and 7 maxillary teeth) and an MNI of 2, with the humerus, pelvis, femur, and calcaneum, the most frequently occurring elements (Table A5.23). Phase 5 dogs have a NISP of 42 (26 bones, 13 mandibular teeth, and 3 maxillary teeth) and an MNI of 3, with the tibia being the most common element (Table A5.24). Similarly to horse, dog occur in lower amounts compared to the three main domesticates, which is displayed in the total MNI%, 1% in Phase 4 and 2.3% in Phase 5 (Table A5.31). Not all bone elements of the dog are present during the early medieval period. The rate of survival for each element is calculated in relation to the MNI (Figures 5.17–5.18). Both phases of activity produced low MNIs for analysis. As discussed previously, more robust bones have a higher chance of survival in comparison to bones of young individuals or those which are more fragile in nature (Lyman 1994, 215). As dog bones are smaller than those of other domesticates, such as cattle, the chance of survival as well as recovery may be lower. As those

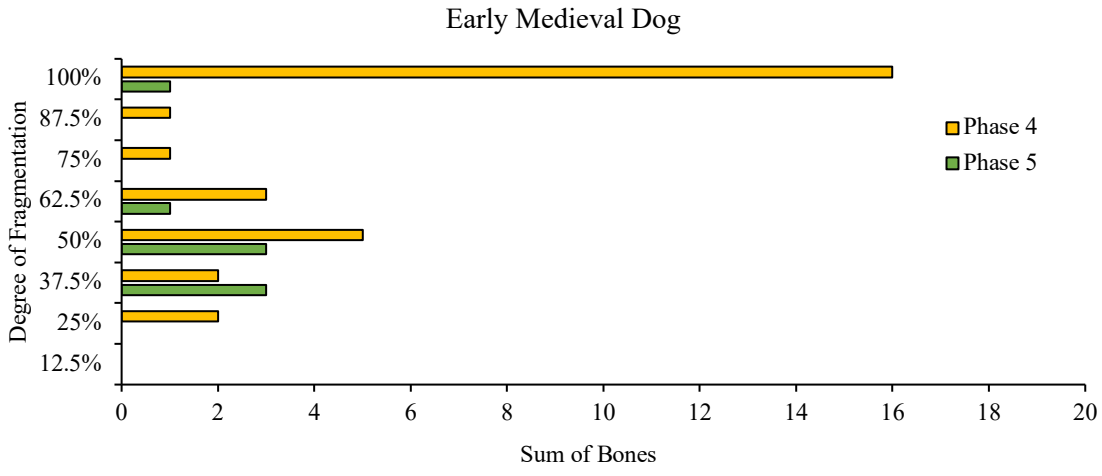


Figure 5.19: Fragmentation of Phases 4 and 5 dog bones from Caherconnell.

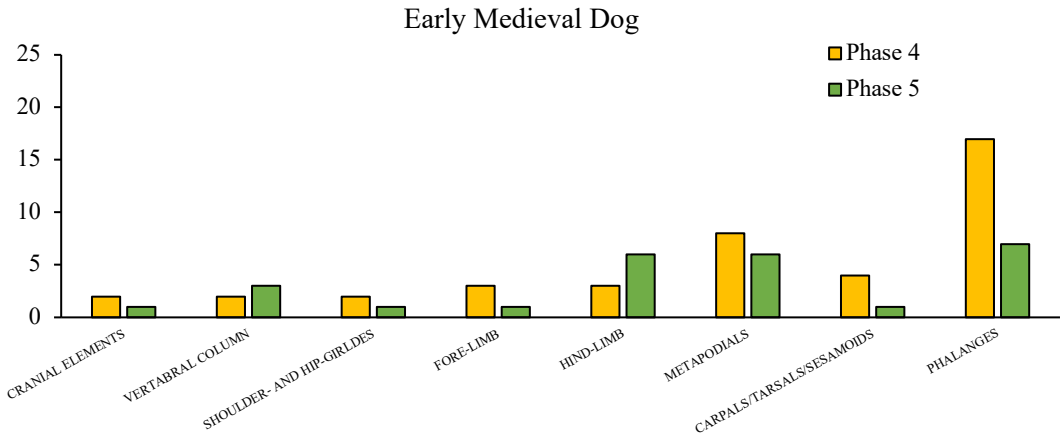


Figure 5.20: Dog bone elements present in early medieval Phases 4 and 5 at Caherconnell.

samples are small, the percentages of survival cannot be interpreted further than noting the element was present and that there was a minimum of two dogs present in Phase 4, and three in Phase 5.

Similar to horses, the presence of certain elements does not necessarily reflect the significance of dogs at Caherconnell. This can be interpreted through other information discussed in later sections, such as biometrical data. This is evident through the degree of fragmentation of the surviving dog bones, particularly from Phase 4. The majority of dog bones from this phase of activity are complete with all eight bone zones surviving (Figure 5.19). Figure 5.20 further highlights that all parts of the dog skeleton are present within the assemblage. These are basic NISP counts and no further methods of quantification were used.

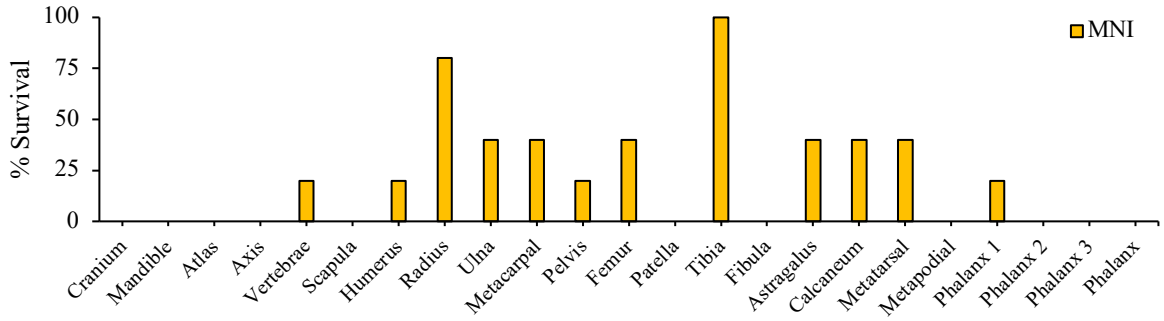


Figure 5.21: Survival of Phase 4 (late 10th/early 11th century) cat bone at Caherconnell.

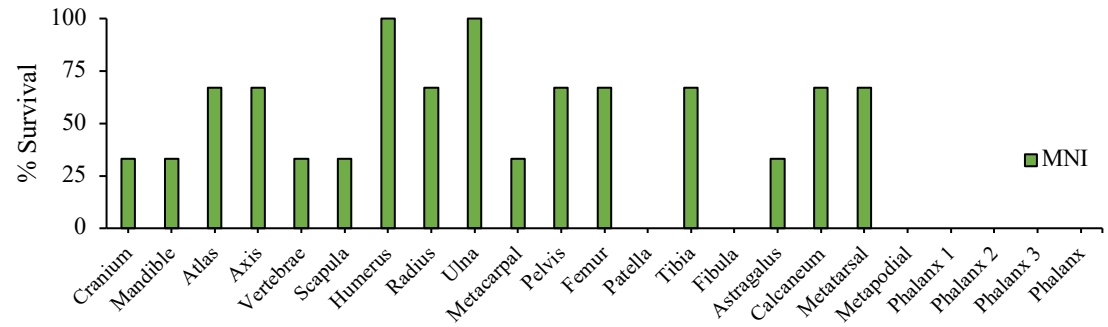


Figure 5.22: Survival of Phase 5 (late 10th/early 11th century) cat bone at Caherconnell.

The most common element group is the phalanges, which is not surprising as there are 12–14 phalanges in each dog foot.

Cat

Cat remains from Phase 4 at Caherconnell have a NISP of 75 (50 bones, 18 mandibular teeth, and 7 maxillary teeth) and an MNI of 5, with the tibia being the most common element (Table A5.27). Phase 5 cat have a NISP of 67 (52 bones, 9 mandibular teeth, and 6 maxillary teeth) and an MNI of 3, with the humerus and ulna the most common elements (Table A5.28). Similarly to horse and dog, cat appear in lower amounts compared to the main domesticates, which is displayed in the total MNI%, 2.5% in Phase 4 and 2.3% in Phase 5 (Table A5.31). Most, but not all, elements of the cat are present during the early medieval period. The rate of survival for each element is calculated in relation to the MNI (Figures 5.21–5.22). As both phases of activity produced low MNIs and so little interpretation can be made.

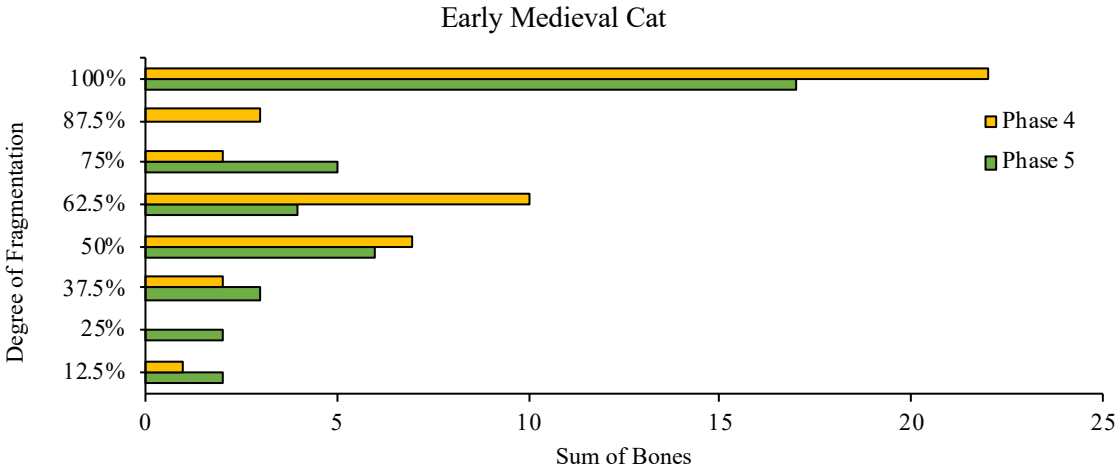


Figure 5.23: Fragmentation of early medieval Phase 4 and 5 cat bones at Caherconnell.

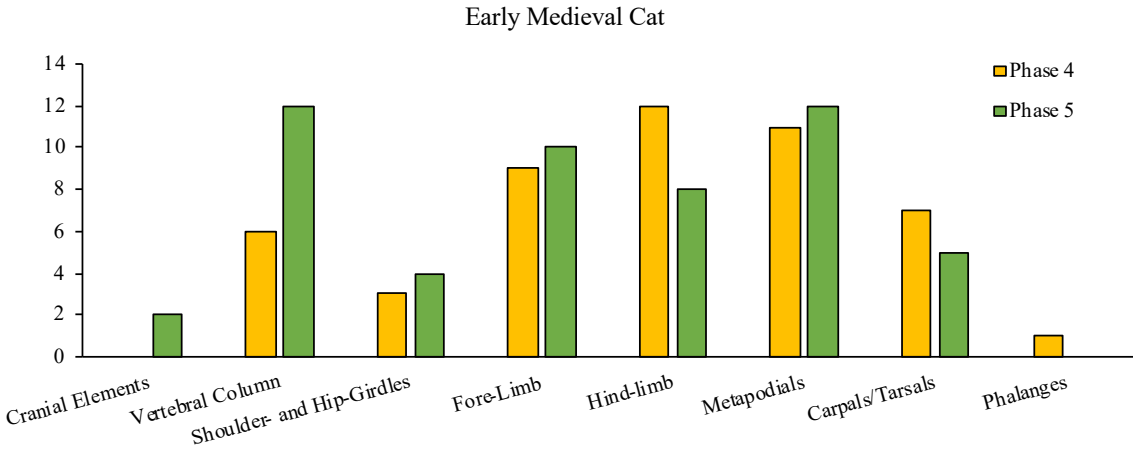


Figure 5.24: Bone elements present in early medieval Phase 4 and 5 cat at Caherconnell.

Similar to horses and dogs, the presence of certain bone elements does not give an insight into the role cats played at Caherconnell. This is further evident through the degree of fragmentation of the surviving cat remains, as the majority of bones are complete with all eight bone zones surviving (Figure 5.23). Figure 5.24 demonstrates that all parts of the cat skeleton were present within the assemblage. The most common elements are the larger cat bones, such as the hind-limb and fore-limb long bones, and the metapodials, as well as the vertebrae, the latter not being surprising given the total amount of vertebrae in a cat skeleton. The quantities displayed here are basic NISP counts and no further methods of quantification were used.

5.2.2 Late medieval results

Cattle

Cattle remains from Phase 6 (11th–14th century) produced a NISP of 2836 (1275 bones, 803 mandibular teeth, and 758 maxillary teeth) and an MNI of 59 (Table A5.9), the most frequent element being the astragalus. Phase 7 (15th–16th century) cattle produced a NISP of 538 (229 bones, 160 mandibular teeth, and 149 maxillary teeth) and an MNI of 9 (Table A5.10), with the

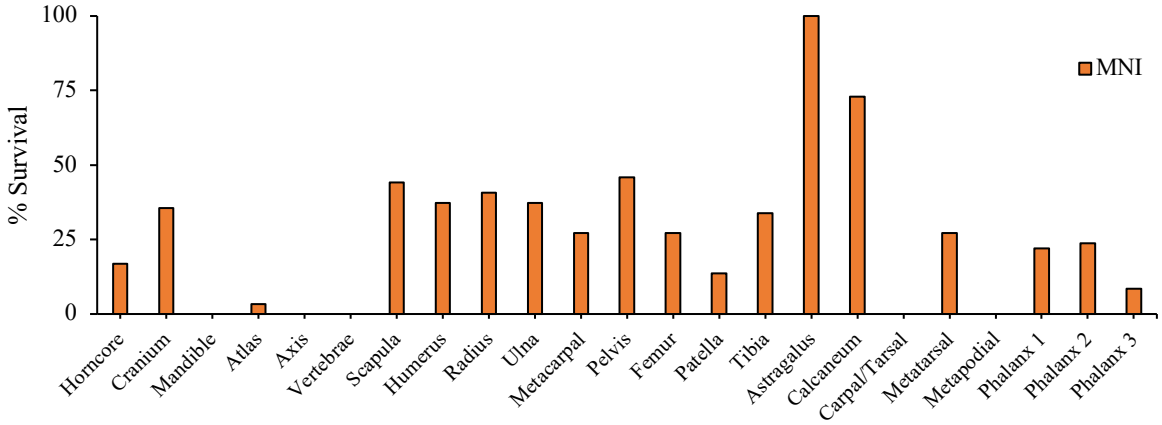


Figure 5.25: Survival rates of Phase 6 (11th–14th century) cattle bone from Caherconnell.

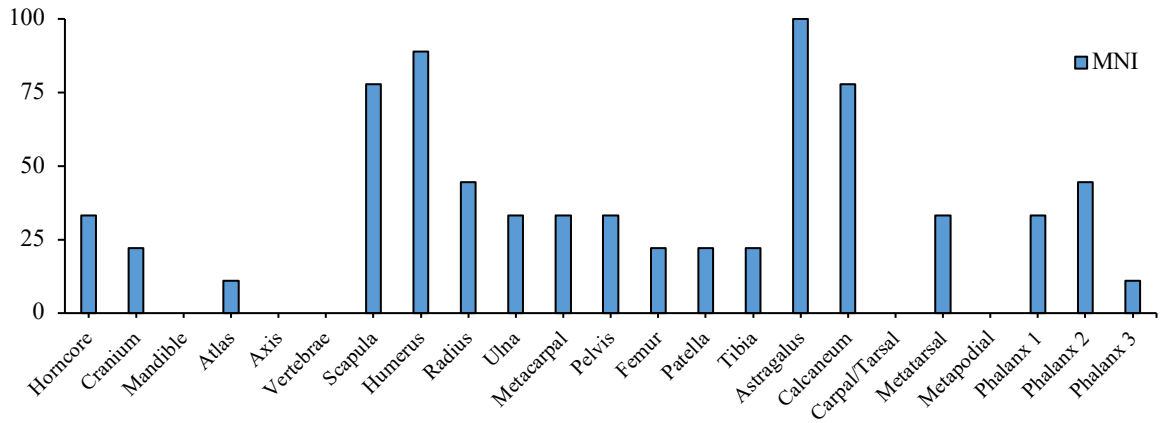


Figure 5.26: Survival rates of Phase 7 (15th–16th century) cattle bone from Caherconnell.

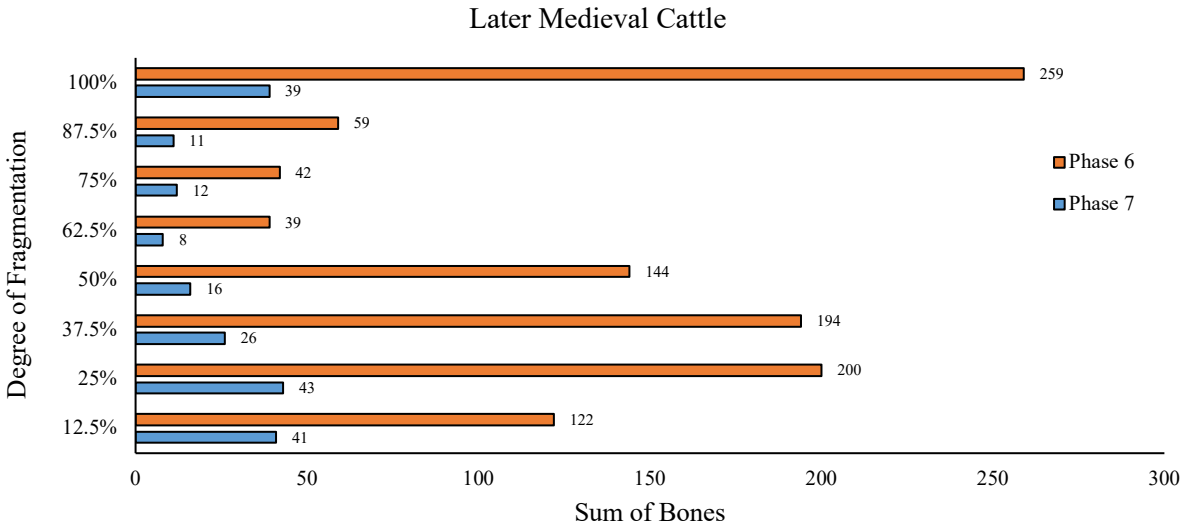


Figure 5.27: Fragmentation of Phase 6 and 7 late medieval cattle bones from Caherconnell.

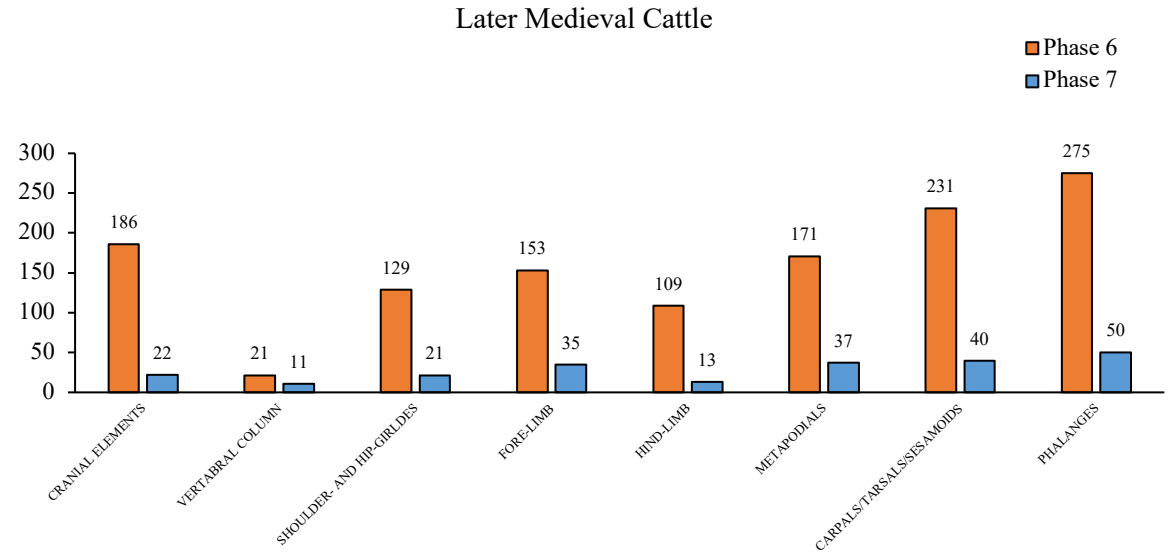


Figure 5.28: Cattle bone elements for late medieval Phase 6 and 7 at Caherconnell.

astragalus again the most common element. The remains from Phase 7 only produced an MNI of 9. As discussed previously, cattle are the most dominant species throughout the assemblage, which is again evident in the total MNI%, 46.1% in Phase 6 and 28.1% in Phase 7 (Table A5.31). All body parts of cattle dating to Phase 6 and Phase 7 were identified within the assemblage, which suggests that cattle were still slaughtered on-site during the late medieval period. The rate of survival for each element is calculated in relation to the MNI (Figure 5.25 and 5.26), using the same process described in the previous section for early medieval cattle. Phase 6 and 7 cattle bones have produced similar survival rates for scapula at 77.8% and humerus at 88.9% in Phase 7 bones. The survival of smaller elements is once again seen from these phases with, for example, the first phalanges represented at 22% in Phase 6 and 33.3%

in Phase 7. The tarsal bones, the astragalus and calcaneum, have a high survival rate similar to the early medieval cattle remains, with the astragalus producing the highest survival rate and the calcaneum with 72.9% from Phase 6 and 77.8% from Phase 7. In contrast to the earlier period, the late medieval cattle bones have a lower survival rate of cranial elements, with 35.6% from Phase 6 and 33.3% from Phase 7. The same overall pattern is present, which indicates that cattle were present and slaughtered on-site.

Figure 5.27 displays the degree of fragmentation of the late medieval cattle bones. Once again, the high level of preservation and varying level of fragmentation of this assemblage is evident. Phase 6 bones with two or eight surviving bones are the most closely related to the early medieval cattle bones. Phase 7 bones produced less of a varying count with the sum of bones ranging 8–43. The probably reflects the low quantity of bones in general from this phase. When the degree of fragmentation is compared to the sum of each bone zone, there is no particular pattern in their survival. Phase 6 produced a count of 504–600, while Phase 7 has a range of 89–106, with both of the lowest counts coming from zone 8 and the highest count from zone 3.

Figure 5.28 provides a good representation of the range of elements and anatomical areas recorded in the late medieval cattle bones. Once again, the counts are basic NISP figures

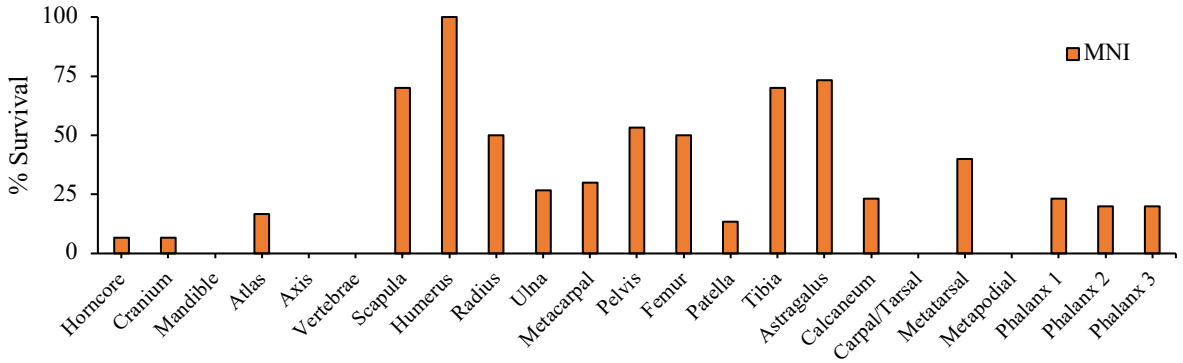


Figure 5.29: Survival of Phase 6 (11th–14th century) sheep bone from Caherconnell.

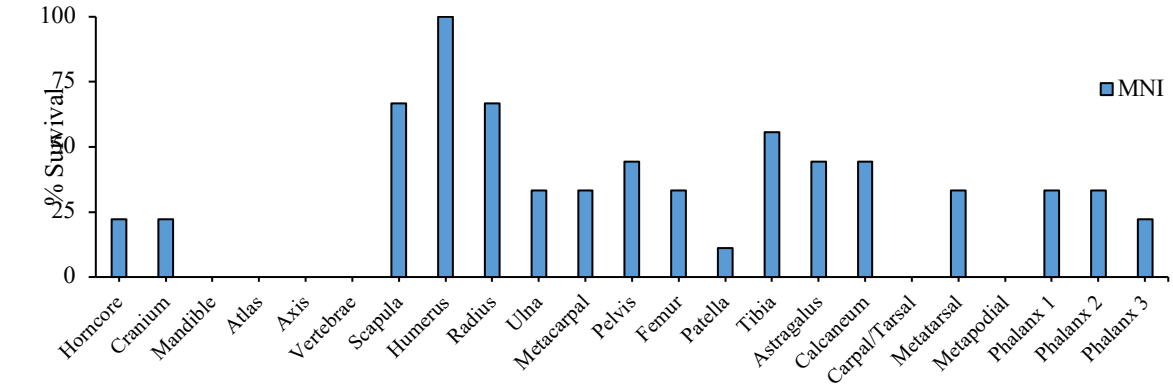


Figure 5.30: Survival of Phase 7 (15th–16th century) sheep bone from Caherconnell.

and no further methods of quantification have been applied. Similarly to the early medieval cattle, all body parts are represented in Phase 6 and 7 bones. The same pattern in the early medieval assemblage is also present here. The highest occurring category of elements is the phalanges, Once again likely due to their general high incidence within the skeleton. The vertebrae is the least frequent category of elements for both late medieval phases, with a particularly low count in Phase 6 when compared to the count of the other categories. This is not indicative of the small frequency of cattle vertebrae as the majority of vertebrae were not recorded to species level.

Sheep

Sheep remains from Phase 6 produced a NISP of 2465 (617 bones, 1027 mandibular teeth, and 821 maxillary teeth) an MNI of 30, the most frequent element being the humerus (Table A5.13). Phase 7 sheep have a NISP of 735 (243 bones, 294 mandibular teeth, and 198 maxillary teeth) and an MNI of 9, with the most frequent element being the humerus (Table A5.14). Similarly to the early medieval material, sheep are the second most dominant species in the late medieval material, which is displayed in the total MNI%, 23.4% in Phase 6 and 28.1% in Phase 7 (Table A5.31). The remains from Phase 7 only produced an MNI of 9. All body parts of sheep dating to Phase 6 and Phase 7 were recorded within the assemblage, which suggests that sheep continued to be slaughtered on-site during the late medieval period. The rate of survival of each element is calculated in relation to the MNI (Figures 5.29 and 5.30), using the same process previously described. Phase 6 and 7 sheep bones have produced similar survival rates for the primary meat joints and meat-bearing bones. As previously stated, the humerus is the highest

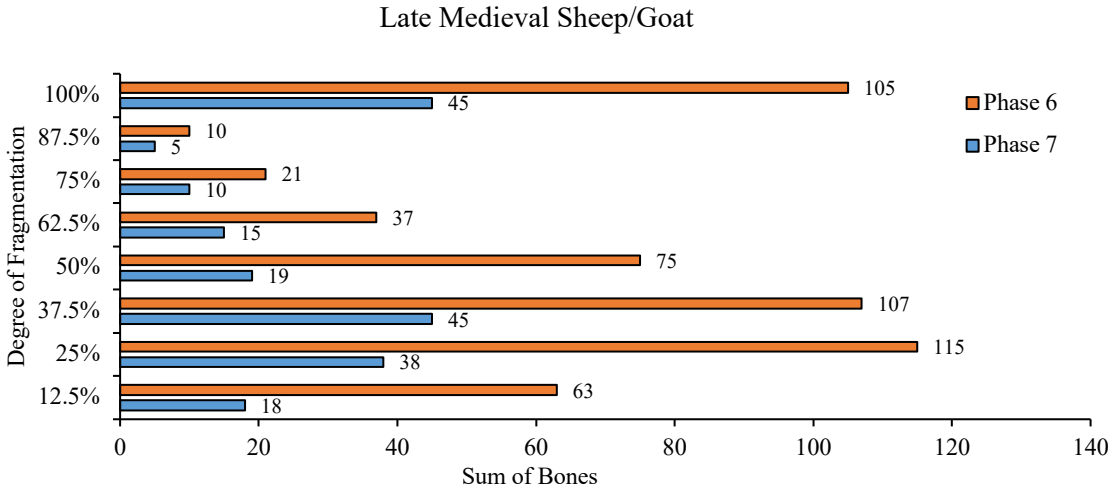


Figure 5.31: Fragmentation of Phases 6 and 7 sheep bones from Caherconnell.

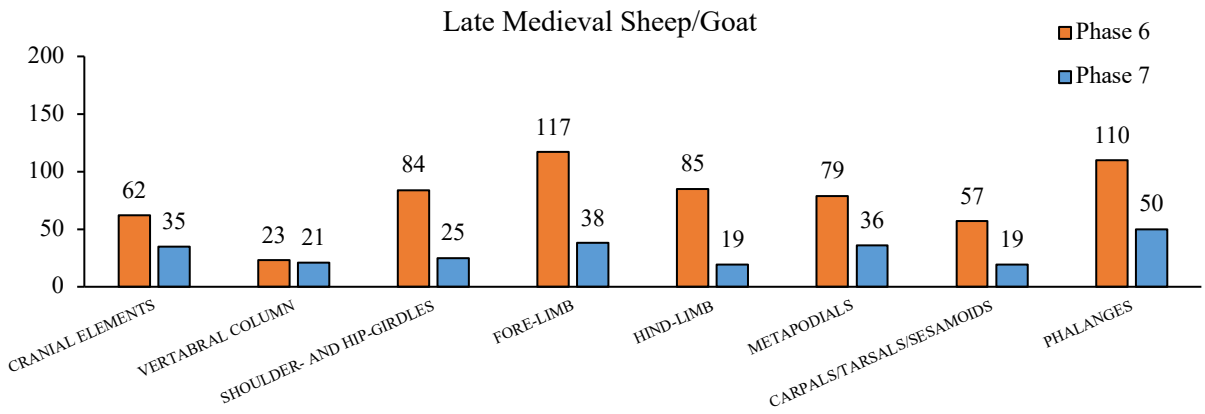


Figure 5.32: Bone elements present in late medieval Phases 6 and 7 in sheep at Caherconnell.

occurring element for the late medieval period. The humerus, along with the other fore-limb long bones, hind-limb long bones, and joint bones have produced high survival rates. The survival of smaller elements is also seen, for example, the first phalanges producing a survival rate of 23.3% from Phase 6 and 33.3% from Phase 7. The astragalus has also once again produced high survival rates, 73.3% from Phase 6 and 44.4% from Phase 7. The survival rates of horncores and cranial elements Phase 6 is lower than that from the early medieval period, both having a rate of 6.7%. Overall, the same pattern is present which indicates that sheep were slaughtered on-site.

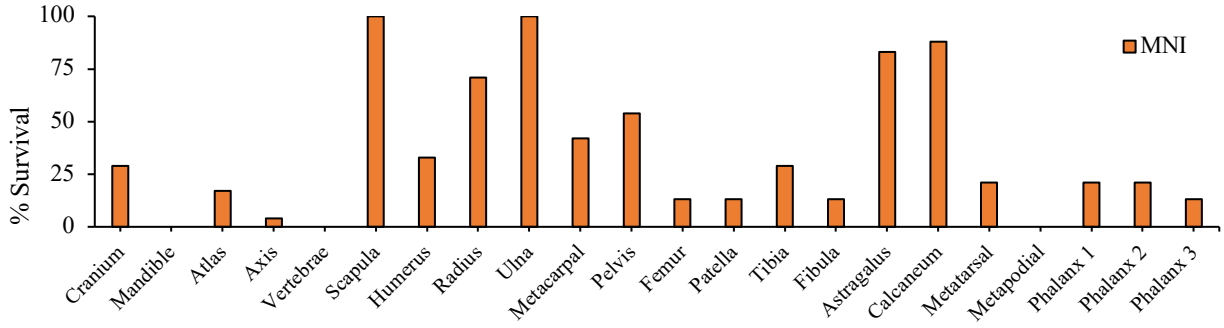


Figure 5.33: Survival of Phase 6 (11th–14th century) pig bone from Caherconnell.

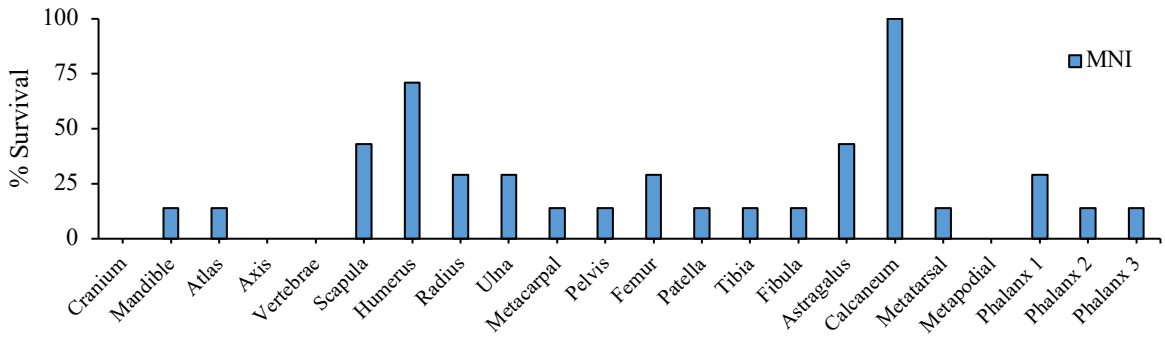


Figure 5.34: Survival of Phase 7 (15th–16th century) pig bone from Caherconnell.

Figure 5.31 displays the degree of fragmentation of the late medieval sheep bones. Once again, the high level of preservation and varying level of fragmentation of this assemblage is evident. Phase 6 bones with two or three zones survive the most, while Phase 7 bones with three or eight zones are most common. When the degree of fragmentation and the sum of each bone zone are compared, there is no particular pattern in their survival. Phase 6 produced a count of 226–290, while Phase 7 has a range of 94–111. Figure 5.32 provides a good representation of the range of elements and anatomical areas in the late medieval sheep bones. Once again the counts displayed in this graph are basic NISP figures and no further methods of quantification have been applied. Similarly to the early medieval sheep, all body parts are represented in Phase 6 and 7 bones. The same pattern in the early medieval assemblage is also present here. As well as the phalanges being close to the highest occurring category as seen in the early medieval results, Phase 6 also produced high counts for the fore-limb bones. The vertebrae is the least frequent category of elements for both late medieval phases, this low occurrence is once again reflective of the majority of vertebrae not being recorded to species level.

Pig

Pig remains from Phase 6 have a NISP of 1721 (619 bones, 526 mandibular teeth, and 576 maxillary teeth) and an MNI of 24 (Table A5.17), the most frequent element being the scapula and the ulna. Phase 7 pigs have a NISP of 296 (111 bones, 110 mandibular teeth, and 75 maxillary teeth) and an MNI of 7 with the most frequent element being the calcaneum (Table A5.18). Similarly to the early medieval material, pig are the third most dominant species in the

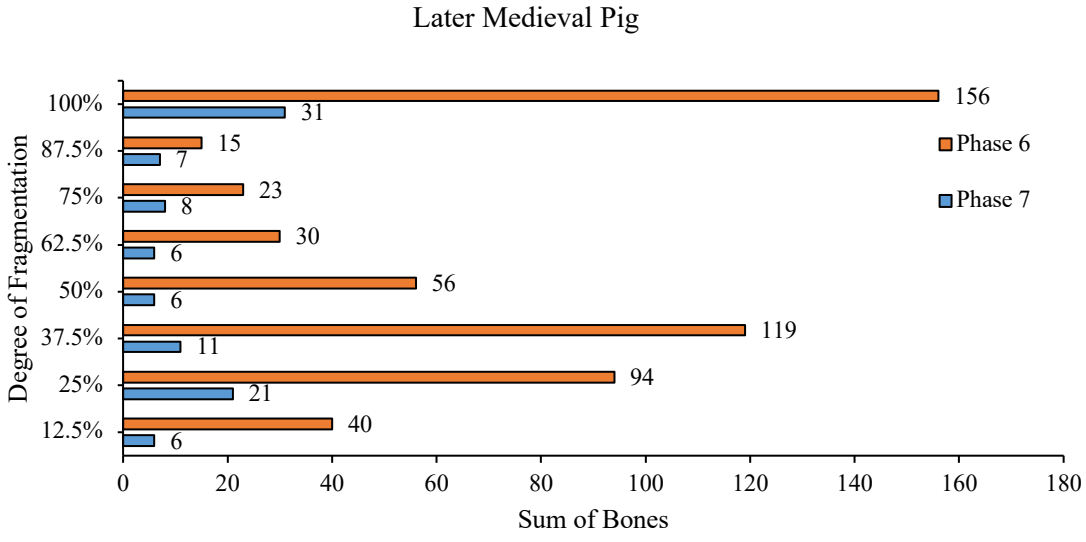


Figure 5.35: Fragmentation of Phases 6 and 7 pig bones from Caherconnell Cashel.

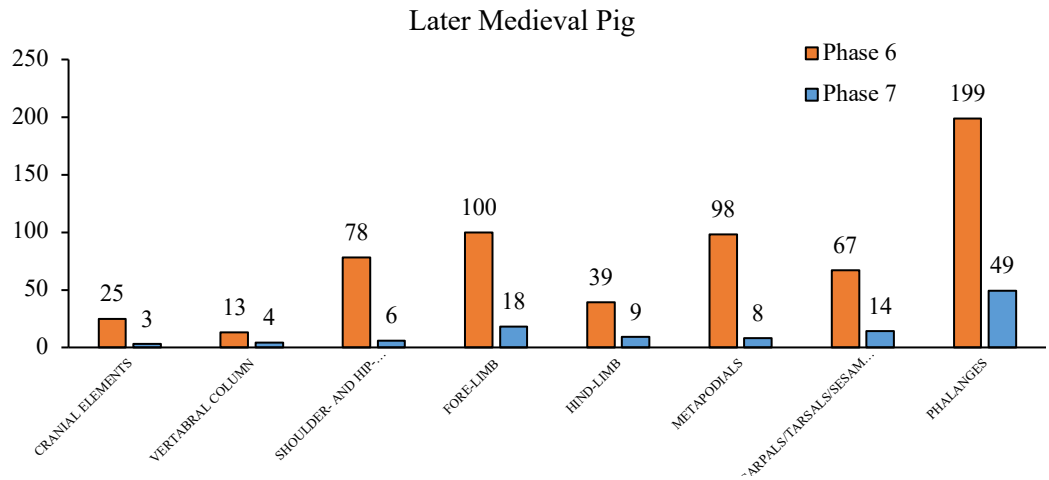


Figure 5.36: Bone elements present in late medieval Phases 6 and 7 at Caherconnell Cashel.

late medieval assemblage, which is evident in the total MNI%, 18,8% in Phase 6 and 21.9% in Phase 7 (Table A5.31). The rate of survival for each element is once again calculated in relation to the MNI (Figures 5.33 and 5.34) using the same process described in the previous sections. The same pattern of all body parts present in the early medieval pig bones is seen in the Phase 6 results. Phase 7, although a very small sample, produced results that also indicate the majority of pig body parts were present within the assemblage. Based on this it can be suggested that pig were also slaughtered on-site throughout the late medieval period at Caherconnell. The late medieval pigs have also produced similar survival rates for the primary meat cuts which are represented by the scapula and pelvis, the scapula being the most frequent element from Phase 6, with a survival rate of 43% from Phase 7. The survival of smaller elements is also seen from these phases with, for example, a survival rate of 21% from Phase 6 and 29% from Phase 7 for the first phalanges. The tarsal bones, the astragalus and calcaneum, have a high survival rate similar to the early medieval pig remains. The calcaneum is the most frequent element from Phase 7 and has a survival rate of 88% from Phase 6, the astragalus produced a rate of 83% from Phase 6 and 43% from Phase 7. Cranial elements produced a similar rate of 29% from Phase 6, however no cranial elements were recorded from Phase 7. In general, the same pattern is present, which indicates that the pig were slaughtered on-site.

Figure 5.35 displays the degree of fragmentation of the late medieval pig bones. Phase 6 pig bones with three or eight zones surviving were the most frequent. Phase 7 pig bones with two or eight zones survived the most, but overall there was less of a varying count with the sum of bones ranging between 6 and 31, probably reflective of the low quantity of bones from this phase. When the degree of fragmentation is compared to the sum of each bone zone, there is no particular pattern in their survival. Phase 6 produced a count of 262–358, while Phase 7 has a range of 58–63. Figure 5.36 provides a good representation of the range of elements and

anatomical area recorded in the late medieval pig bones. Once again, the counts displayed in this graph are basic NISP figures and no further methods of quantification have been applied. Similarly to the early medieval pigs, all body parts are represented in Phases 6 and 7, and the most common element group is the phalanges. As mentioned previously, this is likely because pig phalanges have a much higher count compared to any other element in the pig skeleton, even when compared to the count of phalanges in the other species previously discussed. One of the lowest occurring element groups is the vertebral column, once again due to the fact the majority were not recorded to species level. In general, the same pattern is seen in Phases 6 and 7 when compared to the early medieval pigs.

Horse

Horse remains from Phase 6) have a NISP of 94 (28 bones, 38 mandibular teeth, and 28 maxillary teeth) and an MNI of 4, with the astragalus being the most common element (Table A5.21). Phase 7 horses have a NISP of 59 (17 bones, 31 mandibular teeth, and 11 maxillary teeth) and an MNI of 2 with vertebrae and femur producing this figure (Table A5.22). Similarly to the earlier material, horse are the fourth most dominant species throughout the assemblage,

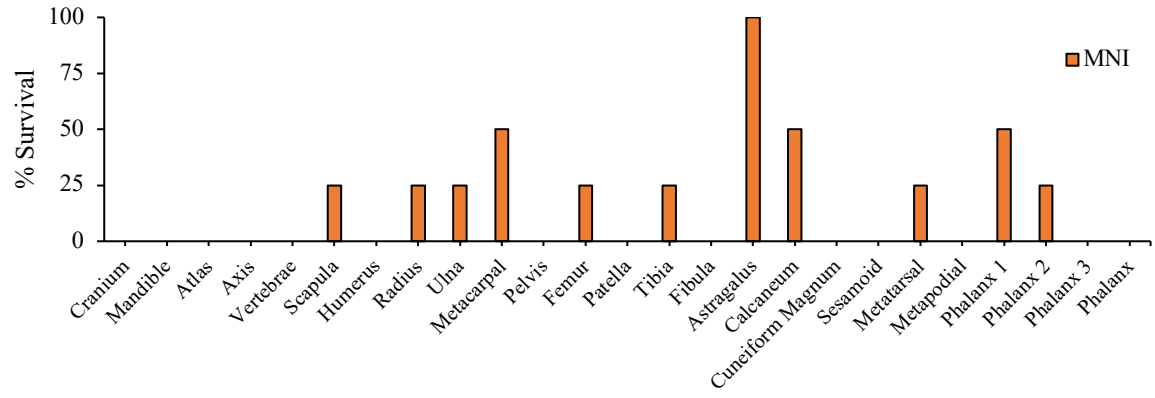


Figure 5.37: Survival of Phase 6 (11th–14th century) horse bone at Caherconnell.

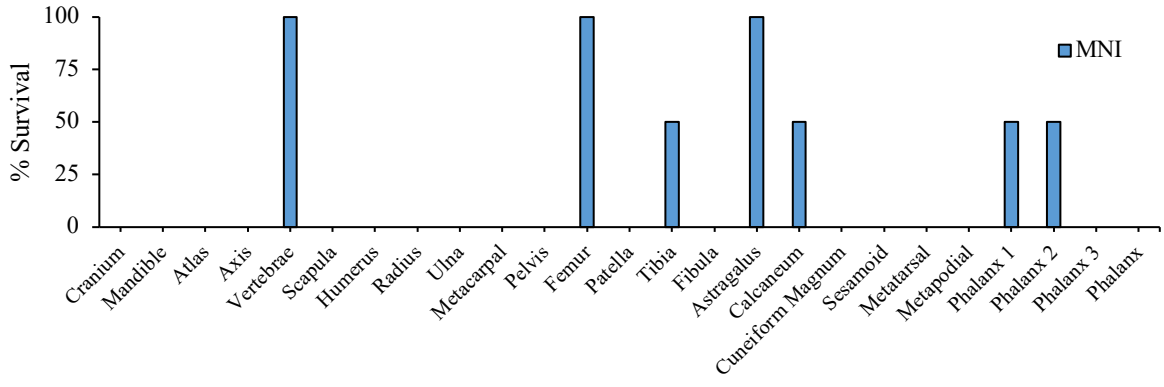


Figure 5.38: Survival of Phase 7 (15th–16th century) horse bone at Caherconnell.

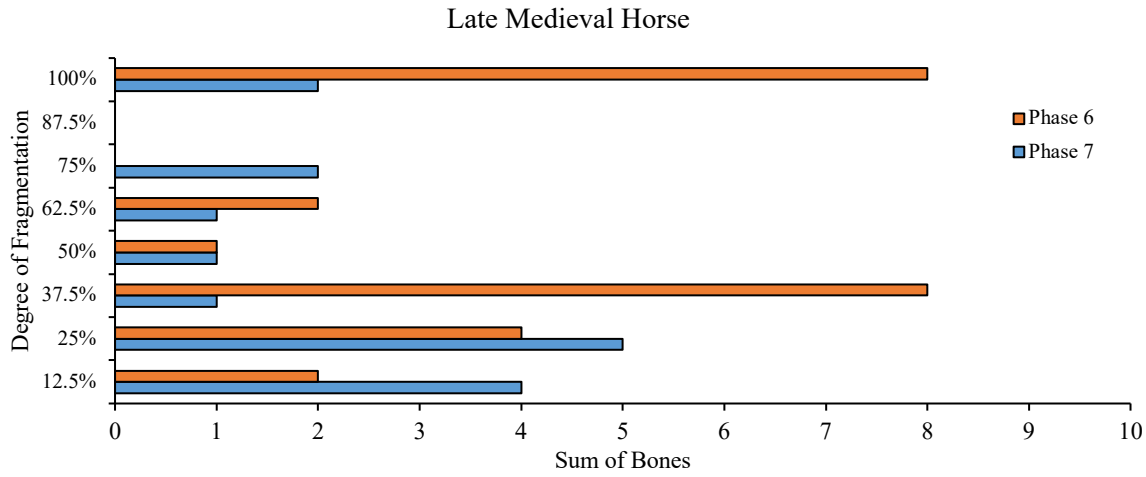


Figure 5.39: Fragmentation of Phase 6 and 7 horse bones at Caherconnell.

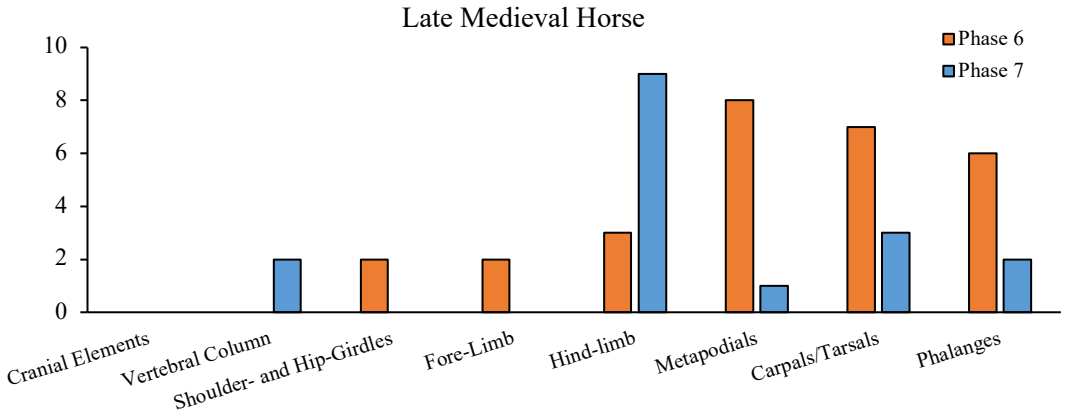


Figure 5.40: Bone elements present in late medieval Phase 6 and 7 horses at Caherconnell.

which is displayed in the total MNI%, 3.1% in Phase 6 and 6.3% in Phase 7 (Table A5.31). Not all bone elements of the horse were present during the late medieval period; for example, there are no cranial elements from these phases, only teeth. The rate of survival for each element is calculated in relation to the MNI (Figures 5.37 and 5.38). As both phases of activity produced low MNIs and so little interpretation can be made.

As discussed previously, the presence of certain horse elements do not provide insight into the role horses played at Caherconnell. This will be discussed further in later sections when all the data is combined. The degree of fragmentation of horse bones from Phase 6 shows that those with three or eight zones survive the most, the former represents the proximal or distal ends of the bones, and the latter representing complete bones. There is no clear trend in the bones from Phase 7 (Figure 5.39). Figure 5.40 further highlights both the dominance and absence of certain elements, similar to the early medieval Phase 6 record, showing a dominance of metapodials, carpals/tarsals, and phalanges, and Phase 7 producing predominantly hind-limb long bones, with neither phases producing cranial elements. The quantities displayed here are

basic NISP counts as no other methods of quantification were possible given the small number of bones.

Dog

Dog remains from Phase 6 have a NISP of 22 (11 bones, 6 mandibular teeth, and 5 maxillary teeth) and an MNI of 1, with all elements present producing and MNE of 1 (Table A5.25). Phase 7 dogs have a NISP of 11 (1 bone, 5 mandibular teeth, and 5 maxillary teeth) and an MNI of 1, with an axis bone being the only dog element present during this late medieval phase of activity (Table A5.26). Dog appear in lower amounts compared to the three main domesticates, which is displayed in the total MNI%, 0.8% in Phase 6 and 3.1% in Phase 7 (Table A5.31). As Phase 7 produced a particularly small sample size, the rate of survival and degree of fragmentation cannot be analysed for this phase of activity. The rate of survival for each element from Phase 6 has been calculated in relation to the MNI. Similarly to the early medieval results little interpretation can be made. It is, however, evident from this data that all parts of the dog skeleton, except the vertebrae and carpals/tarsals, are represented within this small sample.

Cat

Cat remains from Phase 6 at Caherconnell have a NISP of 29 (21 bones, 4 mandibular teeth, and 4 maxillary teeth) and an MNI of 1 (Table A5.29). Phase 7 cat have a NISP of 5 (4 bones and 1 mandibular tooth) and an MNI of 1, as the four bones are the right 2nd, 3rd 4th, and 5th metacarpals and represent part of right fore-limb (Table A5.30). Similarly to horse and dog, cat appear in lower amounts compared to the main domesticates, which is displayed in the total MNI%, 0.8% in Phase 6 and 3.1% in Phase 7 (Table A5.31). As both phases produced samples with an MNI of 1, the rate of survival for each element is 100%. Due to this small sample size, the degree of fragmentation of the bones present does not provide any useful data. As discussed previously, the presence of certain cat elements alone does not provide much insight into the role cats played at Caherconnell. It is possible that the samples from Phase 6 and 7 are representative of one individual per phase. The most frequent element present in Phase 6 is vertebrae elements which is not surprising due to the total count of vertebrae per cat skeleton.

5.3 Age at death

Animal husbandry practices can be examined through the analysis of kill-off patterns. The age at death can indicate the role the animal played as different husbandry practices are undertaken to provide certain products. A meat-producing economy will require animals being killed once maturity is reached (O'Connor 2003, 157). An economy that focuses on secondary products such as milk and wool will reveal evidence of the exploitation of older animals (Davis 1987, 158; McCormick 1992, 201; O'Connor 2003, 157). Methods of record tooth eruption, tooth wear stages, and epiphyseal fusion were used to estimate the age at death for the domesticates. The latter is a less reliable method of ageing, but still useful to cross-check with the dental data where possible (O'Connor 2000, 96).

5.3.1 Early medieval results

Cattle

The results of the tooth eruption and mandibular wear stages of Phases 4 and 5 cattle indicate that cattle were slaughtered at all ages at Caherconnell during the early medieval period (Table A5.32), although with a predominance of adults (aged three years and older) were being exploited throughout this period (Phase 4: 33.8% and Phase 5: 37.8%) (Figure 5.41). There

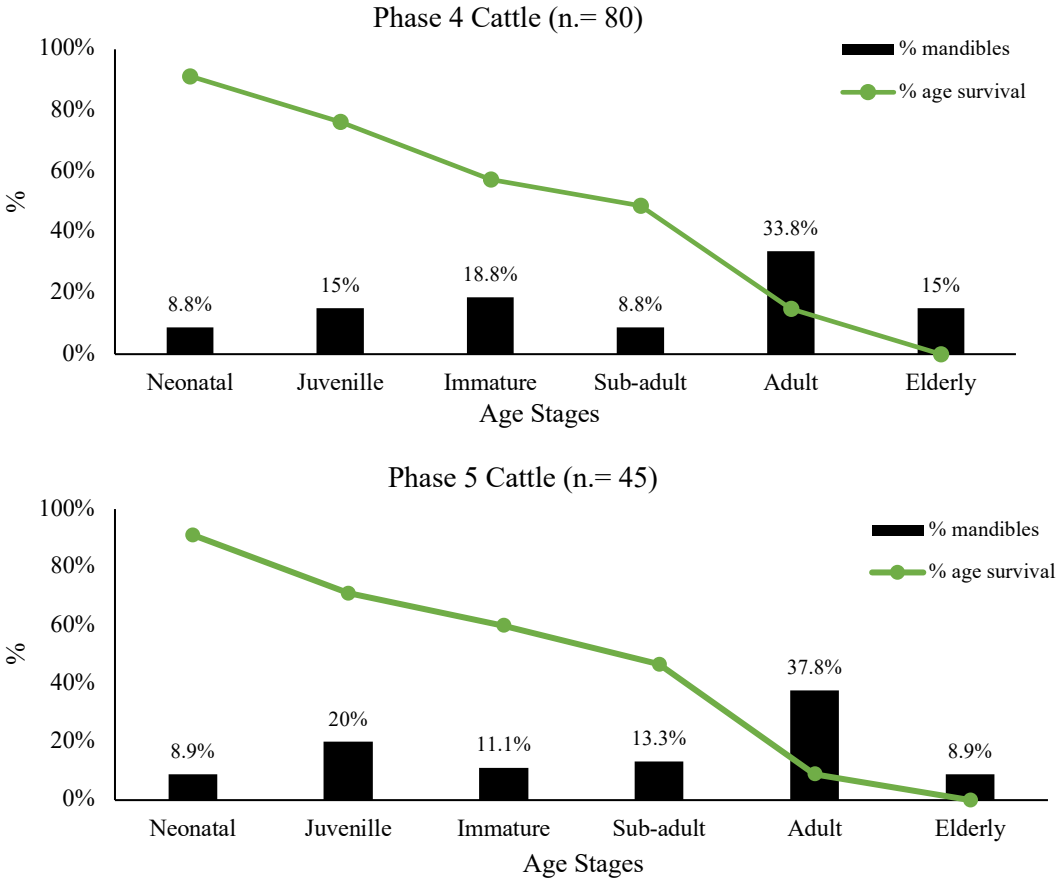


Figure 5.41: Percentages of cattle mandibles by age after Grant (1982) and O'Connor (1988). The data presented are from the early medieval phases of activity, Phase 4 and Phase 5

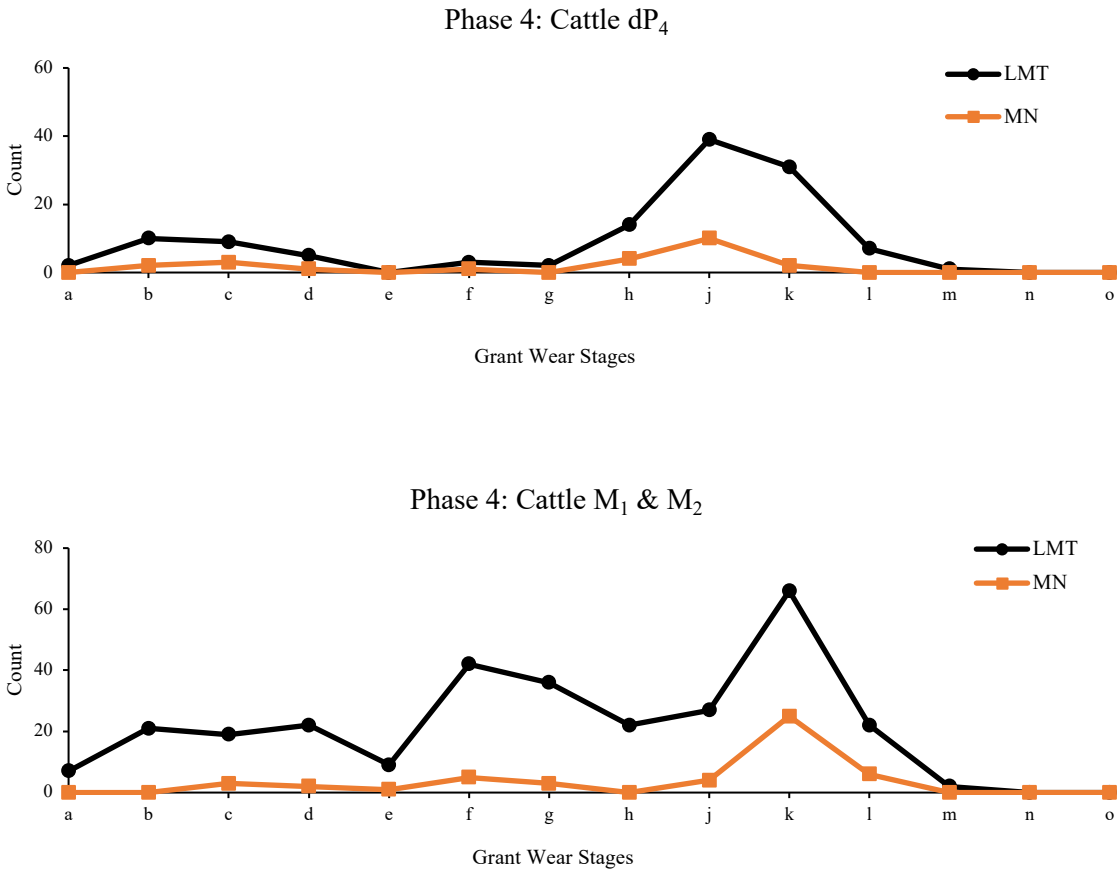


Figure 5.42: Tooth wear stages for M_1, M_2, and dP_4 for loose mandibular teeth (LMT) and teeth in mandible (MN) from Phase 4, Caherconnell. M_1 and M_2 are combined. Tooth wear stages follow Grant (1982).

isn't a great difference between the peak slaughter of cattle in their second and third year (Phase 4: 27.5% and Phase 5: 24.44%, represented by immature and sub-adult cattle. Based on the sexing of cattle bones, discussed below, 83% of early medieval cattle in their second or third year and possibly older are female, which is to be expected in a dairying economy. As males and females are born in near equal numbers, it is possible those killed before the age of two were male cattle providing meat (McCormick, Finbar and Murray 2007, 54). Exploitation of cattle at Caherconnell involves some slaughter of animals in their second and third year, but peak slaughter occurs in older adult individuals aged three years and older. The presence of neonatal and juvenile cattle suggest that cattle were bred on-site or nearby. The slaughter of male cattle in their first year for meat may be represented by these juveniles. An economy focused on dairying is expected to see a low incidence of slaughter of young calves as the calf is required to be present during milking (McCormick, Finbar 1992, 203). As mentioned previously, the presence of these younger cattle are a trait of a producer-consumer site, implying that Caherconnell was involved in production and consumption. It has been suggested that the killing of cattle this young could represent those that died of natural deaths or that were killed for meat in the case of calves of cows not producing much milk (McCormick, Finbar 1986, 88). Elderly individuals, aged seven years and older, are also present on-site. These may

represent those which were used for dairying, breeding, or traction and eventually killed for meat. The presence of certain pathologies, which will be discussed late, may also reflect the presence of these older individuals in the late stages of their working lives.

As taphonomic processes favour the preservation of older animals due to their bones being more robust (Lyman 1994, 252, 288), an example being the mandibles of older cattle, it is important to analyse the tooth wear of loose mandibular teeth as well as the mandibular wear stages. This helps to avoid over-representation of older individuals, which may occur when only analysing the wear stages of *in situ* mandibular teeth (McCormick, Finbar and Murray 2007, 55). In this study, tooth wear was recorded for loose mandibular first and second molars (M_1, M_2) and for deciduous fourth premolars (dP_4) and plotted with those of *in situ* mandibular teeth. The occurrence of unworn M_1 and M_2 indicates the presence of cattle ages between 0–18 months, and dP_4 in wear represent cattle ages between 1–32 months (*ibid.*). The data presented in Figure 5.42 illustrate the tooth wear stages recorded for M_1, M_2, and dP_4 for both loose mandibular teeth (LMT) and teeth in mandibles (MN) from Phase 4 cattle. The presence of unworn M_1 or M_2 is low, only making up 2.4% of loose mandibular molars. The dP_4 wear

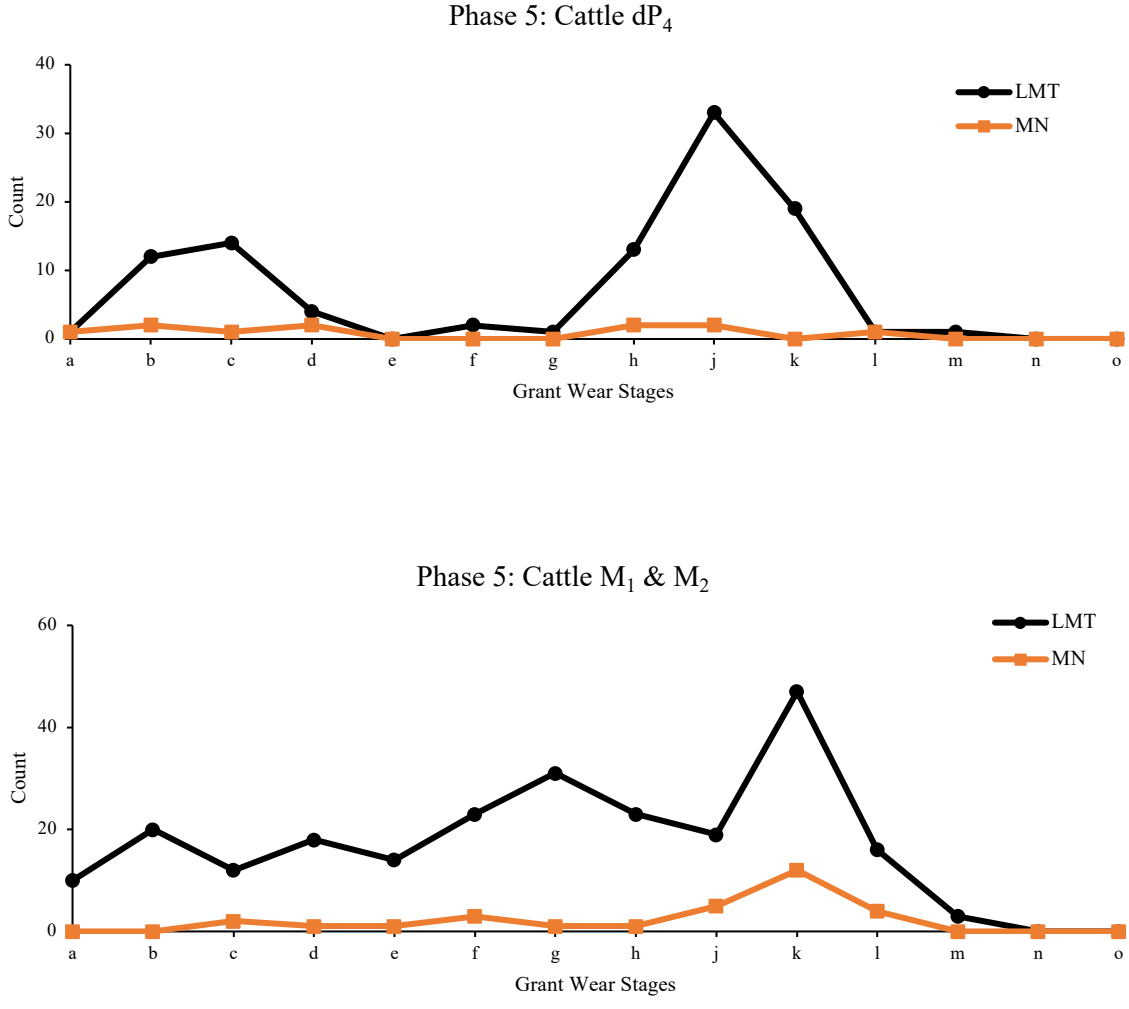


Figure 5.43: Tooth wear stages for M_1, M_2, and dP_4 for loose mandibular teeth (LMT) and teeth in mandible (MN) from Phase 5, Caherconnell. M_1 and M_2 are combined. Tooth wear stages follow Grant (1982).

stages also indicate a low occurrence of young calves, specimens with early stages of wear from 'a' to 'd' only make up 21.1% of the loose teeth and 26.1% of the mandibular teeth. The majority of dP_4 specimens are well worn with 74.8% of the loose teeth being a stage 'h' and greater, and the same for 69.6% of the mandibular teeth. It is evident from this that both *in situ* and loose mandibular teeth present similar patterns and the mandibular wear stages recorded do not underrepresent younger cattle within the assemblage.

The data presented in Figure 5.43 illustrates the same data of loose mandibular teeth and teeth in mandibles for Phase 5 cattle. The presence of unworn M_1 or M_2 is again low, only making up 4.2% of loose mandibular molars. The dP_4 wear stages also indicate a low occurrence of young calves, specimens with wear from 'a' to 'd' only make up 30.1% of the loose teeth and 54.5% of the 11 mandibular teeth. The majority of dP_4 specimens are well worn with 66.3% of the loose teeth being a stage 'h' and greater, and the same for 45.5% of the mandibular teeth. It is evident from this that both the mandibular teeth and loose teeth have

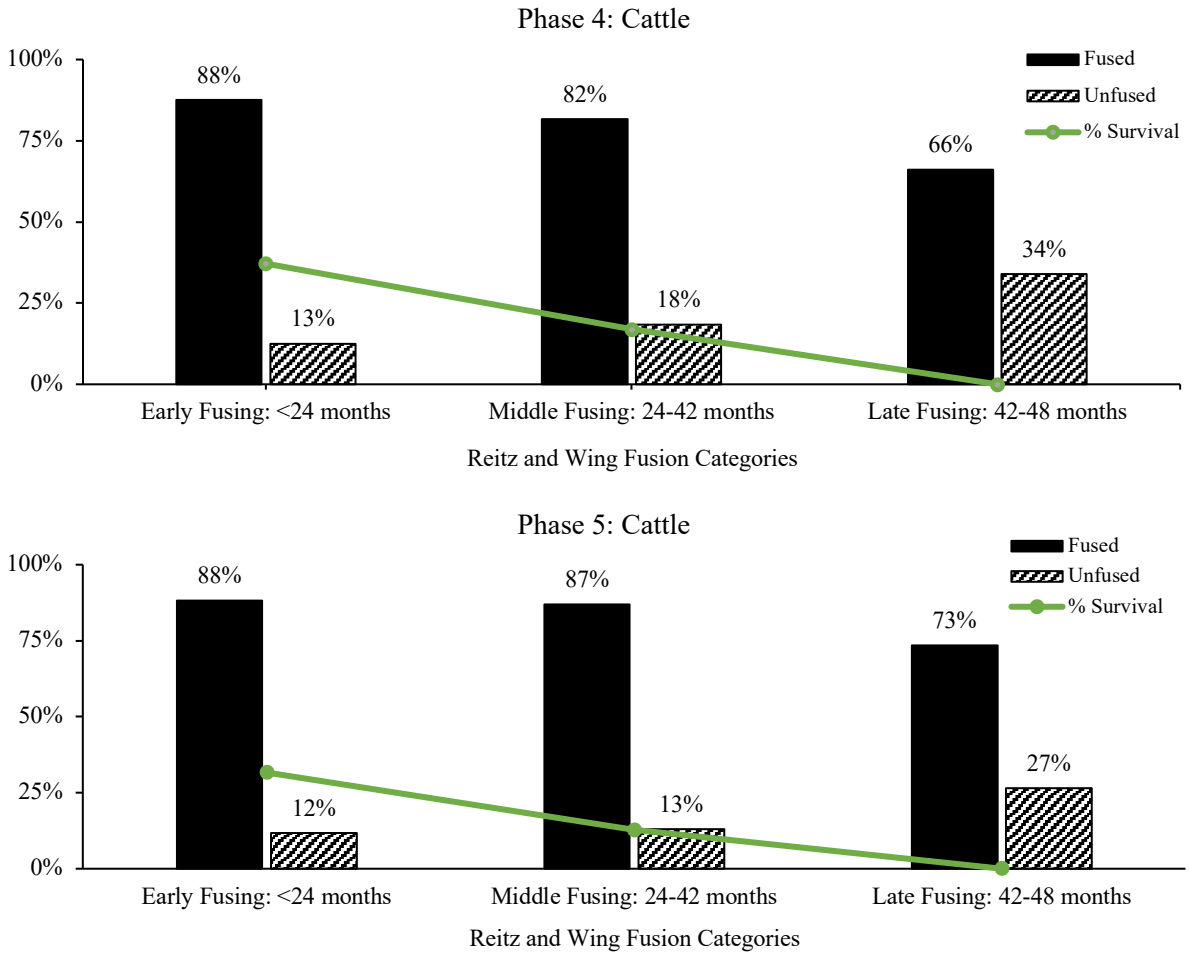


Figure 5.44: Reitz and Wing (2008) fusion categories and counts for early medieval cattle from Phase 4 and Phase 5, Caherconnell.

similar tooth wear patterns and that the results from mandibular wear analysis does not under- or over-represent any age group of cattle within the assemblage.

The epiphyseal fusion data for early medieval cattle has produced the same trends as those from the tooth eruption and wear stages. Table A5.35 displays the results for the fusion stages of Phase 4 cattle bones through a count of the fused and unfused proximal and/or distal ends. The results were divided into three stages of fusion; early (up to 24 months), middle (between 24–42 months), and late (between 42–48 bones) (Reitz and Wing 2008, 72), and the counts display whether an animal lived up to or died before a certain age range. For example, when looking at the data recorded for distal tibia, which fuse between 24–30 months, 70 are fused and 14 are unfused. This means that 70 individuals lived to at least 24–30 months and 14 died before reaching this age.

To sum up the data for Phase 4 cattle, 87.5% of bones which fuse early were fused and 12.5% were unfused. 81.7% of middle fusing bones were fused and 18.3% were unfused. Of the late fusing bones, 66.1% were fused and 33.9% were unfused. The higher occurrence of fused bones throughout all three fusion categories indicates that older cattle dominated the assemblage (Figure 5.44) and correlates with the ageing data recorded from tooth eruption and wear stages. Table A5.36 displays the results for Phase 5 cattle and also follows the trend seen

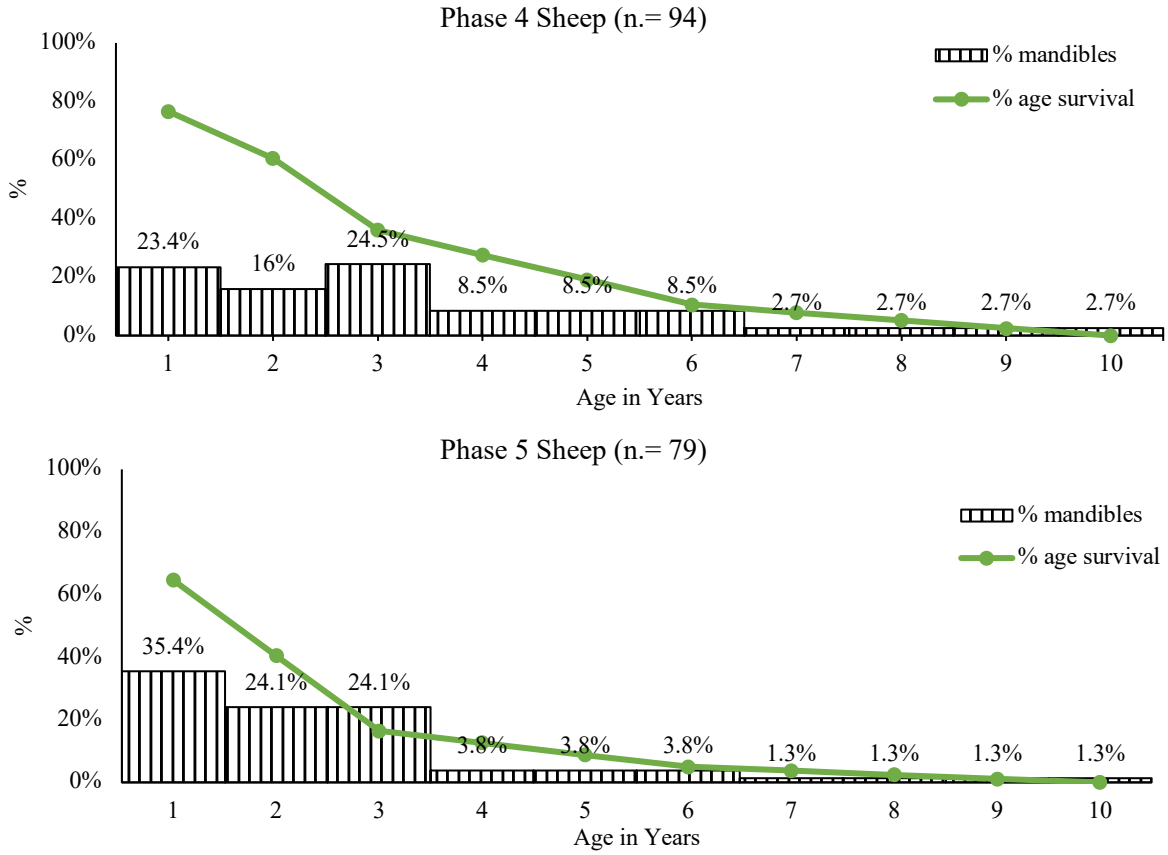
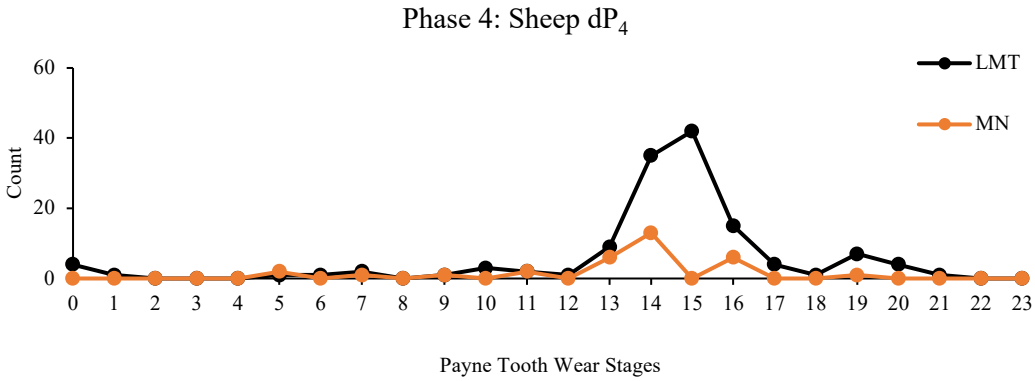


Figure 5.45: Percentages of sheep mandibles by age after (Payne 1973, 1987). The data presented are from early medieval activity, Phases 4 and 5.

in Phase 4 with a dominance of older cattle. 88.3% of bones which fuse early were fused and 11.7% were unfused. 87% of middle fusing bones were fused and 13% were unfused. Of the late fusing bones, 73.5% were fused and 26.5% were unfused. Fused bones within the middle and late fusing categories make up a slightly higher count within Phase 5 data compared to that of Phase 4. The presence of unfused proximal metapodials is evidence of cattle being bred on-site as these bones fuse before birth.

Sheep

The results of the tooth eruption and mandibular wear stages of Phase 4 and 5 sheep indicate that sheep of all ages were present at Caherconnell during the early medieval period (Table A5.33). There is a dominance of sheep in their first, second, and third year, being exploited throughout this period (Phase 4: 63.8% and Phase 5 83.5%) (Figure 5.45). After their third year, slaughter drops to 8.5% and below in Phase 4, and 3.8% and below in Phase 5. The presence of individuals ages 2–6 months (2 recorded from Phase 4 and 3 from Phase 5) suggests that sheep were bred on-site. This kill-off pattern is suggestive of a meat production economy (Payne 1973, 282). If the sheep are primarily being exploited for meat, the majority of young males are killed when optimum size is reached with only a few are kept for breeding, while



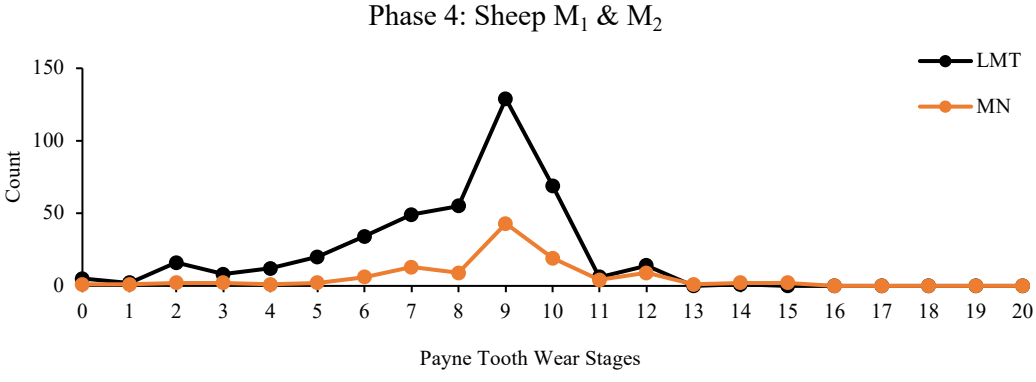


Figure 5.46: Tooth wear stages for M_1, M_2, and dP_4 for loose mandibular teeth (LMT) and teeth in mandible (MN) from Phase 4, Caherconnell. M_1 and M_2 are combined. Tooth wear stages follow Payne (1973, 1987).

young females may or may not be killed (*ibid.* 281). If the primary aim was milk production, there would possibly be a pattern of high numbers of young lambs being kept and then killed once the production of milk is not endangered. If the sheep were primarily exploited for wool production, there would be higher amount and focus of older individuals. Even though meat production was the primary focus at Caherconnell, there is also evidence of a mixed economy with the likely production of secondary products. Although this pattern is seen at other medieval sites and the documentary evidence has some references to mutton consumption, the sources indicate that sheep were primarily exploited for wool (Kelly 1997, 72).

As taphonomic processes favour the preservation of older animals whose bones are more robust, for example the mandibles of older sheep, it is important to analyse the tooth wear data of loose mandibular teeth as well as the mandibular wear stages. This helps to avoid the over-representation of older individuals, which may occur when only analysing the wear stages of *in situ* mandibular teeth (McCormick and Murray 2007, 55). The tooth wear recorded and analysed for loose mandibular dP_4, M_1 and M_2 was plotted with those of *in situ* mandibular teeth. The data presented in Figure 5.46 illustrates the tooth wear stages for recorded dP_4, M_1 and M_2 for both loose mandibular teeth (LMT) and teeth in mandibles (MN) from Phase 4 sheep. The dP_4 wear stages indicate a low occurrence of young lambs through a low count of wear codes 0–13. The peak wear is between 14–15 which are estimated to be wear stages C

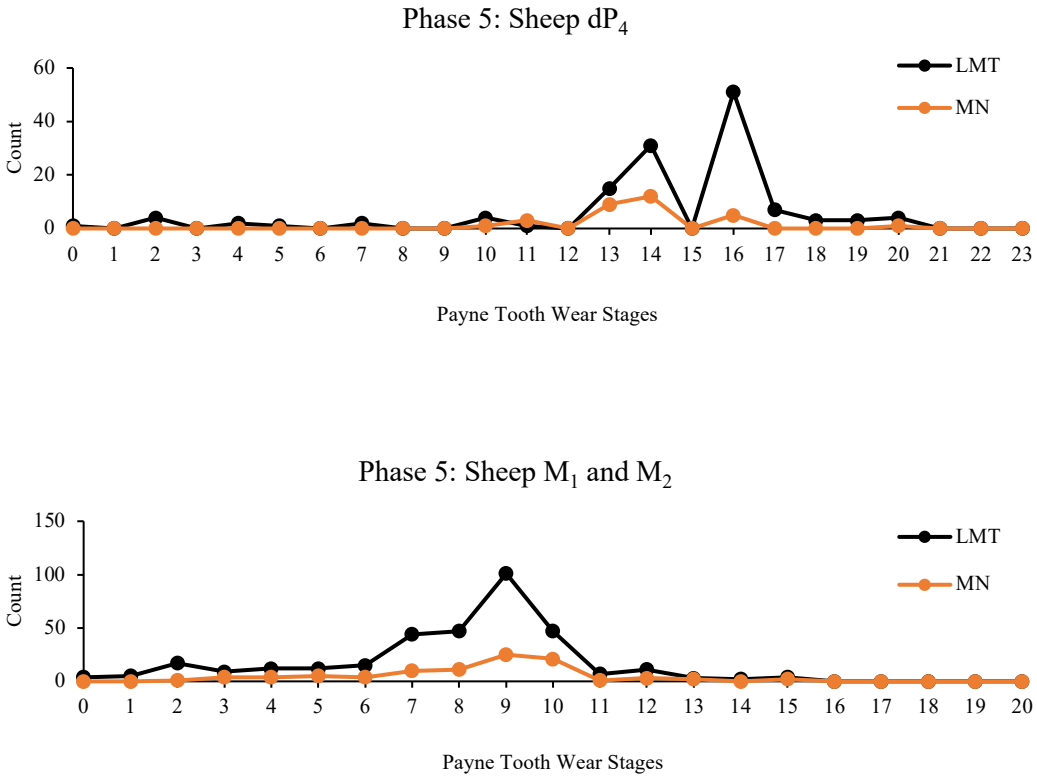


Figure 5.47: Tooth wear stages for M1, M2, and dP4 for loose mandibular teeth (LMT) and teeth in mandible (MN) from Phase 5, Caherconnell. M1 and M2 are combined. Tooth wear stages follow Payne (1973, 1987).

represent individuals in their first year. As the dP_4 is late replaced with the P_4, it cannot provide evidence of sheep aged about 2 years (Silver 1969, 263; Payne 1973, 297). The M_1 and M_2 wear has a peak of 9 which possibly represents individuals in their second and third year. It is evident from this that both the *in situ* and loose mandibular teeth present similar patterns and the mandibular wear stages do not underrepresent younger sheep within the assemblage.

The data presented in Figure 5.47 illustrates the same data of loose and mandibular teeth and teeth in mandibles for Phase 5 sheep. The low occurrence of young lambs is once again evident through this data. The peak wear for dP_4 is 14 and 16, which are once again estimated to be wear stages C and D and represent individuals in their first and second year. The M_1 and M_2 wear has a peak of 9, which possibly represents individuals in their second and third year. It is once again evident that the mandibular wear stages do not under-represent younger sheep within the assemblage. Overall, the tooth wear stages of loose mandibular teeth,

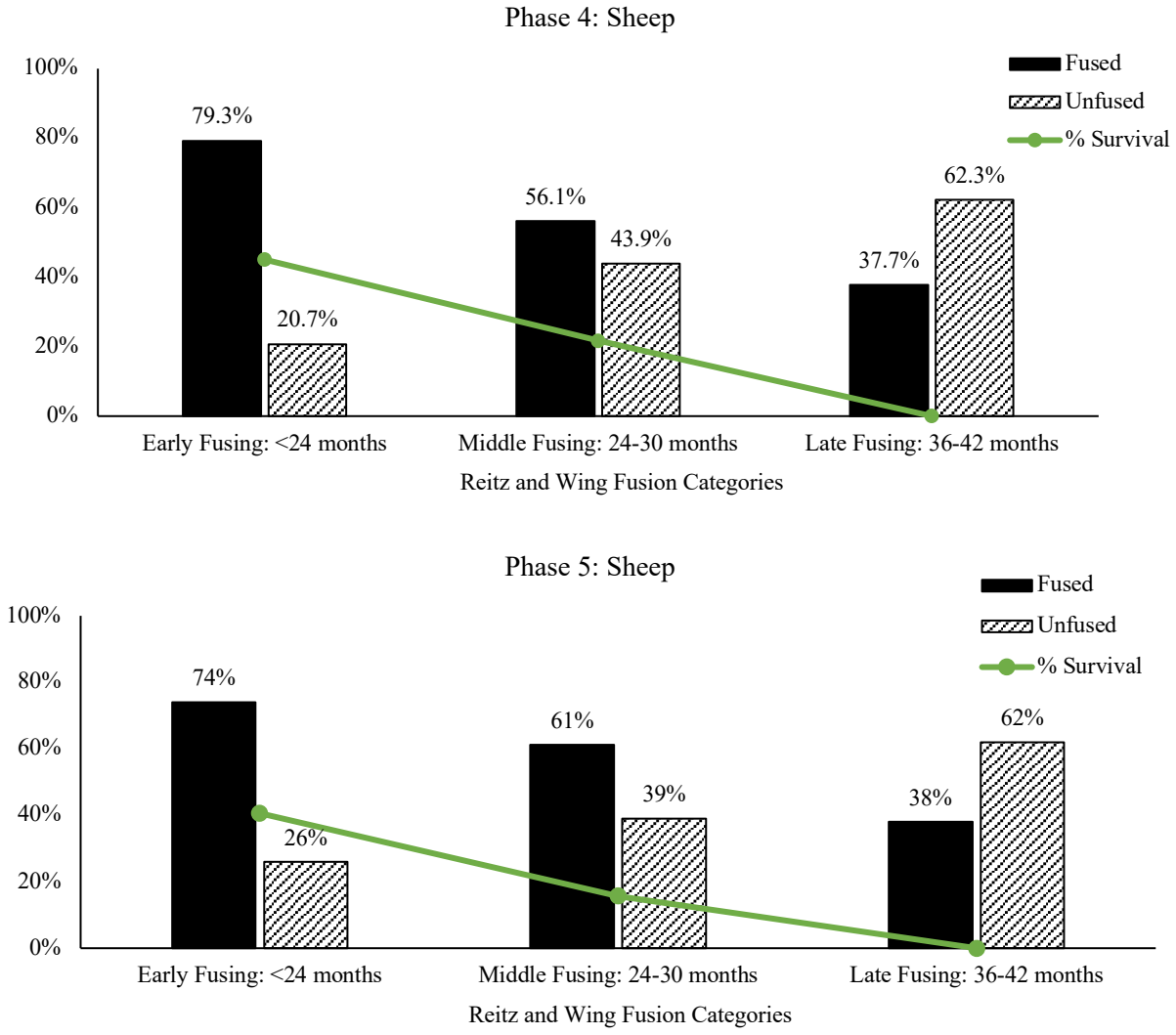


Figure 5.48: Reitz and Wing (2008) fusion categories and counts for early medieval sheep from Phase 4 and Phase 5, Caherconnell.

although less reliable to assign to strict ages, appear to present the same pattern of peak slaughter being in their first, second, and third year which once again suggests meat being the primary product.

The epiphyseal fusion for early medieval sheep produced the same trends of those from the tooth eruption and wear stages. Table A5.39 displays the results for the fusion stages of Phase 4 sheep bones through a count of the fused and unfused proximal and/or distal ends. The results were divided into three stages of fusion; early (up to 16 months), middle (between 15-36 months), and late (between 36–42 months) (Reitz and Wing 2008, 72), and the counts display whether the animal lived up to or died before a certain age range. To sum up the data for Phase 4 sheep, 79.3% of early fusing bones were fused and 20.7% were unfused. 56.1% of middle fusing bones were fused and 43.9% were unfused. Of the late fusing bones 37.7% were fused and 62.3% were unfused. The higher occurrence of fused bones in the first two fusion categories indicates that sheep of ages up to 3 years dominated the assemblage (Figure 5.48) and correlates with the ageing data recorded from the tooth eruption and wear stages.

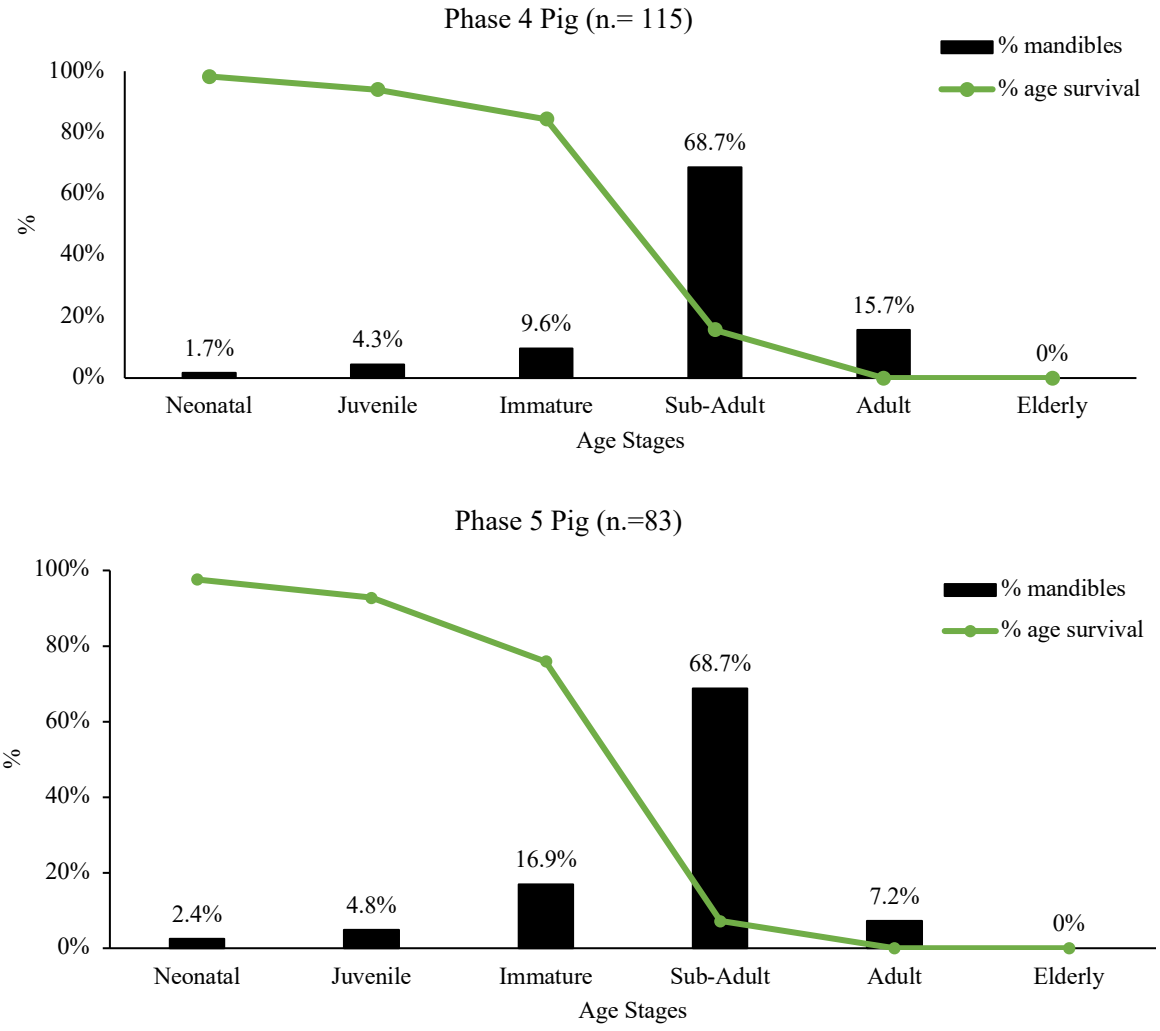
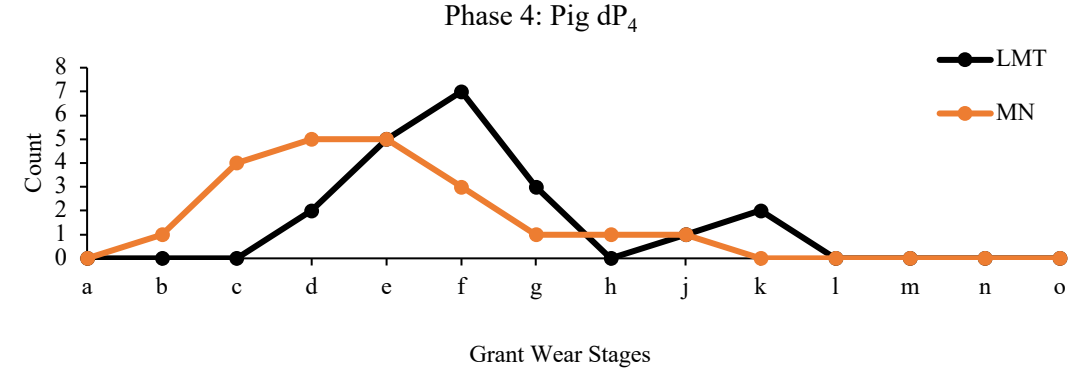


Figure 5.49: Percentages of pig mandibles by age after Grant (1982) and O'Connor (1988). The data presented are from the early medieval Phases 4 and 5.

Table A5.40 displays the results for Phase 5 sheep and also follows the trend seen in Phase 4 with a dominance of sheep between their first to third year. 74% of early fusing bones were fused and 26% were unfused. 61.1% of middle fusing bones were fused and 38.9% were unfused. Of the late fusing bones 38% were fused and 62% were unfused. It should also be noted that the presence of unfused proximal metapodials is evidence of sheep being bred on-site as these bones fuse before birth.

Pig

Unlike cattle and sheep, pigs do not produce secondary products such as milk or wool, and are kept as a source of meat. This is easy to spot in age slaughter patterns as an optimum meat yield suggests pigs would be killed once they have reached full size, or when their rate of growth begins to decline (McCormick, Finbar and Murray 2007, 60). The results of the tooth eruption and mandibular wear stages of Phase 4 and 5 pig (Table A5.34) indicate a dominance of sub-adult individuals, of ages 1.5–2 years, throughout the early medieval period (Phase 4: 68.7% and Phase 5: 68.7%) (Figure 5.49). This age range is said to represent when pigs have reached their full size and is the optimal stage for slaughter for meat exploitation (McCormick, Finbar and Murray 2017, 199). Elderly pigs, aged 6 years and above, were the only age group not to be recorded within the early medieval pigs. The presence of neonatal and juvenile



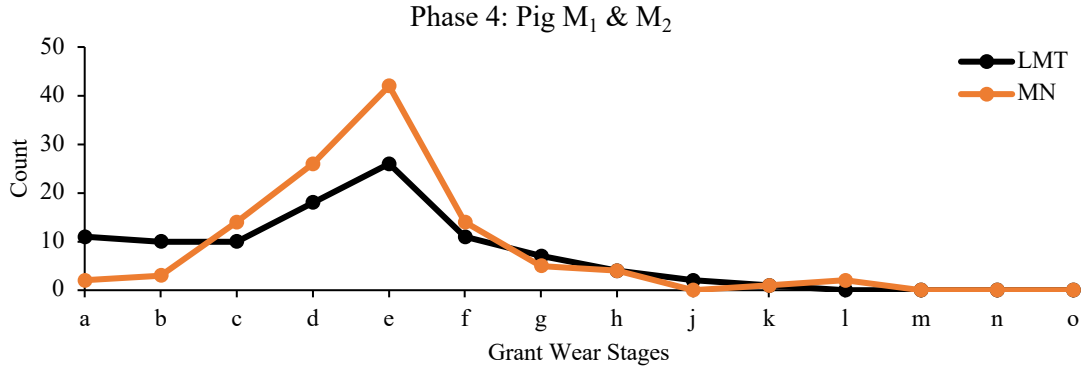


Figure 5.50: Tooth wear stages for M1, M2, and dP4 for loose mandibular teeth (LMT) and teeth in mandible (MN) from Phase 4, Caherconnell. M1 and M2 are combined. Tooth wear stages follow Grant (1982).

individuals indicate that pigs were bred on-site. These younger individuals, older than 12 months, may also represent sucklings being killed for immediate consumption (Kelly 1997, 85). There is also evidence of the killing of sows after they had produced two or three litters (*ibid.*). Exploitation of pigs at Caherconnell also involved some slaughter of immature (1–1.5 years) and adult (2–5 years) individuals.

As discussed previously, taphonomic processes favour the preservation of older animals as their bones are more robust (Lyman 1994, 252, 288). The tooth wear data of loose mandibular teeth was also analysed, as well as the mandibular wear stages, to minimise the over-representation of older individuals. In this study, tooth wear was recorded for loose mandibular first and second molars (M_1, M_2) and for deciduous fourth premolars (dP_4) and plotted with those of *in situ* mandibular teeth. The occurrence of unworn M_1 and M_2 indicates the presence of pigs aged 0–12 months, and dP_4 in wear represent pigs aged 2–12 months. The data presented in Figure 5.50 illustrate the tooth wear stages recorded for M_1, M_2, and dP_4 for both loose mandibular teeth (LMT) and teeth in mandibles (MN) for Phase 4 pig. The presence of unworn M_1 and M_2 is low, making up only 1.1% of loose mandibular molars. The dP_4 wear stages also indicate a low occurrence of young pigs with the majority being well worn. Overall,

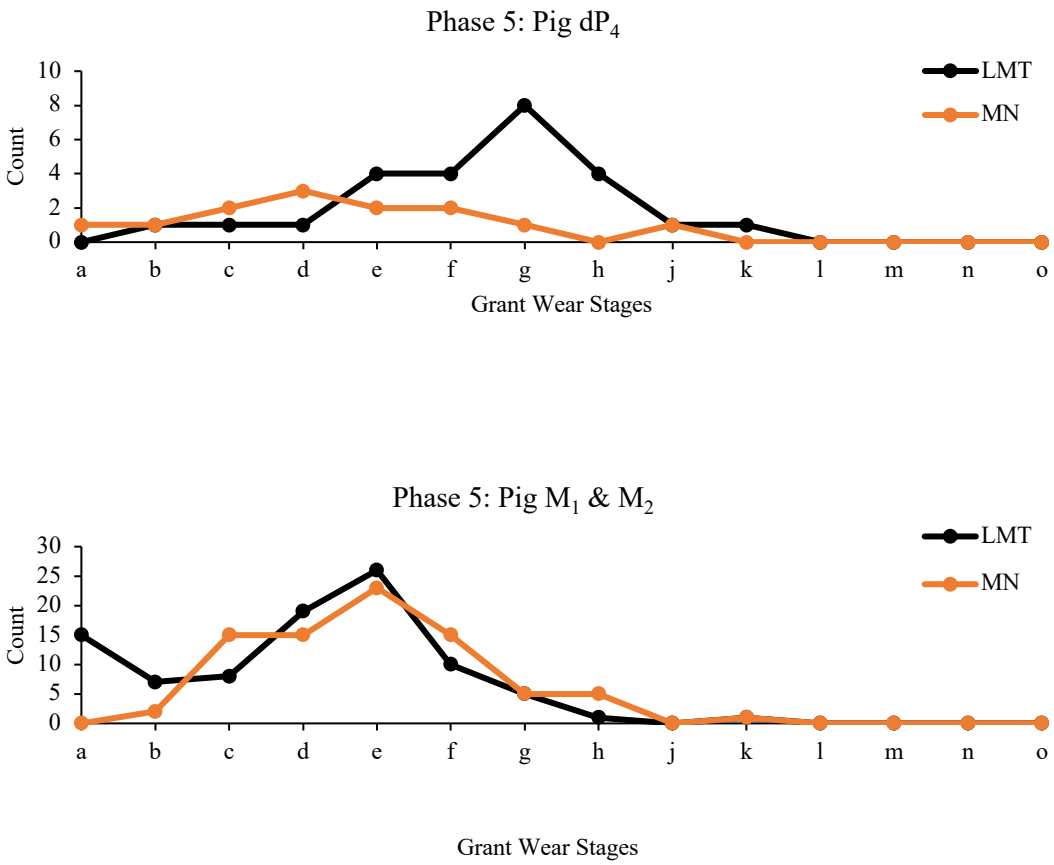


Figure 5.51: Tooth wear stages for M1, M2, and dP4 for loose mandibular teeth (LMT) and teeth in mandible (MN) from Phase 5, Caherconnell. M1 and M2 are combined. Tooth wear stages follow Grant (1982).

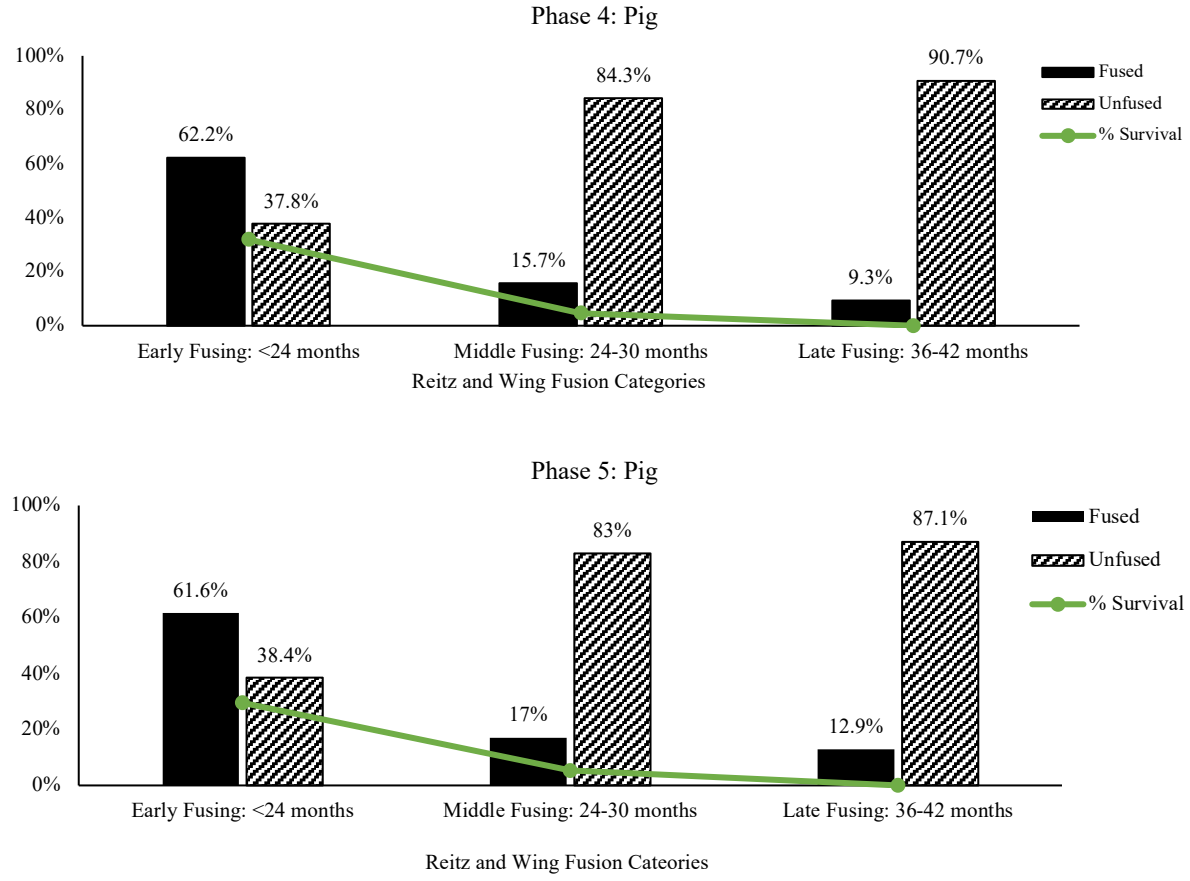


Figure 5.52: Reitz and Wing (2008) fusion categories and counts for early medieval pigs from Phase 4 and Phase 5, Caherconnell.

the data produced from the loose mandibular teeth correlates with that of the mandibular teeth, and the mandibular wear stages do not underrepresent younger pigs within the assemblage.

The data presented in Figure 5.51 illustrates the same data of loose mandibular teeth and teeth in mandibles for Phase 5 pigs. The presence of unworn M_1 and M_2 is again lower than worn molars. The dP_4 wear stages also indicate a low occurrence of young pigs with the majority being well worn. Although dP_4 counts differ slightly, which is likely due to the small sample, it is evident from the data that both the mandibular teeth and loose teeth have similar tooth wear patterns, and the results from mandibular wear analysis does not under- or over-represent any age group of pigs within the assemblage.

The epiphyseal fusion data for early medieval pigs has produced the same trends of those from the tooth eruption and wear stages. Table A5.43 displays the results for the fusion stages of Phase 4 pig bones through a count of the fused and unfused proximal and/or distal ends. As discussed previously, the results are divided into three stages of fusion; early (<24 months), middle (24–30 months), and late (36–42 months) (Reitz and Wing 2008, 72) and the counts indicate whether the pig lived beyond or died before a certain age range. To sum up the

data for Phase 4 pigs, 62.2% of bones which fuse early were fused and 37.8% were unfused. 15.7% of middle fusing bones were fused and 84.3% were unfused. Of the late fusing bones, 9.3% were fused and 90.7% were fused. The fusion data indicates that the majority of pigs were 1–2.5 years when killed. The high occurrence of fused early and middle fusing bones, and unfused late fusing bones (Figure 5.52) correlates with the ageing data recorded from the tooth eruption and wear stages. Table A5.44 displays the results for Phase 5 pigs and also follows the trend seen in Phase 4 with a dominance of pigs aged 1–2.5 years. To sum up this data, 62% of bones which fuse early were fused and 38% were unfused. 17% of middle fusing bones were fused and 83% were unfused. Of the late fusing bones, 13% for fused and 87% were unfused. Overall, the same trend is seen in the Phase 5 pig bones as for the Phase 4 pig bones. The presence of unfused proximal metapodials is evidence of pigs being bred on-site, as those bones fuse before birth.

Horse

Horses were not generally killed off for food or raw materials and were primarily working animals, although there are some references to the consumption of horse meat and the use of their skins for curragh boats (Denham 2007, 80). There are some examples of older horses being killed off with occasional evidence of meat consumption, probably after they ceased to be of use as working animals. Horse meat was probably consumed in times of desperation (McCormick 2007, 92). This is indicated by the presence of butchery marks.

The age at death for the Caherconnell horses was analysed through epiphyseal fusion and tooth eruption using Silver (1969). Phase 4 produced a sample size of 42 bones for analysing the stages of proximal and distal epiphyseal fusion (Table A5.47). These 42 elements include 54 fused epiphyses and two unfused epiphyses. As most of the horse bones were fused, it is evident that the majority of horses at Caherconnell were predominantly mature individuals. The unfused elements represent one individual younger than 20–24 months and one younger than 3 years. Phase 5 at Caherconnell produced a sample of 19 bones for epiphyseal fusion analysis (Table A5.48). This selection included 21 fused epiphyses and 1 unfused epiphyseal fusion, the latter representing an individual under 3 years of age, which suggests that the majority of horses killed or died on-site were mature.

There is tooth eruption data from only three mandibles and one maxilla from Phase 4, with the rest of the teeth from this phase loose and isolated. For the mandibles with tooth eruption data, one erupting P_2 represented an individual younger or at the age of 2.5 years, an erupted P_3 represented an individual older than 2.5 years, and a mandible with an erupted I_1

and I_2 represent an individual older than 3.5–4 years. The one maxilla with tooth eruption data is from an individual older then 4.5–5 years with an erupted I^3. All of the horse teeth from Phase 5 were isolated and so do not provide the necessary data for the analysis of tooth eruption stages.

Dog

Similarly to horses, dogs were unlikely to have been killed as sources of food or raw material as they were working dogs that mostly died of natural causes. If there is evidence of dogs being killed at a younger age, it can indicate they were being exploited for a specific purpose such as harvesting skins, which can be supported by the presence of butchery marks (Denham 2007, 269). In general, the age of death data from epiphyseal fusion and tooth eruption, both estimated following Silver (1969), does not provide much insight into the role dogs played at Caherconnell.

Phase 4 produced a sample size of 29 elements for analysis of epiphyseal fusion (Table A5.51). All of these were fused either at the proximal end, distal end, or both. As these dog elements were fused, it is evident that they came from mature individuals. A total of 19 elements from Phase 5 were analysed for epiphyseal fusion stages (Table A5.52). All but one was fused, with the exception being a femur (Bone ID:1908) with unfused proximal and distal epiphyses indicating this dog was younger than 1.5 years. The remaining 18 elements represent mature individuals.

Although dogs have relatively long lives, their teeth provide little information regarding age at death after the first eight months of life (*ibid.* 265). One mandibular tooth (ID: 328) is a 2nd deciduous premolar (dP_2) within a mandible with the 1st premolar (P_1) and 3rd premolar (P_3) visible on either side. The dP_2 in dogs erupts between the age of 5–8 weeks and the premolars, P_1 and P_3, erupt at 5–6 months. This indicates that particular dog was aged roughly 2–6 months. Only three other dog mandibles with teeth were recovered from Phase 4. One mandible (ID: 6788) has the 2nd premolar (P_2) and 4th premolar (P_4) erupted, meaning this individual is at least 5–6 months in age. The other two mandibles (ID: 427 and 9209) both have erupted 1st molars (M_1) meaning these individuals are at least 4–5 months old. Another mandible (ID: 427) has an erupted P_4 meaning it is at least 5–6 months in age. The 9209 mandible has a heavily worn M_1, but it is uncertain whether this is a due to age, diet, or extreme wear caused by other teeth. A total of 20 loose mandibular teeth were recorded from Phase 4, however no ageing data can be interpretated from this data. Only one mandible with teeth (ID: 1676) was recovered from Phase 5. This has an erupted P_2, which means it was at least 5–6 months in age. A total of 12

loose mandibular teeth were recovered from Phase 5, but again no ageing information can be gained from these teeth.

Cat

Similar to horses and dogs, cats were not generally killed off for food or raw material and their primary role would have been while they were alive. Cats from rural sites during this period in Ireland were predominately mature or old individuals (McCormick 1988, 223). This suggests they were kept as pets, which is supported by the literary sources (*ibid.*). They also would have served the function of keeping the settlement free of mice or other rodents.

The age at death for the Caherconnell cats was estimated through stages of epiphyseal fusion and tooth eruption stages (Habermehl 1961; Silver 1969; Smith 1969). Phase 4 produced a sample size of 36 bones for analysing the stages of proximal and distal epiphyseal fusion (Table A5.54). These 36 elements produced 23 fused epiphyses and 21 unfused epiphyses. This indicates a mixed population in terms of age, with some possible mature individuals as well as younger animals. The majority of unfused epiphyses were in the category of later fusing bones, which fully fuse between the ages of 11.5–20 months. There are 12 elements from individuals that did not live beyond this age range. There are four elements in the process of fusing or the fusion line is open meaning they were somewhere within this age range when they died. Phase 5 produced a sample size of 28 bones for epiphyseal fusion analysis (Table A5.55). This selection included 24 fused epiphyses and nine unfused epiphyses. Unlike Phase 4, this sample has an overall dominance of fused elements. The majority of the unfused elements are from the later fusing category and represent individuals younger than 11.5–20 months in age.

Phase 4 produced a sample size of 13, including nine mandibles and four maxillas, for the analysis of tooth eruption stages. Cat teeth erupt within the first few months of life, and therefore this data cannot tell us much about the age of cats beyond 6 months. Out of the 13 samples, four represented cats older than 4–5 months, five represented cats older than 5–6 months, three represented cats older than 5.5–6.5 months, and one represented an individual 4–5 months or older as the mandibular third premolar (P_3) was still erupting. Phase 5 produced a sample of nine, seven mandibles and two maxillas, for the analysis of the tooth eruption stages. All of the teeth within this sample were erupted and included two which represented cats older than 4–5 months, three represented cats older than 5–6 months, and four older than 5.5–6.5 months. Overall the tooth eruption data represented individuals older than 4–6.5 months and an individual 4–5 months or older.

5.3.2 Late medieval results

Cattle

In comparison to the cattle mandibles from Phases 4 and 5, those from Phase 6 (n=28) and Phase 7 (n=5) produce smaller samples. Nonetheless, some results from the analysis can be considered. Similarly to the early medieval phases, all age classes were present in Phase 6. This suggests the majority of cattle were either in their second and third year (immature and sub-adult) or of ages three and older (adult) when slaughtered, each age groups representing 39.3% (Figure 5.53). The sexing information for Phase 6 cattle shows that 83% of cattle within these age groups are female, and again indicates that those killed before the age of two were male. The presence of young calves also suggests that cattle were also bred on-site during the late medieval period, which is indicative of a producer-consumer site. The occurrence of elderly cattle is also recorded, suggesting their use for dairying, breeding, or traction, as well as meat supply.

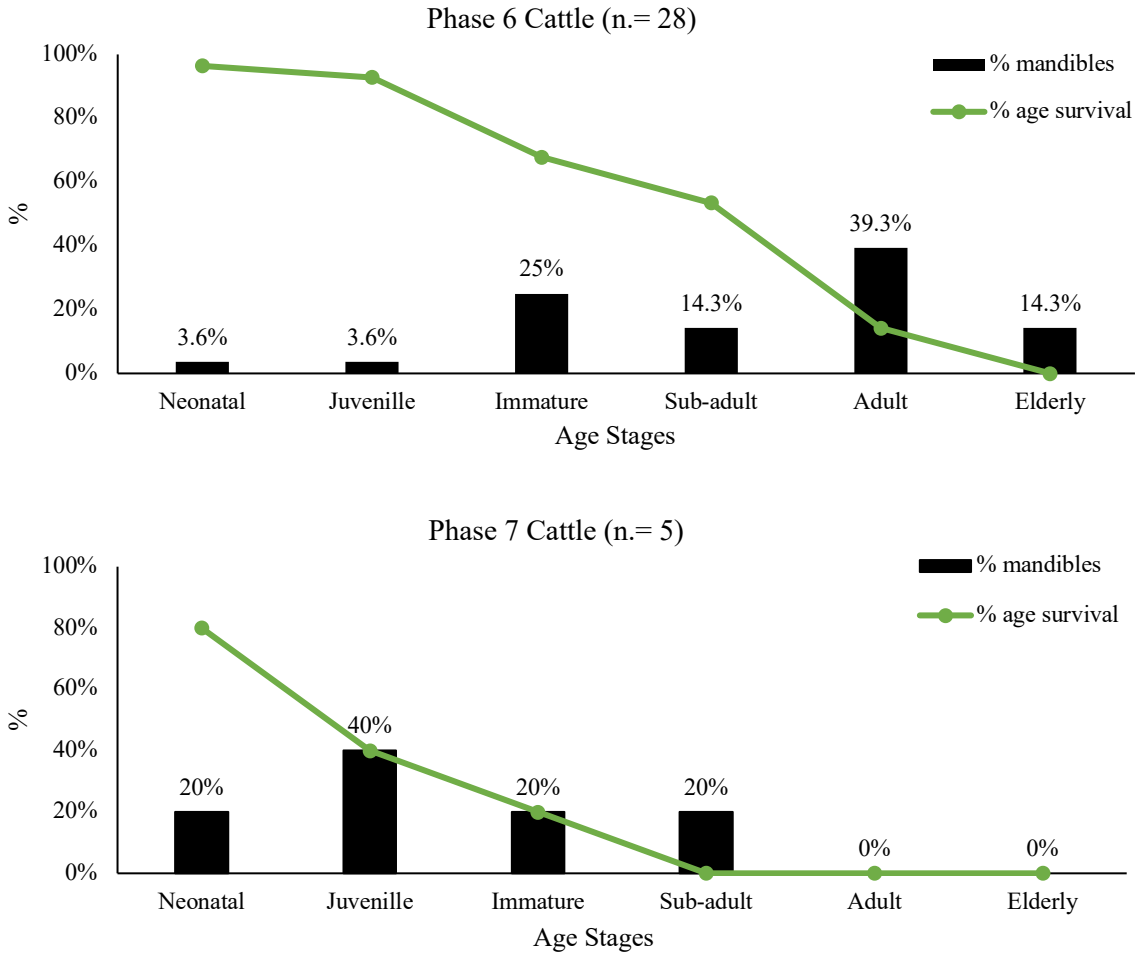


Figure 5.53: Percentages of cattle mandibles by age after Grant (1982) and O'Connor (1988). The data presented are from the late medieval phases of activity, Phase 6 and Phase 7, Caherconnell.

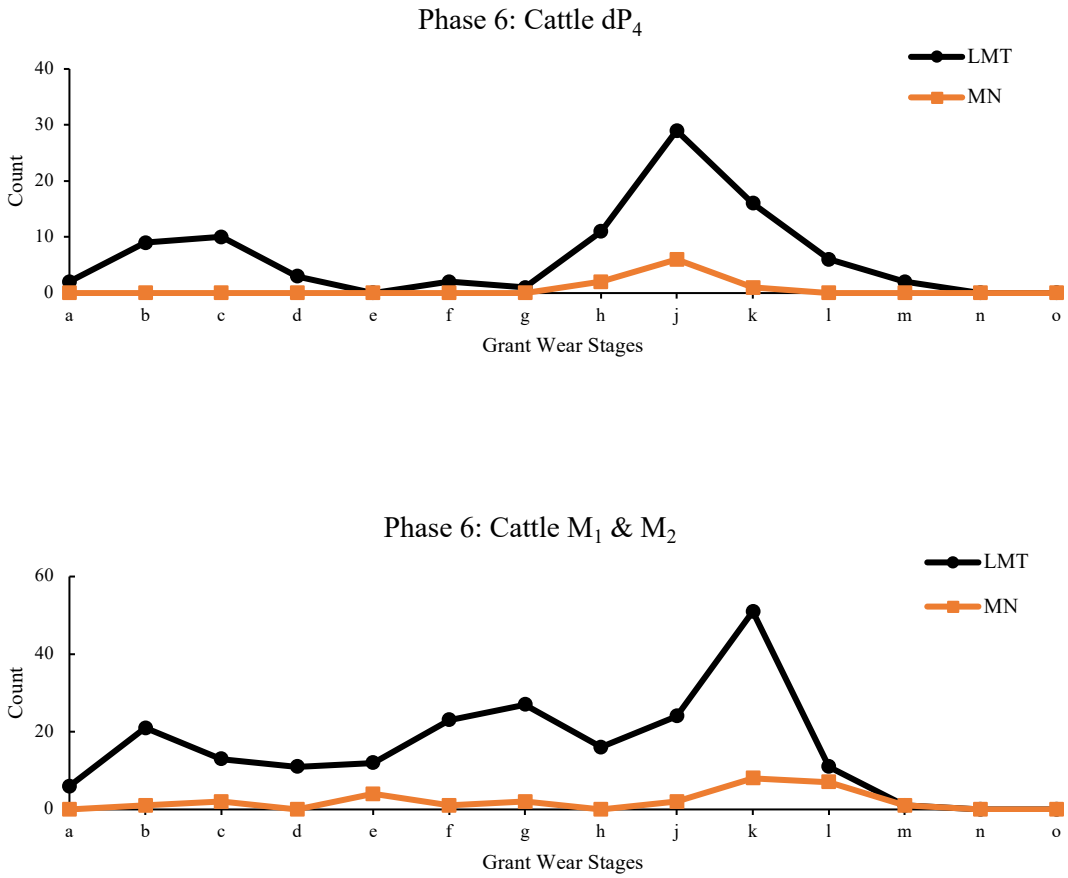


Figure 5.54: Tooth wear stages for M_1, M_2, and dP_4 for loose mandibular teeth (LMT) and teeth in mandible (MN) from Phase 6, Caherconnell. M_1 and M_2 are combined. Tooth wear stages follow Grant (1982).

Tooth wear was also recorded and analysed for loose mandibular teeth (dP_4, M_1, and M_2) and plotted with wear stages of the mandibular teeth from the late medieval phases (Figure 5.54 and 5.55). The occurrence of teeth with wear stages indicative of young calves, namely unworn M_1 and M_2, or dP_4 with early wear stages, from Phase 6 is again low meaning younger individuals were present but in fewer quantities. The majority of dP_4, M_1, and M_2 teeth are well worn, which is representative of older animals. These Phase 6 results from the Grant wear stages follow the same pattern seen in the mandibular age stages discussed previously, and further demonstrate the results from the mandibular wear stage do not underrepresent younger cattle. Overall, this data from Phase 6 follows the same pattern seen within the early medieval results. The mandibular wear stages for Phase 7 is based on a sample of five mandibles with no adult or elderly remains. The Grant wear stages for Phase 7 cattle is also based on a small sample, however the results follow the patterns for Phases 4–6. Phase 7 produced a very small sample for both mandibular wear stages and tooth wear stages, which make interpretation of this data difficult.

The epiphyseal fusion data from late medieval cattle has produced similar trends, which correlates with the ageing data from tooth eruption and wear stages, with Phase 7 again

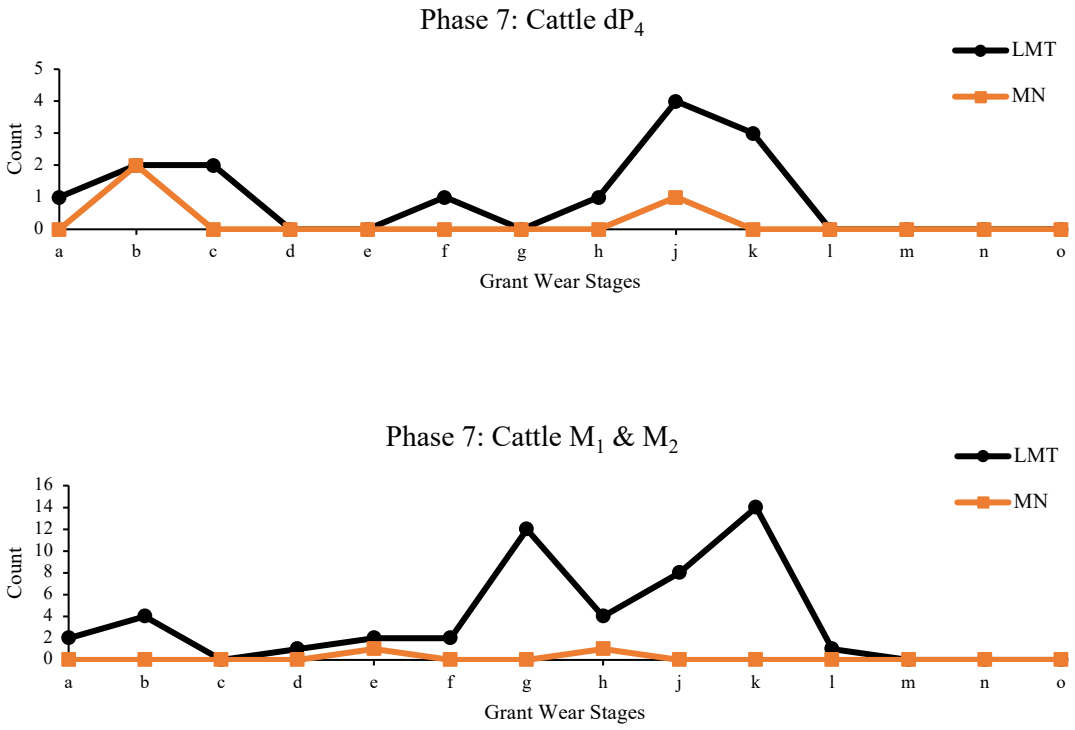


Figure 5.55: Tooth wear stages for M_1, M_2, and dP_4 for loose mandibular teeth (LMT) and teeth in mandible (MN) from Phase 7, Caherconnell. M_1 and M_2 are combined. Tooth wear stages follow Grant (1982).

producing a smaller sample than the other phases. The dominance of older cattle in the late medieval period is visible through the higher count of fused bones throughout the three fusion categories (Figure 5.56). To sum up the Phase 6 data, 92.4% of bones which fuse early (up to 24 months) were fused and 7.6% were unfused. 79.8% of middle fusing bones (between 24–42 months) were fused and 20.2% were unfused. Of the late fusing bones (between 42–48

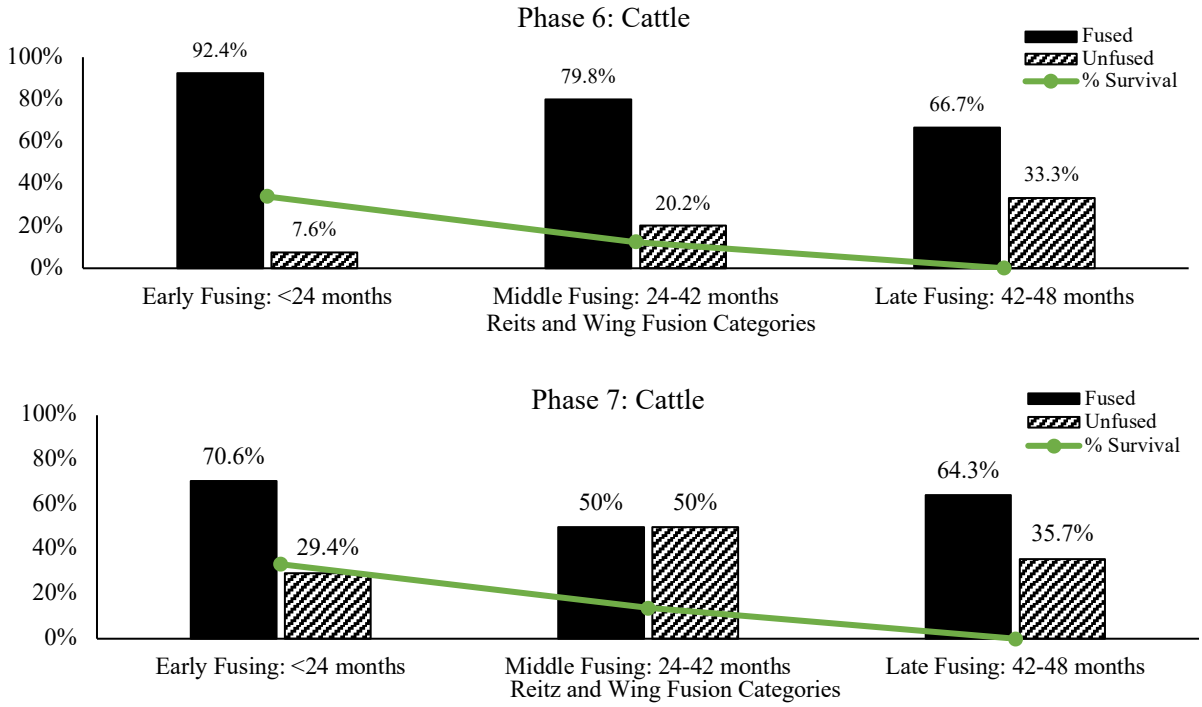


Figure 5.56: Reitz and Wing (2008) fusion categories and counts for late medieval cattle from Phase 6 and Phase 7, Caherconnell.

bones), 66.7% were fused and 33.3% were unfused (Table A5.37). Phase 7 broadly follows the pattern of fused bones having a higher count, however possibly due to the smaller sample size, the middle and late fusing categories have produced less diverse ranges. In summary, 70.6% of bones which fuse early (up to 24 months) were fused and 29.4% were unfused. 50% of middle fusing bones (between 24–42 months) were fused and 50% were unfused. Of the late fusing bones (between 42–48 bones), 64.3% were fused and 35.7% were unfused (Table A5.38).

Sheep

In comparison the sheep mandibles from Phases 4 and 5, those from Phase 6 (n=24) and Phase 7 (n=9) produced smaller samples. Nonetheless, the results from the analysis will be briefly discussed. The mandibular wear stages from Phase 6 indicate most age classes are present. Similar to the early medieval results, the data from Phase 6 suggest the majority of sheep (72.2%) were in their first, second, or third year when slaughtered (Figure 5.57). After their third year, slaughter drops to 5.6% per age group and below. The presence of an individual aged 2–6 months suggests that sheep were also bred on-site during the late medieval period. Although a small sample, the results from Phase 6 roughly follow those seen in the early medieval results and are suggestive of a meat-producing economy. The presence of individuals

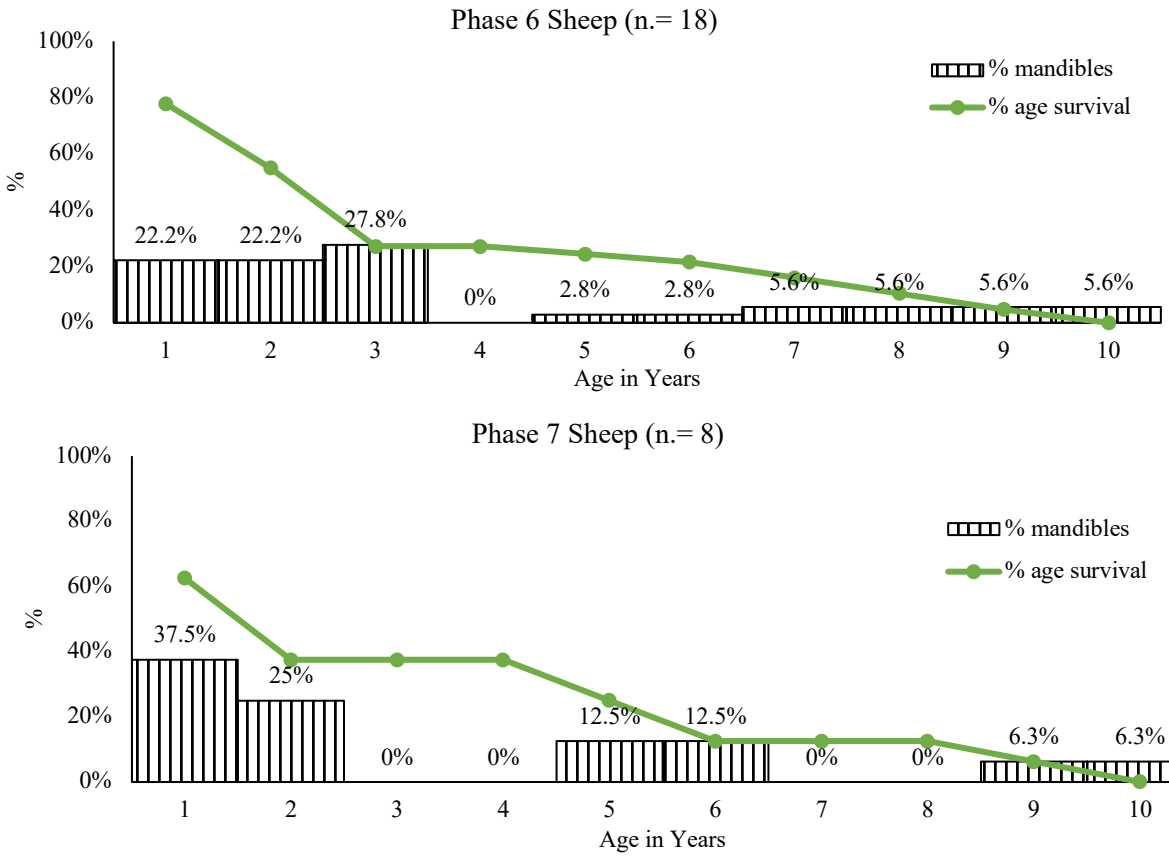


Figure 5.57: Percentages of sheep mandibles by age after (Payne 1973, 1987). The data presented are from the early medieval phases of activity, Phases 6 and 7, Caherconnell.

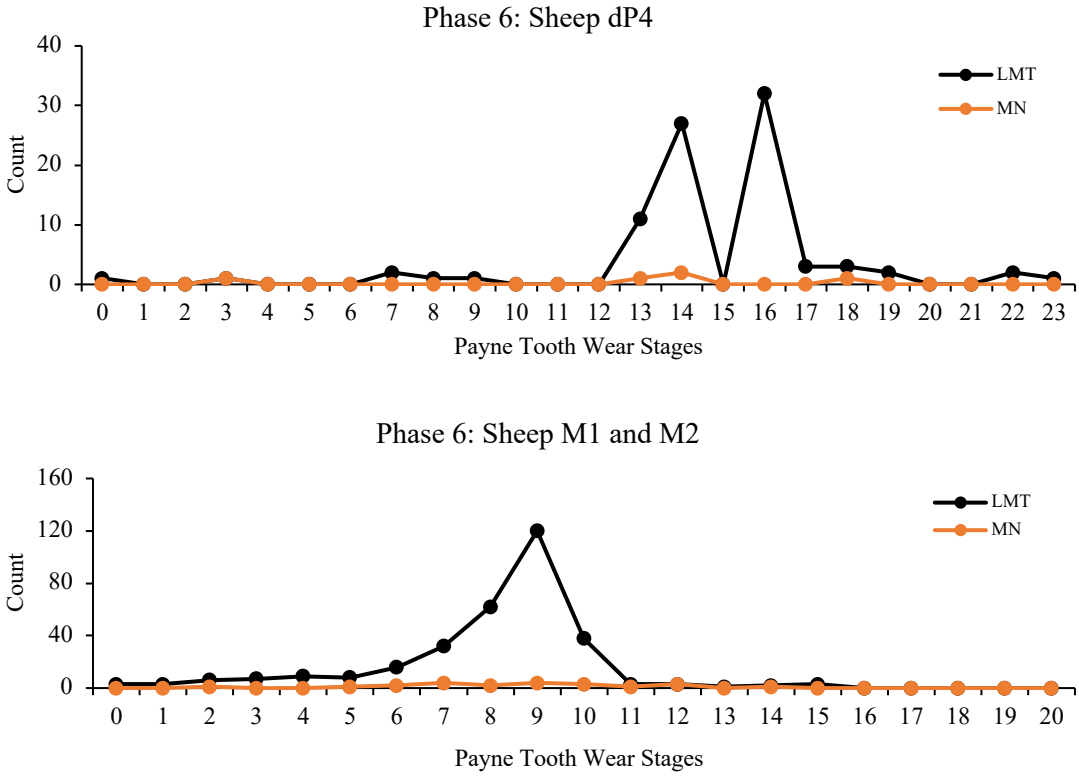


Figure 5.58: Tooth wear stages for M_1, M_2, and dP_4 for loose mandibular teeth (LMT) and teeth in mandible (MN) from Phase 6, Caherconnell. M_1 and M_2 are combined. Tooth wear stages follow Payne (1973, 1987).

younger and older than the majority may represent animals used for secondary products such as milk and wool. This points to a mixed economy at Caherconnell during the late medieval period, with meat production being the primary focus.

As previously mentioned, the sample size from Phase 7 is small and no major conclusions can be drawn from these results. Unlike the other phases of activity, the mandibular wear stages from Phase 7 have produced evidence of an individual up to 2 months old. This is possibly further evidence of sheep being bred on-site during the late medieval period. There is once again evidence of sheep in their first and second year, and older individuals aged 4–6 years. As this sample consists only of nine individuals it is difficult to make any further conclusion, except to say it is possible these results follow the patterns seen in Phases 4–6.

The tooth wear was also recorded and analysed for loose mandibular teeth (dP_4, M_1, and M_2) and plotted with wear stages of mandibular teeth from Phase 6 (Figures 5.58). The occurrence of teeth with wear stages indicative of young lambs from Phase 6 is again low, meaning younger individuals were present, but in fewer quantities. The same pattern seen in the early medieval results is seen here with peak wear for dP_4 being 14 and 16 and possibly representative of individuals in their first and second year, and peak wear for M_1 and M_2 is 9, which possibly represents individuals in their second and third year. This suggests that both the

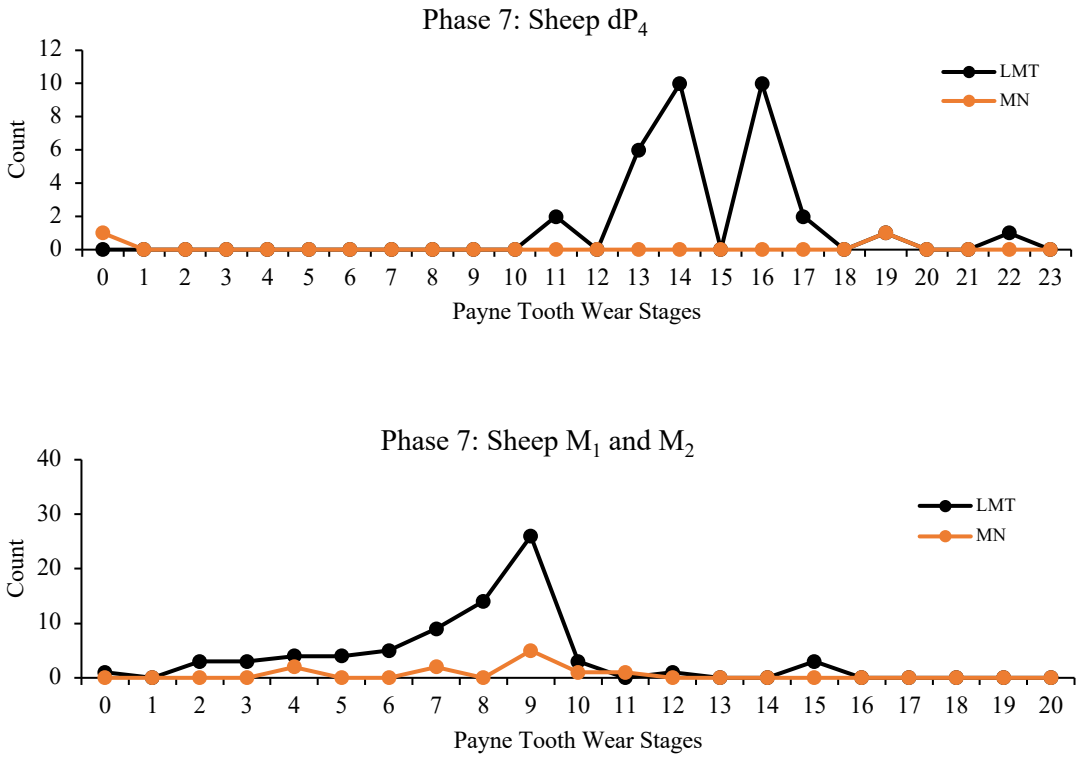
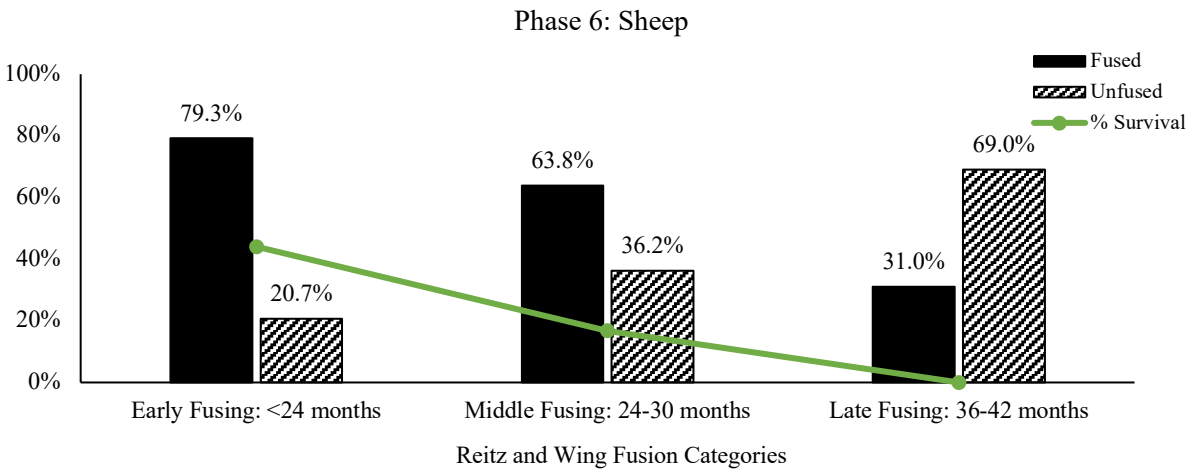


Figure 5.59: Tooth wear stages for M1, M2, and dP4 for loose mandibular teeth (LMT) and teeth in mandible (MN) from Phase 7, Caherconnell. M1 and M2 are combined. Tooth wear stages follow

in situ and loose mandibular teeth present similar patterns and the mandibular wear stages do not underrepresent younger sheep within the assemblage.

Figure 5.59 illustrates similar data of loose and mandibular teeth and teeth in mandibles for Phase 7 sheep. The low occurrence of young lambs is once again evident. The peak wear for dP_4 is 14 and 16, believed to represent individuals in their first and second year. The M_1 and M_2 wear has a peak of 9, which possibly represents individuals in their second and third year. It is again evident the mandibular wear stages do not underrepresent younger sheep within the assemblage. Overall, the tooth wear stages of loose mandibular teeth, although less reliable to assign to strict ages, appear to present the same pattern of peak slaughter of sheep in their first, second, and third year. As in the early medieval phases, this points to meat being the primary product.

The epiphyseal fusion data for late medieval sheep from Phase 6 has the same trends, which correlate with the ageing data recorded from tooth eruption and wear stages, through Phase 7 has a slight difference. Table A5.41 displays the results for the fusion stages of Phase 6 sheep bones through a count of the fused and unfused proximal and/or distal ends. To sum up for Phase 6 sheep, 79.3% of early fusing bones were fused and 20.7% were unfused. 63.8% of middle fusing bones were fused and 36.2% were unfused. Of the late fusing bones 31% were fused and 69% were unfused. The higher occurrence of fused bones in the first two fusion



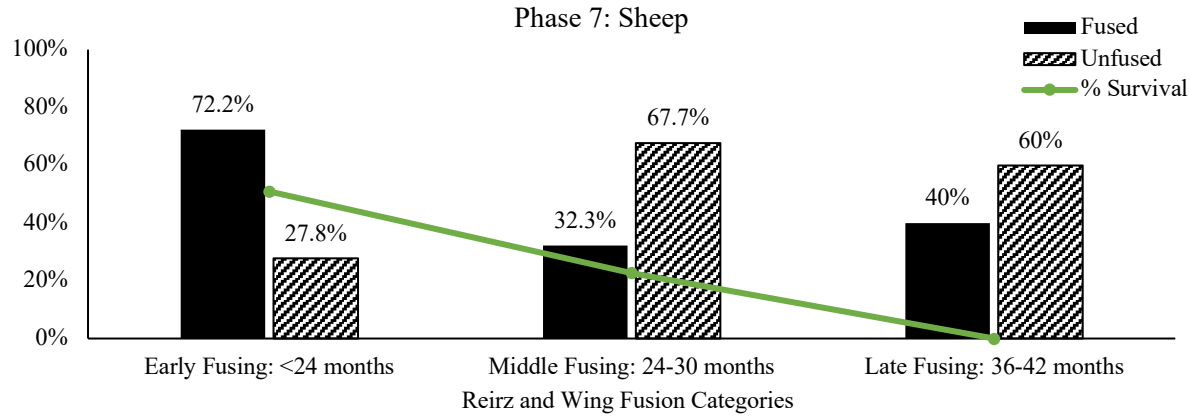


Figure 5.60: Reitz and Wing (2008) fusion categories and counts for late medieval sheep from Phase 6 and 7, Caherconnell.

categories indicates that sheep of ages up to three years dominated the assemblage (Figure 5.60) and correlates with the ageing data recorded from the tooth eruption and wear stages.

The results for Phase 7 sheep follow the trend previously discussed with one difference, the middle fusing bones has a higher count of unfused bones than fused bones (Table A5.42). An estimated 72.2% of early fusing bones were fused and 27.8% were unfused. 32.3% of middle fusing bones were fused and 67.7% were unfused. Of the late fusing bones 40% were fused and 60% were unfused. The higher count of unfused middle fusing bones suggests that the Phase 7 sample consists of slightly younger individuals than those in the early medieval period. The presence of unfused proximal metapodials from both phases is evidence of sheep bred on-site, as these particular bones fuse before birth.

Pig

Phase 7 (n=7) produced a small sample and only produced evidence of sub-adult and adult individuals with dominance of the latter. Phase 6 results are similar to those of the early medieval period (Figure 5.61). Sub-adult individuals dominate the assemblage while there is also some slaughter of immature and adult individuals. Few juvenile individuals were recorded, and as well as no elderly individuals or neonatal pigs. Overall, the results from Phase 6 indicate that the majority of pigs were 1.5–2 years when slaughtered, which likely represents those

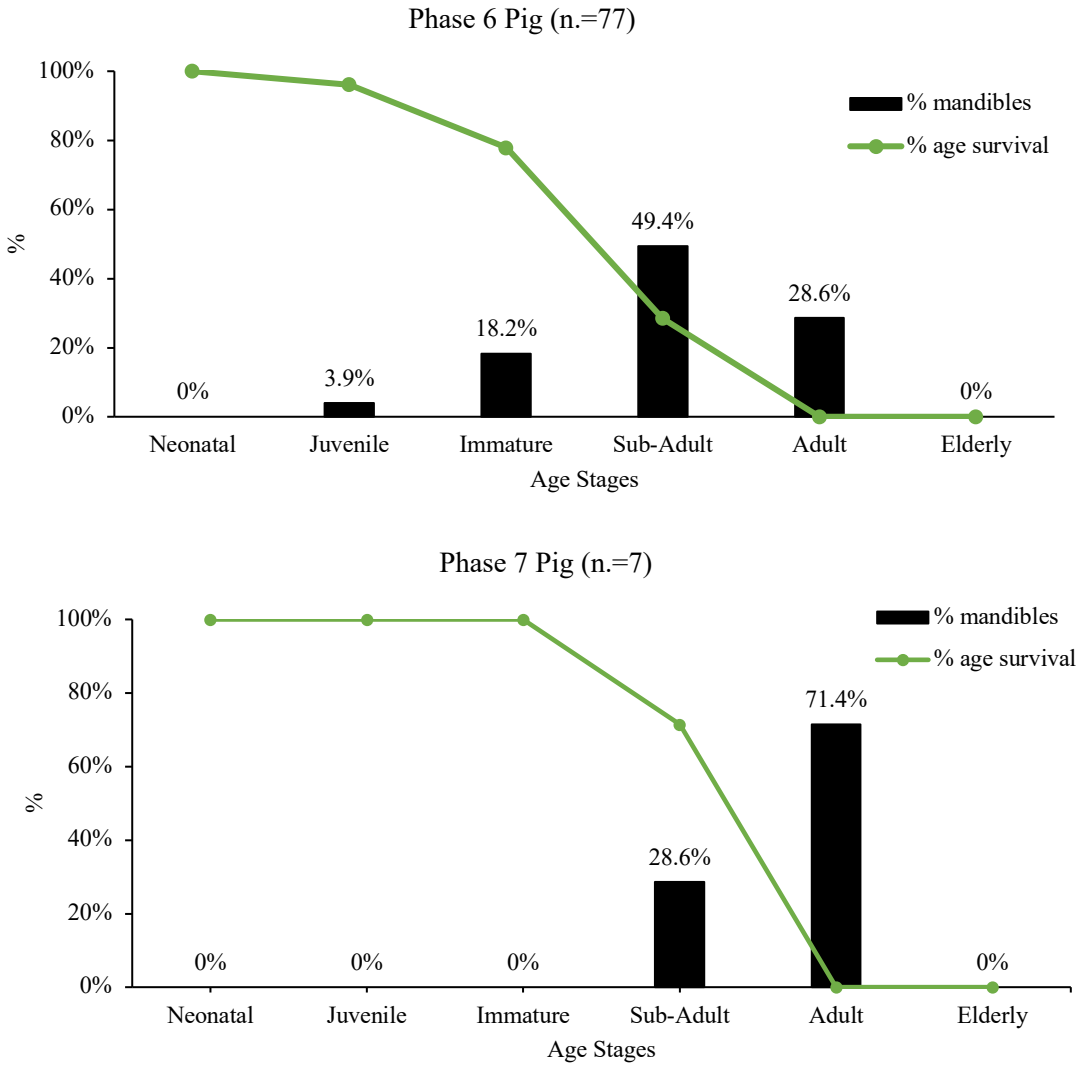
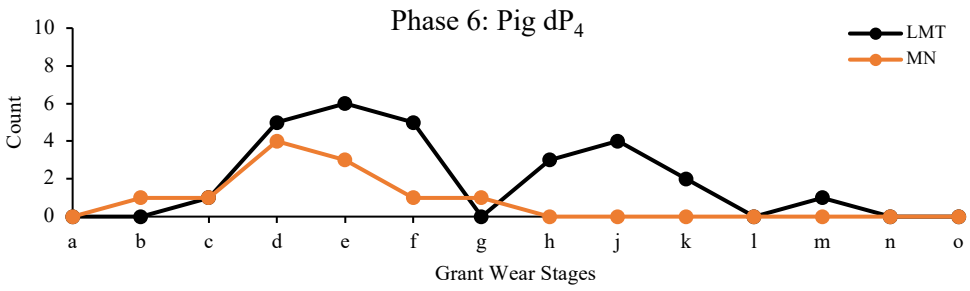


Figure 5.61: Percentages of pig mandibles by age after Grant (1982) and O'Connor (1988). The data presented are from the early medieval phases of activity, Phases 6 and 7, Caherconnell.

killed once full size was reached and were exploited for meat. The presence of younger individuals again suggests pigs were bred on-site during the late medieval period.

Tooth wear was also recorded and analysed for loose mandibular teeth (dP_4, M_1, and M_2) and plotted with wear stages of the mandibular teeth from the late medieval phases (Figures 5.62 and 5.63). The occurrence of teeth with wear stages indicative of young pigs, namely unworn M_1 and M_2, or dP_4 with early wear stages, from Phase 6 is again low meaning younger individuals were present but in fewer quantities. The majority of P_4, M_1, and M_2 teeth have wear stages representative of individuals in their first and second year. The Phase 6 results from the Grant wear stages follow the same pattern seen in the mandibular age stages discussed previously, and further demonstrate that the latter do not under-represent younger pigs. Overall, this data from Phase 6 follows the same pattern within the early medieval results. The mandibular wear stages for Phase 7 are based on a small sample of seven mandibles with no neonatal, juvenile, immature, or elderly individuals present. The Grant wear stages for Phase 7 pigs is also based on a small sample, however the results somewhat follow the patterns for



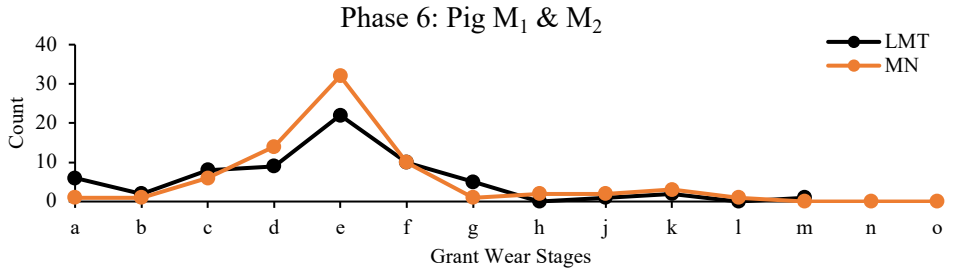
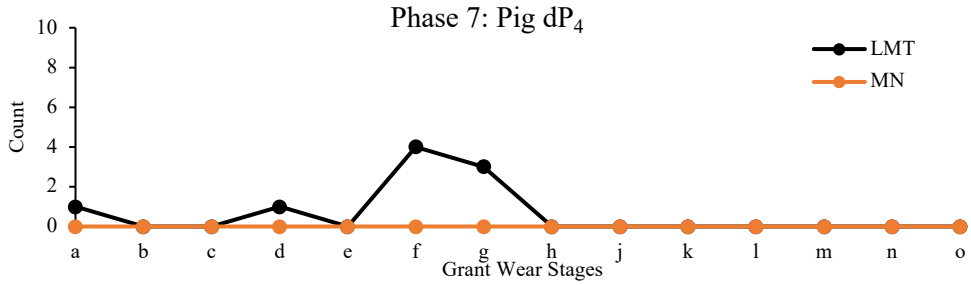


Figure 5.62: Tooth wear stages for M_1, M_2, and dP_4 for loose mandibular teeth (LMT) and teeth in mandible (MN) from Phase 6, Caherconnell. M_1 and M_2 are combined. Tooth wear stages follow Grant (1982).



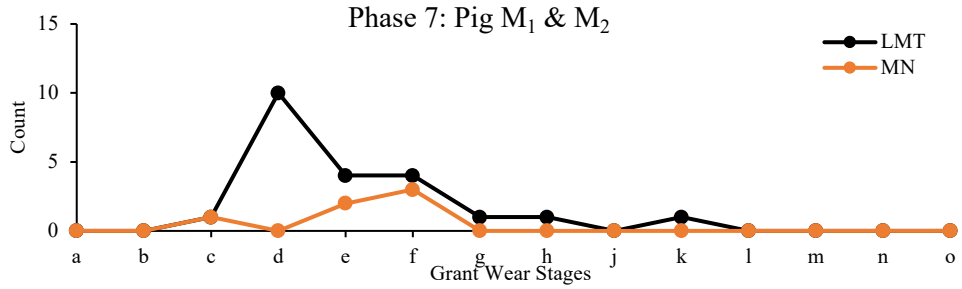


Figure 5.63: Tooth wear stages for M_1, M_2, and dP_4 for loose mandibular teeth (LMT) and teeth in mandible (MN) from Phase 7, Caherconnell. M_1 and M_2 are combined. Tooth wear stages follow Grant (1982).

Phases 4–6. Phase 7 produced a very small sample for both mandibular wear stages and tooth were stages, which make interpretation of this data difficult.

The epiphyseal fusion data from late medieval pigs at Caherconnell correlates well with the aging data recorded from tooth eruption and wear stages, with Phase 7 again producing a smaller sample than the other phases and slightly different results. Tables A5.45 and A5.46 displays the results for the fusion stages of Phase 6 and 7 pig bones through a count of the fused and unfused proximal and/or distal ends. To sum up the Phase 6 data, 65.3% of early fusing bones were fused and 34.7 were unfused. 23% of middle fusing bones were fused and 77% were unfused. Of the late fusing bones 18.5% were fused and 81.5% were unfused. The fusion

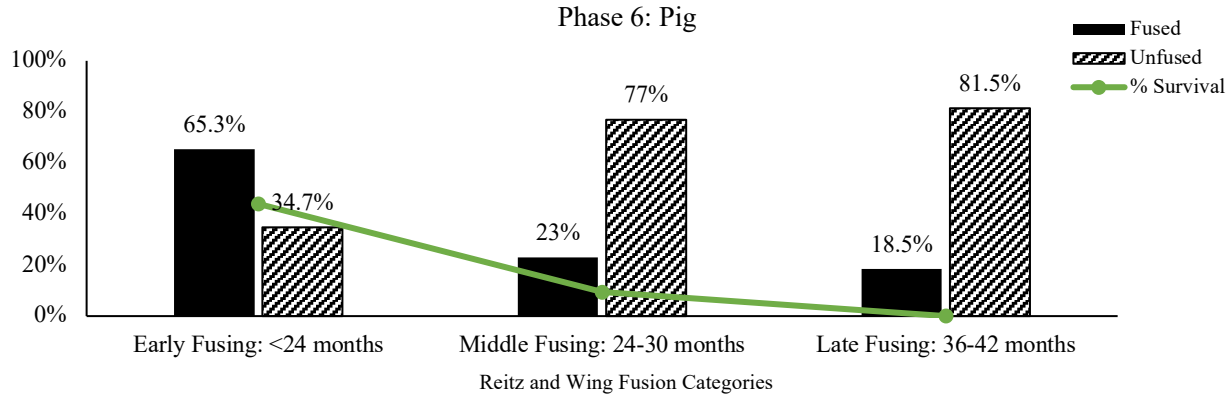
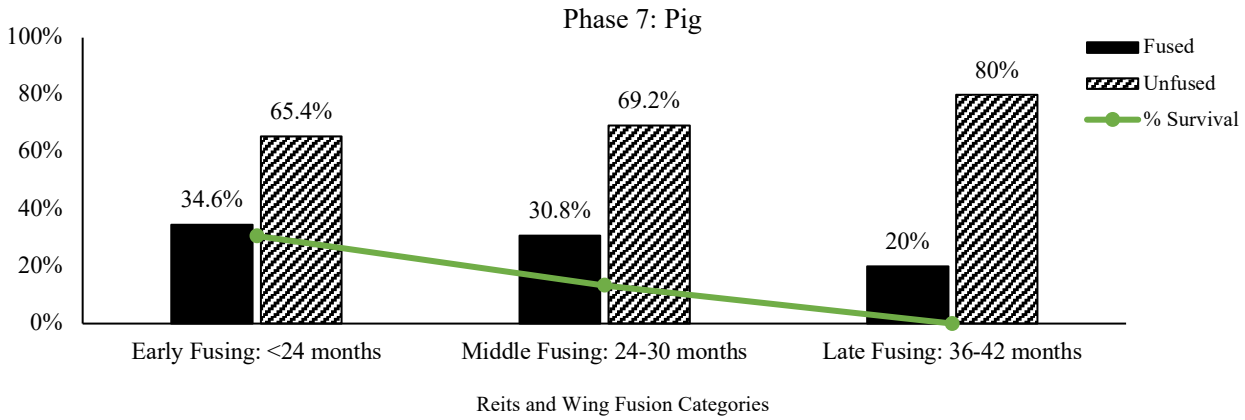


Figure 5.64: Reitz and Wing (2008) fusion categories and counts for early medieval pigs from Phase 6 and Phase 7, Caherconnell.



data indicates that the majority of pigs were between 1–2.5 years when killed and overall, the counts from the three fusing categories correlates with the ageing data recorded from the tooth eruption and wear stages (Figure 5.64). Phase 7 broadly follows the pattern seen in Phase 6, however possibly due to the smaller sample size the ratios for fused and unfused bones varies. In summary, 34.6% of early fusing bones were fused and 65.4% were unfused. 30.2% of middle fusing bones were fused and 69.2% were unfused. For the late fusing bones 20% were fused and 80% were unfused.

Horse

As discussed previously, the killing of horses for food and raw materials was not a common occurrence as they were primarily working animals (McCormick 2007, 92). The age at death for horses from Phases 6 and 7 was analysed through epiphyseal fusion. No ageing data was available from dental records as all of the teeth were isolated.

Phase 6 produced a sample size of 22 bones for analysing the proximal and distal epiphyseal fusion (Table A5.49). These 22 elements include 18 fused epiphyses and seven unfused epiphyses. As the majority of horse bones had fused proximal or distal epiphyses, it is

evident the majority of horses at Caherconnell were mature individuals. The seven unfused elements represent individuals that have not reached a certain age range, with the youngest below the age of 15–18 months, represented by unfused distal epiphyses of metacarpals. Phase 7 presents a sample of 12 bones for epiphyseal fusion analysis (Table A5.50). This selection includes 10 fused epiphyses and 3 unfused epiphyses, again suggesting the majority of horses were mature individuals with the youngest individual younger than two years.

Dog

Both epiphyseal fusion and tooth eruption were analysed for dogs from the late medieval phases at Caherconnell to estimate age at death. Phase 6 produced a sample of eight dog bones for analysing epiphyseal fusion (Table A5.53). All eight bones were fused and represent mature individuals. No dog bones from Phase 7 produced suitable data on epiphyseal fusion. No mandibles with teeth were recovered from Phase 6 and 7 and therefore no data is available for the analysis of tooth eruption in late medieval dogs. A total of six loose mandibular teeth were recovered from Phase 6, with five recovered from Phase 7. As previously discussed, no ageing data can be interpreted from these elements.

Cat

The age at death for the Caherconnell cats was estimated through stages of epiphyseal fusion and tooth eruption stages (Habermehl 1961; Silver 1969; Smith 1969). Phase 6 produced a sample size of five bones for analysing the stages of proximal and distal epiphyseal fusion (Table A5.56). These five elements produced four fused epiphyses and one unfused epiphysis. As the cat bones from Phase 6 are suggested to represent a single individual, it is possible to obtain an age range for this individual from this small sample as all but one bone is fused. In the group of later fusing bones there is one fused distal epiphysis of a tibia and an unfused femur distal epiphysis. The distal epiphysis of the tibia fuses 40–52 weeks, while the distal epiphysis of the femur fuses 54–76 weeks (*ibid.* 526). Therefore the cat bones from Phase 6 probably represent one individual between the age of 40–52 weeks and 54–76 weeks. Phase 7 produced a sample size of four bones for epiphyseal fusion analysis (Table A5.57). This sample includes the four metacarpals found in the right fore-limb, and similarly to Phase 6, are likely representative of one individual. All four metacarpals were fully fused, which is further evidence of them being from one cat, and represent an individual older than 29–40 weeks (*ibid.*).

Phase 6 produced a sample size of five, two mandibles and three maxillas, for the analysis of tooth eruption stages. All five elements have fully erupted teeth, four represent individuals older than 5–6 months and one represents an individual older than 5.5–6.5 months. Phase 7 did not produce any mandibles or maxillas with tooth eruption information; all teeth were loose and isolated.

5.4 Biometry

This section discusses the biometrical data for the domesticates at Caherconnell. The measurements in this section follow those of von den Driesch (1976) with abbreviations presented in Table A1. Metrical variation within an animal population can be reflective of stature, age, sex, or residual individual variation (Payne, and Bull 1987, 29). Metrical analysis included both bone and mandibular tooth measurements. While bone measurements are influenced by genetic, biological, and environmental factors, tooth size is more conservative and more likely influenced by genetics (O'Connor 2020, 67).

The stature of these Caherconnell domesticates was estimated from the metrical data in various ways. Firstly, the estimated withers heights (EWH) were calculated using the multiplication factors of Fock (1966) and Matolcsi (1970) (quoted in von den Driesch and Boessneck 1974, 336, 339, 341). For cattle, this method requires the presence of complete long bones, for the measurement of the greatest length (GL), the occurrence of which was extremely low for cattle bones throughout all four phases of activity. For sheep and pig, as well as the long bone measurements, measurements from the girdle bones (scapula and pelvis), and the large tarsal bones (astragalus and calcaneum) were also used. The size and shape of the three dominant domesticates was further analysed through the log ratio method with the aim of examining change throughout time.

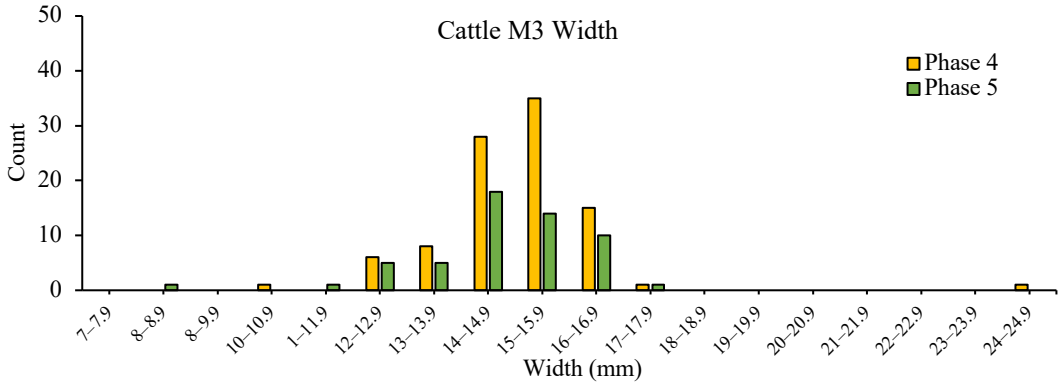


Figure 5.65: Count of width measurements of lower third molar of cattle from Phases 4 and 5, Caherconnell.

5.4.1 Early Medieval Results

Cattle

Only two radii bones, both from Phase 4, provided the measurements required to calculate the estimated withers heights, providing estimates of 109cm and 111cm respectively. No further interpretation can be made on the overall difference of stature between phases of activity based on this limited data. Even though only two estimated withers heights were produced, they both lie within the majority of estimated withers height range seen in other medieval assemblages, including Knowth, Co. Meath, Courthouse Lane Galway, and Deer Park Farms Co. Antrim (Murray 2004, 586; McCormick and Murray 2007, 80; 2011, 474).

To further investigate the stature of the Caherconnell cattle, measurements were compared from both phases of activity. Measurements for the most frequently occurring element, the astragalus, were summarised to display the metrical variation of cattle bones throughout the assemblage. Table A5.58 displays the count, mean, minimum, maximum, standard deviation, and coefficient of variation, for the measurements taken for all cattle astragali. Pearson's coefficient of variation (CV), which expresses the standard deviation as a

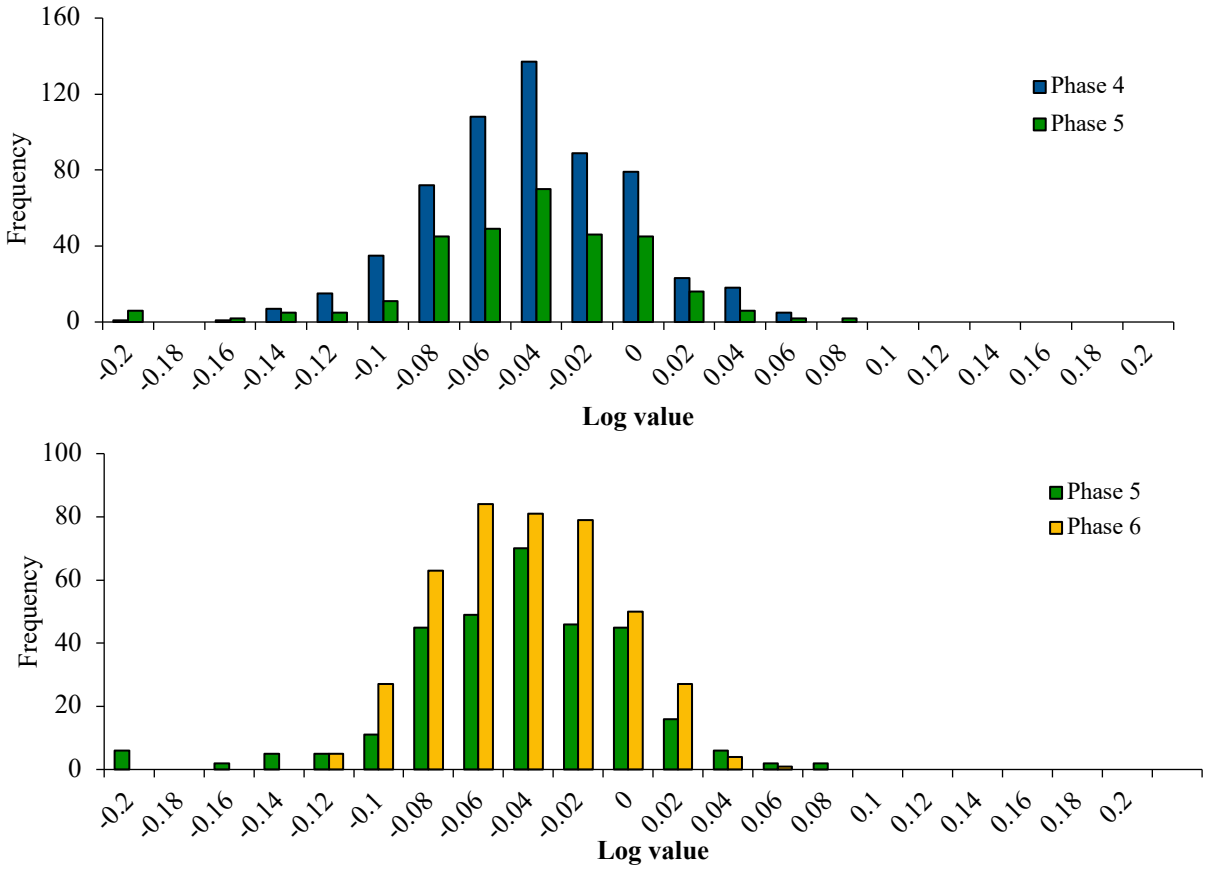


Figure 5.66: Log-scaled cattle post-cranial bone measurements (lengths, breadths and depths combined) between Phases 4, 5 and 6 at Caherconnell.

percentage of the mean (CV=SD x 100/mean), can be used to compare the variation in different measurements and samples (Payne and Bull 1987, 29). The values from Phases 4 and 5 have similar ranges and averages, with no notable difference in stature between the phases. Assessing changes in size through the measurements of astragali is a reliable method as this element is tightly locked within a joint and is less likely to be affected by post-fusion growth or pathological changes (Murray 2004, 586). Another advantage of using the astragalus to analyse the stature of cattle is that it is regarded as one of the least sex-biased elements (Higham 1969, 64).

Another skeletal element that shares this property is the third permanent mandibular molar (M_3) (Albarella and Davis 1996, 16). The metrical data collected from cattle M_3 indicates no variation in this sample, which suggests that there is no change in the genotype of the early medieval cattle (Albarella and Davis 1996, 16). The metrical data clusters in the same area for both phases and display no size increase or decrease over time (Figure 5.65).

Cattle post-cranial bone measurements were further analysed through the log ratio method with the aim of analysing the change in size and shape overtime between the phases of activity. Figure 5.66 shows a skew to the left, indicating a negative value and that the archaeological specimens from Caherconnell are smaller than the standard. The results also show that there is little variation, none of which is statistically significant (Table A5.59), in the size and shape of cattle throughout time between Phase 4 and 5, as well as Phase 5 and 6, a trend previously seen from the other biometrical analysis.

Sheep

The mean of the estimated withers heights is 52.3cm in Phase 4 and 51.9cm in Phase 5 (Table A5.60), which suggests there was no change in stature for sheep between these phases

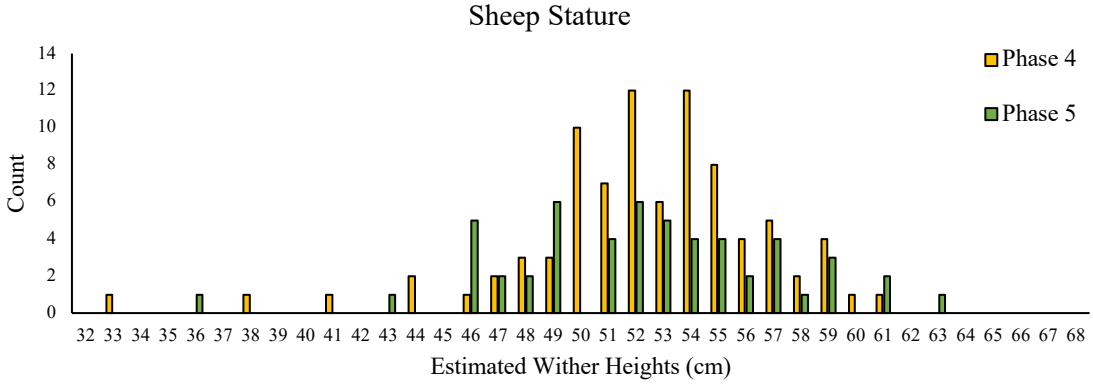


Figure 5.67: Estimated withers heights (EWH) for Caherconnell sheep from Phases 4 and 5.

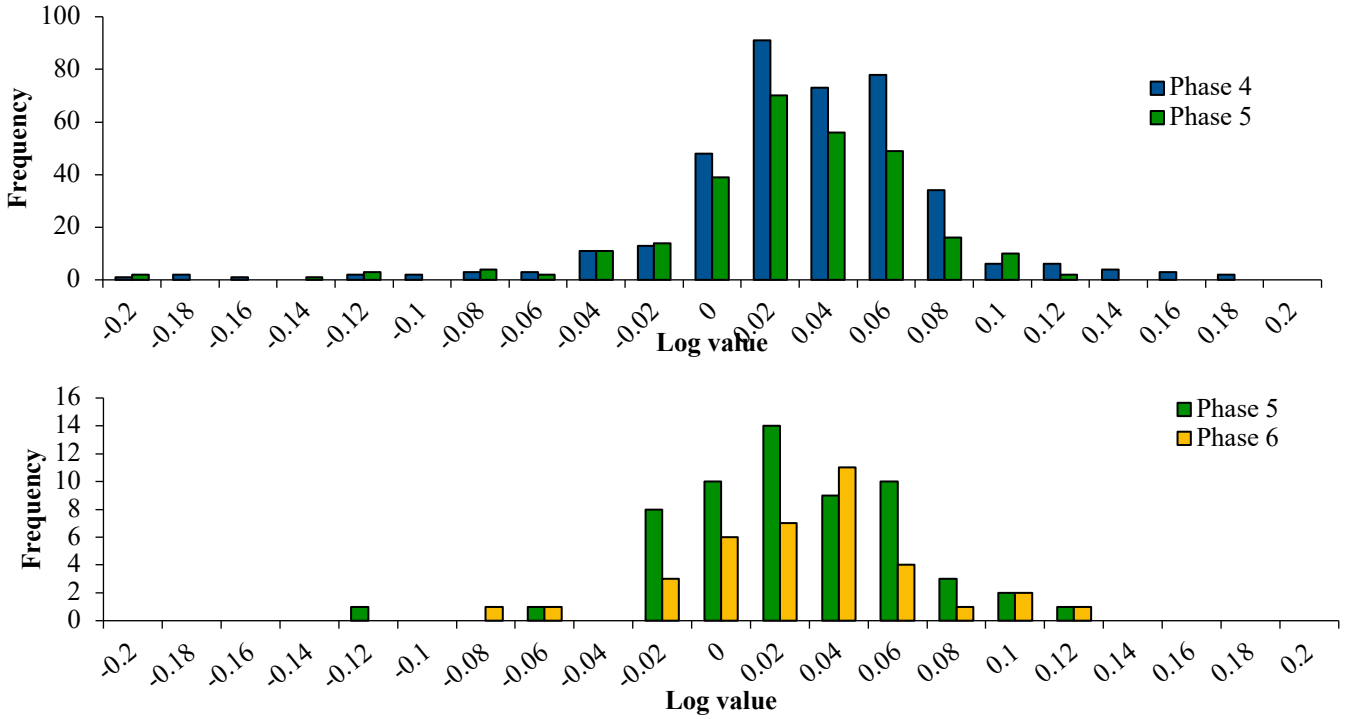


Figure 5.68: Log-scaled sheep post-cranial bone measurements (lengths, breadths and depths combined) between Phases 4, 5 and 6 at Caherconnell.

of activity (Figure 5.67). Sheep post-cranial bone measurements were further analysed through the log ratio method with the aim of analysing the change in size and shape overtime between the phases of activity. Figure 5.68 shows a skew to the right, indicating a positive value and that the archaeological specimens from Caherconnell are larger than the standard. The results also show that there is little variation in the size and shape of sheep throughout time between Phase 4 and 5, as well as Phase 5 and 6, a trend previously seen from the other biometrical analysis. The only statistically significant difference is seen between Phase 4 and 5 depth measurements (Table A5.59).

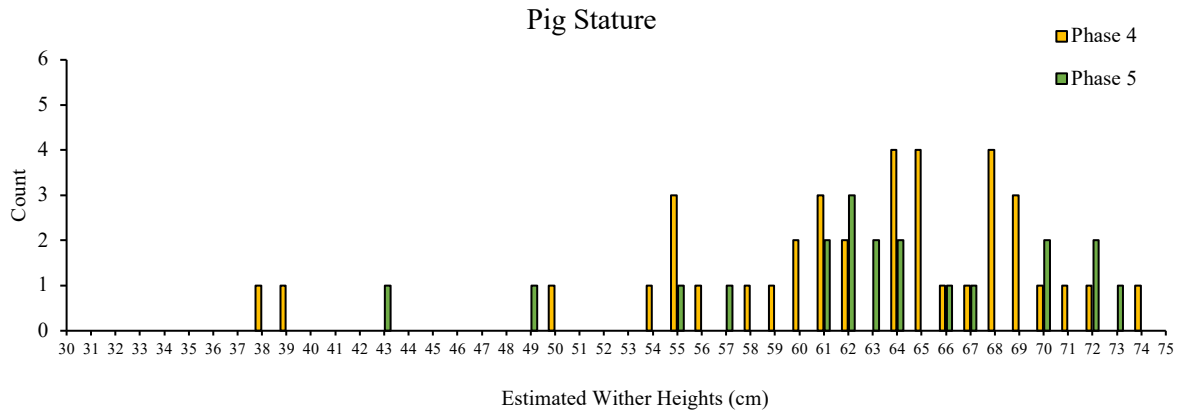


Figure 5.69: Estimated Withers Heights (EWH) for Phase 4 and 5 pigs at Caherconnell.

Pig

The mean of the estimated withers heights from Phases 4 was 62.1cm and 62.8cm from Phase 5 (Table A5.61). This suggests there was no significant change in stature for pigs between these phases of activity (Figure 5.69). Another way of investigating size change between the different phases of activity is to use teeth measurements. It is important to choose suitable measurements, which ideally have low levels of sexual dimorphism, age-related change, and residual individual variability (Payne and Bull 1987, 31). For this analysis tooth widths are most suitable. Measurements taken for the third molar have been used previously to separate wild and domestic pigs. For the Caherconnell pigs, width measurements from the third mandibular molar were compared and indicate no change over time (Table A5.62). Pig post-cranial bone measurements were further analysed through the log ratio method with the aim of analysing the change in size and shape overtime between the phases of activity. Figure 5.70 shows the results centred around zero, meaning the archaeological specimens from Caherconnell are a similar size to the standard. The results also show that there is little variation in the size and shape of pig throughout time between Phase 4 and 5, as well as Phase 5 and 6,

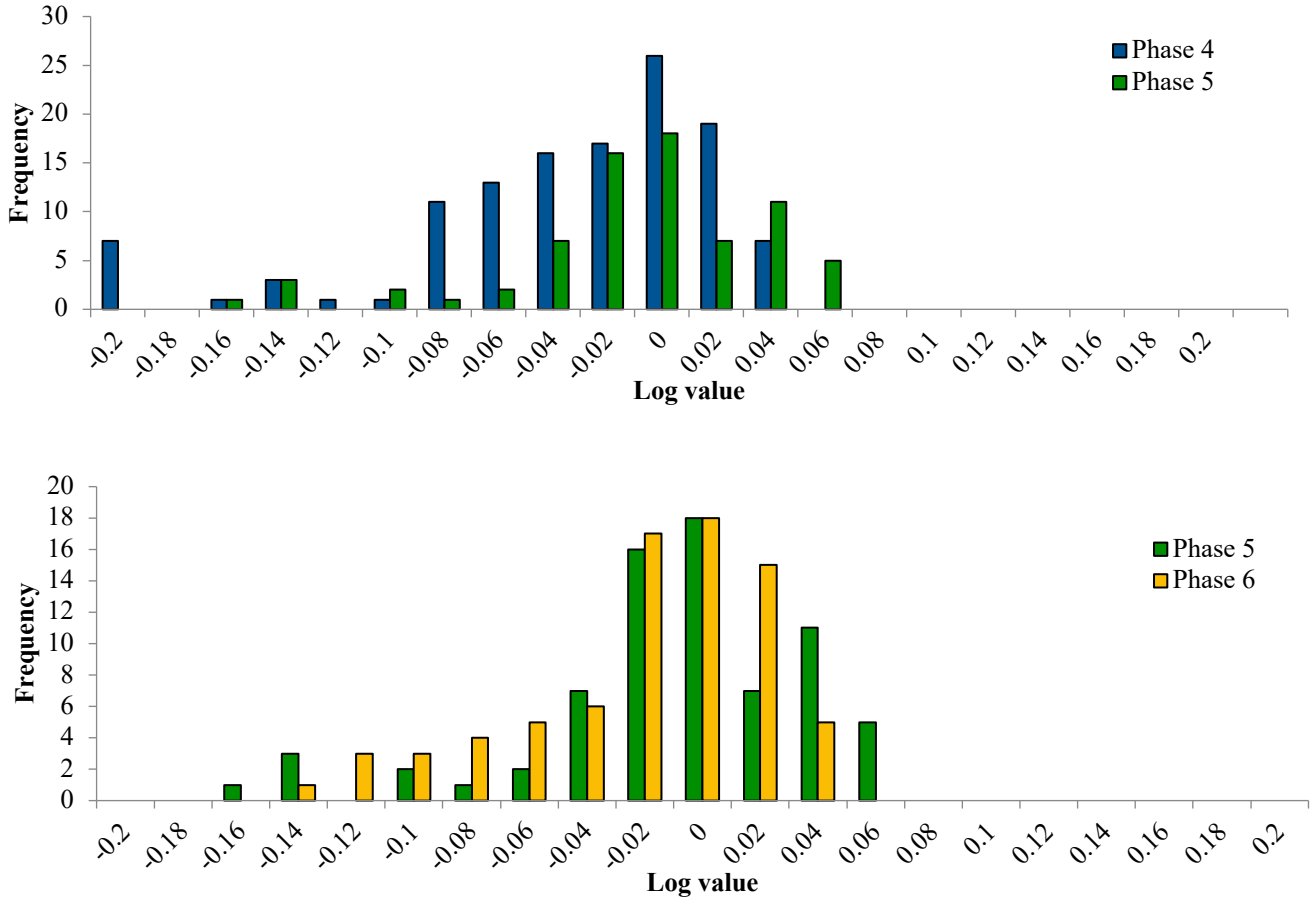


Figure 5.70: Log-scaled pig post-cranial bone measurements (lengths and breadths combined) between Phases 4, 5 and 6 at Caherconnell.

a trend previously seen from the other biometrical analysis. The only statistically significant difference is seen between Phase 4 and 5 breadth measurements (Table A5.59).

Horse

Horse bones from Phase 4 and 5 produced some measurable elements, but only two estimated withers heights (EWH) were calculated, both from Phase 4. Estimated withers heights were calculated through the multiplication factors of von den Driesch and Boessneck (1974, 333–4) (Table A5.63). Greatest length measurements are required for obtaining estimated withers heights, and for horses the length of the lateral part (Ll) is used. Two metacarpals from Phase 4 produced Ll measurements of 196mm (Bone ID: 1331) and 202mm (Bone ID: 19479) which were used to calculate estimated withers heights. The two estimated withers heights measurements of 125.6cm and 129.5cm represent horses of 12.4 and 12.7 hands. Horses of similar sizes have been found in other Irish studies, such as the medieval assemblages from Waterford, and are considered of pony size, comparable to Connemara ponies (Miller 1935, 485; Hurley *et al.* 1997, 832). Horse bones from Cahercommaun, Co. Clare produced three estimated withers heights with a mean of 132.7cm and are compared to the 'well-known Irish pony' (Hencken *et al.* 1938, 75). When comparing the results from Caherconnell to other sites, caution must be taken as estimated withers heights have been calculated incorrectly by the use of the GL measurements instead of the Ll, which results in estimated withers heights calculations being too large (Denham 2007, 264). Overall the average estimated withers height for horses in rural Ireland was 130.7cm which is comparable to the Caherconnell results (McCormick, Finbar 2007, 95).

Dog

Dog bones from the early medieval Phases 4 and 5 produced measurable elements, following von den Driesch (1976). These measurements were analysed to estimate the stature of the dogs at Caherconnell. Other faunal assemblages from early medieval Ireland have produced evidence of the supervised breeding of dogs and not a freely interbreeding population (McCormick 1991b, 44). This has been interpreted from the bimodal distribution produced from estimated withers heights and greatest lengths of early medieval dog bones. Methods used are estimated withers heights, limb bone comparisons, slenderness index, further bone comparisons.

Three estimated withers heights were produced from the Harcourt method (Table A5.64), all three from Phase 5: 34.9cm, 35.1cm, and 36.6cm. When compared to estimated

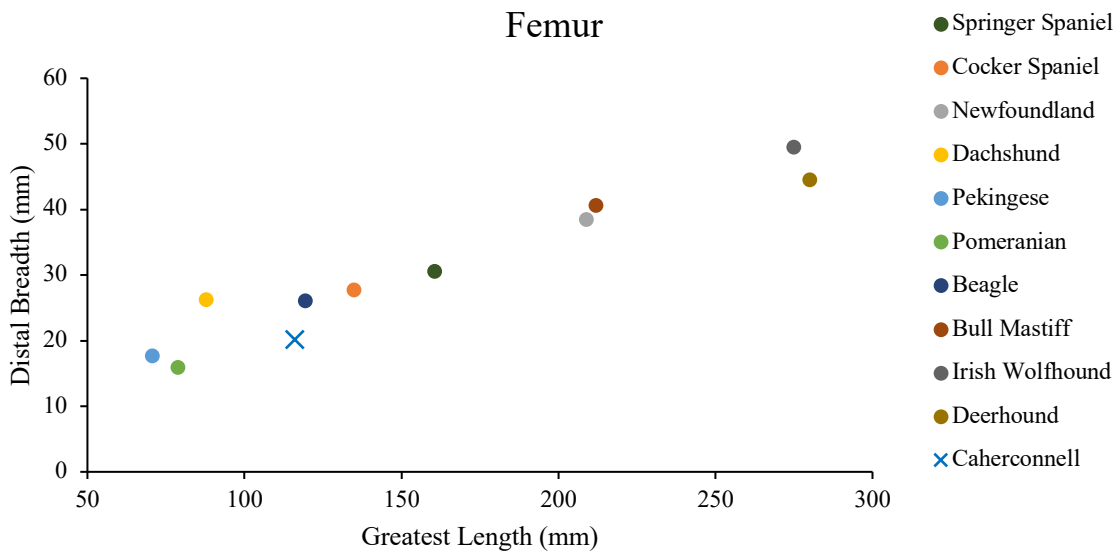


Figure 5.71: Limb bone comparisons of modern dog breeds after (Grieve 2012) with Caherconnell dogs (Phase 5) using the greatest length and distal breadth of the femur.

withers heights from modern dog breeds, these three Caherconnell estimates compare to small-medium size dogs, such as modern Beagles. Five estimated withers heights were produced from Clark's method (Table A5.65), one from Phase 4: 52cm, and the remaining four from Phase 5: 34.6cm, 37.7cm, 38.2cm, and 38.4cm. When these are compared to modern dog breeds, the Phase 4 example is similar to a Springer Spaniel size dog, and the Phase 5 examples compare to Beagle and Cocker Spaniel size dogs. Based on the bimodal distribution observed during the early medieval period, the majority of estimated withers heights fall into the smaller population of dogs between 20 and 45cm, with one example in a taller population between 50 and 75cm.

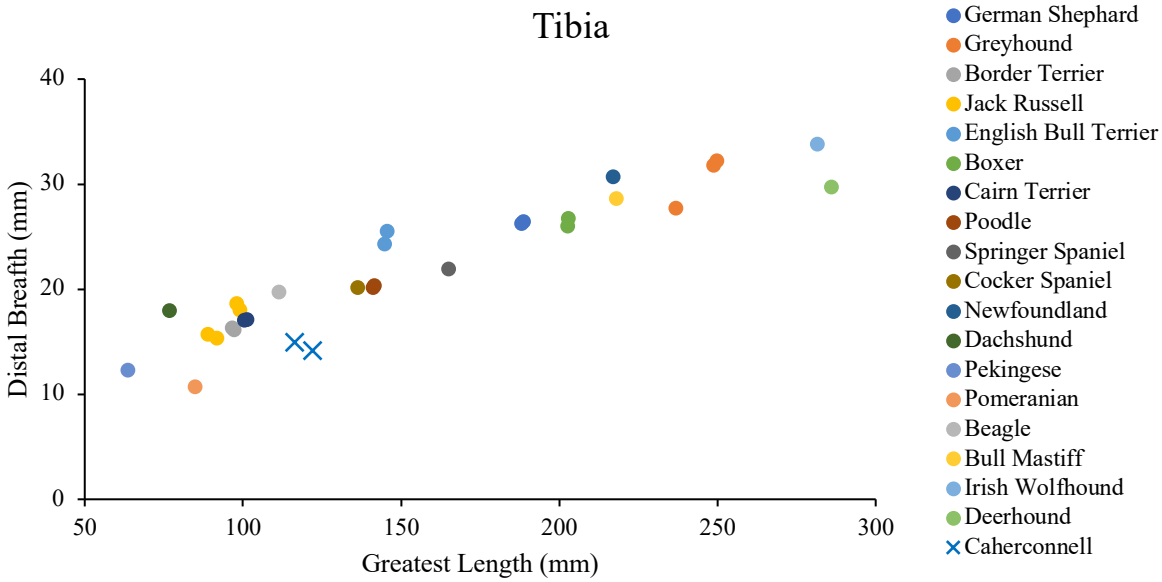


Figure 5.72: Limb bone comparisons of modern dog breeds (after Grieve 2012) with Caherconnell dogs (Phase 5) using the greatest length and distal breadth of the tibia.

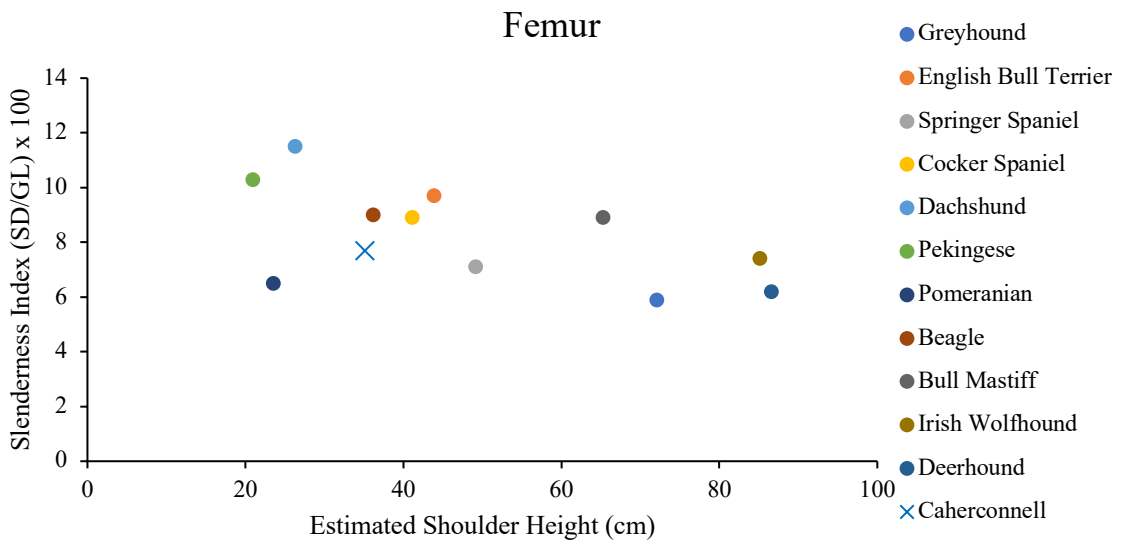


Figure 5.73: Slenderness Index and Estimated Withers Heights comparison of modern dog breeds (after Grieve 2012) with Caherconnell dogs (Phase 5) based on the femur.

Limb comparisons were also undertaken, comparing the greatest length and distal breadth measurements of long bones. The bone measurements from the Caherconnell dogs were compared to those from modern breeds for size comparisons, using data from Grieve (2012). Hasebe (1952) created a classification that groups dogs into five categories, ranging from small to large based on these limb bone GL measurements (Table A5.66). Three GL measurements were available from long bones, all from Phase 5. These were plotted to examine the size range and are compared to modern breeds for further size comparisons. Based on Hasebe's categories, all three represent small dogs, comparable to Beagle size dogs today (Figure 5.71 and 5.72).

Where estimated withers heights were calculated from long bones, the slenderness index was plotted to analyse the overall form of the dogs. This is a technique that can be used to discriminate four types of dogs, namely short and robust, short and slender, tall and slender, and tall and robust (Grieve 2012, 93). The slenderness index is calculated by comparing the smallest diameter (SD) with the greatest length of the different limb bones (De Grossi Mazzorin and Tagliacozzo 2000). The three estimated withers heights from Phase 5 were calculated from long bones. When plotted against modern breed, one of the examples compares to a Beagle sized dogs, while other two are closest to a Cocker Spaniel sized dog (Figures 5.73 and 5.74).

As well as the postcranial elements, measurements of cranial bones and teeth can also be used to analyse dog morphology and size. No skull measurements are available from Phase 4 and 5, but some mandibles are present. Hasebe (1952) groups mandibular lengths into five

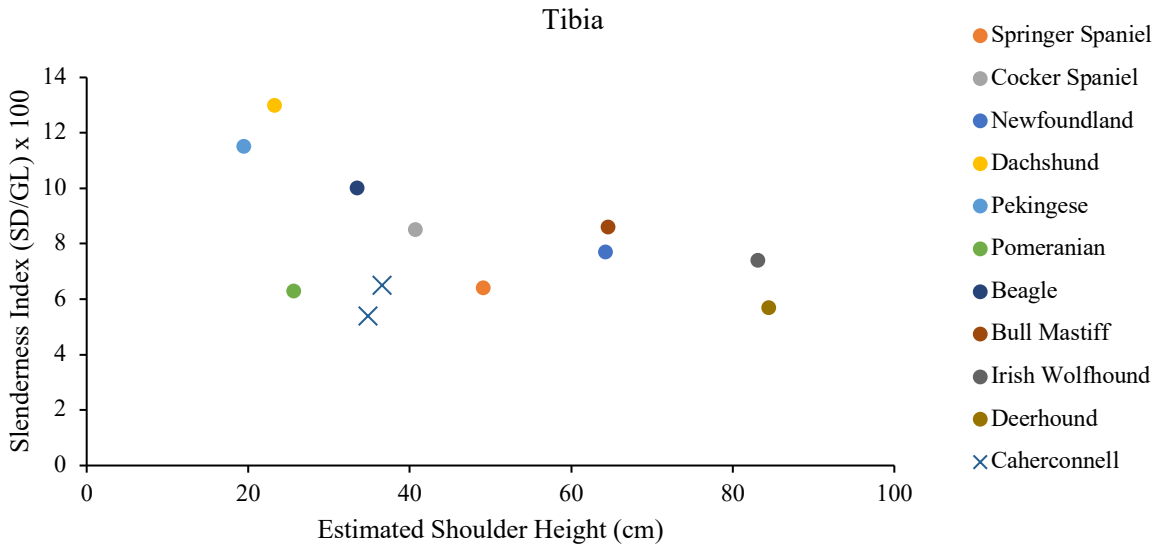


Figure 5.74: Slenderness Index and Estimated Withers Heights comparison of modern dog breeds (after Grieve 2012) with Caherconnell dogs (Phase 5) based on the tibia.

categories, from small to large, however none of the Caherconnell bones provide the necessary measurements. Tooth measurements occur more frequently and both mandibular and maxillary tooth measurements can be compared to those from modern breeds, although this method is of less value. These comparisons do not produce results as linear as the previous methods discussed, but they can give some indications to the size of dog being analysed. Mandibular and maxillary teeth measurements, length (L) and breadth (B), were plotted and compared with those from modern dog breeds for further comparison.

As the assemblage only produced three GL measurements from long bones, measurements from other elements were analysed to make further comparisons with modern dog breeds to further assess the size of dogs at Caherconnell. By working with a larger sample of measurements, it will provide more data to review the results discussed above. As the previous methods usually focus on the long bones, it is not certain that this evidence is as secure, however the results will be discussed in comparison to those from the methods mentioned above. The dog bone elements from Phase 4 that provided measurements were the calcaneum and 1st and 2nd phalanges. For the calcaneum, greatest length and greatest breadth measurements were compared, and for the phalanges the greatest length and distal breadth measurements were compared. One calcaneum is similar to a Springer Spaniel size dog. The other two are smaller in size and do not closely compare with modern dog breeds. The Ph2 examples compare to Springer Spaniel and Cocker Spaniel size dogs. It should be noted that the selection of modern dogs with available measurements for phalanges was small, which may

explain why the two Ph1 measurements are not comparable to any modern breed. Seven tooth length and breadth measurements from Phase 4 were available for comparisons with modern dog breeds, including two 1st mandibular molars (M_1), three second mandibular molars (M_2), and two 1st maxillary molars (M^1). One of the M_1 measurements was comparable to a Pekingese size dog, while the other is comparable to Beagle or Dachshund. Two of the M_2 measurements compare to a Beagle, and the other to a Bull Mastiff. The two M^1 compare to Cocker Spaniel dogs.

Dog bone elements from Phase 5 with measurements for analysis include a femur, a mandible, 1st and 2nd phalanges, a scapula, two tibias, and an ulna. The greatest length (GLC) and the distal breadth (Bd) measurements of the femur was comparable to a dog of small size, such as a Cairn Terrier. The mandible, using measurements length measurements 5 and 6, is comparable to a Boxer or English Bull Terrier. The GL and Bd measurements from 1st and 2nd phalanges are comparable to Cocker Spaniel and Springer Spaniel size dogs. The scapula, using GLP and BG measurements, was comparable to a Pekingese. Both tibias, using GL and Bd measurements, are similar to Beagle size dogs. The ulna, using the DPA and BPC measurements, is comparable to a Pekingese. No dog mandibular or maxillary teeth with measurements were available for comparative analysis.

Overall, the biometrical data suggests that the majority the dogs in the early medieval Phases 4 and 5 at Caherconnell are representative of small dogs comparable to such modern breeds as Beagles, Cocker Spaniels, and Springer Spaniels. Based on previous research of early medieval dog sizes, these fit into the smaller group of the bimodal populations, except for one example. Bone ID: 15322 has an estimated withers heights of 52cm, which is within the smaller part of the larger population, comparable to a Springer Spaniel. Besides the estimated withers

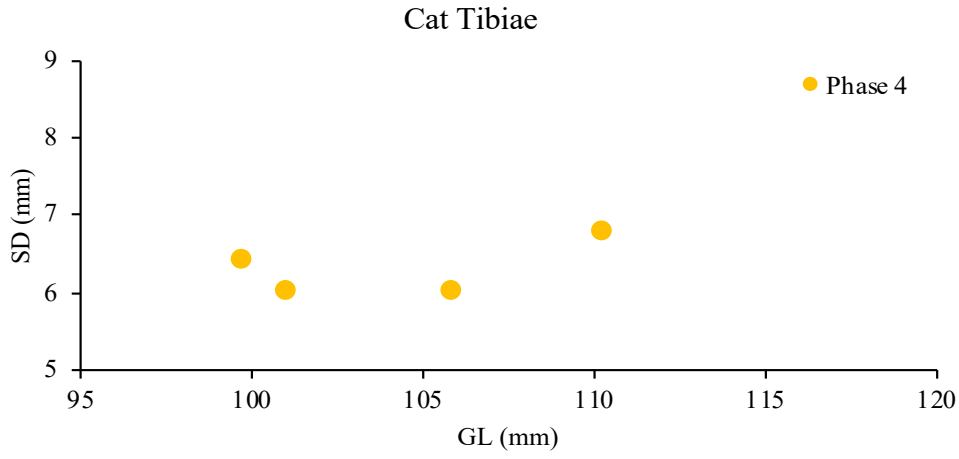


Figure 5.75: Size variation in cat tibiae from Phase 4, Caherconnell.

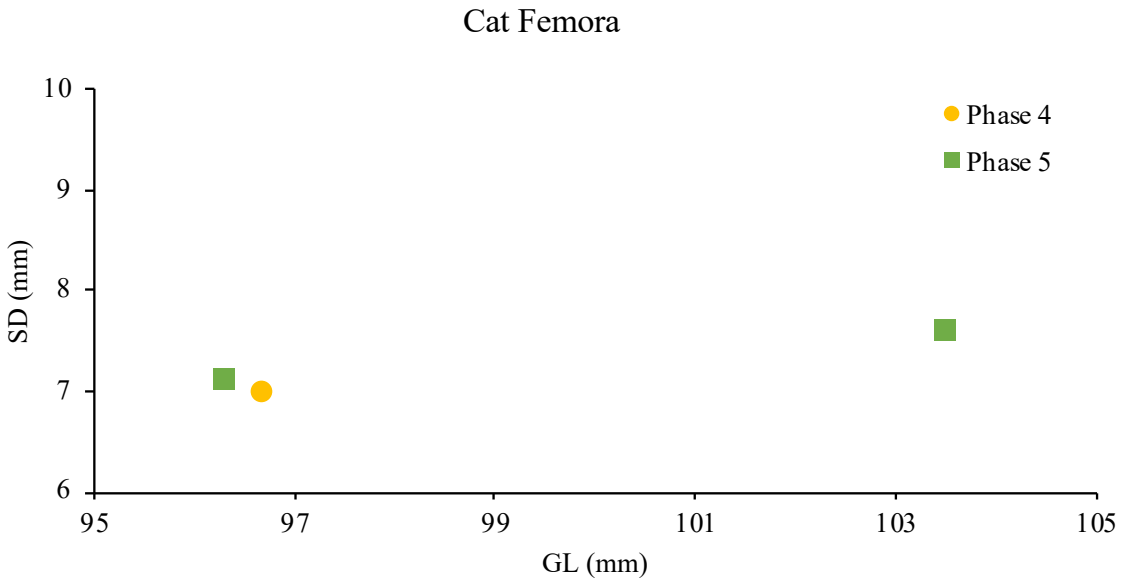


Figure 5.76: Size variation in cat femora from Phase 4 and 5, Caherconnell.

heights, long bone comparisons, and slenderness index, the other measurements suggest the dogs present at Caherconnell were small in size. These further comparisons also indicate the presence of slightly smaller (such as Pekingese) and larger (such as a boxer) dogs than those previously mentioned. It cannot be certain if dogs of these sizes were present based off this data as no proper method of biometrical analysis was undertaken, instead measurement comparisons were plotted.

Cat

Cat bones from Phase 4 and 5 produced some measurable elements. Those from the tibia, humerus, and femur were plotted and compared to those from other early medieval sites in Ireland. Phase 4 produced four tibia bones with comparable measurements. The greatest length (GL) and smallest breadth of the diaphysis (SD) were plotted (Figure 5.75). When these measurements are compared to other assemblages they are comparable to those from Ballinderry II (McCormick and Murray 2007, 101). The mean of tibia GL measurements from Caherconnell is 104.2cm, which falls in between the mean from Waterford excavations (98.9mm) and those from early medieval rural sites (113.6mm) such as Lagore, Ballinderry II, Moynagh, and Uisneach (McCormick 1987; Hurley *et al.* 1997, 834). One humerus with GL and SD measurements was available for comparison from Phase 5. The measurements from this bone were once again comparable to a cat from Ballinderry II. The humerus GL of 91.7mm from Caherconnell, again falls between the mean from the Waterford excavations (87.4mm) and the mean from early medieval rural sites (95.9mm) (McCormick 1987; Hurley *et al.* 1997,

834). Measurements from three femurs, one from Phase 4 and two from Phase 5, were available for analysis (Figure 5.76). The larger of the three was similar to cats from Moynagh and Lagore (McCormick and Murray 2007, 102). The smaller two are closest in comparison to a Lagore specimen. Overall, the cats from the early medieval phases of activity at Caherconnell are comparable in size to those from other early medieval sites.

5.4.2 Late medieval results

Cattle

No cattle bones from the late medieval phases of activity provided measurements needed to calculate withers height. To further investigate the stature of Caherconnell cattle, other measurements were compared from these two phases of activity. The astragalus was also the most frequent element in the late phases of activity and the measurements from this element were summarised to display the metrical variation of cattle bones throughout the assemblage. Table A5.58 displays the count, mean, minimum, maximum, standard deviation, and coefficient of variation, for the measurements taken for all cattle astragali. Pearson's coefficient of variation (CV) was used to compare the variation in measurements and samples (Payne and Bull 1987, 29). It should be noted that the total count of Phase 7 astragali is 19, which is notably lower than the others phases and also includes the presence of a significantly larger individual (Bone ID: 5946). When reviewing the values from Phase 6, they have produced similar ranges and averages to those seen in the early medieval period, with no notable difference in stature between the phases. As discussed previously, the use of astragali measurements to assess changes in size is a useful method as this element is tightly locked within the ankle joint and

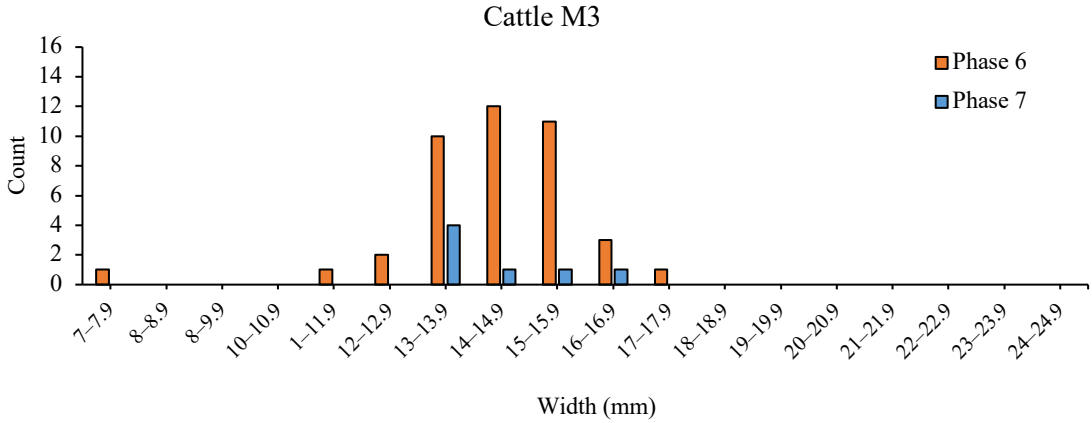


Figure 5.77: Count of width measurements of lower third molar of cattle from Phase 6 and 7, Caherconnell.

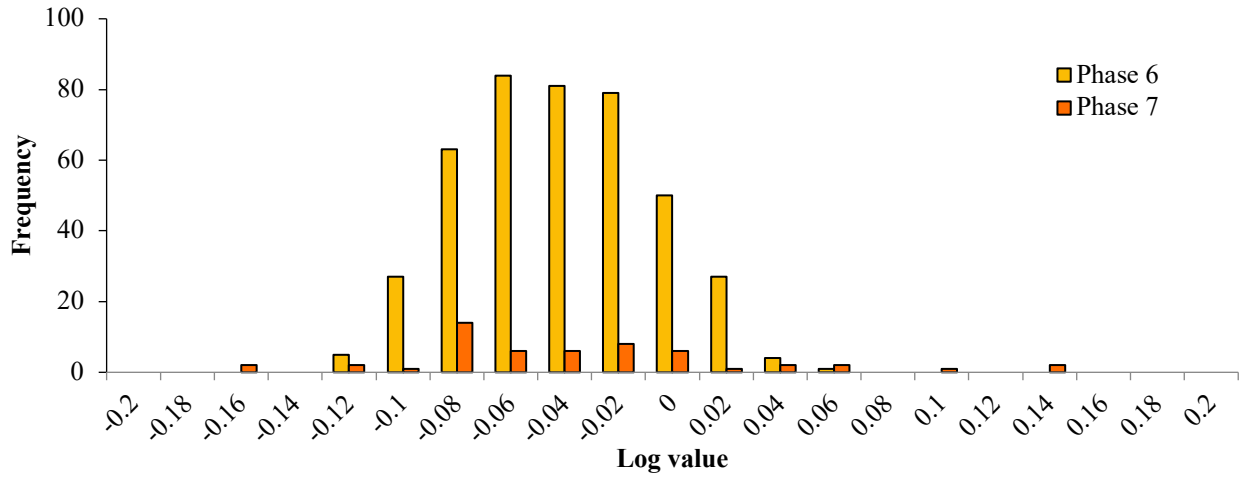


Figure 5.78: Log-scaled cattle post-cranial bone measurements (lengths, breadths and depths combined) between Phases 6 and 7 at Caherconnell.

therefore less likely to be affected by post-fusion growth or pathological changes (Murray 2004, 586). Another advantage of using the astragalus to analyse the stature of cattle is that it has been considered to be one of the least sex-biased elements (Higham 1969, 64).

The third permanent mandibular molar (M_3) is another skeletal element that shares this property (Albarella and Davis 1996, 16). The late medieval cattle M_3 measurements, further confirm there was no significant variation in size in the late medieval cattle. The metrical data clusters in the same area for these phases and produces the same trend seen in the early medieval cattle with no size increase or decrease over time (Figure 5.77).

Cattle post-cranial bone measurements were further analysed through the log ratio method with the aim of analysing the change in size and shape overtime between the phases of activity. Figure 5.78 shows a skew to the left, indicating a negative value and that the archaeological specimens from Caherconnell are smaller than the standard. Similarly to the results from the early medieval phases as well as the previously discussed biometrical analysis,

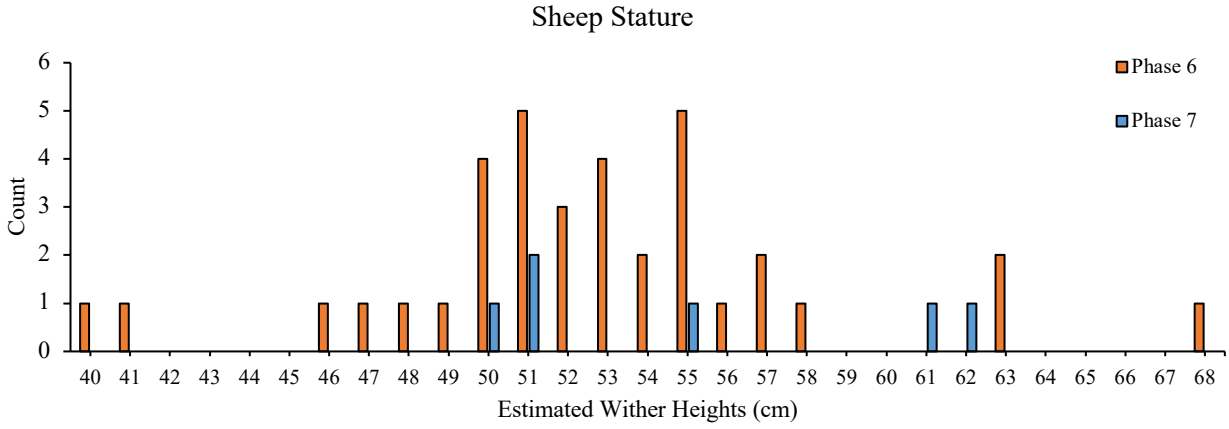


Figure 5.79: Estimated withers heights (EWH) for sheep from Phases 6 and 7, Caherconnell.

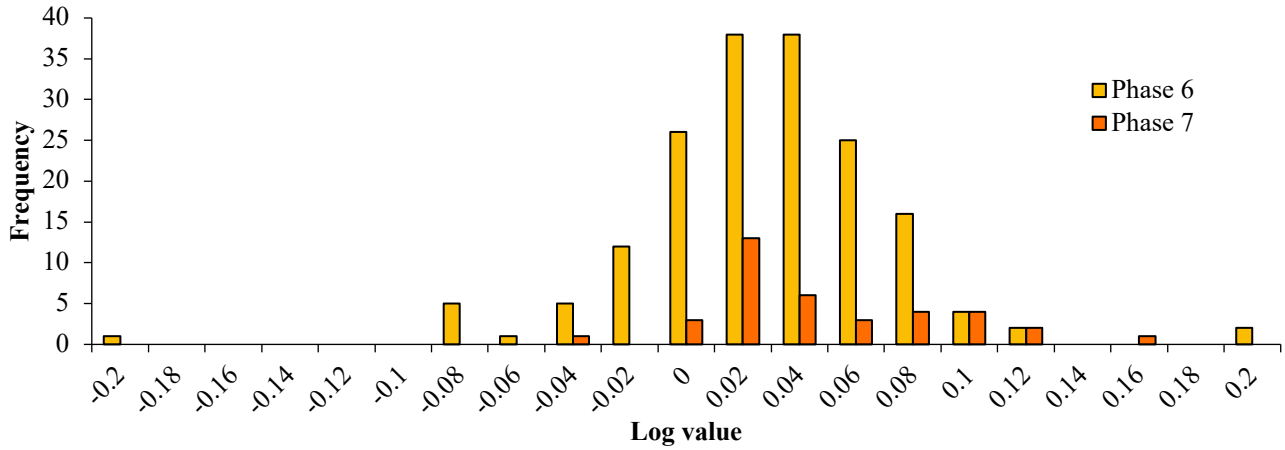


Figure 5.80: Log-scaled sheep post-cranial bone measurements (lengths, breadths and depths combined) between Phases 6 and 7 at Caherconnell.

the results also show that there is little variation, none of which is statistically significant (Table A5.59), in the size and shape of cattle throughout time between Phase 6 and 7.

Sheep

The mean of the estimated withers heights of these animals is 52.7cm from Phase 6 and 55cm from Phase 7 (Table A5.54), which indicates no change in the stature of sheep during the late medieval period (Figure 5.79). Sheep post-cranial bone measurements were further analysed through the log ratio method with the aim of analysing the change in size and shape overtime between the phases of activity. Figure 5.80 shows a skew to the right, indicating a positive value and that the archaeological specimens from Caherconnell are larger than the standard. Similarly to the result from the early medieval phases, the results also show that there is little variation, none of which is statistically significant (Table A000), in the size and shape of sheep throughout time between Phase 6 and 7.

Pig

The mean of the estimated withers heights from Phase 6 was 63.4cm and 66.7cm from Phase 7 (Table A5.56). This suggests there was no change in stature for pigs between these phases of activity (Figure 5.81). Tooth measurements, specifically the width of third molars, were also analysed to further investigate size change between pigs from Phases 6 and 7 (Table A5.58). This measurement was chosen as it has low sexual dimorphism, low age-related change, and low residual individual variability (Payne and Bull 1987, 31). Pig third molar width measurements were compared, and the results further concluded that there is no significant size difference between pigs from these phases of activity at Caherconnell (Table A5.62).

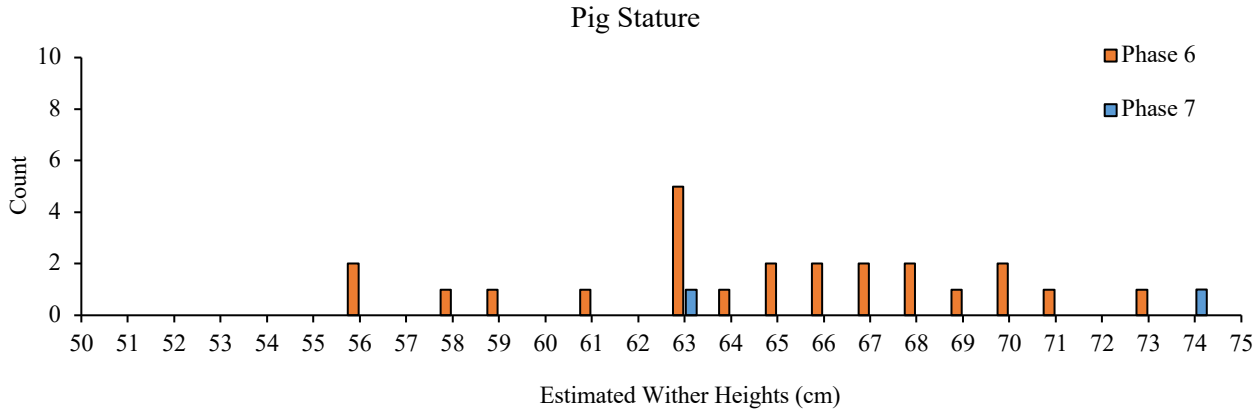


Figure 5.81: Estimated Withers Heights (EWH) for Phase 6 and 7 pigs from Caherconnell.

Pig post-cranial bone measurements were further analysed through the log ratio method with the aim of analysing the change in size and shape overtime between the phases of activity. Figure 5.82 shows the results centred around zero, meaning the archaeological specimens from Caherconnell are a similar size to the standard. Similarly to the result from the early medieval phases, the results also show that there is little variation, none of which is statistically significant (Table A5.59), in the size and shape of pig throughout time between Phase 6 and 7.

Horse

The horse bones from Phase 6 and 7 have a range of measurable elements, but only one estimated withers heights was calculated from Phase 6. A metacarpal with a Ll measurement of 208mm (Bone ID: 10484) was used to calculate an estimated withers heights, 133.3cm or 13.1 hands. This individual is slightly bigger than the estimated withers heights for the early medieval horses at Caherconnell, comparable to the Connemara ponies (Miller 1935, 485;

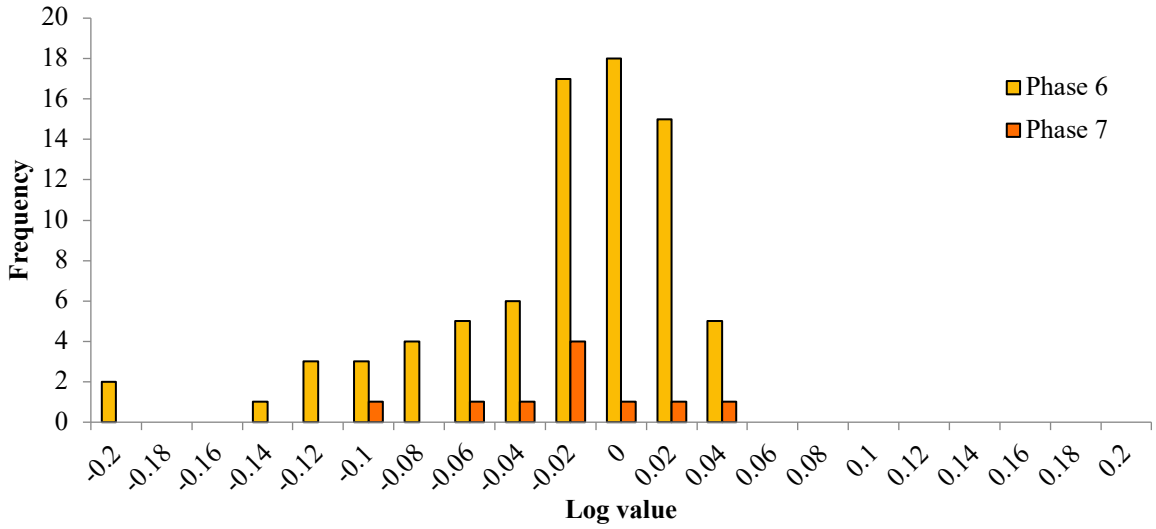


Figure 5.82: Log-scaled pig post-cranial bone measurements (lengths and breadths combined) between Phases 6 and 7 at Caherconnell.

Hurley *et al.* 1997, 832). As mentioned before, the average estimated withers heights for horses in early medieval rural Ireland was 130.7cm. The average for later medieval horses was slightly larger with 12th–13th century horses averaging at 134.8cm, and 14th–15th century horses at 137.4cm (McCormick, Finbar 2007, 98). The size increase between these periods is possibly due to the use of large horses for ploughing (*ibid.*). The estimated withers height produced from the Phase 6 horse is not only comparable to these averages from other Irish studies but may also reflect the size increase between the earlier and later periods.

Dog

Dog bones from late medieval Phases 6 and 7 have elements that can be measured using von den Driesch (1976). As with the early medieval analysis, this data is used to estimate the stature of dogs from Caherconnell by comparing tooth and bone measurements to those from modern dog breeds. No dog bones from Phases 6 or 7 provide the necessary measurements, long bone or metapodial GL, for calculating estimated withers heights, limb bone comparisons, or slenderness indexes. The measurements available from bones and teeth were plotted and compared to modern breeds.

The relevant bones from Phase 6 are 1st and 2nd phalanges, and one ulna. One of the 1st phalanges is similar in size to a Cocker Spaniel and the 1st phalanx of a Springer Spaniel. The other 1st phalanx is not comparable to any of the available modern breeds. Once again this is likely due to the fact that the amount of available phalanx measurements from modern dog does not provide much data for comparison. The 2nd phalanx is slightly larger but similar to a phalanx of a Springer Spaniel. The ulna is comparable to a small dog and similar to a Pekingese size dog. The M^1 is closest to a Cocker Spaniel, the M^2 is similar to a Dachshund, while the P^4 is from a small dog larger than a Pekingese but smaller than a Beagle.

The 15th/16th century assemblage at Caherconnell provides even fewer measurements for comparison. Only one dog bone was recorded from Phase 7, an axis comparable a Springer Spaniel size dog, when BFcr and LAPa measurements were compared. One M_1 and one M^1 were plotted and both also similar to a Springer Spaniel.

Similar to the early medieval period, the biometrical data suggests that the majority the dogs in the late medieval Phases 6 and 7 are representative of small dogs comparable to the modern breeds such as the Cocker Spaniel. Based on previous research that indicates dogs of all sizes were present during the later medieval period (McCormick 1991b, 44), it is difficult to interpret this as the dogs present at Caherconnell from this period only represent smaller dogs. This suggests the trend seen in the early medieval period is continued into the late

medieval period at Caherconnell. Again, it is not certain if dogs of these sizes were present based on this measurement data alone, as no proper method of biometrical analysis was undertaken.

Cat

Cat bones from Phase 6 and 7 produced some measurable elements, but none were suitable for the analysis of size variation in cats were available.

5.5 Sexing

This section discusses the sexing of the Caherconnell domestic species. The sexing of species was only possible for cattle and pig. Biometrical analysis was used to sex cattle bones, namely the measurements of the metacarpals. Morphological characteristics of pig canines were used to sex the pig specimens.

5.5.1 Early Medieval Results

Cattle

Biometrical data can be used to sex cattle bones with a particular focus on metrical variation in the forelimbs, primarily the metacarpals. There is a high degree of sexual dimorphism in cattle metacarpals, which can be analysed through the distal breadth (Bd) once it has fused (Higham 1969, 64). The metacarpal fuses 2–2½ years, which means this method only allows for the sexing of mature cattle (Silver 1969, 252). The distal breadth is plotted and compared with the slenderness index (SI) which is calculated as SI = SD/GL x 100 (McCormick, Finbar

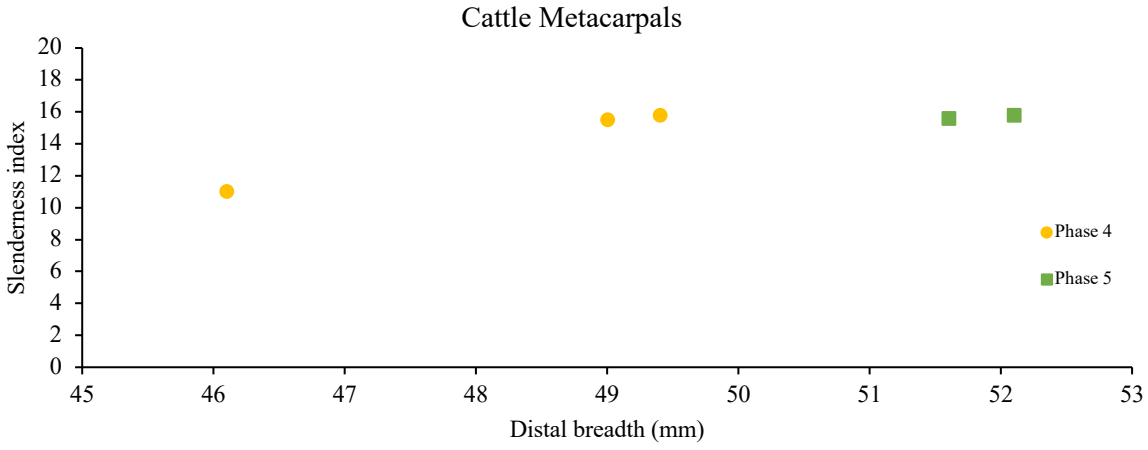


Figure 5.83:Cattle metacarpals from Phase 4 and 5 Caherconnell, comparing the distal breath (Bd) and the slenderness index (SI = SD/GL X 100)

1992, 205) (Figure 5.83). A total of 267 cattle metacarpals were recovered however it was only possible to calculate the slenderness index for very few individuals.

A total of five complete metacarpals were recovered from the early medieval phases of activity, three were from Phase 4, and two from Phase 5. This low quantity of complete metacarpals could be explained by the breaking of this element for marrow extraction (Murray 2004, 582). When compared to results from other sites, such as Knowth or Moynagh Lough, the five metacarpals from Caherconnell appear to represent cows. As previously mentioned, cattle metacarpals fuse 2–2½ years, so this data represents female adult cattle. As few complete metacarpals were recovered, another method using the measurements of metacarpals was employed. This method follows the criteria of McCormick (1997), which states that if the distal breadth of the metacarpal is less than 56mm the individual is female, and male if it is greater than 57.5mm, with slight overlap (*ibid*. 822). Based on this criteria, the majority of metacarpals from these phases at Caherconnell represent females, and also adult cows as these measurements were taken on fused elements (Table 5.2). Out of 23 measurements from Phase 4 cattle, 20 represent cows with a Bd range of 45.9–56mm, two bulls are represented with measurements of 58.2mm and 60.9mm respectively, while the remaining measurement cannot be classified as it lies within the overlap range with a Bd of 56.2mm. Twelve Bd measurements were taken for Phase 5

Phase 4		Phase 5	
Bd	M/F	Bd	M/F
49.73	*F*	51.9	*F*
46.1	*F*	51.6	*F*
51	*F*	51	*F*
45.9	*F*	56	*F*
49	*F*	53.8	*F*
48.8	*F*	53.6	*F*
51.2	*F*	63.5	*M*
56	*F*	60.6	*M*
56.2	*M/F*	64	*M*
53.9	*F*	53.1	*F*
50.3	*F*	52.6	*F*
51.8	*F*	52.1	*F*
50.8	*F*		
53.2	*F*		
50	*F*		
60.9	*M*		
54.9	*F*		
50.1	*F*		
51.9	*F*		
49.4	*F*		
58.2	*M*		
53	*F*		
47.6	*F*		

Table 5.2: Cattle metacarpal Bd (distal breath) measurements (mm) from Phase 4 and Phase 5, Caherconnell.

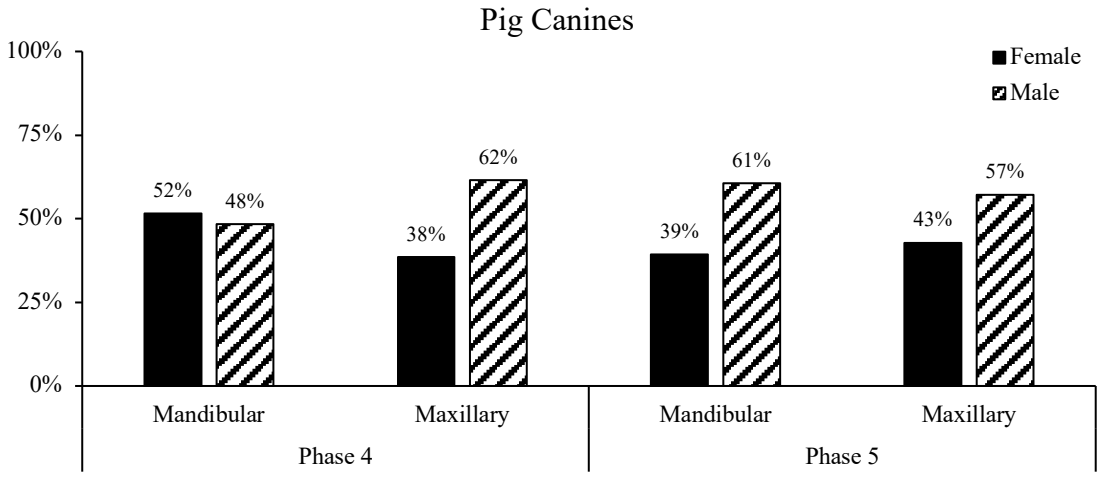


Figure 5.84: Female and male pig canines from Phase 4 and Phase 5, Caherconnell.

cattle, nine represent cows with a range of 51–56mm, and three represent bulls with a Bd range of 60.6–64mm. Overall, a total of 35 metacarpals provide Bd measurements, cows making up 82.9%, bulls 14.3%, and the remaining 2.8% classed as intermediate. Indirect evidence of female bovine within the assemblage can be seen through the presence of neonatal cattle remains, which are present in all four phases of activity. As calves of both sexes are born in roughly equal amounts, it can be assumed the majority of immature cattle were male (McCormick, Finbar and Murray 2007, 54).

Pig

The pigs from Caherconnell were sexed using morphological characteristics. Pig canines, particularly the size and shape, are used to distinguish boars from sows (Schmid 1972, 81). Some studies suggest a recovery bias regarding pig canines. When loose canines and canines in mandibles are considered, males can be more common due to recovery bias as their canines are larger (Albarella and Davis 1994, 17). Both mandibular and maxillary canines were analysed and sexed. The majority of canines were loose and very few were surviving in mandibles. There is a slight dominance of male pigs from Phases 4 and 5 (Figure 5.84). This trend is seen at other medieval sites, such as Roestown 2 (Sloane 2009, 52). It is possible that the dominance of male canines is due to the aforementioned recovery bias. Only four canines were in mandibles which provided ageing information, two female canines (mandibular tooth ID's: 10517 & 10521) from Phase 4 were from sub-adult individuals and two male canines (mandibular tooth ID's: 8279 & 9055) from Phase 5 were from sub-adult individuals. As this

data comes from such a small sample of canines, it is not possible to interpret any patterns from the sexing evidence alone.

Phase 6		Phase 7	
Bd	M/F	Bd	M/F
63	*M*	43.2	*F*
66.6	*M*	54	*F*
53.6	*F*		
50.5	*F*		
51.6	*F*		
61	*M*		
52.9	*F*		
51.8	*F*		
50.9	*F*		
51	*F*		
52.9	*F*		
49.2	*F*		
50.5	*F*		
51.7	*F*		
50	*F*		
51.2	*F*		
47.1	*F*		
52.5	*F*		

Table 5.3: Cattle metacarpal Bd (distal breadth) measurements (mm) from Phase 6 and Phase 7, Caherconnell.

5.5.2 Late medieval results

Cattle

Out of 267 cattle metacarpals, only two (both from Phase 6) were complete, which means a small sample was available to calculate the slenderness index. When compared to other sites as well as the results from the early medieval sample, these two metacarpals probably represent mature cows. As cattle metacarpals fuse between 2–2½ years, this data is representative of female adult cows. As there are few complete metacarpals, another method using available measurements was used to further analyse the late medieval cattle. This method follows the criteria of McCormick (1997) which states that if the distal breadth of the metacarpal is less than 56mm the individual is female, and male if it is greater than 57.5mm, with slight overlap (*ibid.* 822). Based on this method, the majority of metacarpals from Phase 6 and Phase 7 at Caherconnell represent females, once again adult cows as these measurements were taken on fused metacarpals (Table 5.3). A total of 18 measurements were recorded for Phase 6 cattle, 15 representing cows with a range of 49.2–53.6mm, and three represent bulls with a range of 61–66.6mm. Only two measurements were recorded for Phase 7 metacarpals, 43.2mm and 54mm, both representing cows. Overall, a total of 20 metacarpals provided Bd measurements, cows making up 85% and bulls making up 15%. Once again, the presence of neonatal cattle remains throughout these

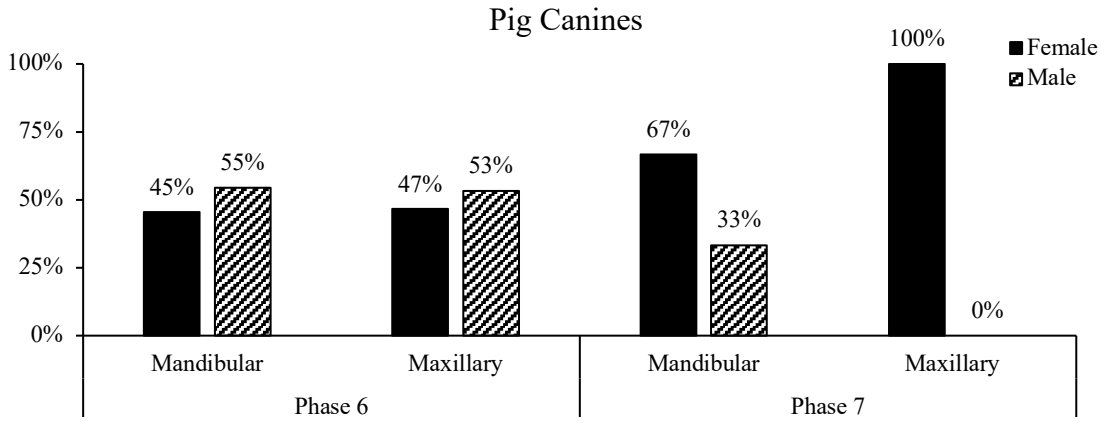


Figure 5.85: Female and male pig canines from Phase 6 and Phase 7, Caherconnell.

phases of activity is further evidence of the presence of female bovine within the assemblage. As calves of both sexes are born in roughly equal amounts, it is likely the majority of younger cattle were male (McCormick, Finbar and Murray 2007, 54).

Pig

Morphological characters were used to sex the late medieval pigs of Caherconnell. Pig canines, both mandibular and maxillary, were analysed and sexed. As mentioned previously, the size and shape of pig canines can be analysed to distinguish between boars and sows (Schmid 1972, 81). Similarly to the early medieval sample, the majority of canine were loose and very few were surviving in mandibles. It should be noted that Phase 7 produced a small sample size of four. Phase 6 sample size is 26 and produced the trend seen in the early medieval pigs with a slight dominance of males (Figure 5.85). Only one of the late medieval pig canines was in a mandible (ID: 8070), in that case, from an adult individual.

5.6 Estimated meat weights of cattle, sheep, and pig

As well as the previously discussed methods of quantification, estimated meat weights for cattle, sheep, and pig were calculated. As previously mentioned, it should be noted that due to factors such as sex, breed, and age, these estimates can be problematic, however relative proportions can be examined (McCormick, Finbar and Murray 2007, 41). The estimates for the dressed-out meat weights of the three domesticates 'were made assuming a live animal weight of 450kg for cattle (Legge 1981, 99), 23kg for sheep (Boyd *et al.* 1964, 145), and 80kg for pig ((van Wijngaarden-Bakker 1986, 71), with a dressing-out weight of 50% for cattle and sheep, and 80% for pig' (McCormick, Finbar and Murray 2007, 147) (Table A5.67 and A5.68). The

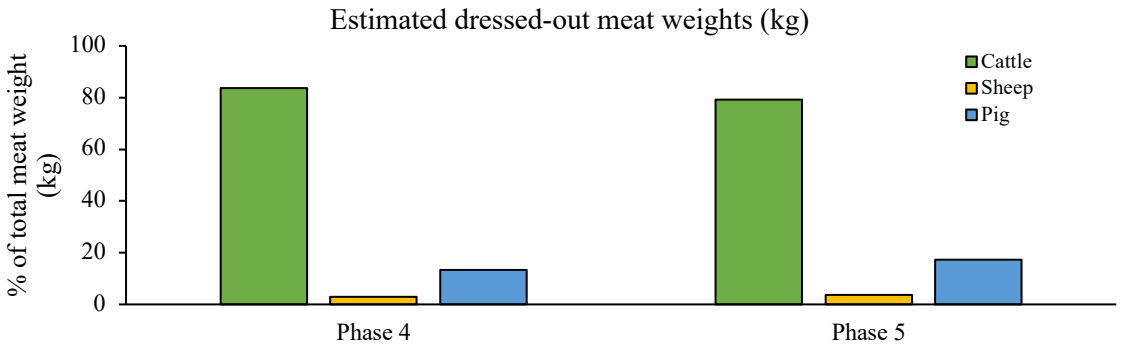


Figure 5.86: Estimated dressed-out meat weights (kg) of cattle, sheep, and pig, from early medieval activity (Phases 4 and 5) at Caherconnell.

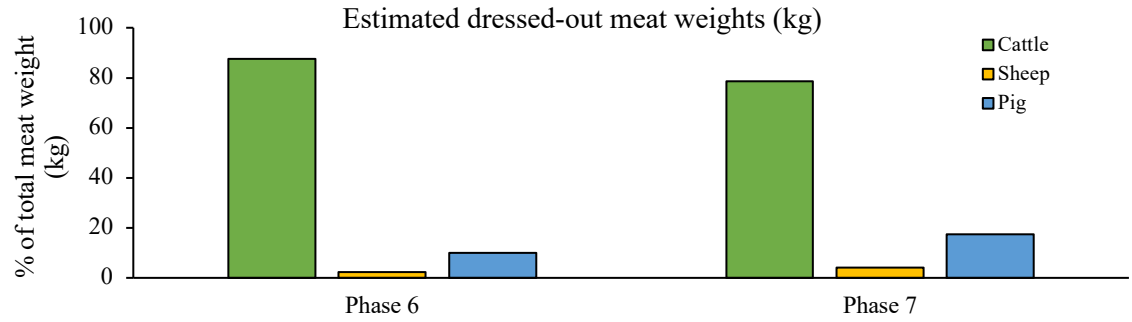


Figure 5.87: Estimated dressed-out meat weights (kg) of cattle, sheep, and pig, from late medieval activity (Phases 6 and 7) at Caherconnell.

results from the early and late medieval assemblages at Caherconnell exhibited the same trend with no visible change over time (Figures 5.86 and 5.87). Similar to the trends produced from the other methods of quantification, cattle dressed-out meat weights are significantly larger than those of sheep and pig and supply 78.6–87.6% of the meat from these phases of activity. Sheep exhibited the lowest amount 2.3–4% and pig were slightly higher providing 10.1–17.4% of the meat consumed.

5.7 Butchery, burning, and gnawing

5.7.1 Butchery

Cattle

As discussed previously, all parts of the cattle skeleton were recorded in the Caherconnell assemblage from all phases of activity, indicating that these animals were butchered on-site. A total of 939 cattle bones exhibited evidence of butchery through chop and/or cut marks. Cutmarks are caused by a knife, while chop marks are caused by a heavier tool, such as an axe, both connected to the skinning, and splitting of the carcass, and the removal of meat (Reitz and Wing 2008, 128). Out of the 939 bones, 445 were from Phase 4 (18.4% of total cattle bone

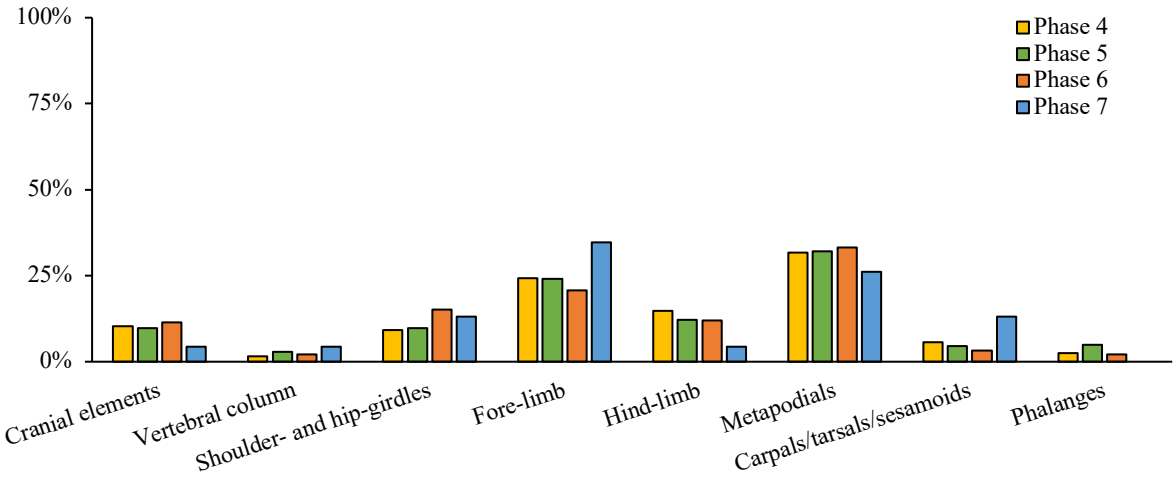


Figure 5.88: Butchered cattle bones by element group for all phases of activity at Caherconnell.

from Phase 4), 287 from Phase 5 (20.7% of total cattle bones from Phase 5), 184 from Phase 6 (14.4% of total cattle bones from Phase 6), and 23 from Phase 7 (10% of total cattle bones from Phase 7. Figure 5.88 shows that all parts of the cattle skeleton presented evidence of butchery throughout time, with the trend of butchery remaining the same between Phase 4 and 7. Cranial elements produced a range of examples with both chop and/or cut marks. A total of 18 horn-cores had cut marks on the horn or at the base of the core, possibly sawn (Figure 5.89). The presence of these marks can be evidence of cutting the skin around the horn or also from loosening and removing the horn sheath (Albarella 2003, 74). Cutmarks were also present on the frontal, premaxilla, and orbital bones, all indicative of skinning. Some mandibles have chop and cut marks, in the area of the condyle and body, which may also be evidence of skinning or butchery (Figure 5.90). Vertebrae produced the least butchery evidence across all four phases. As mentioned before, the majority of vertebrae were not recorded to species level and this small sample may not be a reflection of the lack of butchered vertebrae. Those that were recorded produced evidence of vertebrae chopped down the middle or had portions chopped off. Vertebrae chopped cranio-caudally can be an indication of the division of the carcass in half (Murray 2004, 588). Chop- and cut-marks were also present on the atlas and axis, which is further evidence of dismembering the carcass. The scapula

Figure 5.89: Bone ID: 12921 Cattle horn-core from Phase 4, Caherconnell, with evidence it was cut from the skull at the base.

Figure 5.90: Mandibular Tooth ID: 6078 Cattle mandible from Phase 6, Caherconnell, with cut marks and unerupted P_3.

and pelvis, which make up the shoulder- and hip-girdles, are areas commonly used within the primary butchery stage and the initial dismemberment into larger joints (Johnstone and Albarella 2015, 32). The scapula produced a pattern of cut-marks around bone zones 4, 5, and 6, which represent the caudal border at the neck, the cranial border, and the caudal border, which is representative of food preparation (Reitz and Wing 2008, 171). The pelvis produced marks predominantly around the acetabulum and on the ilium (Figures 5.91 and 5.92).

Figure 5.91: Bone ID: 21412 Cattle pelvis with butchery marks near acetabulum from Phase 4, Caherconnell.

The humerus, radius, ulna, which are the long bones of the fore-limb, all have evidence of butchery from all phases of activity. The majority of marks present on the humeri occurred on the distal end, while the majority for radii occurred on the proximal end. This may reflect the dismemberment of the elbow joint, which is again associated with food preparation (Reitz and Wing 2008, 243). Chop and cut-marks present on the ulna were predominantly on the body of the olecranon and semilunar notch, with example of the ulna being separated from the radius. The long bones of the hind-limb, the femur and tibia,

Figure 5.92: Bone ID: 21411 Cattle pelvis with butchery marks on ilium from Phase 4, Caherconnell.

produced lower amounts of bones with butchery marks. These marks, mainly chops marks, were present on all areas of the femur including examples of the femoral head being chopped in down the centre. The majority of marks on the tibia occurred on the distal end and were dominated by chop-marks, which are an indication of dismemberment which occurs in the primary butchery stages before cooking the meat (*ibid.* 128). Metacarpals and metatarsals had the highest occurrence of butchery marks, mostly chop marks, with some being split longitudinally for accessing marrow. Although the carpal and tarsal bones do not bear much meat, they make up the wrist and ankle joints and often have evidence of butchery linked with food preparation and skinning. Chop and cutmarks on these bones has occurred less than the previously discussed bone categories. The astragalus has produced the highest amount within this bone group, with the majority of cut-marks located at the distal end and also examples of bone portions being chopped off. The calcaneus only presented evidence of cut marks, with most examples consisting of multiple parallel cut-marks. Butchery marks on these two large tarsal bones are probably associated with the dismembering of the ankle joint for food preparation purposes. The phalanges do not bear much meat and therefore any cut-marks present are likely a result of skinning. Chop marks were also recorded on cattle phalanges, with one example being cut longitudinally down the centre of a first phalanx.

Sheep

As discussed previously, all parts of the sheep skeleton were recorded in the Caherconnell assemblage from all phases of activity. The results make it likely that sheep were butchered on-site. A total of 176 sheep bones exhibited evidence of butchery through chop and/or cut marks.

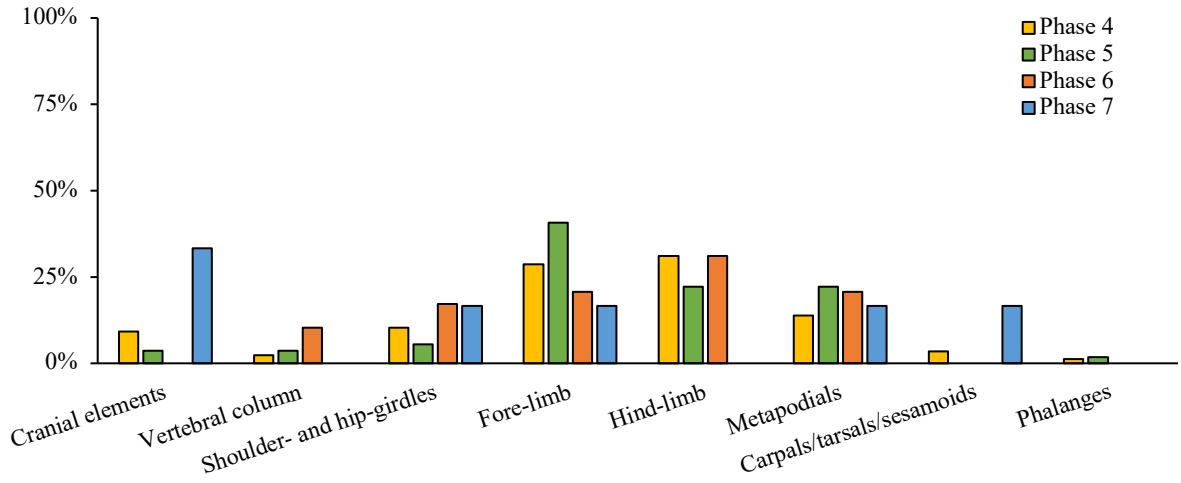


Figure 5.93: Butchered sheep bones by element group for all phases of activity at Caherconnell.

Figure 5.94: Bone ID: 12924 Sheep/goat horncore with saw marks from Phase 4, Caherconnell.

Figure 5.95: Bone ID: 18363 Sheep/goat horncore in two parts with saw marks from Phase 4, Caherconnell.

Out of the 176 bones, 87 were from Phase 4 (5.6% of total sheep bones from Phase 4), 54 were from Phase 5 (20.6% of total sheep bones from Phase 5), 29 were from Phase 6 (4.7% of total sheep bones from Phase 6), and 6 from Phase 7 (13.6% of total sheep bones from Phase 6). Figure 5.93 shows that all parts of the sheep skeleton presented evidence of butchery throughout time, with no major changes in the butchery trends between Phase 4 and 7. Cranial elements produced a range of examples with both chop and/or cut marks. A number of sheep/goat horncores had chop or cut-marks, with some examples (Bone ID: 12924 & 18363) appear sawn towards the base of the core (Figures 5.94 and 5.95). Others display evidence of cut-marks around the same area, which are likely a result of skinning or the removal of the horn sheath. Other possible evidence of skinning was evident on other cranial elements, such as the condyle of the mandible which displayed cut marks. The vertebrae produced low amounts of butchery evidence, which may be due to the majority of vertebrae not being recorded to species level. The scapula and pelvis, that make up the shoulder- and hip-girdles are areas commonly used within the primary butchery stage and initial dismemberment into larger joints (Johnstone and Albarella 2015, 32). Both elements produced evidence of chop and/or cutmarks, the majority of scapula evidence being situated around the caudal or cranial border, and the majority from the pelvis around the acetabulum and ischium. The fore-limb and hind-limb long bones had the highest occurrent of butchery marks throughout all phases of activity at Caherconnell. The fore-limb long bones, the humerus, radius, and ulna, all produced evidence of butchery, predominantly chop marks. The majority of marks on the humerus occurred on the distal end, and the majority of marks on the radius occurred towards the proximal end which suggests the dismemberment of the elbow joint. The mark present on the

ulna also predominantly occurred on the proximal end, suggesting the same practice and removal of this element from the radius.

The hind-limb long bones, the femur and tibia, also displayed a range of chop and/or cut marks, predominantly the former. A tibia from Phase 6 (Bone ID: 10897) displayed evidence of a perforation at the distal shaft, possibly a result of the carcass being hung up, such as an example from Castlefarm 1 (Foster 2009, 41). The majority of chop marks on the tibia occurred at the distal end, which is another example of dismemberment in the primary butchery stages before cooking (Reitz and Wing 2008, 128). Sheep metapodials, the metacarpals and metatarsals. Also displayed evidence of butchery marks, with all but one represented by chop-marks. Although the carpal and tarsal bones do no bear much meat, they make up the wrist and ankle joints and often have evidence of butchery linked with food preparation and skinning. Only four examples were recorded all of which were cutmarks, with one example of a calcaneum displaying evidence of cutmarks and burning. Only two examples of phalanges with butchery marks were recorded, both first phalanges, one with cut-marks on the distal end and the other with evidence of chop-marks on the distal end, the latter also displaying evidence of burning.

Pig

As discussed previously, all parts of the pig skeleton were recorded within the Caherconnell assemblage from all phases of activity, and it is likely that these animals were butchered on-site. An estimated 116 pig bones exhibited evidence of butchery through chop and slash or cut marks. Out of the 116 bones, 50 were from Phase 4 (3.5% of total pig bones from Phase 4), 38 were from Phase 5 (4.2% of total pig bones from Phase 5), 23 from Phase 6 (3.7% of total pig

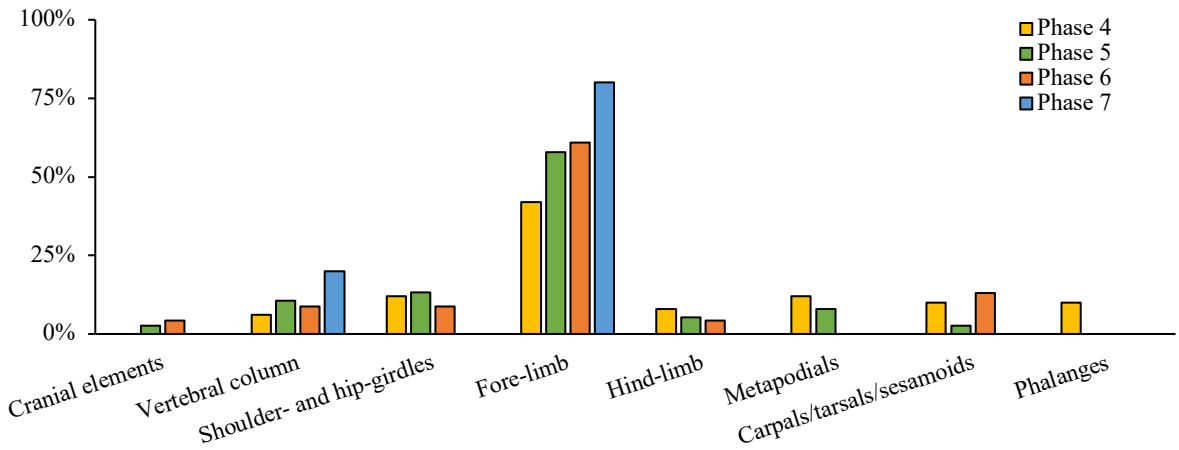


Figure 5.96: Butchered pig bones by element group for all phases of activity at Caherconnell.

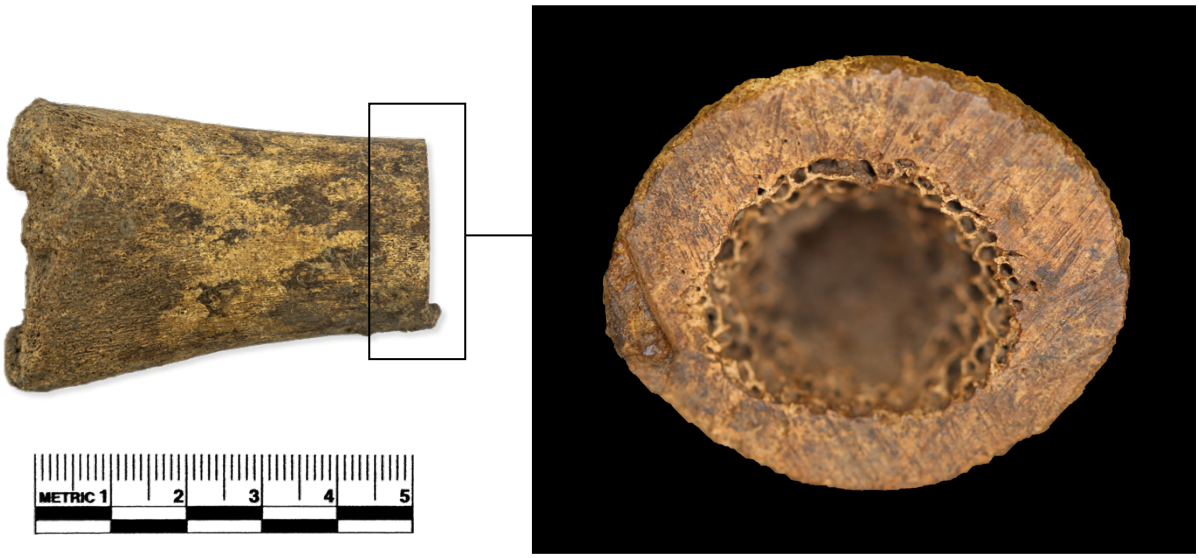


Figure 5.97: Bone ID: 10483 Horse metacarpal from Phase 6, Caherconnell, with saw marks. Dorsal view of metacarpal on left and proximal view of sawn area on right.

bones from Phase 6), and 5 from Phase 7 (4.5% of total pig bones from Phase 7). Figure 5.96 shows that all parts of the pig skeleton presented evidence of butchery throughout time, with no major changes in butchery trends between Phase 4 and 7. Cranial elements produced the smallest sample of pig bones with butchery marks. There are two examples of cranial elements with butchery marks were recovered, both cut marks, one from Phase 5 and one from Phase 6. The example from Phase 5 is a skull fragment with a cut mark near the occipital bone slash the right side of the nuchal crest. The example from Phase 6 is the condyle of the right mandible with small linear symmetrical cut marks on the outside side of the mandible. Both cranial examples are likely results of skinning. The vertebral column also produced a small sample of pig bones of buttery marks from all phases. These were a mix of chop, chop and cut, and cut marks. Some of these examples produced evidence of the atlas being chopped down the middle, which itself is evidence of dismembering the carcass. The small sample of both cranial elements and vertebral column with evidence of butchery may reflect the small sample of these bones recovered.

The shoulder and hip girdles, the scapula and pelvis, produced slightly larger quantities of butchered bones from Phases 4–6. These also included examples of chop, chop and cut, and cut marks. The presence of these marks is an indication of the initial dismemberment of the pig into larger joints for the process of food preparation. The foreleg bones, which consists of the humerus, radius, and ulna, have the highest amount of butchery marks through all four phases of activity. Once again, these included examples of chop, chop and cut, and cut marks. These

examples, as well as a smaller number on the hind leg bones, are reflective of the butchery of meat-bearing bones and primary meat cuts. The smaller bones of the metapodials, carpals, tarsals, sesamoids, and phalanges, also have some butchery evidence, primarily from Phase 4. These bones make up the area from the ankles down to the feet and do not bear much meat. Butchery marks on these bones likely represent evidence of food preparation and skinning.

Horse

A total of 14 horse bones from Caherconnell have evidence of butchery. Nine bones from Phase 4 have butchery marks, including seven metapodials, one radius, and one tibia. All nine bones have chop marks, while the radius has both chop and cut marks. None of these elements were unfused and therefore represent mature individuals. Three bones from Phase 5 have butchery marks, including an astragalus, femur, and a metapodial. The astragalus has cutmarks as well as scorch marks. The femur has fine cutmarks at the proximal end, as well as evidence of dog gnawing, while the metapodial was chopped at the distal end. As well as the astragalus, a 1st phalanx also has evidence of scorching. Once again, all of these elements were fused and represent mature individuals. Two elements from Phase 6, both metacarpals, have chop marks. One of these metacarpals (Bone ID: 10483) was unfused at the distal end indicating it is from an individual younger than 15–18 months and is cleanly sawn at the distal part of the shaft (Figure 5.97). None of the horse bone from Phase 7 has evidence of butchery. Overall, the presence of these butchery marks could be indicative of marrow removal or meat consumption.

Dog

No dog bones from the early and late medieval phases of activity had evidence of butchery.

Cat

The presence of butchery marks can be evidence of the use of cats for furs and pelts. Cat bones with butchery marks have been recovered from medieval sites, predominantly urban

Figure 5.98: Mandibular Tooth ID: 6657 – Cat mandible with cut marks, possibly knife marks indicative of skinning.

assemblages which indicates a commercial exploitation of cat skins (McCormick 1988, 226). Although most of this evidence is from urban sites, examples of cat elements with signs of butchery have been found at rural settlements; for example, a cat mandible with skinning marks was found at Knowth, Co. Meath (McCormick and Murray 2007, 49). The test trench assemblage from Caherconnell Cashel produced a cat 'mandible with a fine knife mark on its buccal aspect indicative of skinning' (Murray 2008, 4).

There are two examples of cat bones with possible butchery marks in the Caherconnell assemblage, one from Phase 4 and the other from Phase 5. No examples were found among the late medieval cat bones. The example from Phase 4 is a cat mandible and based on the tooth eruption stages the cat was older than 5.5–5.6 months. This example (Mandibular Tooth ID: 6657) has a cut mark on the lingual aspect, possibly a knife mark that may indicative of skinning (Figure 5.98). A humerus (Bone ID: 9091) from Phase 5 appears to be chopped on the distal part of the shaft between bone zones 5 and 6.

5.7.2 Burning

Cattle

A total of 416 cattle bones from all phases of activity at Caherconnell have indications of burning, ranging from scorched, charred, and calcined. This sample represents less than 8% of the total amount of cattle bones and is made up of all parts of the cattle skeleton. The majority are scorched bones, produced by burning at a low temperature, possibly as a result of cooking. Charred and calcined bones occurred the least, with eight examples of the former and six of the latter. Calcined bones, were dominated by phalanges with also examples from metapodials and cranial elements. These bones carry very little meat and fat, and so are likely to burn at a higher level as they are more exposed to the flame (Reitz and Wing 2008, 131). The burning of bones can be a form of waste disposal, which may be represented by highly fragmented unidentifiable bones and not those identified to species.

Sheep

A total of 236 sheep bones from all phases of activity at Caherconnell have indications of burning, ranging from scorched, charred, and calcined. The majority are scorched bones, produced by burning at a low temperature, possibly as a result of cooking. Charred and calcined bone occurred the least, with 20 examples of the former and 26 of the latter. All parts of the sheep skeleton have evidence of burning and there were no particular patterns across the four

phases of activity. The overall low count of sheep bones with burning is not surprising as the burning of bones can be a form of waste disposal undertaken perhaps outside the Caherconnell enclosure.

Pig

A total of 208 pig bones from all phases of activity at Caherconnell have indications of burning, ranging from scorched, charred, and calcined. This sample represents around 3% of the total amount of pig bones and includes all parts of the pig skeleton. The majority are scorched bones, produced by burning at a low temperature, possibly as a result of cooking. Lesser amounts of charred and calcined bones are also present, mostly represented by the smaller bones such as phalanges which may be because these bones carry very little meat and fat and are likely to burn at a higher level. Burning bones can be a form of waste disposal however that practice may be represented by highly fragmented unidentifiable phones and not those identifiable to species.

Horse

An estimated five horse bones have evidence of burning. A tibia and a metatarsal also have evidence of burning with scorch marks. As well as these two examples, a tarsal bone has also

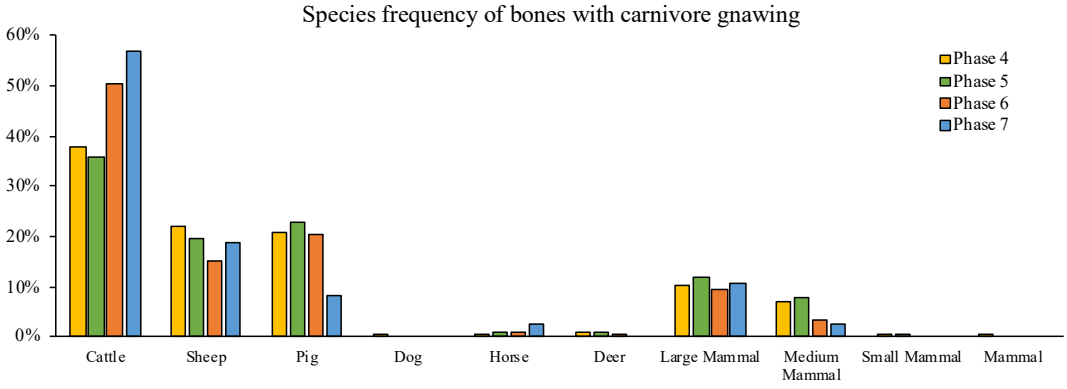


Figure 5.99: Species frequency of bones with carnivore gnawing at Caherconnell.

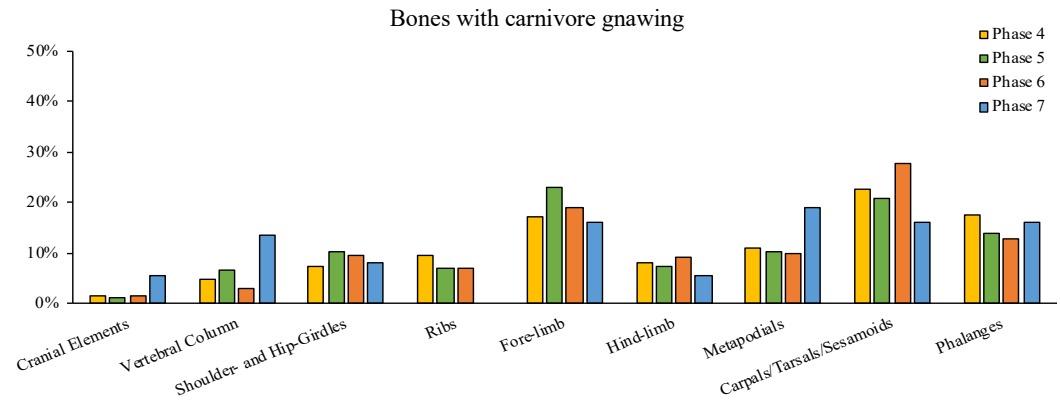


Figure 5.100: Bone elements with carnivore gnawing at Caherconnell.

been scorched. As previously mentioned, an astragalus which has cutmarks also has scorch marks. As well as the astragalus, a 1st phalanx also has evidence of scorching. None of these elements were unfused and therefore represent mature individuals. None of the late medieval horse bone from Phases 6 and 7 have evidence of burning. It is not possible to say if the presence of burning is from cooking processes or a result of discarding bones in a fire.

Dog

No dog bones from the early and late medieval phases of activity had evidence of burning.

Cat

A total of three cat bones had evidence of burning, and appear to display scorched levels of burning. The three bones, two tibiae and a femur, came from the same sample (722) and all have an unfused epiphyses that place them within the same age range, therefore it is likely that these three elements come from the same individual.

5.7.3 Gnawing

Another source of evidence for the presence of dogs at Caherconnell is the occurrence of bones with dog gnawing marks. A total of 1353 bones from the faunal assemblage had evidence of dog gnawing, with 582 bones from Phase 4, 376 bones from Phase 5, 358 bones from Phase 6, and 37 bones from Phase 7. Dog gnawing was present on a range of species and on all areas of the skeleton. The frequency of species with gnawing marks not only follows the quantification trends, but also possibly the patterns of the human diet at Caherconnell, with cattle, sheep, and pig producing the highest amount of bones with butchery marks (Figure 5.99). This is supported by the frequency of certain skeletal elements with gnawing marks. The majority of skeletal elements with dog gnawing marks the large tarsal bones, the astragalus and calcaneum, phalanges, and fore-limbs long bones (Figure 5.100). The large number of bones with gnawing marks could reflect both the meat-bearing bones that made up the human diet, but also those parts of the carcass discarded during butchery processes. The presence of gnawing marks suggests that the dogs were allowed to wander around the settlement. This is further supported by the dog coprolites which suggest the dogs were ‘ingesting material in the vicinity of the human settlement’ (O’Meara 2021, 2).

5.8 Pathology

Figure 5.101: Caherconnell Bone ID: 2235 – Cattle right 1st phalanx with exostoses and eburnation. Image on the left is the dorsal view with area of exostoses within the rectangle. Image on the right is a closeup proximal view with the area of eburnation marked by the white arrow.

Figure 5.102: Caherconnell Bone ID: 8697- Cattle left 1st phalanx. Image on the left is the dorsal view with area of exostoses and lateral extension of the articular surface within the rectangle (the two red stars are areas of concretion and not pathology). Image on the right is a closeup proximal view with area of eburnation marked by the white arrow.

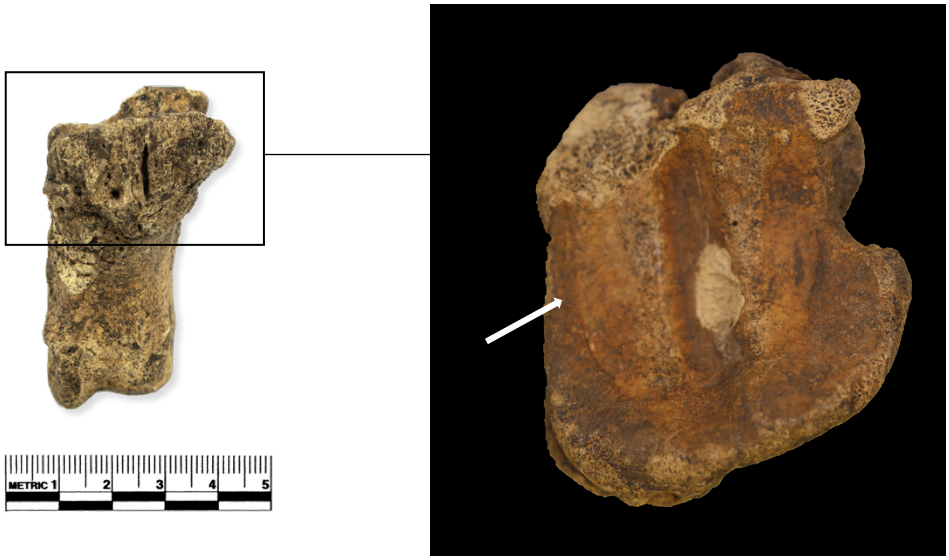


Figure 5.103: Caherconnell Bone ID: 15605 – Cattle right 1st phalanx with exostoses and eburnation. Image on the left is the dorsal view with area of exostoses within the rectangle. Image on the right is a closeup proximal view with the area of eburnation marked by the white arrow.

Various sources were used to aid in the identification and interpretation of pathologies. There can, however, be difficulties when assigning pathologies to faunal remains. One of the issues relates to accurate identification and developing a diagnostic terminology to ensure consistency across zooarchaeological studies (O'Connor 2008, 165). Another is estimating the significance of pathologies in the population in question and quantifying those pathological changes (*ibid.,* 166). Lastly, not only are there challenges with the identification and interpretation of pathologies, but taphonomic processes may also affect the preservation of specimens with pathologies (Bartosiewicz 2008).

Figure 5.104: Bone ID: 15606 - Cattle right 1st phalanx with possible high ring bone, Caherconnell.

Cattle

The total number of bones from Caherconnell with pathologies is 21, including 14 1st phalanges, two astragali, two pelvises, two thoracic vertebrae, and one patella (Table A5.69). Most of the pathologies are likely to be osteoarthrosis, which is a degenerative process, age-related condition that begins as cartilage lesions (O'Connor 2008, 171). This condition results from mechanical and biological events that causes the degeneration of cartilage and underlying bone (Huch *et al.* 1997, 667) The occurrence of osteoarthritis in the Caherconnell assemblage is further evidence of the presence of older cattle.

- *Phalanges*

The majority of cattle bones with pathologies are the 1st phalanges, all of which have indications of what is probably osteoarthritis. Osteoarthritis is visible on 14 examples primarily through the presence of exostoses, eburnation, and the lateral extension of the articular surface. Exostoses refers to the formation of new bone and eburnation, the degeneration and polishing of bone surface, is a result of wear and tear over time. Typical cases of osteoarthritis are seen in Figures 5.101–5.103. These three examples display typical signs with marginal osteophytes,

lateral extension of the articular surface, as well as eburnation. One example (8697) also has at least one small cavity in the articular surface. For the remaining phalanges, the same traits were present only primarily the proximal end, but also the distal end, and the lateral, medial, and plantar surfaces.

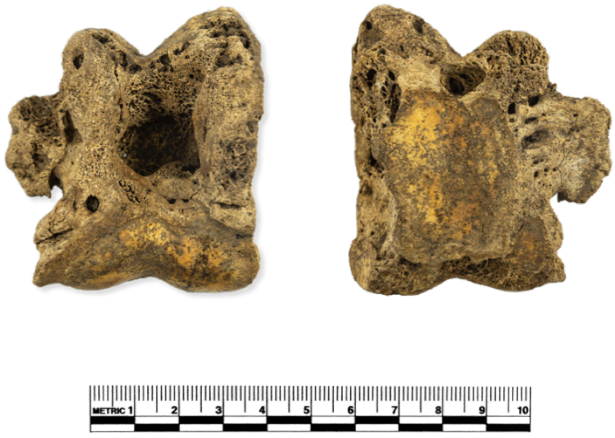


Figure 5.105: Bone ID: 11563 – Cattle left astragalus with chronic septic arthropathy, Caherconnell.

There are many causes or factors that can result in osteoarthritis. The condition is produced by constant trauma to the joint, an example being draught animals in heavy use with constant impact on hard surfaces with phalanges being valuable for identifying draught cattle as they are 'susceptible to remodelling because of their role in transmitting power and absorbing stress during locomotion (Baker and Brothwell 1980, 115; Lyman 1994, 215; Thomas *et al.* 2021, 85). Osteoarthritis is common in the feet of cattle, with metapodials as well as phalanges providing an opportunity to detect draught cattle in an assemblage (Baker and Brothwell 1980, 117; Thomas *et al.* 2021, 85). Ring bone, another form of exostosis, is a pathology that principally occurs in the fore feet

Figure 5.106: Caherconnell Bone ID: 20981 - Cattle right astragalus with eburnation on the medial side of the distal end. The image on the left is the anterior view with the area with eburnation highlighted with an arrow. The image on the right is a closeup of the distal area with the eburnation highlighted again with an arrow.

of draught animals, such as cattle and horses, due to extra strain on the interphalangeal joints (Baker and Brothwell 1980, 120). The lesions caused as a result of ring bone tend to be greatest in the lateral and medial aspects of the bone (*ibid.* 121), an example from Caherconnell being 15606 which is a possible high ring bone (Figure 5.104). The use of draught animals can be identified through the presence of pathologies, such as pathological changes in the feet of cattle due to the biochemical strain caused from heavy strain (Holmes *et al.* 2021, 258). Phalanges are suitable for this examination for two main reasons. Firstly, as mentioned previously, they are susceptible to remodelling due to their role in locomotion, and secondly their high survival rate due to their dense composition and unlikely chance of undergoing major butchery processes (Lyman 1994, 215; Holmes *et al.* 2021, 258). Metapodials are also useful for the same reason, however no cattle metapodials with pathological changes were recorded at Caherconnell. As two thirds of cattle weight is supported by the front legs, the metacarpals and forelimb bones may be expected to produce higher amounts of pathologies. Individuals used for draught work may exhibit higher amounts of metatarsals or hind-limbs with pathological changes, indicative of the additional strain placed during draught work (Bartosiewicz 2008, 154; Thomas *et al.* 2021, 88).

Figure 5.107: Caherconnell Bone ID: 21413 - Cattle pelvis, eburnation on acetabulum.

Figure 5.108: Caherconnell Bone ID: 14931 - Cattle thoracic vertebrae, close up of proximal end with depression.

Figure 5.109: Caherconnell Bone ID: 19281 Cattle thoracic vertebrae an osteolytic lesion.

- *Astragali*

Two cattle astragali were identified to have evidence of pathology of the ankle. One astragalus (Figure 5.105) has evidence of chronic septic arthropathy which is a result of the introduction of infectious agents into the joint cavity (Buikstra 2019, 745). Both extreme exostosis and bone destruction has occurred, and the formation is well remodelled in places suggesting the condition was chronic. The other astragalus (Figure 5.106) shows evidence of degenerative joint disease through eburnation on the medial side on the distal end. The presence of pathological changes in the astragalus may reflect the contribution tarsal bones play in the hind leg for forward locomotion, which is more likely to be damaged in draught animals (Bartosiewicz 2008, 158).

Figure 5.110: Caherconnell Bone ID: 1582 Cattle patella with evidence of exostoses.

- *Pelvis*

Two cattle pelvises displayed evidence of osteoarthritis of the hip joint, also known as coxarthrosis. The hip joint is one of the synovial joints which are among the most frequently affected (Galindo-Pellicena *et al.* 2017, 6). One of the specimens (Figure 5.107) is a typical example of osteoarthritis with an area of eburnation on the pubic face of the acetabulum. The eburnation has also revealed the porosity of the underlying bone. Coxarthrosis, the eburnation of the hip joint, can be caused by a combination of factors such as age or stall confinement (Rassadnikov 2021, 99). Some examples show early stages of osteoarthritis through pitting. The coxarthrosis of the hip joint, similarly to the previously discussed pathologies, is a marker of working cattle exploitation. As the hip joint is deeper than the shoulder, the former is likely to endure excess strain when going in a forward motion during traction (Groot 2005, 53; Bartosiewicz 2008, 157).

- *Vertebrae*

Two thoracic vertebrae from Caherconnell displayed pathologies, one with an osteolytic lesion on the proximal end of the body (Figure 5.108), while the other has an osteolytic lesion on the

posterior surface of the body (Figure 5.109). This destruction is caused by a subchondral cyst, which is a space occupying lesion that penetrates into the bone (Galindo-Pellicena *et al.* 2017, 6). Both lesions are well defined, with 14931 having a rounded morphology, and both with inner structures characterised by porosity. The formation of these lesions can reflect osteoarthritis of the spine which is a result of work activities such as draughting (*ibid.* 7).

- *Patella*

One cattle patella displayed evidence of exostoses (Figure 5.110). The knee is a synovial joint, which as mentioned before are the most frequently affected by osteoarthritis. Exostoses is present on the anterior surface. This example also exhibits a bony spur, also known as an osteophyte. Osteophytes can form due to osteoarthritis or factors such as age and trauma. They are defined as fibrocartilage-capped bone outgrowths, and because of its location and morphology this is likely to be an example of a traction spur, also known as an enthesophyte (*ibid,.* 6). Pathologies such as enthesophytes are skeletal responses to physiological needs to improve joint stability and to cope with biomechanical stress (Craig *et al.* 2016, 137–8). It is no surprise that pathology is present on the patella as the knee joint, which only moves in one plane and about one axis, can bear heavy loads without the need of many muscles spanning the joint to keep it stable (Vann 2008, 36).

Figure 5.111: Caherconnell Bone ID: 13642 - Sheep 1st Phalanx

Sheep

14 sheep elements produced evidence of pathology, seven are bone pathologies and the other half being oral pathologies. Four of the bone pathologies occurred on phalanges, two on metacarpals, and one was a radius. Five of the oral pathologies occurred on mandibular molars, the other two occurred on maxillary premolars (Table A5.70).

Figure 5.112: Caherconnell Bone ID: 15965 - Sheep 2nd Phalanx

- *Phalanges*

Figure 5.113: Caherconnell Bone ID: 13849 Sheep metacarpal with proximal exostosis. Image on left is view of complete metacarpal with area of pathology within rectangle. Image on right is a closeup of the proximal end.

Three of the four phalanges displaying pathologies were 1st phalanges, the other being a second phalanx. All four phalanges displays evidence of exostoses. 13642 appears to have new bone deposition on the medial and lateral sides (Figure 5.111). 15965 appears to have new bone formation on both the proximal end and lateral side (Figure 5.112). There is no evidence of eburnation or grooving of the articular surface, and the occurrence of exostoses alone is not enough to diagnose these examples as having osteoarthritis (Baker and Brothwell 1980, 115).

- *Long bones*

Three forelimb long bones, two metacarpals and a radius, had evidence of pathology through the presence of exostoses. Both metacarpals had proximal exostoses with new bone formation around the margins of the articular surface (Figure 5.113). The radius had distal exostoses on the unfused distal epiphysis.

- *Oral pathology*

Seven sheep teeth had oral pathologies, five mandibular molars and two maxillary premolars. All seven teeth had abnormal tooth roots. The formation of abnormal roots is usually linked to a chronic low-grade infection (*ibid.* 151).

Pig

Five specimens produced evidence of pathology, two are bone pathologies and the remaining three are teeth pathologies. The two examples of bone pathology occurred on phalanges and

Figure 5.114: Caherconnell Bone ID: 20830 – Syndactyly in pigs, two 2nd phalanges (proximal, plantar, and dorsal view).

Figure 5.115: Caherconnell Bone ID: 20849 - Syndactyly in pigs - two third phalanges (proximal, plantar, and dorsal view).

actually involved 4 bones, both examples being two phalanges fused together. The three teeth with pathologies included on mandibular molar and two maxillary molars (Table A5.71).

- *Phalanges*

Two cases of syndactyly in pigs were identified. Syndactylism is the complete or partial fusion of two or more digits (*ibid.* 228). The aetiology of this pathology has been debated, and although congenital in other animals such as cattle, it has been proven that nutritional deficiency is a critical factor in the occurrence and severity of syndactyly (Ross *et al.* 1945; Madgwick *et al.* 2013, 398). Fusion occurs through an intermediate ossified structure at the axial midline and may represent the ossification of a fibrocartilage bridge between the phalanges (*ibid.* 405). The occurrence of this pathology in archaeological assemblages is rare. Both examples recovered from Caherconnell are well preserved and possibly show evidence of an intermediate ossified structure. *20830* involves the fusion of two second phalanges (Figure 5.114). The two phalanges have fully fused at the distal end, however the proximal

ends remain separate. The area which has fused also appears to have the presence of exostoses or an ossified structure, possibly of an intermediate supernumerary element. It is possible that the this is an example of an earlier stage of syndactyly where the two bones have not fully fused together. This example, along with other research, suggests that fusion of the two elements progresses to completion as the individual ages (*ibid.* 406). *20849* involves the fusion of two terminal phalanges (Figure 5.115). The two phalanges has fully fused and there is almost the complete absence of fusion lines on the proximal articulation. The two terminal phalanges appear to be symmetrical. There are shallow linear impressions that indicate the border of the originally two separate phalanges which is visible from the proximal view. The articular surface of both sides have a reduced axial facet. The axial part of the proximal articular surface of each phalanx is not as distinguishable as it normally would be and therefor it can be suggested that the two associated second phalanges were also modified (*ibid.* 401). The dorsal view of *20849* shows what is possibly a small intermediate supernumerary element fused and protruding from the proximal end of the phalanges.

Figure 5.116: Caherconnell Mandibular Tooth ID: 10535

- *Oral pathology*

Three examples of oral pathology in pig remains *were* recorded, two for mandibular teeth and one for a maxillary tooth. One mandibular example *735* is a second molar (M_2), from Phase 4, which displays evidence of enamel hypoplasia. This M_2 has undergone burning as the tooth appears calcined, it also has a tooth wear stage of 'b' recorded, estimated to be from a 'sub-adult' individual (Grant 1982, 94; O'Connor 2003, 160). Enamel hypoplasia can appear as lines, pits, or grooves on the enamel surface which form as a result of pauses in the growth process. This is an indicator of nutritional deficient and illness in

Figure 5.117: Caherconnell Maxillary tooth: 1847 - M3 with pitting enamel hypoplasia

young animals (Roberts and Manchester 1995, 58; Vann 2008, 84). The 735 example appears to have moderate linear enamel hypoplasia based on Dobney and Ervynck's (1998) recording method. The second mandibular tooth, an M_3 (10535) is also from Phase 4 (Figure 5.116). It appears to be an unerupted tooth which has deformed and halted development as the crypt began laying down a thick lining of cementum. It is possible that an infection in the crypt or gum was the cause of this, for example, a gum injury would trigger excessive cementum formation, referred to as hypercementosis (García-González *et al.* 2019, 150). Even though the diagnosis is not clear, it is evident that the damage occurred before eruption. A maxillary third molar (M^3) from Phase 5 (1847) (Figure 5.117), also displays evidence of enamel hypoplasia, however in this case it is an example of pitting enamel hypoplasia which can be defined as numerous circular to oval defects that form on the crown area (Towle and Irish 2020, 1). There are five pit-type hypoplastic enamel defects on the upper part of the crown on the mesial side. The formation of these defects are an indication of a marked disturbance of dental hard tissue formation which can be caused by factor such as nutritional stress (Kierdorf *et al.* 2009, 1645).

Horse

Only one horse bone, a 1st phalanx from Phase 4 (Bone ID: 11534), has evidence of pathology in the form of extra bone growth, likely caused by exostosis.

Dog

Only one dog bone (Bone ID: 8343) has evidence of pathology, namely a 1st phalanx from Phase 5. This phalanx has evidence of exostoses, through the presence of extra bone growth at the proximal end.

Cat

Only one cat bone (Bone ID: 21342) has evidence of pathology, a right tibia with eburnation on the proximal end, likely caused by bone on bone wear (Figure 5.105).

5.9 Taphonomy of indeterminate fragments

Butchered, burnt, and gnawed bones were also recorded for elements which were unidentifiable to element and species, therefore regarded as uncountable, and were highly fragmented remains. Phase 4 revealed 1234 bones with evidence of butchery, 1067 with chop-marks, 130 with cut-marks, and 37 with both. The bulk of these, 1112 bones, were recovered from the an

early medieval occupation later across the majority of excavation cuttings with no visible distribution trend (c.36). Phase 5 revealed 793 butchered bones, 673 with chop-marks, 110 with cut-marks, and ten with bone. The early medieval occupation layer from this phase of activity (c.16) produced 638 of these bones, and again there is no visible pattern in the spread of butchered bones. An estimated 562 butchered boned were retrieved from Phase 6, 504 with chop-marks, 54 with cut-marks, and four with both. The late medieval occupation layer from this phase (c.25) yielded 494 of these butchered bones, with no visible pattern in the spread of butchered bones. Phase 7 produced the lowest amount of butchered bones with a total of 115, 105 with chop-marks, nine with cutmarks, and a single bone with both. The late medieval occupation material (c.23) revealed 89 of these, again no evident distribution pattern across the site.

A total of 8828 burnt bones were recorded from Phase 4, including scorched (1056), charred (1678), and calcined (6094) elements, and 6740 came from the early medieval occupation layer (c.36). Phase 5 revealed 7019 bones which were scorched (1060), charred (1333), and calcined (4626), and 4408 of these were recovered from the occupation layer (c.16). An estimated 3807 burnt bones were counted from Phase 6, 641 were scorched, 942 were charred, and 2224 were calcined, with 2650 from the occupation layer (c.25). Phase 7 produced 739 burnt bones, 159 from the occupation material (c.23), 81 were scorched, 81 were charred, and 577 were calcined.

An estimated 406 gnawed bones were recorded from Phase 4, 403 were gnawed by dogs and three by rodents, and 337 were from the early medieval occupation layer (c.36). Phase 5 revealed 373 gnawed bones, 367 dog gnawing, five rodent, and a single cat gnawed bone, and 298 were recovered from the occupation layer (c.16). A total 370 bones, 319 from the late medieval occupation layer (c.25), have gnawing, 367 gnawed by dogs and three by rodents. Phase 7 produced 41 gnawed bones, 33 from the occupation material (c.33), 39 were gnawed by dogs and two by rodents.

Chapter 6

Presentation of Results: Wild Species and Birds

6.1 Wild mammals, rodents, and amphibians

6.1.1 Introduction

As well as domesticated animals of wild species were also recovered at Caherconnell. The wild fauna represented are deer, hare, rabbit, fox, badger, red squirrel, and small rodents, the first three most commonly found within medieval bone assemblages in Ireland. As well as these wild mammals, amphibian, bird, and fish bones were also recovered.

During the early medieval period, red deer would have been hunted on land owned by a *tuath*, which would have required the permission of the landowner, a practice which followed into the late medieval period with the Anglo-Norman introduction of forests, chases, and deer parks (Kelly 1997, 406; Neeson 1997, 138; Beglane 2010, 2). As certain wild species and their habitats were being managed, such as deer parks, rabbit warrens, and dovecotes, particularly in the late medieval period, their presence can be an indication of high status (Denham 2007, 177). Another species of deer that turns up in assemblages is fallow deer and they would have been kept in deer parks. Fallow deer were introduced to Ireland during the 13th century by the Anglo-Normans and are generally found in castle or urban contexts, which supports the historical evidence of their association with high-status hunting (McCormick 1999, 360; Denham 2007, 271; Beglane 2018, 2). Roe deer are rarely found in medieval assemblages, only being recovered from few later medieval assemblages (Denham 2007, 270–1). Red deer would have been more widespread during the medieval periods and this is reflected through their high counts, particularly those from rural sites.

Hare were hunted for their meat during the early and later medieval periods (McCormick 1999, 366). Unlike the hare, which is a native animal, the rabbit was an Anglo Norman introduction. The earliest literary record of rabbits is 1191 AD and the first archaeological evidence is mid 13th century (McCormick 1997, 827; McCormick and Murray 2007, 40). Rabbit pelts were an important export during the later medieval period (McCormick 1999, 366). The remaining wild species tend to occur in small quantities including fox, badger, red squirrel, rodents, and amphibians. Their remains never hold much significance, with some being intrusive.

6.1.2 Deer

Deer bones are recorded from all all four phases of activity at Caherconnell, the majority of which have been identified as red deer. The remaining deer bones, not identified to species are most likely to also represent red deer, particularly those from the early medieval activity, as fallow and roe deer were a later introduction.

Deer remains from Phase 4 (early occupation late 10th – early 11th century) at Caherconnell have a NISP of 50 (30 bones, 14 mandibular teeth, and 6 maxillary teeth) and an MNI of 2, with the pelvis being the most common element (Table A6.1). A total of 38 of the 50 deer elements from Phase 4 were identified as red deer. Phase 5 (middle occupation: late 10th – early 11th century) deer also have a NISP of 48 (20 bones, 20 mandibular teeth, and 8 maxillary teeth) and an MNI of 2, with the radius being the most frequent element (Table A6.2). A total of 34 of the 48 deer elements from Phase 5 were identified as red deer.

Deer remains from Phase 6 (late occupation: 11th – 14th century) have a NISP of 43 (21 bones, 13 mandibular teeth, and 9 maxillary

Figure 6.1: Bone ID: 14277 – Main beam of red deer antler from Phase 4 at Caherconnell.

Figure 6.2: Bone ID: 12920 – Pedicle of red deer antler from Phase 4 at Caherconnell.

Figure 6.3: Bone ID: 12541 – Red deer antler tine from Phase 4 at Caherconnell.

teeth), with a MNI of 3 with the calcaneum being the most common element (Table A6.3). A total of 21 of the 43 deer elements from Phase 6 were identified as red deer. Deer remains from Phase 7 (final occupation: 15th – 16th century) have a NISP of 20 (4 bones, 10 mandibular teeth, and 6 maxillary teeth) and an MNI of 1 (Table A6.4). Six of the 20 deer elements from Phase 7 were identified as red deer.

Both cranial and post-cranial deer elements are present in the Caherconnell assemblage. Deer antler, usually associated with craft working, may represent either the collection of shed antler or the removal of antler from a dead animal. The post-cranial deer bones in the Caherconnell assemblage represent mature individuals as the majority of elements were fully fused. The occurrence of antler indicates the presence of male deer within the assemblage.

A total of 11 antlers were recovered within the Caherconnell assemblage, 8 from Phase 4, 2 from Phase 5, and 1 from Phase 6. Various parts of deer antler are included in this selection of elements. Phase 4 produced the largest sample of antler, and included examples of the main beam (Figure 6.1: Bone ID: 14277), antler tines (Figures 6.3–6.5: Bone ID: 12541, 14278 and 14279), and the pedicle (Figure 6.2: Bone ID: 12920). The antler beam and tines were used for bone comb making, for crafting both the plates and teeth of the comb. The high volume of bone combs recovered from Caherconnell and presence of antler within the assemblage indicate that craft production on-site. The presence of an antler pedicle is evidence of the removal of antler from a deer skull and not the use of shed antler. This pedicle has evidence of sawing in order to remove the antler, and also has the presence of chop marks (Figure 6.2). As antlers shed seasonally, the supply of shed antler was also seasonal and it is possible that hunting and removing antler was done to provide a supply of antler all year round (MacGregor 1985, 35).

Figure 6.4: Bone ID: 14278 – Red deer antler tine from Phase 4 at Caherconnell.

Figure 6.5: Bone ID: 14279 – Red deer antler tine from Phase 4 at Caherconnell.

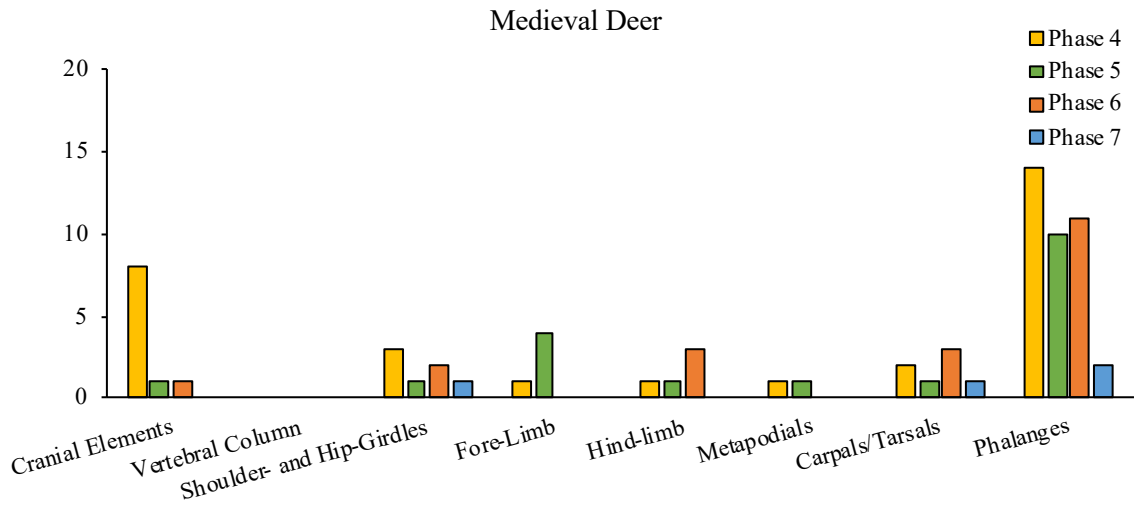


Figure 6.6: Bone elements present in early and late medieval deer at Caherconnell.

As previously discussed, post-cranial deer bones were also recovered throughout the assemblage (Figure 6.6). The most common element group of deer elements were the phalanges, possibly due to their overall high count within the deer skeleton. They are also seen as an indicator of hide trade as they can be left attached to the skins after removal (Serjeantson 1989, 136; Denham 2007, 291). The presence of non-meat bearing bones, such as the phalanges, suggests that the deer may have been brought on-site and these elements were then discarded during the dismemberment and butchery process. Fewer amounts of meat-bearing bones were recovered in the assemblage. Those recovered included the fore-limb and hind-limb long bones, as well as the shoulder and hip-girdles. Some of these bones also displayed butchery marks, both chop and/or cut marks. The presence of butchery marks on the post-cranial elements may be evidence for not only craft working, but either the consumption of deer or removal of hides.

Some of these post-cranial bones have dog gnawing marks. Phase 4 and 5 deer remains with dog gnawing include bones such as the phalanges or tarsal bones, which would have been discarded as they are not meat-bearing bones. Phase 4 produced 5 deer bones with dog gnawing marks which are all phalanges, Phase 5 produced 4 with gnawing, 3 phalanges and 1 calcaneum. 1 deer bone with gnawing marks, the proximal end of a femur, was recovered from Phase 6. A scapula from Phase 7 had evidence of rodent gnawing.

6.1.3 Hare and rabbit

Lagomorph bones recovered in the Caherconnell assemblage, have identified as hare and rabbit, with some identified as hare/rabbit. Lagomorph remains from Phase 4 (early occupation

late 10th – early 11th century) at Caherconnell have a NISP of 115 (60 bones, 30 mandibular teeth, and 25 maxillary teeth) (Table A6.5). Out of the 60 bones, 33 were identified as hare, 16 as rabbit, and 11 as hare/rabbit. 10 of the 30 mandibular teeth were identified as hare and the remaining 20 were identified as hare/rabbit. A total of 12 of the 25 maxillary teeth were identified as hare and the remaining 13 as hare/rabbit. The 30 hare bones have an MNI of 3, the 16 rabbit bones have an MNI of 1, and the 11 hare/rabbit bones have an MNI of 2. As rabbits were an Anglo Norman introduction, the bones from Phase 4, may represent intrusive burrowing. This is supported by the lack of evidence of butchery marks.

Phase 5 (middle occupation: late 10th – early 11th century) lagomorph bones have a NISP of 90 (44 bones, 29 mandibular teeth, and 17 maxillary teeth) (Table A6.6). Out of the 44 bones, 30 were identified as hare and the remaining 14 were identified as hare/rabbit. Three of the 29 mandibular teeth were identified as hare and the remaining 26 were identified as hare/rabbit. Four of the 17 maxillary teeth were identified as hare and the remaining 13 were identified as hare/rabbit. Those recorded as hare/rabbit likely represent hare or intrusive rabbit. The 30 hare bones have an MNI of 3 and the 14 hare/rabbit bones have an MNI of 3.

Phase 6 (late occupation: 11th–14th century) lagomorph bones have a NISP of 85 (34 bones, 32 mandibular teeth, and 19 maxillary teeth) (Table A6.7). Out of the 34 bones, 7 were identified as hare, 2 were identified as rabbit, and 25 were identified as hare/rabbit. All of the mandibular and maxillary teeth were identified as hare/rabbit. The 7 hare bones have an MNI of 2, the 2 rabbit bones have an MNI of 1, and the 25 hare/rabbit bones have an MNI of 3. Phase 7 (final occupation: 15th–16th century) lagomorph bones have a NISP of 22 (15 bones, 5 mandibular teeth, and 2 maxillary teeth) (Table A6.8). Out of the 15 bones, 7 were identified as hare, 2 as rabbit, and 4 as hare/rabbit. 4 of the 5 mandibular teeth were identified as rabbit, and 1 as hare/rabbit. Both maxillary teeth were identified as hare/rabbit. The 7 hare bones have an MNI of 1, the 4 rabbit bones have an MNI of 1, and the 2 hare/rabbit bones have an MNI of 1.

Only 1 bone, a hare astragalus from Phase 4, has a possible butchery mark as the distal end appears to be chopped off. A total of 8 bones had evidence of burning, 7 appeared scorched and 1 was calcined. A phalanx (Bone ID: 4484) from Phase 6 has possible evidence of pathology with the presence of exostoses.

6.1.4 Other wild species

- *Fox*

Fox remains from Phase 4 (early occupation late 10th – early 11th century) at Caherconnell have a NISP of 9 (6 bones, 1 mandibular tooth, and 2 maxillary teeth) and an MNI of 1 (Table A6.9). Phase 5 (middle occupation: late 10th – early 11th century) fox have a NISP of 7 (5 bones and 2 mandibular teeth) with an MNI of 1 (Table A6.10). Two fox bones were recovered from Phase 6 (late occupation: 11th – 14th century), both left scapula with an MNI of 2 (Table A6.11). No fox bones were recovered from Phase 7 (final occupation: 15th – 16th century). All of the fox bones from the assemblage were mature individuals. None of the fox bones have any butchery marks. Only 1 bone, a fox calcaneum from Phase 5, has evidence of burning and appeared scorched. No fox bones have evidence of pathologies. A total of 130 bones, 38 mandibular teeth, and 15 maxillary teeth from the Caherconnell assemblage were identified as dog/fox.

Figure 6.7: Bone ID: 12257 - Red squirrel left femur from Phase 4, Caherconnell.

- *Badger*

Badger remains were only recovered from Phase 4 (early occupation late 10th – early 11th century) and Phase 6 (late occupation: 11th – 14th century). Phase 4 produced a NISP of 8 (4 bones and 4 mandibular teeth) with an MNI of 3. Phase 6 produced 1 badger bone, a possible badger mandible. None of the badger bones have evidence of butchery, burning, gnawing, or pathology.

- *Red squirrel*

A single red squirrel bone (Bone ID: 12257) was found from Phase 4, the proximal end of a left femur (Figure 6.7).

- *Rodents*

A total of 220 Rodent bones were identified in the Caherconnell assemblage, represented by mouse, rat, and unidentified small rodent. Rodent bones from Phase 4 (early occupation late

10th – early 11th century) had a NISP of 82 (71 bones, 10 mandibular teeth, and 1 maxillary tooth). Phase 5 (middle occupation: late 10th – early 11th century) rodent bones have a NISP of 62 (44 bones, 13 mandibular teeth, and 6 maxillary teeth). Phase 6 (late occupation: 11th – 14th century) rodents have a NISP of 10 (4 bones and 6 mandibular teeth). Rodent bones from Phase 7 (final occupation: 15th – 16th century) have a NISP of 65 (40 bones, 19 mandibular teeth, and 6 maxillary teeth). It is likely that the rodent bones within this assemblage are intrusive.

- *Amphibian*

A total number of 59 amphibian bones were recovered from the Caherconnell assemblage, all of which are likely to be intrusive. Seven of these 59 bones were identified as frog.

6.2 Bird and fish

6.2.1 Introduction

As well as mammal remains, the bones of bird and fish also appear in archaeological assemblages, usually in lower quantities. The exploitation of bird and fish varies between periods and site types, which reflects on the diet, cultural practices, status, local environment, seasonal activities, and the lifestyle of the inhabitants (Hamilton-Dyer 2007a, 105). Even where present in small quantities, they would have been included in the diet for variety in taste, as well as sources of proteins, vitamins, and minerals (*ibid.*). The importance of a site can be reflected through the presence of certain birds and fish, either those local species regarded as rarities, and others indicating high status through the occurrence of imported species (*ibid.*). The presence and quantity of bird and fish can reflect on settlement economy by giving an insight into the role of hunting and fishing relative to agriculture and also an indication of the surrounding environment through the availability and habitats of certain species. Some species can be seasonal indicators and can provide information on when the site was occupied. The preservation of bird and fish bones, particularly the latter, are affected by taphonomic factors and can therefore result in the under-representation of these species (*ibid.*).

Our understanding of the exploitation of birds and fish in the medieval periods comes from documentary sources and the archaeological record, which have only in recent years provided the same narrative (Hamilton-Dyer 2007a, 102). With sieving employed on many recent excavations, the recovery of bird and fish bones is an increasingly important part of the

faunal collection at many sites. The larger assemblages are typically from early medieval coastal sites and late medieval urban sites (*ibid.* 103). A range of medieval texts include references to birds and fish, however their focus is towards status and legal matters, with the representation of everyday life less frequent, which is generally what is represented in the archaeological record (*ibid.*). With both sources of information providing an insight into food economy, it is valuable to interpret both understand the role or birds and fish in medieval Ireland.

6.2.2 Birds

A total of 129 bird bones were recovered at Caherconnell making up a very small portion of the entire faunal assemblage. Even though sieving is essential in the recovery of small bones such as bird bones, the majority of bird bones within this assemblage were collected by hand. It should be noted that the assemblage produced no evidence of a medullary bone or spurs and therefore no sexing information is available from the domestic fowl.

Phase 4 (early occupation: late 10th–early 11th century) at Caherconnell produced a total of 45 birds bones, while some were put into bird size groups. One of the bird bones identified to size, a tracheal ring bone from a hooded crow sized bird, is evidence of minimal assemblage attrition. The species with the highest NISP counts are domestic fowl, buzzard, and starling. Domestic fowl have a NISP of 5 and an MNI of 2. Buzzard have a NISP of 11 and an MNI of 1 coming from a single context, which probably represents a single buzzard. One buzzard ulna (Bone ID: 12533) has small possible cutmarks on the proximal end (Figure 6.8). Two buzzard carpo-metacarpus (Bone ID: 17367 and 18400), which are one of the wing bones, both show

Figure 6.8: Bone ID: 12533 - Buzzard ulna with faint cutmarks on proximal end from Phase 4 Caherconnell.

Figure 6.9: Bone ID: 17367 – Buzzard carpo-metacarpus with defects on proximal and distal end from Phase 4 Caherconnell.

signs of pathology. Bone I.D. 17367 has defects on the proximal and distal end (Figure 6.9). Bone I.D. 18400 appears to have a healed fracture, the extensor process is curved and there is extra bone growth below the alular process (Figure 6.10). In both cases, the bird(s) represented by these bones are likely to have been caught when injured. Starling produced a NISP of 3 and an MNI of 1. The remaining species, namely greylag goose, mallard, teal/garganey, woodcock, snipe, crow/rook, and gull (common gull size), all have a NISP of 1 and MNI of 1. A total of 18 bird bones from Phase 4 could only be placed into size groups and not identified to species.

Phase 5 (middle occupation: late 10th– early 11th century) at Caherconnell produced a total of 47 bird bones. Twelve different species of bird were identified in the Phase 5 bones, with the remaining bones were put into size groups. The species with higher NISP counts than 1 are domestic fowl, red grouse, greylag goose, woodcock, raven, and starling. Domestic fowl have a NISP of 2 and an MNI of 1. Red grouse have a NISP of 3 and an MNI of 1. Greylag goose have a NISP of 1 and an MNI

Figure 6.10: Bone ID: 18400 - Buzzard metacarpal with pathology on proximal end from Phase 4 Caherconnell.

of 1. A goose tibia (Bone ID: 1879) have a chop mark on the proximal end of the shaft (zone 4) and cutmarks on the distal end, which is likely indicative of the disjointing process (Figure 6.11). Woodcock have a NISP of 5 and an MNI of 1. Raven produced a NISP of 14 and an MNI of 1. Starling have a NISP of 5 and an MNI of 1. The remaining species; teal/garganey, snipe, corncrake, crow/rook, rock dove/pigeon, and song thrush all have a NISP of 1 and MNI of 1. Nine bird bones from Phase 5 were put into size groups and not identified to species.

Phase 6 (late occupation: 11th–14th century) at Caherconnell produced a total of 28 bird bones. Ten different species of bird were identified in the Phase 6 bird bones, and the remaining bones were put into size groups. The species with a higher NISP than 1 are domestic fowl, greylag goose, plover (golden plover size), raven, and jackdaw/magpie. Domestic fowl have a NISP of 6 and an MNI of 1, with one of these a possible domestic fowl metatarsal with possible faint cutmarks (Bone ID: 7707). A domestic fowl coracoid has a crunch gnawing mark (Figure 6.12: Bone ID: 4415). Greylag goose have a NISP of 2 and an MNI of 1. One of these bones, a humerus, has evidence of butchery through a chop marks, appears to be scorched, and also has a crunch mark (Figure 6.13: Bone ID: 3280). Plover (golden plover size) have a NISP of 2 and an MNI of 1. Raven have a NISP of 7 and an MNI of 2. Jackdaw/magpie have a NISP of 3 and an MNI of 1. The remaining species; brent goose, mallard, crow/rook, and starling all have NISP of 1 and MNI of 1. 4 bird bones from Phase 6 were put into size groups and not identified to species.

Phase 7 (final occupation: 15th–16th century) at Caherconnell produced a total of 9 bird bones. 4 different species of bird were identified in the Phase 7 bird bones, and the remaining

Figure 6.11: Bone ID: 1879 - Greylag goose (Anser sp.) tibia from Phase 5 with chop mark (black arrow) and cutmarks (white arrows), Caherconnell.

bone was placed into a size group. The species with a higher NISP than 1 are domestic fowl and jackdaw/magpie. Domestic fowl have a NISP of 4 and an MNI of 2. Jackdaw/magpie have a NISP of 3 and an MNI of 1. One of the jackdaw/magpie bones, the distal end of a humerus, has a deep depression and is possibly from a male individual. The remaining species, crow/rook, both have NISP of 1 and an MNI of 1. One bird bone from Phase 7 was put into a size group of domestic fowl sized bird.

Figure 6.12: Bone ID: 4415 - Domestic Fowl coracoid with crunch gnawing mark from Phase 6 Caherconnell.

Discussion

The majority of the bird bones from Caherconnell come from the early medieval period (Phases 4 and 5), with lesser amounts recovered from the later medieval occupation (Phases 6 and 7). This follows the general trend across the entire faunal assemblage (Figure 6.14). A total of 97 of the 129 bird bones were identified to species, with the remaining 32 identified to a bird size group. Overall, the Caherconnell bird assemblage is dominated by corvids and domestic fowl. Also present in the assemblage are a mix of domestic and wild species, including *Anatidae*, game birds, birds of prey, waders, gulls, crakes, columbids, and small passerines. From the numbers present, it is evident that birds did not play a major role in the economy or diet at

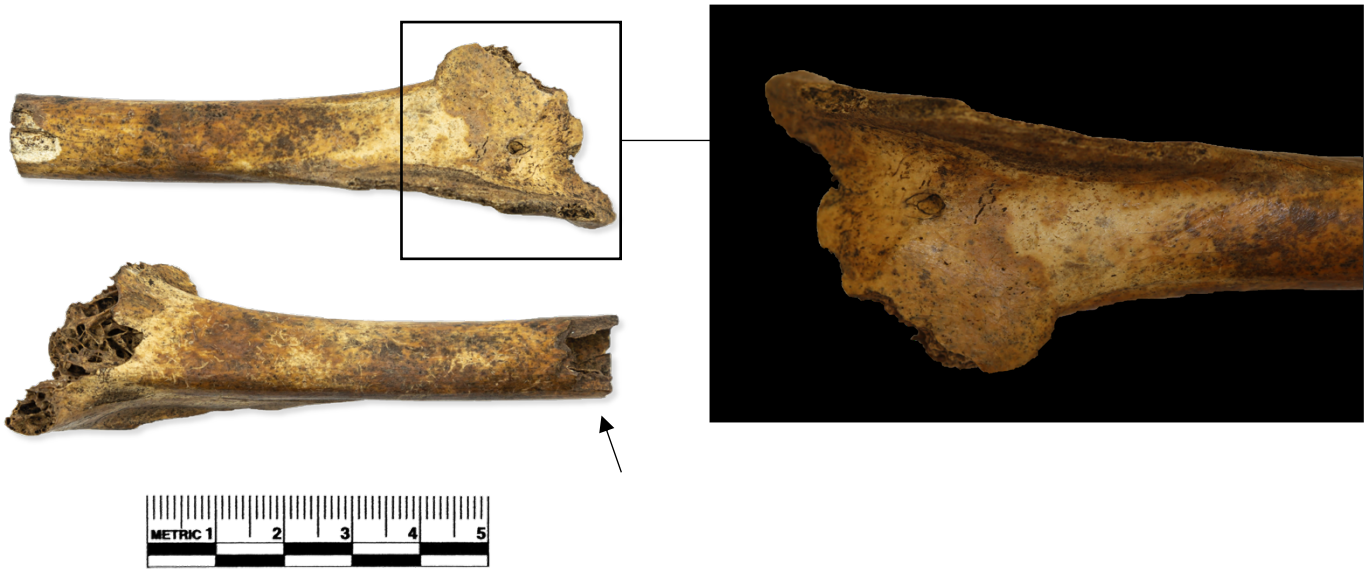


Figure 6.13: Bone ID: 3280 - Greylag goose (Anser sp.) humerus from Phase 6 with chop mark (black arrow) and crunch mark, Caherconnell.

Caherconnell. The majority of birds were represented by wild species throughout all phases of activity, a pattern that follows the early medieval rural trends. Although birds did not play a major role, a bird bone was used for one of Caherconnell's most significant artefacts. An ink pen was recovered from the Phase 5 late 10th/early 11th century occupation layer which was made by attaching a copper-alloy nib to a bone shaft, the latter likely to be from the radius of a mute swan (Comber and Parsons 2021, 15).

- *Domestic birds*

Domestic fowl are one of the dominant bird species within the assemblage. Domestic fowl have the highest MNI from Phase 4 and 7, both with an MNI of 2. The assemblage produced no evidence of a medullary bone or spurs and therefore no sexing information is available from the domestic fowl. Only one bone provides evidence of consumption, a coracoid (4415) from Phase 6 with a crunch mark. The distribution of domestic fowl elements, particularly from the later medieval phases, suggests that whole birds were present on-site. Domestic fowl being one of the dominant bird species at Caherconnell follows the trends seen within the early medieval economy in Ireland (Hamilton-Dyer 2007, 106). Although likely minor, it is likely that domestic fowl, as well as their eggs, played a role in the diet at Caherconnell.

Possible evidence of domestic *Anatidae* is represented by greylag goose and mallard, the former recovered from Phase 4, 5, and 6, and the latter from Phase 4 and 6. It can be difficult to distinguish between different species of geese. The examples discussed in this section have

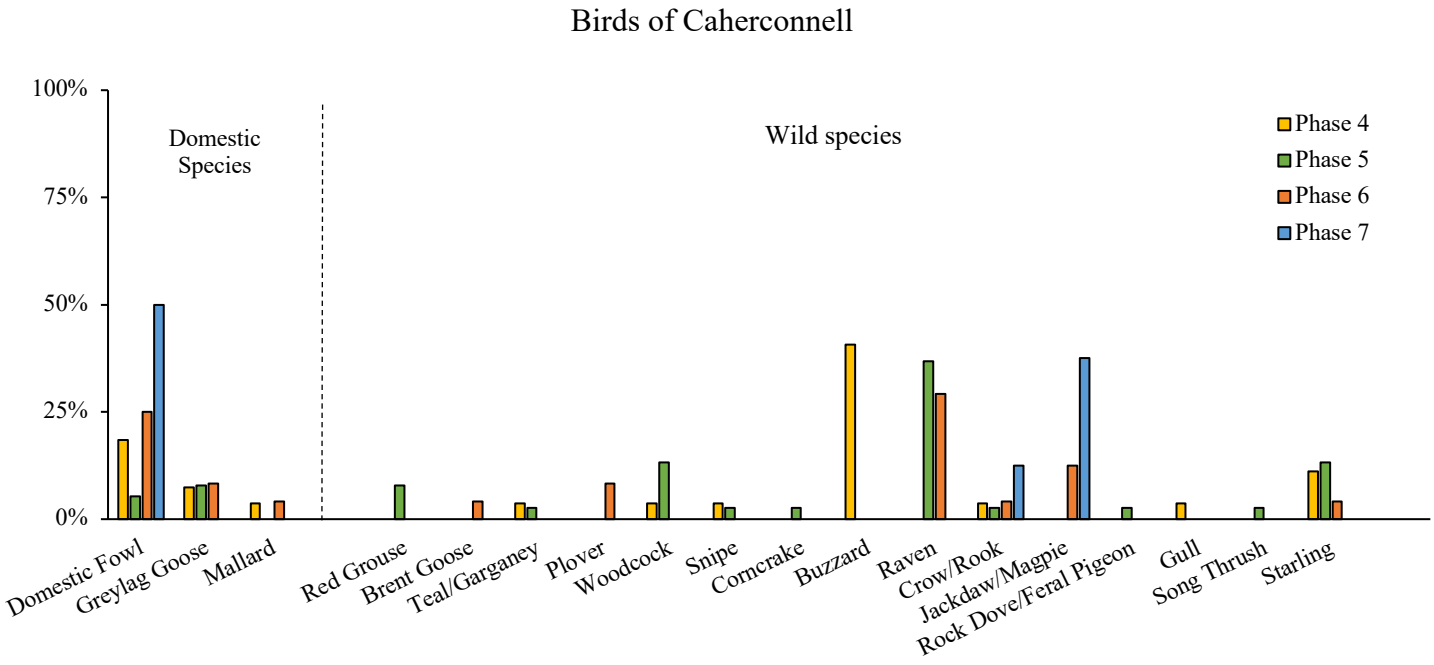


Figure 6.14: Bird species from all phases of activity in the Caherconnell assemblage.

been identified as greylag goose (*Anser sp.)* and possible represent the domesticated form of this species, the farmyard goose. Greylag goose produced evidence of butchery, a tibia (1879) and a humerus (3280). The butchery present on the tibia is indicative of the disjointing process. The humerus not only has the presence of a chop mark but also a crunch mark. Although only two examples, it is possible that this is evidence of the consumption of goose meat at Caherconnell. The possible domestic geese bones include those from the wing, leg, and foot bones, but it is unclear whether the whole bird was present on site. Similar to geese, it is difficult to distinguish between domestic ducks and the wild mallard. The ducks in this section have been identified as mallard, which may represent the mallard-size domestic or farmyard duck. The possible domestic duck is only represents by two metacarpals and it is not clear whether the whole bird was present on site.

- *Wild birds*

Wild birds were more numerous than domestic species within the Caherconnell assemblage, a trend seen in medieval assemblages elsewhere in Ireland. Evidence of fowling is present throughout all phases of activity, with Phase 5 producing the largest range of wild species. As well as domestic fowl, corvids also dominated the Caherconnell bird assemblage, making up 31 bones, and included raven, crow/rook, jackdaw/magpie. There are several way corvids end up in faunal assemblages. Corvids were sometimes kept as pets and they adapt well to domestication (Kelly 1997, 129). They are also 'carrion feeders and predators of young poultry' and therefore killed as vermin (Hamilton-Dyer 2007a, 106). Raven dominated the Phase 5 and 6 bird bones, the former producing an MNI of 1 and the latter an MNI of 2. Crow/rook have been found in all phases of activity in small quantities. Jackdaw/magpie were recovered only from Phases 6 and 7.

Red grouse, a game bird, is represented by a single bone from Phase 5. As well as the domestic goose and domestic duck previously discussed, *Anatidae* are also represented by Brent goose and teal/garganey, none were recovered from Phase 7. Brent goose were recovered from Phase 6 and teal/garganey was recovered from Phase 4 and 5. Buzzard dominate the Phase 4 bird bones, which was likely to be an opportunistic capture which was possibly consumed as an ulna (12533) had faint cutmarks. Waders were recovered from all phases, except Phase 7, and included plover (golden plover size), woodcock, and snipe. Gulls were represented by a bone comparable to common gull in size from Phase 4. A singular corncrake bone, rock dove/feral pigeon, and song thrush bone were recovered from Phase 5. As well as the song thrush, another small passerine, the starling, were recovered from Phase 4, 5 and 6. The small

passerine bones likely represent birds living onsite or nearby, possibly brought into the site by domestic cats.

6.2.3 Fish

A total of 26 fish elements were recovered at Caherconnell, including both cranial and post cranial elements. A total of 18 of the fish bone elements were identified to species, and the remaining 8 identified as fish. A total of 13 fish bones were recovered from Phase 4, 6 from Phase 5, 6 from Phase 6, and 1 from Phase 7.

A range of species were present in the Phase 4 fish bones, including Atlantic salmon, whiting, ballan wrasse, and mackerel/scad (Figure 6.16). Atlantic salmon is represented by a single caudal vertebrae (Bone ID: 17365). Whiting is represented by 1 abdominal vertebrae (Bone ID: 17366). Ballan wrasse is represented by 3 cranial elements, a dentary lower jaw (Bone ID: 550), and 2 fragments of pharyngeal teeth (Mandibular tooth ID: 679 and 680). A total of 4 vertebrae, 2 anterior vertebrae and 2 posterior vertebrae, were identified as mackerel/scad (Bone ID: 10151-10154), 10153 has evidence of mastication (Figure 6.15). Mackerel and scad vertebrae can be distinguished by texture (Watt *et al.* 1997, 149), however as these are archaeological samples it is difficult to make this distinction. The remaining 4 bones are vertebrae identified as fish.

The species represented in the Phase 5 bones are cod, ling, and mackerel/scad. Cod is represented by 1 abdominal vertebrae (Bone ID: 8981). Ling is represented by 1 caudal vertebrae (Bone ID: 18654). Mackerel/scad is represented by 1 posterior vertebrae (Bone ID: 4066) and 1 anterior vertebrae (Bone ID: 9150). The remaining 2 fish bones are not identified to species and are cranial elements, either interopercular or subopercular cranial elements (Bone ID: 16182 and 16183). Three fish vertebrae from Phase 6, 2 anterior and 1 posterior, can be identified as mackerel/scad. The remaining 3 fish bones were identified as fish vertebrae. The singular fish bone from Phase 7 is a whiting abdominal vertebrae.

Figure 6.15: Bone ID: 10153 - Mackerel/scad vertebrae with evidence of mastication from Phase 4 Caherconnell.

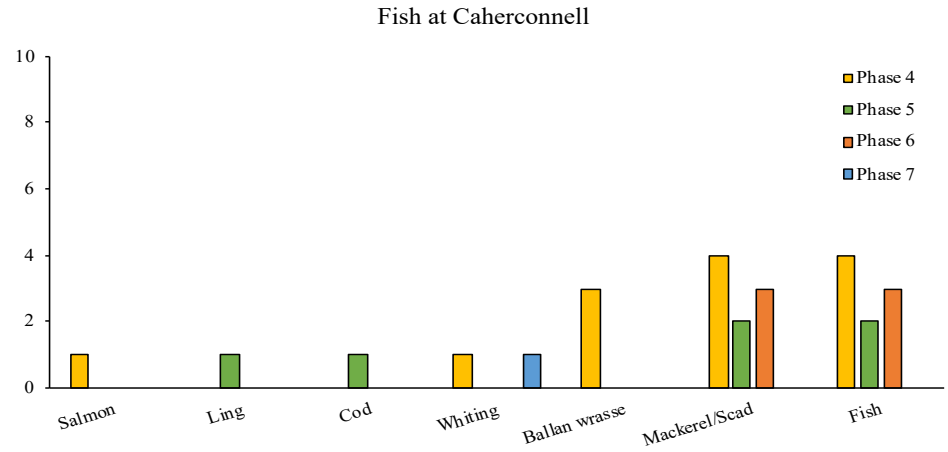


Figure 6.16: Fish species from all phases of activity at Caherconnell.

Discussion

The Caherconnell assemblages includes a range of species from all phases of activity. For medieval assemblages in Ireland, a notable aspect is the prevalence of marine fish rather than freshwater fish (Hamilton-Dyer 2007a, 111). All of the species identified within the Caherconnell assemblage are marine species, including salmon, ling, cod, whiting, ballan wrasse, mackerel/scad. Salmon are migratory species and can also be found in freshwater rivers. Literary sources have references to sea fishing, however in general the sources favour freshwater fish (Kelly 1997, 296). It is evident that fishing did not play a major role in the economy of Caherconnell, even with Ballyvaughan bay only 10 kilometres away. With only a sample of 26 fish bones in the assemblage it is evident that fish did not play a significant role in the diet at Caherconnell. The analysis of the marine mollusc assemblage highlighted that 'the contribution of shellfish to the diet of the occupants was minimal' (Murray 2020, 3). The shellfish assemblage was made up of bivalves (the common oyster, mussels, the great scallop, carpet shells, razor clams, and quahog clam) and gastropods (limpets, periwinkles, dogwhelk, and topshell) (*ibid.* 1–2). Based on the fish bones and the evidence from shellfish assemblage, it is evident that the coastal resource was exploited on occasion, but were not a key food resource for the settlement. It should be noted that the low quantity of fish in archaeological assemblages such as Caherconnell may be due to various reasons, such as taphonomic processes as the preservation of fish bones can vary with some being more fragile and other a more robust (Wheeler and Jones 1989, 63; Colley 1990, 215). Due to the size of fish bones, consideration in the choosing sampling and retrieval methods is imperative to their recovery. Colley (1990, 208) describes how the loss of fish bones can occur by passing through larger sieves and that those with mesh sizes ranging between 0.5 and 2mm are preferred for the recovery of smaller fish remains.

Part 3: Interpretation

Chapter 7

The Animals

7.1 The role of animal husbandry, hunting, and fishing

7.1.1 Animal husbandry

An insight is gained into the animal husbandry practices at Caherconnell by analysing the role of each domesticate. One way of identifying these practices can be done through the analysis of kill-off patterns, particularly of the three main domesticates, namely cattle, sheep, and pig. A meat-producing economy will produce patterns of these animals being killed once maturity is reached. An economy that focuses on secondary products such as milk and wool will reveal evidence of the exploitation of older animals. Species frequencies, sexing information, and taphonomic evidence can also give insight into these roles. The other domesticates of Caherconnell that give further understanding into the practices and economy of the site are horse, dog, cat, and domestic fowl. As this assemblage primarily comprises of food refuse, the low amounts of these other domesticates may not be a total representation of their role at Caherconnell. It is therefore important to acknowledge the supporting evidence for these animals, such as the presence of carnivore gnawing providing further potential evidence for dogs at Caherconnell. Overall, the results from this assemblage reveal a producer-consumer site, while also providing evidence of the use of by-products including hides, wool, furs, bone, and marrow.

Domesticates

The three main domesticates were bred on-site and their slaughter patterns provide insight into the husbandry practices and role each animal played. The results show that the kill-off patterns do not change from the early to late medieval periods for all three domesticates. The early medieval phases produced higher amounts of faunal material when compared to the later medieval phases. Phase 4 produced the highest amounts of these domesticates, with the frequency decreasing throughout the other phases. All parts of the skeleton were present throughout the assemblage to indicate they were slaughtered on-site or nearby. The results of the faunal analysis suggest that Caherconnell was a self-sufficient producer-consumer site.

Cattle were the dominant domesticate with an overall dominance of adult cows, to reveal a site focused on a dairying economy. Meat also played an important role in economy through the consumption of beef, lamb/mutton, and pork. Other secondary products, such as wool and bone, were used, but were not a primary focus.

- *Cattle*

The literary sources state that cattle were an important part of the early medieval economy in Ireland, with an emphasis on dairying. Produce such as butter and cheese, would have been most important during the summer months as cows gave little milk in winter (Lucas 1960, 28; Edwards 1999, 57). The products of butchery, such as meat and hides, appear to be lower value than live cattle and their milk (O'Sullivan *et al.* 2008, 194)**.** As a unit of wealth, they can give an indication to the social status of both the individuals and settlement. The *Críth Gablach* states that the livestock herd of the *bóaire*, the 'cow-freeman' or ordinary well-off farmer, should include '20 cows, 2 bulls, 6 oxen, 20 pigs, 20 sheep, 4 domestic boars, 2 brood-sows, and a saddle horse' (Binchy 1941; de Paor and de Paor 1960, 78–9; Kelly 1997, 27). The importance of cattle is not only seen in the literary sources but also in the zooarchaeological record. Cattle tend to be the dominant species in early and late medieval faunal assemblages, particularly dairy cows, which is not surprising as they are regarded higher in value (McCormick and Murray 2017, 199, 203).

The cattle at Caherconnell were kept in large numbers, predominantly adult cows, and the evidence suggests that they were bred and butchered on-site or nearby. Older cattle dominated the assemblage, with the majority being three years and older. As well as the dominance of adult female cattle, the low occurrence of young individuals in the faunal assemblage is another indicator of dairying being a primary focus as the calf is required to be present during milking (McCormick 1992, 203). Payne's (1973) model for dairying has an age slaughter pattern of the deliberate slaughter of calves, however the evidence from early medieval Ireland doesn't follow fit this model (McCormick and Murray 2017, 199). As well as dairying, cattle were also exploited for primary and other secondary products. The presence of cattle, six years and older, may represent those used for dairying, breeding, or traction, and eventually killed for meat. The consumption of beef is also evident through the presence of immature cattle, which are assumed to be male, that were slaughtered once they reached full size. As well as the ageing data, further evidence of beef consumption comes from the presence of butchery marks with patterns indicating the dismemberment of the primary beef joints and

food preparation processes. Marrow exploitation may be represented by the presence of metapodials split longitudinally.

Other butchery marks, indicative of skinning may be evidence of the exploitation of cattle hides and, by inference, leather working. The use of cattle for traction may be evident through the presence of older individuals, as well as presence of pathologies, mostly osteoarthritis. Eburnation on cattle phalanges may be a result of constant trauma to the joint, an example of which is draught animals undergoing heavy use and constant impact on hard surfaces such as the limestone surface of the Burren landscape. The presence of pathological changes in the astragalus, could be due to their importance in the hind-leg for forward locomotion, which is likely to be damaged in draught animals.

- *Sheep*

Sheep tend to be either the second or third dominant domesticate in medieval assemblages in Ireland (McCormick and Murray 2017*,* 198, 203–4). The faunal record indicates sheep were primarily used for their meat, with secondary products playing less of an important role (*ibid.* 200). The late medieval trends, particularly the urban evidence, take a slight shift where there is more than one economic strategy, as sheep were used for wool as well as meat (*ibid.* 205). Sheep with white fleeces, which were less common than those of brown or black colour, were of higher value, possibly because of the ease of dyeing (Kelly 1997, 71). Female sheep would have also been regarded as higher in value due to their ability to produce milk and potential for breeding.

As the second most dominant species at Caherconnell, sheep reveal evidence of a mixed economy. They were primarily exploited for their meat, while there is also evidence of the likely production of secondary products such as milk and wool. Similar to cattle, sheep also produced evidence of being bred and butchered on or near the settlement. All ages of sheep were present with a dominance of individuals ages between one and three years, while the smaller amounts of older individuals were possibly those used for secondary products such as wool. The butchery evidence is further confirmation of meat consumption as a large portion of the butchered bones are meat-bearing bones indicative of dismemberment. Other butchery evidence indicated by the removal of the sheep horn-core, possibly to be used for bone working.

- *Pig*

Pig tend to be either the second or third most important domesticate in medieval assemblages in Ireland (McCormick and Murray 2017*,* 198, 203–4). They are primarily single purpose

animals exploited for their meat, but can also provide materials for craft activities such as bone working. Literary sources indicated that products such as pork, bacon, puddings, and sausages were popular in early medieval Ireland (Lucas 1960, 17; Edwards 1999, 58). The consumption of the flesh of piglets is considered to reflect high status (McCormick 1997, 831; McCormick and Murray 2017, 205). Farrowing took place in spring and a litter could have up to nine piglets (Kelly 1997, 81). Sows tended to be slaughtered after having two or three litters, or if they failed to reproduce (Kerr *et al.* 2013, 14).

Pigs are the third most dominant domesticate in the Caherconnell, with evidence they were bred and butchered on-site or nearby. The consumption of pork is evident through the bone survival rates, ageing data, and butchery evidence. There is a dominance of pigs aged 1.5–2 years, which represents individuals that have reached their full size and ideal age for slaughter. The presence of younger individuals may be evidence of sucklings killed for immediate consumption. The butchery patterns from the pig bones are indicative of the dismemberment process of the primary meat joints, which is further evidence of pork consumption.

- *Horse*

There are two main types of horse in the early medieval literary sources, namely a work-pony (*capall fognamo*) and a horse for riding (*ech immrimme*) (*CIH* ii 563.9; *CIH* iii 779.29; Kelly 1997, 90). The working horse, often referred to as a *gerrán,* was 'small and sturdy' and comparable to the modern Connemara pony (Stelfox and Roche 1936, 233; Kelly 1997, 90–1). There are also references to the colour of horses, including white, black, grey, brown, and yellow (*ibid.* 92). Teaching a young horse to carry a load, a rider, or pull a cart required a lot of training, the former being the simplest usually starting in its third year (*ibid.* 93–4). Horses are associated with high status men in the literary sources and there are very few references to women riding horses (*ibid.* 89, 96). The same sources provide little evidence of horse-mounted warriors; however, such scenes are depicted on High Crosses, such as the east base of the Market Cross at Kells, Co. Meath, which dates to the middle of the 9th century (Harbison 1992, 105; Hicks 1993, 238; Kelly 1997, 97). A High Cross from Bealin Co. Westmeath depicts a hunting scene with a huntsman riding a horse as his dog catches a deer (Harbison 1992, 27; Kelly 1997, 97). The literary sources contain more references to horses used for draught work than those used for riding (*ibid.* 95). The plough-horse was first introduced in the 13th century, and are regarded to be 'faster, cheaper, and more enduring than an ox' (*ibid.*). Although there was a religious taboo of consuming horse meat at the time, there is evidence of eating

horseflesh at sites, such as Ballinderry crannóg 1 and 2, and Peter Street in Waterford (Stelfox and Roche 1936, 234; Stelfox 1942, 68; Hurley *et al.* 1997, 832). As the majority of horses in medieval assemblages are mature in age with signs of butchery, it is likely these animals were exploited to their full extent (McCormick 2007, 92). It is also possible that horse flesh may have been destined for other purposes, such as dog feed, which is seen elsewhere in Europe (Wilson and Edwards 1993; Thomas and Lacock 2000).

MNI counts indicate that Caherconnell produced a handful of horses from each phase of activity, the lowest being two and highest being five. The law text, *Críth Gablach*, states that a *bóaire* or the common well-off farmer, is expected to own two horses, a work-pony and a horse for riding (Binchy 1941, 77). The higher a person's status, the more horses they own. A typical lord was expected to own a riding horse and four others for different tasks (Kelly 2005, 31). As the majority of horses from Caherconnell are mature individuals, it is likely these were kept as working animals and possibly killed when no longer of use. The butchery evidence suggests these individuals were used for bone marrow or meat consumption. The teeth show no sign of extreme abrasion caused by the use of a cheek-bit, but they could still have been used for riding or traction. The size of the horses from Caherconnell are comparable to the Connemara pony, which further suggests these represent working animals. The estimated shoulder heights from the Caherconnell horses are comparable to the mean estimated shoulder heights from early and late medieval sites in Ireland. The increase in estimated shoulder heights between the earlier and later medieval periods in the Caherconnell data probably reflects the demand for larger horses for ploughing (McCormick 2007, 98).

- *Dog*

The use of dogs cannot be determined from the skeletal remains and the size of the animals alone. Based on the results of this zooarchaeological analysis, and also information from other sources such as literary sources and iconography, some suggestions can be made. Overall, the value of a dog comes down to their ability to assist humans in different aspects of their work, such as hunting, herding, or guarding (Grieve 2012, 245). A dog did not necessarily fill only one role; for example, if a guard dog could also hunt, they had an even higher value.

An important role of these dogs was to protect property and livestock. The literary sources indicate that the guard dog was regarded as the most important type of dog (*ibid.* 253). Its bark and bite was important serving to alert the household, with even small dogs useful in this way (Kelly 1997, 114). The early medieval literary sources have more references to the larger guard-dogs such as the *árchú* 'slaughter hound', which was 'bred and trained to kill'

(*ibid.* 115). Although the texts have a bias towards the larger guard dogs, not all guard-dogs were 'fierce mastiffs' like the *árchú*. On that basis, it is possible that any of the dogs present at Caherconnell filled this role. Based on the metrical data from the early medieval dog bones, there is possible evidence of larger dogs present Caherconnell. However it is not possible to say whether any of these dogs represent the *árchú* mentioned in the legal sources.

Although the hunting dog was a valuable resource, they were not regarded as high of value like the guard dog (*ibid.* 117). They would have been used for hunting to assist in tracking and capturing the prey. Hunting dogs, referred to as *mílchú* which means 'animal-hound', were bred for both their speed and ability to locate prey (*ibid.*). Another hunting dog mentioned in the literary sources is the *gadar,* which suggests there was more than one hunting dog in early medieval Ireland (*CIH* iv 1268.14; Kelly 1997, 118). The *gadar* was the hunting dog used in the beginning of the hunt and hunted by scent (Scharff 1924, 81). The larger hunting dog, the *cú,* also referred to as *cú selga* 'hound of the chase', would have hunted down the prey (*ibid.*; *CIH* iii 889.8). The *mílchú* has been assumed to represent a greyhound (Scharff 1924, 83).

These dogs would have hunted animals such as deer, hare, and fox. Hunting scenes were frequently depicted in medieval sources; for example, the representation of a stag, dog, and horse with a rider carved on High Crosses associated with the Clonmacnoise workshop (Hicks 1993, 174–5; Grieve 2012, 251). This is not always evident in animal bone assemblages. Deer hunting was regarded as a high status sport and social activity and venison was not an important part of the early medieval diet. This explains why deer remains are present in faunal assemblages in small quantities. A total of 164 deer bones and teeth were identified in the Caherconnell assemblage, with the majority red deer and the remainder just classed as deer. With indicators of butchery and bone working from these remains, this suggests some consumption of venison at Caherconnell, using the bone and antler for craft activities. Although deer did not play an important role in diet, it is evident that they were hunted with the assistance of some of the dogs at Caherconnell. Other animals that were probably hunted include the hare, again probably with the help of dogs. 106 hare bones and teeth were identified within the assemblage (other bones identified as rabbit or lagomorph). A total of 18 fox bones and teeth were identified in the Caherconnell assemblage (other as dog/fox). Fox were hunted for their pelts and also because they were regarded as predators (Kelly 1997, 282).

Herding dogs, referred to as *conbúachaill* in early medieval texts (*ibid.* 119), were of value. They were trained to move livestock from one place to another, but primarily to guard the flock (Lucas 1989, 22). Similarly to the guard dogs, the literary sources state that a herd dog did not need to be a large dog (Kelly 1997, 119). There were three types of herd dog: herd

dog of large livestock, herd dog of calves, and herd dog of sheep (*CIH* i 171.18-20; cf. *CIH* iii 1107.33-5; Kelly 1997, 119). The old Irish word for sheep-dog, *conbúachaill*, meaning herd dog, used in Irish law texts suggests this was 'the herd-dog of each cattle' (Scharff 1924, 83). Based on the quantity and importance of cattle and sheep at Caherconnell during all phases of activity, it is highly likely that the dogs represented in the assemblage were herd dogs.

Dogs kept as pets were probably smaller in size. The literary sources refer to *messán*, meaning little dog, and orc, used to refer to pet or lap dogs (*ibid.* 84). It has been suggested that the earliest pet dogs were of Spaniel type (*ibid.*). House-dogs would have been useful for catching vermin and guarding the house (*ibid.* 81). Pet dogs were associated with gatherings, certain professions, and with women, possibly in the latter case as a lap-dog (Kelly 1997, 120). Lap-dogs would have been small in size, with the Lagore example comparing to the size of a modern Pekingese with an estimated shoulder height of 26cm (McCormick 1991a, 8). The Caherconnell assemblage has produced possible evidence of dogs of similar size, though it is not certain that they represent lap-dogs. The latter are generally associated with sites of high status, such as the Lagore example. As Caherconnell can be regarded as a site of high status, it is possible that they were also present here. As briefly mentioned, pet dogs were associated with certain professions including physicians, harpists, hospitallers, as well as with queens (*CIH* iv 1268.16-17; vi 2128.26-7; Kelly 1997, 120). The presence of harpists at Caherconnell is evident through the recovery of harp tuning pegs recovered during excavation. There are also references to pet dogs providing supernatural protection from the fairies while giving birth (*CIH* iii 806.33-807.10; cf. *CIH* iv 1531.3-4; Kelly 1997, 120).

None of the dog bones from the early and late medieval phases of activity have butchery (or burning) marks and so there is no evidence for the consumption of dog meat or the exploitation of their skins. Faunal assemblages in Ireland with evidence for the skinning of dogs have mainly come from urban sites (McCormick and Murray 2007, 49–50, 2017, 206). One dog 1st phalanx from Caherconnell has evidence of either an attempted perforation to possibly make a bone toggle, or else a gnawing mark which has perforated the bone. There is evidence elsewhere that dog were also used for their primary products during the medieval periods, with references to dog skins being used for gloves (Denham 2007, 130). This can be difficult to identify from the faunal evidence alone. Dog bones with skinning marks were recovered from other medieval sites such as Waterford, and Fishamble street, Dublin (Grieve 2012, 258). Dog pelts were an export during the 16th century, however this may only have been an urban practice (Longfield 1929, 220).

As mentioned briefly previously, the faunal evidence from Ireland suggests a change in dog breeding patterns between the early and late medieval periods. The assemblages from the earlier period suggest a supervised breeding of dogs, which produced a bimodal distribution that indicates two size groups were present (McCormick 1991b, 44). A change seems to occur in the later medieval period as there is no longer two separate size groups of dogs but instead they merge into a 'freely interbreeding population' (*ibid.*). Even though only a small sample of Caherconnell dog bones were available for metrical analysis, the early medieval material from Phases 4 and 5 appears to follow the previously established trend of a bimodal distribution. Seven of the estimated shoulder heights fit into the smaller populations, and the remainder indicate a larger population. As very little evidence was available from the later medieval period, it is not possible to suggest whether the breeding pattern continues or follows the pattern seen from contemporary urban sites in Ireland of a freely interbreeding population.

- *Cat*

Cats in medieval Ireland would have had several uses, including to keep the settlement free from rodents, as pets, or for their furs. They tend to only make up a small portion of medieval assemblages, with the Caherconnell cats producing an MNI of five from Phase 4, three from Phase 5, one from Phase 6, and one from Phase 7. Assemblages from rural settlement mostly reveal a trend of mature cats, and in general a longer life expectancy when compared to urban assemblages, such as late medieval Dublin or Waterford (McCormick 1988, 223). The cat remains from the early medieval phases of activity at Caherconnell indicate a mixed population, with both mature and younger individuals. It is possible the younger individuals were exploited for their skins, but there is very little evidence of skinning marks, or butchery in general in the Caherconnell assemblage. Similar to dogs, most of the faunal evidence for the skinning of cats is from urban assemblages (McCormick and Murray 2007, 49–50, 2017, 206). It is likely the cats kept at Caherconnell played the role of pets or pest control, with a slight possibility some individuals were used for their furs.

- *Domestic birds*

A range of domestic birds are recorded from the medieval period in Ireland, mainly consisting of domestic poultry, one of the prominent ones being domestic fowl. Hens are a domesticate regarded of high value and of considerable importance in the early Irish economy. This is evident by their frequent mention in early medieval law texts and other sources, where they feature more than other domestic birds, such as the goose or duck (Kelly 1997, 102). Domestic

fowl eggs were also frequently referenced and seem to have played an important role in the medieval diet (*ibid.* 104). Hens were also a unit of value in the early Irish currency system; for example, a *cerc céin dothas* (laying hen) was worth two bushels of grain (*ibid.* 102, 588). Due to their poor flying ability, and possible clipping of wings, they were vulnerable to predators (*ibid.* 103). Our understanding of housing hens comes from an 8th century law text that states they were not free roaming in settlements and were housed in an *árus*, a movable hen-coop (*ibid.* 103). Legal texts refer to diseases (*galair bunaid*) of domestic fowl, *confad* and *idu*, the former normally refers to rabies however here it likely refers to a disease which affects the nervous system, and the latter is a general term for serious disease (*ibid.* 213).

References to geese in the written texts include the farmyard goose (Old Irish *géd*), which is the domesticated form of the greylag goose (*Anser anser*) (*ibid.* 105). References to the domesticated version of the mallard (*Anas platyrhynchos*), the farmyard duck, appear so infrequently in written sources that these are unlikely to have been important in the medieval economy (*ibid.* 107). The dove (*colum*), the domestic descendent of the rock dove (*Columba livia*), is frequently referenced in medieval texts, particularly in religious contexts, while built dovecotes first appear in the later medieval period (Hamilton-Dyer 2007a, 110). Pigeon bone has been recovered from medieval assemblages in Ireland, with those from early medieval sites identified as the woodpigeon (*Columba palumbus*) and those from the late medieval sites possibly domestic pigeon (*ibid.*). The peacock (*Pavo cristatus*) is depicted in the Book of Kells through illustrations of its feathers, but these have yet to be identified in archaeological assemblages (Kelly 1997, 108; Hamilton-Dyer 2007a, 110). The turkey (*Melagris gallopavo*) was introduced to Ireland in the post-medieval period, as recorded in urban assemblages (*ibid.* 110).

Although domestic fowl feature prominently in written texts, they are not well represented in early medieval faunal assemblages, becoming common for the first time in the Viking levels at Fishamble Street, Dublin (O'Sullivan 1990). The discovery there of spurs and medullary bones indicates that they were bred on-site for their meat and eggs, and also for cock-fighting (Hamilton-Dyer 2007a, 106). Assemblages from the later medieval period are dominated by hens and geese, as well as increased numbers of mallard-size duck. The increase in geese bone is due to the possible introduction of the domestic goose by the Anglo-Normans (*ibid.* 109).

Overall, birds did not play a major role in the economy or diet at Caherconnell. Domestic fowl are one of the dominant species within the bird bone assemblage which follows the trends seen within early medieval economy in Ireland. With no evidence of medullary

bones or spur, and only one element providing evidence of consumption, few conclusions can be drawn from the faunal remains alone. Although early medieval literary sources contain frequent references to hens and their eggs as highly valued items, the faunal evidence highlights the importance domestic fowl played in the Anglo-Norman diet, it appears that domestic fowl were not significant in the diet at Caherconnell (McCormick 1991b, 49; Hamilton-Dyer 2007a, 109). Although not abundant in the assemblage, domestic fowl are more consistent throughout the history of this site when compared to most bird species within the assemblage.

As well as domestic fowl, it is possible that domestic *Anatidae* are also present at Caherconnell, however it is also possible these were wild birds. Domestic geese and duck appear within the written sources, the former being the domesticated form of the greylag goose and the latter is the domesticated form of the domestic duck (Kelly 1997, 105). Similarly to domestic fowl, domestic geese can dominate assemblages from late medieval Ireland which is reflective of Anglo-Norman influence on diet, something not reflected in the Caherconnell assemblage. A greylag goose tibia from Phase 5 has evidence of butchery through chop and cut marks and are indicative of the disjointing process. Another greylag goose bone, a humerus from Phase 6, has a chop mark and a gnawing crunch mark. Both examples suggest the consumption of greylag goose. Both the greylag goose and mallard occur in low numbers, whether domestic or wild, and so did not play an important role in the economy or diet at Caherconnell.

7.1.2 Hunting

The Caherconnell assemblage has produced evidence of the exploitation of wild animals, with some species giving an insight into the hunting activities at this settlement. Hunting practices can be deliberate, such as the hunting of deer, and they can also be opportunistic, such as the hunting of an injured individual. Other species may represent animals that naturally made their way on-site such as small passerine birds. As well as hunting practices, some wild species can give an indication to the status of the settlement. For example, during the late medieval period, certain wild species and their habitats were being managed, such as deer parks, rabbit warrens, and dovecotes, and their presence can be an indication of high status (Denham 2007, 177). As well as those that were hunted, other animals, such as dogs and horses, may have assisted with the hunt. As discussed previously, dogs such as the *mílchú, gadar, and cú*, were bred for their speed and ability to locate prey and would have assisted in the tracking and capturing (Kelly

1997, 117). The riding horse, *ech immrimme*, would have also been used by the huntsman in hunting activities (*CIH* ii 563.9; *CIH* iii 779.29; Kelly 1997, 90). The High Cross at Bealin, Co. Westmeath depicts the role of both animals within a hunt, with the huntsman riding on the horse while the dog catches the deer (Harbison 1992, 27; Kelly 1997, 97).

- *Deer*

During the early medieval period, red deer were hunted on land owned by *tuath,* which would have required the permission of the landowner. This practice followed into the late medieval period with the Anglo-Norman introduction of forests, chases, and deer parks (*ibid.* 406; Neeson 1997, 138; Beglane 2010, 78). In the 13th century we see the introduction of the fallow deer by the Anglo-Normans and they generally tend to be found within castle or urban assemblages which supports the historical evidence of their association with high status hunting (McCormick 1999, 360; Denham 2007, 271; Beglane 2018, 2). Roe deer are rarely found and have only been recovered from few later medieval assemblages (Denham 2007, 270–1). Red deer would have been more widespread during the medieval periods and this is reflected through their high counts in the assemblages, particularly those from rural sites.

The early medieval written sources indicate that deer hunting is associated with individuals of high status and viewed as a pastime or training, rather than contributing to the diet (Kelly 1997, 273). Various methods of deer hunting were present in the early medieval period, the most discussed being chasing with hounds, as seen in the aforementioned hunting scene depicted in the High Cross at Bealin, Co. Westmeath (Harbison 1992, 27; Kelly 1997, 274, 276). The other methods that appear in literary sources or as iconographic representations include deer-ambush, driving to a barrier, hidden spikes, deer-pits, and leg-traps (*ibid.* 276–80).

Hunting during the late medieval period was regarded as a high status activity by both the Gaelic lords and Anglo-Normans, although undertaken differently by both groups (Beglane 2012, 357). Red deer would have been hunted by both, however the introduction of deer parks and fallow deer would have played an important role for the latter group. There is no evidence of Gaelic Irish lords establishing deer parks and furthermore no fallow deer remains have been found at Gaelic sites (*ibid.* 345). Late medieval hunting methods used in Gaelic Ireland are described in literary sources, which indicate the cross-country hunting was the preferred method (*ibid.* 346). This method of hunting red deer would have provided sport, training, and venison (*ibid.* 357). Similarly to the early medieval period, there are iconographic representations of deer hunting scenes from late medieval contexts (*ibid.* 103).

The main evidence of hunting at Caherconnell comes from the deer bone. Red deer has been recovered from both early and late medieval contexts at Caherconnell. It is possible that red deer are the only species of deer in the assemblage, with Caherconnell being a Gaelic site, and both fallow and roe deer were later introductions (Denham 2007, 270–1). Deer antler may represent either the hunting of deer or the collection of shed antler. As there is evidence of antler which has been sawn and removed from the skull, there is evidence of the use of hunted deer, however it is still possible that shed antler was exploited at the site. The latter is a seasonal supply and the hunting of deer provides a further resource of this material (MacGregor 1985, 35). The presence of antler in the assemblage and the volume of bone combs recovered from Caherconnell indicate craftworking was undertaken on-site.

Post-cranial deer bones were also recovered from the assemblage. Phalanges are the most common element group and the high volume may be evidence of hide processing as they can be attached to the skins after removal (Serjeantson 1989, 136; Denham 2007, 291). Post-cranial meat-bearing bones occur in small amounts, with some butchery marks. This may be indicative of the consumption of deer, as well as craftworking or the removal of hides. The presence of elements, such as part of the skull or metapodials, suggest the deer were brought on-site before dismemberment took place. Overall the assemblage produced no evidence of selective body part representation, a trait which is referred to as the unmaking signature and is seen in elite sites in England with Norman influence (Thomas 2007, 131). The absence of this practice at Caherconnell may be further evidence of the lack of Anglo-Norman influence at this site. In conclusion, the low incidence of deer remains at Caherconnell indicates these animals were not an important part of the food economy, contributing to diet on special occasions after a successful hunt.

- *Hare and rabbit*

Hare were hunted for their meat during the early and later medieval periods in Ireland (McCormick 1999, 366). Unlike the hare, which is a native animal, the rabbit was an Anglo Norman introduction. The earliest literary record of rabbits dates to 1191 AD, while the earliest archaeological evidence is mid 13th century (McCormick 1997, 827; McCormick and Murray 2007, 40). Rabbit pelts were an important export during the later medieval period (McCormick 1999, 366).

Both hare and rabbit were recovered throughout the Caherconnell assemblage, the latter mainly representing intrusive material, particularly those recovered from early medieval contexts as rabbit are an Anglo-Norman introduction. It is difficult from the low incidence of

hare and rabbit bones to understand of their role at Caherconnell. It is likely that hare were hunted for their meat and skins, but this activity did not play a major role. In general, the low occurrence of hare from rural sites has posed the possibility of those that were caught were being sold in towns (Beglane 2015, 189). As burrowing animals, the presence of rabbit within the assemblage it is difficult to determine if the material is intrusive or not, with the absence of butchery marks suggesting the former.

- *Fox, badger, and red squirrel*

There is a very small incidence of fox, badger, and red squirrel bones were recovered at Caherconnell. Fox make up a small portion of the assemblage and little interpretation can be made on their remains, particularly as no fox elements have evidence of butchery marks that could be indicative of consumption of pelt exploitation. It is unclear if they are present in the assemblage for those reasons or if they were killed as predators. The other wild mammals recovered were badger and red squirrel. Both are considered edible and can also be used for their skins (*ibid.* 190). As only eight badger bones were recovered and a single red squirrel bone were recovered, no certain conclusions can made as to the significance of these species.

- *Wild birds/fowling*

References to wild birds in written sources, include game-birds such as woodcock (*Scolopax rusticola*), snipe (*Gallinago gallinago*), wild duck (*Anas platyrhychos* etc), and red grouse (*Lagopus scoticus*) (Kelly 1997, 298). There are also references to the *géis*, the swan. The mute swan (*Cygnus olor*) believed to be an Anglo-Norman intriductive, while the *géis* is thought to refer to whooper swan (*Cygnus cygnus*) (*ibid.* 299). Two species of wild geese, the barnacle goose (*Branta leucopsis*) and the brent goose (*Branta bernicla*) appear in written texts, the former as *gigrann* and the latter as *cauth* (*ibid.*). Sites with little Anglo-Norman influence appear to follow the early medieval trend, with low amounts of poultry and the occasional occurrence of waterbirds and waders, the former including gulls (*Lariidae*), cormorant (*Phalacrocorax carbo*), heron, swans, and the crane (Hamilton-Dyer 2007a, 109). Waders and certain native game birds, the quail (*Coturnix coturnix*), partridge (*Perdix perdix*), and capercaillie (*Tetrao urogallus*), are only found frequently recovered from later sites (*ibid.*). The presence of quail or corncrake bone are of interest as these are migratory species that arrive from Africa in the early summer (*ibid.* 110).

Wild birds that may provide evidence of fowling in medieval Ireland including the partridge, the capercaillie, and the pheasant (*Phasianus colchicus*), the latter probably a later

medieval introduction (Kelly 1997, 300). Methods of fowling recorded in written texts include trapping, hunting with missiles, and hawking (*ibid.* 301–3). Raptors were also common throughout medieval Ireland, including the white white-tailed eagle (*Haliaeetus albicilla*), the kite (*Milvus* sp.), osprey (*Pandion haliaetus*), harriers (*Circus* sp.), and the buzzard (*Buteo buteo*), which are considered as scavengers (Hamilton-Dyer 2007a, 109). Evidence of falconry is absent in the earlier sites and fowling appears to only be of interest in the late medieval period and remains from the earlier assemblages are likely to represent scavenger remains (*ibid.* 110). Birds of prey, including the peregrine falcon (*Falco peregrinus*), the sparrow hawk (*Accipiter nisus*), the goshawk (*Accipiter gentilis*), the kestrel (*Falco tinnunculus*), and the hen harrier (*Circus cyaneus*), were a risk to domestic fowl (Kelly 1997, 188). Ravens (*Corvus corax*) are found in both early medieval and rural assemblages. They are particularly numerous in Viking deposits from Dublin, which could be linked to their prominence in Viking mythology (Hamilton-Dyer 2007a, 109). The raven and the hooded crow (*Corvus cornix*) also feature in early Irish literature and mythology (Kelly 1997, 191).

The presence of wildfowl in medieval faunal assemblages in Ireland is limited. The evidence that does exist indicates the exploitation of the local environment on a seasonal basis, with limited contribution to diet (McCormick and Murray 2017, 208). Where bird bone has been recovered there is some evidence of fowling, with the remains of wild birds present in higher quantities than those of introduced species, the assemblage from Lagore crannóg being a good example (Kelly 1997, 298). Crannóg sites have produced a particularly wide range of bird species reflecting the abundance of different types of water-bird in lacustrine environments. In coastal districts sea-birds and their eggs may have been hunted on the cliffs. A bone from a white-tailed sea eagle was recovered at Cahercommaun stone fort in Co. Clare. The bird assemblage from that site is overall dominated by raven bones (Hencken *et al.* 1938, 76). Shag (*Phalacrocorax aristotelis*), cormorant and puffin (*Fratercula arctica*) bones were found at Larrybane Co. Antrim while cormorant, gannet (*Sula bassana*), and red-throated diver (*Gavia stellata*) were noted at Beginish, Co. Kerry (O'Kelly and Kavanagh 1955, 191; Proudfoot *et al.* 1961, 106). The presence of small passerine bones, such as those from the thrush family (*Turdidae*), are difficult to interpret unless there is clear evidence of consumption, such as butchery marks, to indicate they represent bird that lived on-site, or were introduced by domestic cats (Hamilton-Dyer 2007a, 110).

Something which may not be visible in the archaeological record is the use of wild birds as pets as recorded in the early medieval sources. The *corr* is one the of most frequently mentioned pets in medieval sources, though it is not clear whether this refers to the heron

(*Ardea cinerea*) or the crane (*Grus grus*) (Kelly 1997, 125). Excavations from early medieval sites, such as Lagore Crannóg and Ballinderry Crannóg 2, produced the bones of both these birds (Stelfox 1938, 42, 1942, 73). Another bird referenced in written texts is the *senén* or 'old bird', and it is possible that it referred to various birds, particularly birds of prey including the eagle and the hawk (Kelly 1997, 129). Corvids were frequently kept as pets, with text references to the pet jackdaw (*cáóc*) and the pet crow (*teithre*).

Wild birds were more numerous than domestic birds at Caherconnell, a trend seen in medieval assemblages elsewhere in Ireland. The Caherconnell wild birds are dominated by corvids, including raven, crow/rook, jackdaw and magpie. There are several ways corvids end up in faunal assemblages. Corvids were sometimes kept as pets and they adapt well to domestication (*ibid.* 129). They are also 'carrion feeders and predators of young poultry' and therefore killed as vermin (Hamilton-Dyer 2007a, 106). Raven dominated the Phase 5 and 6 bird bones, while crow/rook were found in all phases of activity in small quantities. Jackdaw and magpie were recovered only from Phases 6 and 7.

Evidence of fowling is present throughout the phases of activity, with Phase 5 producing the largest range of wild species. Red grouse, a game bird, is represented by a single bone from Phase 5. As well as the possible domestic goose and duck previously discussed, *Anatidae* are also represented by Brent goose and teal. Brent goose was recovered from Phase 6, while teal was recovered from Phase 4 and 5. Buzzard dominate the Phase 4 bird bones. This was likely an opportunistic capture as two bones appeared to have pathologies, and another bone had faint cut-marks, the latter suggesting it was consumed. Waders were recovered from all phases, except Phase 7, and included golden plover, woodcock, and snipe. Gulls were represented by a common gull bone from Phase 4. A singular corncrake bone, rock dove/feral pigeon, and song thrush bone were recovered from Phase 5. As well as the song thrush, another small passerine, the starling, were recovered from Phase 4, 5 and 6. The small passerine bones likely represent birds living onsite or nearby, possibly brought into the site by domestic cats. Although no swan bones were recovered from the assemblage, the radius of a mute swan was used to make the shaft of an ink pen recovered from Phase 5 occupation layer dating to the late 10th/early 11th century (Comber and Parsons 2021, 15).

Overall, the assemblage has produced a range of wild birds, some hunted deliberately or opportunistically, as well as other wild birds occurred natural on-site. It is evident that birds did not play a major role in the economy or diet at Caherconnell. Based on the assemblage it appears that the hunting of birds was not a frequently practiced activity at Caherconnell.

7.1.3 Fishing

Fish are recorded in medieval texts in various ways, from the discussion of the importance of fishing in the early Irish economy to decorative depictions of fish on manuscripts such as the Book of Kells (Kelly 1997, 285). There is no surviving law text on fishing rights, but there are references in other texts to indicate their importance (*ibid.* 286). Different fishing methods were used throughout the medieval period, with written sources referring to the catching of fish in weirs erected in river or estuaries, as well as other methods including nets, line and hook (*ibid.* 287, 290). The majority of early references relate to salmon (*Salmo salar*) fishing on rivers, which seems to have been a prestige food with a royal association (*ibid.* 291). The importance of salmon is also evident from the many names used, including *éo* and *bratán* (*ibid.* 293). References are also made to the fishing of trout (*Salmo trutta*) and eels (*Anguilla anguilla*) which, along with salmon, are the most important freshwater fish (*ibid.* 296). Although the written sources focus on freshwater fish, there are references to sea-fishing and the majority of medieval assemblages are dominated by marine fish (*ibid.* 296; Hamilton-Dyer 2007a, 103).

Fish bone is recorded from different site types of medieval date in Ireland (*ibid.* 111). It is common for fish bones to be found in small amounts despite the fact that fishing was often referred to in early written sources (Kelly 1997, 285). This may be down to taphonomic factors, which is likely to be the case with salmon remains as they are regularly referenced but rarely appear in the archaeological record. The low profile of fish remains may also be due to cultural attitudes in what was a predominantly agricultural economy (McCormick and Murray 2017, 209). That said, the importance of fishing has almost certainly been underestimated. Because of their small size, fish bones are very difficult to retrieve without sieving, and therefore the range and proportions of fish bones reported on earlier excavations are unlikely to be representative of their contribution to food economy (Edwards 1999, 66). This is demonstrated by the importance of sieving for the recovery of fish bones at Trim Castle, Co. Meath. Both hand collection and sieving was undertaken, with only a single cod (*Gadus morhua*) vertebra recovered from the former sample, while 14 species were identified in the sieved assemblages, including three pike (*Esox lucius*) bones from late 13th–early 14th century contexts (Hamilton-Dyer 2007a, 113). This is the first discovery of pike from an Irish assemblage, which is notable as this species is believed to be an Anglo-Norman introduction, though it is possible this bone represents imported preserved fish (*ibid.* 115).

Fish assemblages in Ireland are mostly from early medieval sites on the west coast and late medieval urban sites (*ibid.* 113). Assemblages from inland sites that contain marine or

estuarine fish may represent the trading of fish, for example, cod and hake (*Merlucius merlucius*) were found at Knowth Co. Meath (McCormick and Murray 2007, 75). A prominent feature of medieval fish assemblages is the dominance of marine fish over freshwater fish, with the monastic site of Clonmacnoise, Co. Offaly, being the only site with all fish likely coming from the river (Hamilton-Dyer 2007a, 111), not surprising given its location on the Shannon. This is interesting as most of the documentary sources are dominated by references to freshwater fish (Kelly 1997, 296). There was a general lack of freshwater fish in Ireland during the early medieval period, the species present were those that migrate to the sea, including salmon, trout, eel, lamprey, and landlocked marine species such as pollan (McCormick 1991b, 50). From the late medieval period onwards there was a range of Anglo-Norman introductions, including various freshwater species (McCormick 1999, 367). The limited range of fish in lakes and rivers in the earlier period could explain the absence or low amounts of freshwater species at crannóg sites such as Lagore and Moynagh (McCormick and Murray 2007, 75).

The large assemblages from urban sites are dominated by *Gadidae* including cod, ling (*Molva molva*), haddock (*Melanogrammus aeglefinus*), and hake. The dominant presence larger fish was originally thought to be due to the lack of sieving, however excavations that undertook sieving confirmed the genuine preference for larger fish (Hamilton-Dyer 2007a, 113). Coastal sites have produced a wider variety of species, primarily wrasse (*Labridae*), scad (*Trachurus trachurus*), pollack (*Pollachius pollachius*), and sea bream (*Sparidae*), which reflects the exploitation of local resources (*ibid.* 114). The assemblage from the medieval city of Galway, notable due to its location, follows similar trends to eastern urban assemblages such as the Dublin assemblages with a dominance of the large gadids (Hamilton-Dyer 2004, 615). It is suggested that large gadids were primarily fished for trade, both internal and external. Fish were an important Irish export during the Anglo-Norman period (McCormick 1991b, 50). The results from Galway City suggest there was an overall difference in fishing practices between early medieval and urban late medieval sites. Fish including freshwater eels, herring (*Clupea harengus*), sea-fish, salmon, and lamprey (*Petromyzonidae*) would have also been exported (Caulfield 1878, xxvi). Assemblages from Cork are dominated by hake, gadids, herring, and conger eel (McCarthy 2003, 383). Several of these assemblages involved sieved material and are the only ones to have produced herring bones, once again highlighting the importance of sieving (Hamilton-Dyer 2007a, 114). The conger eel (*Conger conger*) generally occurs in small amounts primarily in Anglo-Norman and later medieval contexts, as one of few marine species mentioned in documentary sources. It has only been recovered from one early medieval site, namely Illaunloughan Co. Kerry (McCormick and Murray 2005, 69).

The Caherconnell assemblage includes a range of species from all phases of activity. For medieval assemblages in Ireland, a notable aspect is the prevalence of marine rather than freshwater fish (Hamilton-Dyer 2007a, 111). All of the species identified at Caherconnell are marine species, including salmon, ling, cod, whiting, ballan wrasse, mackerel/scad. Salmon are migratory species that can also be found in freshwater rivers. Literary sources have references to sea fishing, however in general the sources emphasise freshwater fish (Kelly 1997, 296). As most fish in the Caherconnell assemblage were represented by vertebrae it is difficult to determine whether the entire fish was originally present on-site. Ballan wrasse was represented by the dentary and pharyngeal bones, however with only three elements found at Caherconnell it is difficult to know whether the complete fish was present.

It is evident that fishing did not play a major role in the economy of Caherconnell, even with Ballyvaughan Bay only 10 kilometres away. With only a sample of 26 fish bones in the assemblage fish did not play a significant role in the diet of this settlement. The analysis of the marine mollusc assemblage highlighted that 'the contribution of shellfish to the diet of the occupants was minimal' (Murray 2020, 3). Shells were recovered from all four phases with no obvious concentration of material, and was made up of bivalves (45%) and gastropods (55%) (*ibid.* 1). Based on the fish bones and the evidence from shellfish assemblage, it is evident that the coastal resource was exploited on occasion, but were not a key food resource for the settlement.

7.1.4 Craft working of antler, bone, and horn

Bone working was one of the craft activities occurring at Caherconnell. As a by-product of animal husbandry, bone would have been plentiful for craft working in this settlement. Cattle

Figure 7.1: Bone Comb (1781) from Phase 4 (late 10th–early 11th century) at Caherconnell.

and sheep horn would have also been available for craft working, with the latter known for is use in bone comb making (Kelly 1997, 74). Antler is another material used in bone working and would have been sourced through deer hunting or through the possible collection of shed antler. Antler, particularly the beam and times, could be used for the plates and teeth of bone combs (MacGregor 2015, 68–9). Some 400 bone artefacts were found at Caherconnell. As well as finished artefacts and the large supply of raw materials at Caherconnell, the presence of unfinished worked pieces is further evidence of on-site bone working (Comber 2019, 39).

The majority of the bone artefacts from Caherconnell are bone combs, which include unfinished examples, comb fragments, and almost complete examples (Figure 7.1). Bone combs can either be single-piece or composite combs made of bone, antler, and horn, with all three materials readily available at Caherconnell. Smaller quantities of artefacts, such as pins, cylinders, and perforated bones, were also recovered. In comparison to other bone artefacts, the perforated bones are not as heavily worked and allow for the identification of the individual bones. The perforated bones likely represent toggles and are made from sheep or pig phalanges (Figure 7.2(, and one pig metapodial. Although the majority of toggles from Caherconnell are made from phalanges, they

Figure 7.2: Bone ID: 385 - Bone toggle made from pig 1st phalanx with perforation from Phase 4 (late 10th–early 11th century) at Caherconnell.

Figure 7.3: Bone ID: 7510 - Bone toggle or buzz bone made from pig metapodial from Phase 4 (late 10th–early 11th century) at Caherconnell.

Figure 7.4: Gaming piece (660) from Phase 5 (late 10th–early 11th century) at Caherconnell.

generally tend to be made from the carpals and metapodials of sheep and pigs (MacGregor 2015, 102). One example from Caherconnell is made from a pig metapodial (Bone ID: 7510) and has two perforations cut through the centre of the metapodial shaft with possible evidence of polishing around the perforations (Figure 7.3). This example can be identified as a probable toggle or a buzz bone, the latter with twisted strings through the perforations to make a noise when spun (*ibid.* 103). In addition, other bone artefacts such as a harp tuning peg, a gaming piece (Figure 7.4), and a pen shaft, are representative of music and writing at Caherconnell.

7.2 Changes in livestock farming between the early and late medieval periods

7.2.1 Livestock farming in early medieval Ireland

Agricultural practices and their produce played a central part in the social status and roles of all members of society during the early medieval period in Ireland (O'Sullivan, *et al.* 2014, 179). Our understanding of early medieval agriculture comes from sources such as documentary sources, pollen analysis and zooarchaeological studies. The documentary sources concentrate on pastoral farming, predominantly cattle farming (*ibid.*). The early medieval texts discuss how livestock were occasionally kept within the farm or enclosures during the night, with this being one of the functions of the ringfort (McCormick 2008, 215, 2014, 120). Results from pollen analysis suggest a landscape of scrubby woodland and mixed farming dominated by pasture, as well as the areas of highlands and bog cover (*ibid.* 119). The terraced uplands of the Burren landscape are suited for pasturage with its thin soil cover and springs which provided drinking water (Comber 2018a, 2).

Cattle are the dominant domesticate in the majority of early medieval assemblages in Ireland and so represent an important part of the livestock economy (McCormick 2014, 121). Cows in particular played an central role in the economy, not only for their ability of producing dairy products, but also as a unit of wealth and an essential part of social status (*ibid.* 122). Female sheep were also regarded as higher in value due to their ability to produce milk. As well as playing a dominant role in the dairy economy, cattle were also used as working animals and for products of butchery (O'Sullivan *et al.* 2008, 194). The cattle age-slaughter patterns give insight into what the role cattle played at a site and whether it was a producer and/or consumer site. Pig tend to be the second most dominant domesticate, followed by sheep, or vice versa, with both produce valuable primary and secondary products. Early medieval trends,

particularly the age-slaughter data, show they were both primarily used for their meat (McCormick and Murray 2017, 199–200). Goats are a rare occurrence at early medieval rural sites and tend to appear more within urban assemblages (McCormick 2014, 124).

As discussed previously, there were two types of horses present during the early medieval period, a work-pony (*capall fognamo*) and a horse for riding (*ech immrimme*) (*CIH* ii 563.9; *CIH* iii 779.29; Kelly 1997, 90). The documentary sources indicate that there was more than one type of dog present during the early medieval periods which filled rolls of hunting, herding, and guarding (Grieve 2012, 245). The metrical analysis furthers this and also suggests strict breeding practices that produced two size populations (McCormick and Murray 2017, 206). The faunal evidence suggests cats were treated well during this period as they are represented by mature large examples (McCormick 1988, 223). Domestic fowl, particularly hens and their eggs, appear to have been important within the early medieval economy and were regarded high in value (Kelly 1997, 102–4). They are more common in documentary sources when compared to the domestic geese and ducks, which seem to have played a less important role in this economy (*ibid.* 102, 107).

7.2.2 Livestock farming in late medieval Ireland

Changes in the animal husbandry practices of late medieval Ireland are generally associated with the arrival of the Anglo-Normans. This includes a decline in the socio-economic role of the cattle, mainly the milk cow, and also the introduction of cash rent caused change to the livestock economy (McCormick 1991b, 46). The age-slaughter pattern for cattle changes to a dominance of older animals, particularly within the urban assemblages, suggesting these urban sites acted as consumer sites that were supplied with cattle (Denham 2007, 204; McCormick and Murray 2017, 202). Documentary sources discuss the importance of sheep in the late medieval period, specifically in regard to wool that could be repeatedly produced and was an important export during this period (McCormick 1991b, 46). Faunal assemblages from this period supports this view as they produced evidence of more than one economic strategy for sheep as wool played a more prominent role (McCormick and Murray 2017, 205). Goat are once again primarily found on urban sites (McCormick 1991b, 46). It is likely that the areas and settlements that remained in Gaelic control had little influence from the Anglo-Normans and subsequently continued the trends from the earlier period; for example, dairying seemed

to hold a central role in their economy and there is little evidence of these sites shifting focus to specialisation in a market economy such as the wool production (*ibid.* 47–8).

Two age-slaughter patterns are seen for pigs, with urban assemblages producing trends of both younger and older individuals present, while the other pattern follows that seen during the early medieval period (Denham 2007, 254, 256; McCormick and Murray 2017, 205). The plough-horse first appears in the 13th century and the gradual change from oxen to horse was not completely established until the 15th century (Kelly 1997, 95; McCormick 2007, 96). Dog remains from the later medieval period, predominantly from urban sites, suggest a change in breeding practices to a 'freely interbreeding population' (McCormick 1991b, 44). These urban assemblages have also produced evidence of smaller and younger cats during this period, which suggests a change in the treatment of these animals (McCormick 1988, 223). Evidence of skinning dogs and cats, mostly come from urban sites, suggests these animals played a more economic role at these sites during the late medieval period (McCormick 1991b, 44–5; McCormick and Murray 2007, 49–50, 2017, 206). Domestic birds, particularly hens and geese, appear in higher amounts in late medieval assemblages from Anglo-Norman sites, a trend not generally seen in Gaelic sites (McCormick 1991b, 49).

7.2.3 Livestock farming at Caherconnell

There seems to be no significant change in the animal husbandry practices at Caherconnell between the early and late medieval periods. The results indicate that this settlement followed the trends typically seen at early medieval rural sites, as a self-sufficient producer consumer site. The majority of faunal material comes from the early medieval phases of activity. This may reflect a decline in animal husbandry into the later medieval period, however it is still evident that the overall trends did not change in that later period. Cattle remain as the dominant species throughout all phases of activity, followed by sheep and then pig. Cattle were primarily used for dairying, which was the main economic focus of the site, and were also used as working animals and for products of butchery (O'Sullivan *et al.* 2008, 194). With evidence of a mixed economy during both periods, sheep were primarily exploited for meat as well as secondary products such as wool, and notable very little possible evidence of goat. Primarily a single purpose animal, pigs were exploited for their meat. These three domesticates played an important role in the livestock economy of the settlement by not only producing a range of primary and secondary products, but also by creating an important form of exchangeable

wealth, namely cows. The local environment of Caherconnell provided an ideal setting for the grazing of these domesticates (Comber 2018a, 6).

While it is not certain what horses were used for at Caherconnell, based on the documentary sources it is possible that these included work-ponies and a horses for riding. An increase in the height of the Caherconnell horses between the early and late medieval period could possibly be linked to the use of horses for ploughing and the demand for larger horses (Kelly 1997, 95; McCormick 2007, 96, 98). There is no evidence of the consumption of dog meat or the use of their skins, which suggests that this was more of an urban practice. It is difficult to assess whether the general change in dog breeding practices between the early and late medieval period is occurring at Caherconnell as the sample from the later period there is small. That said, the two separate size groups of dogs seen in the earlier period is reflected in the Caherconnell sample through a bimodal distribution, the majority being in the small population. It is likely that the dogs at Caherconnell took part in hunting activities, herding and protecting livestock, guarding the settlement, and as pets, rather than an economic commodity for their skins. Similar to dogs, cats probably played the role of pets or pest control, with only a slight possibility they were exploited for fur. It is evident that domestic birds did not play an important role within the Caherconnell diet or livestock economy. Although there is evidence of their consumption, their dominance in the late medieval Anglo-Norman diet elsewhere in Ireland is not obvious at Caherconnell, as they remain of low importance throughout both periods of site occupation.

Overall, any changes in food economy and farming associated with the arrival of the Anglo-Normans are not evident within the data gained from the faunal analysis of the Caherconnell assemblage. The animal husbandry practices during both periods of activity at Caherconnell follow the early medieval trends previously established. The late medieval results follow these earlier trends and do not switch to the late medieval urban practices. This continuation of earlier practices and native tradition is evident from other material recovered from the excavations. This evidence includes ‘the incorporation of ancestral burials into the settlement, the deliberate use of a centuries-old native settlement form, the continuation of long-established processes such as metalworking, textile-production and grain processing and the use of tradition artefact types such as the bone comb, bronze pin, and rotary quern’, and lastly the absence of pottery (Comber 2019, 60–1).

7.3 The status implications

7.3.1 Animals as a unit of wealth and a symbol of status

The range and volume of species in a faunal assemblage can give insight into the livestock economy of a settlement. Livestock farming played a central role in both the social status and role of individuals during the early medieval period in Ireland, something that carried into the later period for certain sites (O'Sullivan, A. *et al.* 2014, 179). A discussed previously, the *Críth Gablach* states the *bóaire* should have '20 cows, 2 bulls, 6 oxen, 20 pigs, 20 sheep, 4 domestic boars, 2 brood-sows, and a saddle horse' within their herd (Binchy 1941; de Paor and de Paor 1960, 78–9). The trend of species at Caherconnell follows this pattern, with cattle, sheep, and pig being the dominant domesticates, and horse occurring in lower numbers, although the higher the status of an individual, the more horses they owned (Kelly 2005, 31). Cattle were a core unit of wealth and although their economic role declines during the late medieval period (McCormick 1991b, 46), particularly in urban sites, their role within the livestock economy of Gaelic sites, such as Caherconnell, remains the same into the later period. Another late medieval trend which does not appear to take place at Caherconnell is the strong focus on wool production. Although is it likely that some sheep at Caherconnell were exploited for their wool, they were primarily used for meat during both periods of occupation. In general the Caherconnell assemblage suggests the site had a strong livestock economy with a focus of dairy and meat production.

Another potential indicator of high status activity is the consumption of piglet meat (McCormick 1997, 831; McCormick and Murray 2017, 205), which may be evident in the presence of younger individuals in the assemblage. The *Críth Gablach* also discussed how the 'leading noble' would own deer-hounds and his wife would own lap-dogs (Edwards 1999, 59). Caherconnell has produced evidence of both small and larger dogs, it is possible but not certain that they are representative of these dog types. As mentioned, the overall value of a dog relied on their ability to assist humans in activities such as hunting, herding, or guarding (Grieve 2012, 245). During the early medieval period hens were a unit of value and were regarded high in value along with their eggs (Kelly 1997, 102, 588), and admittedly in small numbers domestic fowl are present at Caherconnell throughout both periods.

As well as these domesticates, wild species and hunting activities may reflect site status, predominately those associated with deer (McCormick and Murray 2017, 208). The documentary sources from the early medieval period discuss deer hunting as a high status social or training activity and was not undertaken to supply food for the diet (Kelly 1997, 273). As

discussed previously, although done differently, both Gaelic lords and Anglo-Normans took part in this high status activity (Beglane 2012, 357). As only red deer were recorded at Caherconnell there is no evidence of the hunting of fallow deer in deer parks, further evidence of Caherconnell sticking to earlier trends and not those of Anglo-Norman influence. It would appear from the faunal assemblage that Caherconnell was a site of high status. With a strong livestock economy dominated by dairy and meat production, the site functioned as a self-sufficient producer consumer site. The presence of the other domesticates in the faunal assemblage, backed up by the documentary sources such as the *Críth Gablach*, further highlights the high status of its occupants who engaged in such activities as deer hunting.

Chapter 8
Caherconnell in Context

Faunal assemblages from a range of early and late medieval sites in Ireland indicate how activities such as animal husbandry, hunting, and fishing differed between site types and periods. A change in the farming economy is evident at some sites over time, particularly associated with the arrival of the Anglo-Normans (O'Sullivan *et al.* 2014, 179). Early medieval sites are generally of a producer-consumer nature with the three main domesticates forming a mixed economy. In contrast, later urban contexts display traits of consumer sites, with some animal species playing stronger economic roles, such as dogs and cats, when compared to the earlier period. The animal bone record from Caherconnell reveals no major changes in the agricultural economy from the early to late medieval period, with little evidence of Anglo-Norman influence.

8.1 Comparison of early medieval results from domestic species at Caherconnell

The main similarity between sites of this period is the dominance of three main domesticates, namely cattle, pig, and sheep. Cattle are generally the dominant domesticate, followed by pig and sheep. MNI percentages are displayed in Figure 8.1 to demonstrate inter-site comparisons of the frequencies of these domesticates between the early medieval phases of activity at Caherconnell and other early medieval sites (Albarella 2019, 18). Cattle tend to make up 40–50% of domesticates, with extreme cases such as Cahercommaun where they accounted for 97% (Hencken, *et al.* 1938, 75). The overall domesticate pattern differs at several sites, such as Castlefarm 1 Co. Meath, where pig are the dominant species during the 8th–10th centuries (Foster 2009, 22; McCormick and Murray 2017, 198). Although activity at Caherconnell in Phase 4 and 5 is in the later part of the early medieval period, the livestock farming at this site follows patterns seen at other early medieval sites.

The assemblage from Caherconnell shows that it was a self-sufficient producer consumer site. With a dominance of adult cows of 3 years and older, the rearing of cattle at Caherconnell focused on a dairying economy while also producing primary and other secondary products. Rural sites such as Caherconnell tend to produce a similar pattern indicative of a producer-consumer site. In the Caherconnell townland, the sub-square enclosure (F36) assemblage exhibited a dominance of cattle aged 3 years and older (Comber 2016a, 172).

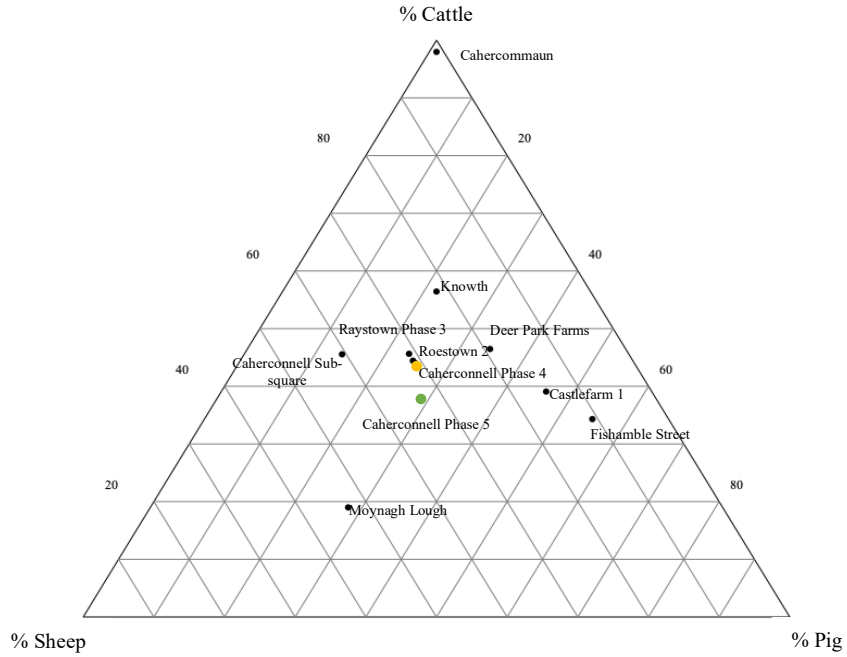


Figure 8.1: Ternary plot of % MNI for three main domesticates from the early medieval phases of activity at Caherconnell Cashel and other early medieval sites

Cattle from Castlefarm 1 had a peak slaughter of 36+ months, which is suggested to reflect the dairying society of this period (Foster 2009, 41–2). Knowth Stage 9 also has a peak slaughter of 36+ months, which is an increase in older cattle compared to Stage 8 (McCormick and Murray 2007, 51–2). This suggests dairying cattle are no longer an important unit of wealth when compared to the earlier part of the period, or the possibility that beef was coming into Knowth from elsewhere (*ibid.* 57). As early medieval activity at Caherconnell is also 10th–11th century, the same could be suggested for this settlement, however, the dominance of female adult cattle suggests dairying was the focus of the farming economy there with a smaller amount of male cattle used for meat, breeding, and traction. Moynagh Lough crannóg and Deer Park Farms have also produced similar results with a dominance of older cattle and a higher incidence of young calves compared to other sites (McCormick 1986, 87–8; McCormick and Murray 2011a, 473). This higher prevalence of young cattle at Deer Park Farms is suggested to be a response to shortage of fodder, which is something seen on Scottish sites, of the period, as well as the coastal site of Illaunloughan Island, Co. Kerry (McCormick 1998, 00; McCormick and Murray 2005, 68, 2011a, 474). Although not as high, Caherconnell has also presented evidence of the presence of young calves. As discussed previously, and in the same case as Moynagh, these probably represent individuals that died of natural causes or were else killed for meat in the case of calves of cows not producing much milk (McCormick 1986, 88).

In addition to cattle, sheep and pig also provided meat at Caherconnell, with sheep were the second most frequent domesticate. As mentioned previously, sheep and pig can typically be the second or third most dominant species in early medieval assemblages in Ireland. Pig

tends to occur in higher frequencies in the early medieval period, compared with sheep (McCormick and Murray 2007, 105). That said, sheep also appear as the second most domesticate at some sites, such as Raystown Phase 3 (MNI 32%) and Roestown 2 (Murray 2009, 158; Sloane 2009, 7). At Moynagh Lough (A1) there is a particularly high instance of sheep making up 50% of the MNI (McCormick *et al.* 2011, A345). Sites in a marginal farming environments, such Dún Eoganachta and Larrybane, have produced high MNIs of 40% and 50% (Jope 1961; Murray 2013; McCormick 2014, 124). Sheep from the Caherconnell sub-square enclosure were not only the second dominant domesticate (MNI: 41%), but appear to be farmed in somewhat even numbers to cattle (MNI: 46%), with this higher frequency suggested to be a geographical trend (Comber 2016a, 171, 177).

The majority of sheep in the early medieval period were killed before 28 months, which suggests they were primarily used for their meat, with less importance attached to their secondary products (McCormick and Murray 2017, 200). Animals reared for meat would have been slaughtered once they reached optimal size, which for sheep is typically 6–12 months (Davis 1987, 150). Sheep were primarily exploited at Caherconnell in their first, second, and third year during the early medieval phases of activity. There is evidence there of a mixed economy, with a primary focus on meat production, as well as the likely exploitation of secondary products such as milk and wool. Sheep at Castlefarm 1, Deer Park Farms, and Knowth Stage 8 and 9 had a peak slaughter of 12–28 months which represents those animals used for meat, while animals older than 28 months were used for their secondary products . A peak slaughter of 12–28 months is also suggested to be an indication of wool exploitation as sheep of this age range have a softer and finer quality wool (McCormick and Murray 2007, 59). Roestown 2 has a peak slaughter of sheep over the age of 28 months and although this dominance of older individuals contrasts with the trend seen at the sites previously mentioned, its likely that as well as meat, they were also exploited for their secondary products of milk and wool, in spite of their possibly coarser fleece (Sloane 2009, 28, 65). The main difference between Caherconnell and these sites appears to be higher amounts of sheep 12 months and younger at Caherconnell, particularly from Phase 5, which probably represent those used for meat.

As mentioned before, pigs tend to be either the second or third most dominant domesticate in early medieval assemblages in Ireland. They are the third domesticate at Caherconnell with MNI's of 25% and 29% and an age slaughter pattern of 1.5–2 years. As single purpose animals, there can be less variation in pig age slaughter patterns across sites with the majority slaughtered 1.5–2 years once they reached full size, and with a trend of males

killed off at an earlier age (McCormick and Murray 2017, 199–200). This age slaughter pattern is seen at sites such as Knowth, Deer Park Farms and Moynagh Lough crannog (McCormick 1986, 89; McCormick and Murray 2007, 60, 2011a, 476). Although the ageing pattern at Moynagh follows the early medieval rural trend, the sexing information differs with the majority of the older pigs being male (McCormick and Murray 2007, 63). The presence of neonatal pigs at Knowth, Deer Park Farms, Fishamble Street, and Caherconnell, suggests that they were bred on-site. Castlefarm 1 had a higher frequencies of pigs compared to other sites, with a MNI of up to 40%, higher than cattle and sheep, which highlights the importance pig played in that diet (Foster 2009, 22, 37). Pigs at Castlefarm 1 had a peak slaughter of 12–17 months, which is more similar to the urban trends than the general early medieval pattern of 1.5–2 years (*ibid.* 39). The sexing information from Castlefarm 1 produced higher proportions of males, similar to Caherconnell, which is expected when males would be killed off at a younger age and the females kept for breeding (*ibid.* 42). Pigs from the Caherconnell sub-square enclosure produced a similar trend of 2–2.5 years when slaughtered and a slight dominance of male pigs (Comber 2016a, 172).

Evidence from Viking Dublin suggests pigs played a central role, which suggests a high degree of self sufficiency (McCormick and Murray 2017, 197). These pigs had a peak slaughter of 6–12 months which indicated an adapted rearing practice in this urban setting (*ibid.* 200). All of the older pigs at Fishamble Street were female with only few males kept for breeding. As sows produce large litters, younger male pigs would have been killed to ensure that the population was manageable within the urban environment (McCormick and Murray 2007, 62–3). Overall, there appears to be a rural pattern with the majority of pigs being killed at optimal slaughter size aged 1.5–2 years, with sites such as Castlefarm 1 produced slightly differing results. Urban evidence from Viking Dublin also differs from this rural picture with an even younger age slaughter peak. As well as this, the sexing information shows a general dominance of younger male pigs and older female pigs, suggesting these sites were producer consumer sites. Moynagh Lough produced differing evidence with the majority of older pigs being male, which may indicate it was more of a consumer site in relation to pigs (*ibid.* 64). Caherconnell yielded little interpretable evidence for individuals with both ageing and sexing data, however based on the results individually, Caherconnell appears to be a producer-consumer site.

The remaining domesticates, horse, dog, cat, and domestical fowl, tend to make up low percentages of the total MNI at early medieval sites in Ireland. The majority of horses at Caherconnell were mature individuals that are comparable in size to the Connemara pony and probably represent working animals or horses for riding. This dominance of older horses is a

pattern seen at other early medieval sites, which indicates these animals were generally killed once their working life ended (McCormick 2007, 92). A majority of mature horses is also seen at Castlefarm 1, Knowth, and Fishamble Street (McCormick and Murray 2007, 65, 230; Foster 2009, 36). There also some butchery evidence of the possible consumption of horse meat and marrow exploitation at Caherconnell. Similar evidence of occasional eating of horse meat has come from other important early medieval settlements such as Knowth and Deer Park Farms (McCormick and Murray 2007, 49, 2011a, 478), however the majority of this evidence comes from sites of low status (McCormick 2007, 92). Due to the nature of the site, horse recovered from Moynagh crannog indicates the consumption of horse meat as there would be no reason other to bring horse on-site (McCormick 1986, 90, 2007, 92).

The majority of dogs at Caherconnell were mature individuals of small to medium size, which fit into the smaller group of a bi-modal distribution observed during the early medieval period in Ireland. Cahercommaun produced evidence of dogs of the same size (Hencken *et al.* 1938, 75). A larger sized dog was also present at Caherconnell, with some smaller dogs that may even represent lap dogs, associated with high status and high-ranking woman (Kelly 1997, 120). Dogs during this period were used for work such as hunting, herding, or guarding, and also as pets, and it is possible they filled multiple of roles at Caherconnell. As none of the dog bones from Caherconnell displayed butchery marks, there is no evidence of the consumption of dog meat or use of their skins. Knowth produced evidence of mature individuals of larger size, with no evidence of skinning or butchery (McCormick and Murray 2007, 49, 65, 98). There were no lap dogs present at Knowth, which is surprising as this site is considered to be of high status (*ibid.* 98). Lap dogs were noted at the high status sites of Ballinderry 2 and Lagore (Stelfox 1942, 73; McCormick 1991a, 8). Dogs from Fishamble Street were mostly mature individuals and produced evidence of butchery which were not indicative of skinning and likely indicate consumption of dog meat (McCormick and Murray 2007, 231). The consumption of dog meat is generally associated with sites of low status or times of food shortage (McCormick 1991a, 9). That said, a dog metapodial from the Caherconnell sub-square enclosure has evidence of skinning through the presence of a cut-mark (Comber 2016a, 174).

During the early medieval period, cats were retained to keep settlements free from rodents, or else used as pets, and occasionally for their furs. Although rural sites tend to produce evidence of mature cats, Caherconnell has produced evidence of a mixed population with both mature and younger individuals. Knowth also produced evidence of a mixed population, the majority being mature (McCormick and Murray 2007, 65). The size of the cats at Caherconnell are comparable to those at other early medieval sites such as Ballinderry 2 (*ibid.* 101). The age

and size of cats in medieval Ireland has produced trends typically based on site type, with early medieval rural sites tending to have larger cats that lived longer lives in comparison to animals from urban sites that appear to live shorter lives and were smaller in size, which follows into the later period (McCormick 1988, 222). It is likely that cats at Caherconnell were kept as pets or for pest control, with a slight possibility some were exploited for their furs though there is little evidence of skinning. Other rural sites such as Roestown 2 and Castlefarm 1 produced no evidence of cats being exploited for their pelts, which suggests this tends to be an urban phenomenon (Foster 2009, 42; Sloane 2009, 68). Knowth has evidence of skinning, which suggests cats played a commercial role at this site in a manner usually seen at urban sites such as Viking Dublin (McCormick and Murray 2007, 49, 116, 231).

Although the Caherconnell bird assemblage was dominated by wild birds, domestic fowl are one of the dominant species during the early medieval period. Their meat and eggs likely contributed to the diet, albeit in a small way. With no evidence of spurs, it is not possible to suggest domestic fowl were bred for cock fighting. Evidence of this however has come from other rural sites such as Lagore crannóg where the presence of long spurs suggest game cocks (Stelfox 1938, 38; Hencken, *et al.* 1950, 230, 241). Wild species tend to dominate early medieval assemblages, however at Knowth domestic fowl were also most frequent, and were one of the most common birds at Ballinderry 2 (McCormick and Murray 2007, 72, 200). Domestic fowl were also the most common species at the urban site of Fishamble street (*ibid.* 232). Other sites produced no evidence of domestic fowl, such as Cahercommaun and Moynagh crannóg (Hencken *et al.* 1938, 76; McCormick and Murray 2007, 261). Domestic geese and ducks may also be present at Caherconnell and other early medieval sites, however this cannot be confirmed as it is difficult to distinguish the wild and domestic species.

8.2 Comparison of late medieval results from domestic species at Caherconnell

Similar to the earlier period, the three main domesticates remain the same, although the frequency can vary when compared to early medieval assemblages and across the later medieval period in Ireland. Late medieval sites dating to the 11th and 12th centuries have evidence of livestock trends following the earlier medieval patterns (McCormick and Murray 2017, 201). Cattle remain the most dominant domesticate for the majority of late medieval sites, however there is more variability within the MNI when compared to the earlier period, with values ranging between 15% at High Street, Waterford to 70% at Carrickfergus (*ibid.* 201,

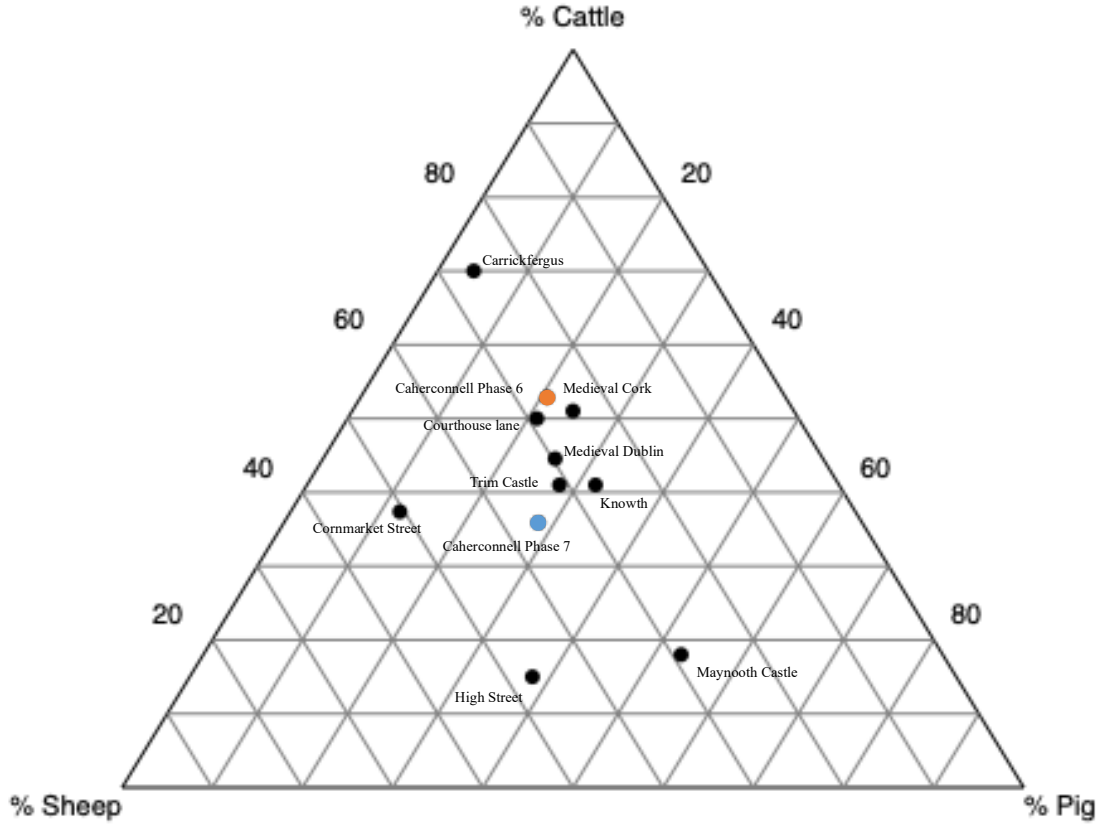


Figure 8.2: Ternary plot of % MNI for three main domesticates from the late medieval phases of activity at Caherconnell Cashel and other late medieval sites

203) (Figure 8.2). The frequency of sheep and pig within assemblages also varies in comparison to early medieval assemblages. Higher proportions of pigs are seen at elite sites, such as Maynooth Castle, while there is also a rise in sheep at other sites. It is suggested the latter may reflect the wool trade, as seen at Cornmarket Street in Dublin (O'Neill 1987, 58–67; McCormick and Murray 2017, 201–2). The rise in the wool industry is also reflected in the assemblage from South Main Street, Cork city where over time the frequency of sheep overtakes that of pigs (McCarthy 2014, 248). There also appears to be an increase in sheep over time in comparison to pig which suggest a preference for mutton (McCormick and Murray 2017, 202). Evidence from urban and castle sites suggests these sites were supplied with these species and acted as consumer sites. South Main Street in Cork produced evidence of primary butchery which suggests these animals were brought on site alive and then slaughtered (McCarthy 2014, 248). Compared to the other two domesticates, pigs do not require grazing and would have been easy to keep within an urban environment (*ibid.*). The late medieval activity at Caherconnell spans the 11th–16th century and has produced lower amounts of animal

bones in comparison to the earlier phases, with a particularly small sample from Phase 7. As a late medieval rural site, the livestock economy at Caherconnell follows the pattern previously established within the earlier period, as a self-sufficient producer-consumer site with cattle as the dominant species with an emphasis on dairying, sheep were the second most dominant domesticate with evidence of a mixed economy, while pig were the third most dominant species and as single purpose animals were reared for meat.

In the later medieval period, the varying frequency of cattle can be linked to the decline in their socio-economic role, or to the development of the wool trade and subsequent increase in sheep products (Denham 2007, 275). This decline in cattle is evident in the later stages of activity at Knowth, where there is also a rise in sheep and pig, particularly the latter (McCormick and Murray 2007, 106). The age-slaughter patterns of this period changes to a dominance of older animals. The results from the late medieval Caherconnell cattle bones indicate the same age slaughter pattern seen in the earlier period, with a dominance of adult cows in their second and third year. Assemblages from urban and castle sites are dominated by cows 3 years and older, which indicates that the majority were consumer sites supplied with cattle from producer sites using their former dairy cattle (Denham 2007, 204, 207; McCormick and Murray 2011b, 420, 2017, 202). The majority of cattle from late medieval contexts in Cork city were mature and over 4 years, probably used for their secondary products and fattened up for slaughter once their role was filled (McCarthy 2003, 377). Courthouse Lane in Galway city also produced evidence of an urban site supplied with cattle, which again were older and finished their working life (Murray 2004, 576). Medieval Dublin produced further evidence of a majority of cattle aged 36 months and older being slaughtered (Denham 2007, 206).

As discussed, dairy products played an important role in the diet of Gaelic sites, in later medieval Ireland. While sites were essentially consumer sites in that period, the importance of dairy produce was still prevalent (*ibid.* 275). The increase in the age of cattle in late medieval Dublin may be evidence for the importance of dairying (*ibid.* 276). South Main Street in Cork city has evidence of mature individuals to indicate the dairying leather production for animals not reared primarily for meat (McCarthy 2014, 248). Rural evidence from this period has produced a different trend, with higher amounts of younger individuals, probably due to these sites acting as producer sites (Denham 2007, 210). This higher incidence may reflect the consumption of younger individuals at rural sites, while the older cattle were sent to the urban consumer sites (*ibid.* 276). The retention of cattle to at least the age of 3 or 4 years could be due to the exploitation of hides and horn as such products were exported during this time

(McCarthy 2003, 377). Cow hides and calf skins were exported during this time (O'Neill 1987, 77), with possible evidence of this at Caherconnell.

Assemblages from late medieval sites dating to the 11th and 12th centuries reveal sheep as the third most dominant domesticate. This follows the trend seen in early medieval assemblages (McCormick and Murray 2017, 201). Sheep continues to be the second dominant domesticate at Caherconnell during the later medieval phases of activity. There is also a general rise in sheep production in areas of Ireland during this period, which is likely to reflect wool being an important export (*ibid.* 202). The integration between Anglo-Norman and Irish market economy is suggested to be one reason the value of sheep raised during this period (Denham 2007, 278). There is evidence from South Main Street in Cork for mature sheep used for wool production (McCarthy 2014, 248). The importance of wool is not always evident in late medieval assemblages, such as Trim Castle in Co. Meath, where mutton was not an important part of the diet (McCormick and Murray 2011b, 422). Urban assemblages from the 13th and 14th centuries have greater variability, with a notable rise in sheep due to the wool industry (Denham 2007, 273). The ageing evidence from late medieval assemblages show two peaks of slaughter; those animals killed in their second year and older individuals (McCormick and Murray 2017, 205). This is suggestive of a mixed economy where the younger group were used for meat and the older exploited for wool (Denham 2007, 279). The evidence from the late medieval activity at Caherconnell also points to a mixed economy, with meat production being the primary focus and secondary products such as milk and wool also produced. The 14th and 15th century activity at Trim Castle includes consumption of lambs, which may be evidence of a high-status feast (McCormick and Murray 2011b, 421). In contrast, many 15th and 16th century urban sites in Ireland have evidence of lower amounts of older sheep which reflects a decline in the wool industry (Denham 2007, 235–6; McCormick and Murray 2017, 205). Urban assemblages have also produced evidence of higher amounts of goats than sheep in comparison to the earlier period (*ibid.* 205).

Pigs from late medieval assemblages in Ireland have evidence of being the second dominant domesticate at the majority of rural and urban sites, and the most dominant at castle sites with high MNI percentages reaching 53% and 61% (*ibid.* 201, 203). Pig remained the third dominant domesticate at Caherconnell and produced similar age slaughter patterns to the earlier phases of activity. Similarly to the early medieval period, there is a peak slaughter for pigs in their second year and another younger peak in urban assemblages of pigs aged 7–12 months (Denham 2007, 254; McCormick and Murray 2017, 205). It is not surprising that slaughter patterns for pigs did not change much since the earlier period as they are single

purpose animals. Trim Castle has evidence from 12th–13th century of pigs being killed within a smaller age window (17–21 months) compared to other sites (McCormick and Murray 2011b, 420). Castle sites appear to have higher proportions of pigs compared to urban sites and also follow the slaughter trend of early medieval rural sites (Denham 2007, 256, 273). Although live cattle were brought on-site at Trim Castle, the assemblage suggests pigs were being bred through evidence of post-cranial neonate bones (McCormick and Murray 2011b, 420). As pigs were being kept on this castle site, it is not surprising that it has produced patterns of a producer site similarly to rural sites. As mentioned previously, pigs were also kept at urban sites as they do not require grazing and would have been easy to keep (McCarthy 2014, 248). Neonatal pig bones were also recovered from South Main Street in Cork and it is suggested that they were supplied with pregnant sows (*ibid.*). Piglet meat is considered to be a high-status delicacy as a sample of young individuals was recovered in association with high status imported German pottery from 13th-century Waterford (McCormick 1997, 831; McCormick and Murray 2017, 205).

The late medieval period brought a significant change in the use of horses, replacing cattle for ploughing. The earliest evidence of this is from 13th century and it was not until the 15th century the horse became the primary plough animal (Denham 2007, 15). Horse remains a minor species in late medieval assemblage, generally in fourth position after the three main domesticates. As working animals, horses from late medieval sites tend to be older individuals, with the majority from late medieval activity at Caherconnell being mature animals. The urban town of Cork has produced low amounts of horse all being mature individuals which suggests that they were not bred on-site (McCarthy 2003, 378). Horses from urban sites also appear to be smaller than those found on rural sites, as rural farms would have required stronger horses and the smaller horses suited the nature of an urban site (*ibid.*) One individual from Caherconnell was larger than those from the earlier phases, which may reflect the need for larger horses for ploughing (McCormick 2007, 98). As well as working animals, horses could also be used for primary products such as meat, marrow, and hides (Denham 2007, 266). The consumption of horse may have been confined to times of food shortages (Kelly 1997, 352). Horse bones are occasionally recovered from food refuse, and are a common find urban assemblages such as the Cork sites of South Main Street and Barrack Street (McCarthy 2003, 379, 2014, 248). Assemblages from medieval Waterford and Trim Castle provide evidence of marrow extraction (McCormick 1997, 832; McCormick and Murray 2011b, 421). Two horse bones from late medieval contexts at Caherconnell have butchery marks, that may indicate marrow removal or meat consumption.

The dogs from the late medieval phases of activity at Caherconnell seem to be mature individuals of small size, similar to those from the earlier period, although only a smaller sample is available for the later medieval period. One of the main differences between the early and late medieval period in regards to dogs is the change in breeding patterns, with a strict breeding practice in the earlier period and a mixed population in the latter (McCormick 1991b, 44). With most of the later evidence coming from urban sites, it is suggested that this switch is reflective of a change in roles, from pets and working dogs to an economic commodity (*ibid.* 44–5; McCormick and Murray 2017, 206). Faunal material from Cork city produced evidence of mature dogs of small and large size, filling such roles as guard dogs and vermin control, with no evidence of skinning or butchery (McCarthy 2003, 379). Trim Castle also produced evidence of dogs small and large in size (McCormick and Murray 2011b, 422). Dogs from Waterford were a mix of young and mature individuals, and produced evidence of both skinning and the occasional consumption of dogs, as well as cruelty towards dogs, something generally found in urban sites (McCormick 1997, 833). Biometrical data from the Waterford dogs show evidence of dogs sized 40–50 cm, the size range which is missing in earlier sites with bimodal populations (*ibid.* 834). This may be evidence of a decline in the strict breeding practices of the earlier period or possibly the importation of new dogs during the later medieval period (*ibid.*)

Late medieval activity at Caherconnell produced low amounts of cat bones, with the selection of bones from both phases of activity suggested to represent a single individual per phase, none being young individuals. Cats from later medieval sites tend to be smaller with a shorter life expectancy when compared to those of the earlier period (McCormick 1988, 221). The low amount of cats within the Caherconnell assemblage may not reflect the volume of cats present on-site, as they may not have ended up in an assemblage mostly made up of food waste. They were likely used as pets and vermin control, the latter also being an important role for urban site (McCormick 1997, 836). Urban assemblages, from sites such as Washington Street and Tuckey Street in Cork city, have produced evidence of large quantities of cats, which may reflect their economic value (McCarthy 2003, 379). Cats were a commercial commodity during this period, particularly at urban sites, with evidence of the exploitation and exportation of their furs (McCormick 1988, 226). Assemblages from Cork City excavations have produced large amounts of young individuals with evidence of these cats being killed once a suitable size was reached for their fur (McCarthy 2003, 379, 2014, 248). Medieval Waterford also produced large numbers of cats, particularly young cats, which were exploited for their pelts between the 11th and 13th centuries (McCormick 1997, 834–5). None of the possible butchery evidence from

Caherconnell is of late medieval date and therefore is it unclear whether the same economic value was placed on cats there during the late medieval period.

Domestic fowl were one of the more dominant birds in the late medieval phases of activity at Caherconnell. The bone evidence indicates they were bred on-site and played a minor part in the diet, similarly to the early period of activity. Domestic birds, including domestic hens and geese, were favoured by the Anglo-Normans and are frequently found within urban and castle assemblages (Hamilton-Dyer 2007a, 108; McCormick and Murray 2017, 208). The late medieval period also saw the introduction of dovecotes, domestic geese, and pheasants (Hamilton-Dyer 2007a, 109). Domestic fowl dominate bird bone assemblages from Cork City, with a mix of younger and mature individuals and high amounts of medullary bones, to indicate they were kept in the town and reared for their eggs (McCarthy 2003, 382, 2014, 249). Domestic goose are another dominant domestic in the Cork City assemblages and were exploited for their meat, eggs, down, and bones (McCarthy 2003, 382). This trend of domestic fowl and domestic geese dominating avian assemblages is also seen at castle sites such as Trim Castle (Hamilton-Dyer 2011, 411–2). Similarly to the early medieval activity at Caherconnell, it is possible that domestic geese and ducks may have also been present, however the distinction with wild species is difficult.

8.3 Wild species

A range of wild species are common in assemblages from early and late medieval sites in Ireland, with most sites having a low occurrence of these species throughout these periods. The range of species is similar across these sites, with deer, hare, and rabbit being the most common, while fallow deer, roe deer, and rabbit are restricted to the later medieval assemblages as later introductions (McCormick 1999, 360, 361, 366). The range of wild species at Caherconnell includes deer, hare, rabbit, fox, badger, red squirrel, small rodents, bird, fish, and amphibian, the latter likely being intrusive. Though small in quantity, the presence of wild species in this assemblage can give insight into the role hunting and fishing played at a site.

In terms of diet, wild species played a minor role when compared to that of the domestic species. The only species of deer identified at Caherconnell was red deer, which suggests the inhabitants at the site did not hunt in Anglo-Norman deer parks of the late medieval period. Assemblages from both periods, such as Deer Park Farms and medieval Waterford, indicate that venison played a minor role in the diets of these sites (McCormick 1997, 836; McCormick

and Murray 2011a, 478, 2017, 208). Trim Castle has evidence of hunting both red deer and fallow deer, the latter suggesting there was a deer park near the site (McCormick and Murray 2011b, 422). Urban assemblages, such as those from Cork City, showed that wild species did not play an important part in the diet of the town. These studies suggest that red deer were occasionally hunted and brought back to the town for its meat as well as antler for craft working (McCarthy 2003, 379–80, 2014, 248–9). The surrounding forest landscape of Cork would have been suitable for deer and the inhabitants of the town were making use of their local resources (McCarthy 2003, 380). The presence of deer antler, whether shed or removed from the skull, can give insight into the hunting practices. Medieval Waterford produced a much higher volume of shed red deer antler, and a low amount of post-cranial deer bones, which suggests that the supply of antler was not a by-product of the venison trade (McCormick 1997, 836). Roe deer and fallow deer antler were also recovered from Waterford, the former being evidence of trade (*ibid.* 837).

The Anglo-Normans introduced these species for economic reasons, such as the trade of rabbit pelts (McCormick 1991b, 49). Rabbit is suggested to be intrusive at Caherconnell and other sites such as Knowth as it is a later introduction and did not present any evidence of butchery (McCormick and Murray 2007, 38, 40). Hare and rabbit were also occasionally recovered in the Cork City assemblages, both for dietary reasons and for furs (McCarthy 2003, 380, 2014, 248). Small quantities of hare and rabbit were also recovered from Waterford, as well as other wild species not at Caherconnell such as grey seal and hedgehog (McCormick 1997, 837). Trim Castle produced evidence of hunting wild pig, something not seen in the Caherconnell assemblage (McCormick and Murray 2011b, 422). Due to the low incidence of the remaining wild species, such as fox or badger, there are few conclusions can be made based on their significance for the occupation of this site.

As discussed previously, major bird and fish assemblages have been recovered from early and late medieval sites in Ireland. The range of bird and fish species differs between these sites, mainly due to Anglo-Norman diet preferences, as well as the introduction of new species. Assemblages show regionality differences due to the availability of species being influenced by the local environment, whether rural or urban, or coastal or inland.

Wild birds tend to dominate assemblages from rural sites, such as the assemblage from Lagore Crannóg (Stelfox 1938, 37), while domestic birds appear in higher amounts in assemblage from late medieval urban sites, such as the Courthouse Lane assemblage from medieval Galway (Hamilton-Dyer 2004, 609). As Caherconnell is a rural site with activity spanning both periods and little evidence of Anglo-Norman influence, it is not surprising that

the assemblage, although small, is dominated by wild birds. Some of the wild birds, such as scavenging corvids, are representative of opportunistic hunting. This can give indication, for sites such as Caherconnell, to the little importance birds played within the economy and diet of some rural sites. That said, rural sites such as Lagore Crannóg and Illaunloughan Island, have produced larger bird bone assemblages. The assemblage from the early medieval monastic site at Illaunloughan, reflects both the site type and location reflective of a coastal monastic diet with a preference for wild species, which is further evident within the fish assemblage (McCormick and Murray 2005, 77–8).

Urban assemblage, such as those from medieval Cork, Viking and medieval Dublin, and medieval Galway have all produced assemblages dominated by domestic birds (McCarthy 2003, 382; Hamilton-Dyer 2004, 609; Wallace 2016, 219). These are examples of the Anglo-Norman influence and preference of domestic fowl within their diet (McCormick 1991b, 49). This urban trend of domestic birds dominating later assemblages is seen in the assemblage from Knowth between Stage 8 (7^{th}–8^{th} century, the early Christian period) and Stage 9 (10^{th}–11^{th} century, the later Christian period) with domestic fowl dominating the later stage (Hamilton-Dyer 2007b, 72). Even though activity at Caherconnell spans 10^{th}–16^{th} century, the amount of domestic fowl, as well as the other possible domestic bird species, remains more or less consistent throughout this time and the early medieval rural trends remain into the later period.

Although the literary sources are dominated by references to freshwater fish, the assemblages from rural and urban sites are dominated by marine species, which is what we see at Caherconnell. Early medieval rural sites such as Illaunloughan Island produced an assemblage reflective of the local environment. Unlike Caherconnell, Illaunloughan produced a large volume of fish bones, which could either reflect a coastal or monastic diet (McCormick and Murray 2005, 77). Located near the Boyne, Knowth also produced evidence of the use of nearby resources, with salmon recovered within the assemblage. The presence of cod and haddock in the Knowth assemblage is possible evidence of trade or exchange with coastal areas (McCormick and Murray 2007, 75). The urban trend of a dominance of Gadidae is likely reflective of trading during the late medieval period. The larger assemblages have come from these late medieval urban sites and early medieval west coast sites (Hamilton-Dyer 2007a, 113). Similar to Caherconnell, fish appeared to be of low importance at sites such as Deer Park Farms (McCormick and Murray 2011a, 478).

Chapter 9
Conclusion

Animals were central to the economy of early and late medieval Ireland in various ways, whether in relation to the farming and agricultural economy or the wealth and social status of a settlement or individuals in society. The role each species played is visible in the historical sources as well as the archaeological record, which offers a valuable opportunity to compare and contrast both records. The zooarchaeological analysis of medieval animal bone assemblages in Ireland has established trends that can be further investigated through the Caherconnell record. Several research aims were established before undertaking this analysis, looking at the role of animal husbandry, hunting, and fishing, as well as changes in livestock farming between the early and late medieval periods. It is also important to assess potential impacts associated with the arrival of the Anglo-Normans; and the status implications of different animal species at Gaelic medieval settlements.

9.1 Main findings

The Caherconnell study provides an insight into animal husbandry through the results from the three main domesticates cattle, sheep, and pig, as well as horse, dog, cat, and domestic fowl. This provides evidence of a self-sufficient producer-consumer mixed farming economy, a picture previously established from other early medieval assemblages as well as the law-texts (Kelly 1988, 3). This pattern of farming appears to carry into the later phases of activity at Caherconnell. The three main domesticates were bred and slaughtered on-site or nearby. There is an emphasis on dairying, with adult cows dominating the bone assemblage, producing products such as milk, butter, and cheese. Beef would have also contributed to the diet, and cattle would have been kept for breeding, as working animals, and for the supply of primary products such as hides and horns. The mixed farming economy is particularly seen through the production of beef, lamb/mutton, and pork, sheep being the second dominant domesticate, followed closely by pig. Both sheep and pig were primarily exploited for their meat, with evidence they provided other products; for example, sheep were used for milk and wool, while pig provided materials for craft working.

The remaining domesticates were less abundant throughout the early and late medieval occupation. The horses may have been riding or working animals, with evidence of some killed once they were no longer of use, either for bone marrow and/or meat consumption. Dogs played various roles during the medieval periods in Ireland, including herding, hunting, guarding, pets, and pest control. As farming economy was central to Caherconnell, it is likely that herding and the protection of livestock was one of the key roles of these dogs. Hunting is evident through the presence of certain wild species and so it is possible that dogs, as well as horse, played a part there. Their use as pets and for pest control is also likely, with possible evidence in the assemblage of a small lap-dog. Evidence from medieval urban sites in Ireland indicates that both dogs and cats played stronger economic roles in the later period through the exploitation of their skins. This is not evident in the Caherconnell assemblage and suggests this may have been primarily an urban phenomenon. Cats were also likely kept on-site as pets and pest control, with only a slight possibility that they were used for their furs. Occurring in small yet consistent amounts, domestic fowl did not appear to play an important role in the diet at Caherconnell, even though hens and their eggs were highly valued during these periods.

The occupants at Caherconnell took part in various activities, namely hunting, fowling, and fishing. Red deer appear to be the only species of deer represented at Caherconnell. These animals would have been widespread during the early and late medieval periods, particularly in comparison to the later introductions of fallow and roe deer kept in deer parks (Beglane 2010, 78). Although not an important part of the Caherconnell food economy, red deer occasionally played a part in the diet, as well as providing raw materials for craft working. Hare and rabbit are also present in the assemblage, with the former possibly hunted for their meat or skins. It is likely the rabbit bones are intrusive, which is supported by the lack of butchery marks. The remaining wild mammals, fox, badger, and red squirrel, are present in few numbers and evidently did not play a significant role in the hunting activities at Caherconnell.

Based on the faunal record, fowling and fishing appeared to play a minor role at the site. The majority of wild birds were corvids and probably, which likely ended up in the assemblage as vermin. The remainder include a variety of wild birds, all occurring in small amounts, which suggests the occupants of this cashel were not regularly involved in fowling. Caherconnell produced a small sample of marine species. The absence of freshwater fish is consistent with other medieval assemblages in Ireland. A sample of marine molluscs was also recovered, with analysis revealing that ‘the contribution of shellfish to the diet of the occupants was minimal’ (Murray 2020, 3). It seems the occupants of Caherconnell only occasionally exploited the coastal resource, even with Ballyvaughan Bay only 10 kilometres away. With

agriculture the centre of site economy, it is no surprise that these activities only played a minor role.

Craft activities were also a part of life at Caherconnell, including bone working. The supply of this material would have been a by-product of animal husbandry and hunting. An estimated 400 bone artefacts recovered at Caherconnell exhibit the use of various skeletal elements, such as antler and horn, as well as post-cranial bones including phalanges and long bones. The assemblage of bone artefacts contained a number of unfinished worked pieces which suggest that some, if not all, of this craft activity was on-site. This is not surprising when the residents had access to an abundant supply of raw material readily available.

The livestock farming at Caherconnell was further analysed by comparing the results between the early and late medieval periods with the aim of identifying potential impacts associated with the arrival of the Anglo-Normans in Ireland. With early medieval sites providing evidence of a self-sufficient producer-consumer mixed farming economy, and the later urban evidence displaying traits of consumer sites, Caherconnell provides the opportunity to gain an insight into the economy of a rural Gaelic site with activity spanning both periods. The early medieval activity at the site produced the majority of animal bone, possibly suggesting a decline in animal husbandry and/or a significant change in occupation in the later period. Given the environmental constraints of its location, it is not surprising there was a continued focus on livestock farming during the medieval occupation, when the settlement was a self-sufficient, mixed farming, producer-consumer site with an emphasis on dairy cows, as well as the production of meat from the three main domesticates, and various primary and secondary products.

Situated in the west of Ireland, the surrounding landscape controlled by Gaelic lords appears to be less affected by the arrival of the Anglo-Normans when compared to the urban areas to the south and east, one suggested reason being because of the environment of the landscape (FitzPatrick 2012, 5). This lack of direct influence and continuation of native tradition is not only reflected in the faunal record but also in the ‘incorporation of ancestral burials into the settlement and deliberate use of a centuries-old native settlement form’, as well as an artefact record that provides evidence of ‘the continuation of long-established processes such as metalworking, textile-production and grain processing and the use of traditional artefact types such as the bone comb, bronze pin, and rotary quern’, not to mention the absence of pottery (Comber 2019, 60–1). When all of this evidence is combined it appears there was a ‘deliberate effort to assert their native tradition’ made by the occupants of Caherconnell (*ibid.* 61).

The status of Caherconnell is reflected throughout the material recovered from the recent excavation, including the faunal assemblage. As agriculture played a central role in the economy, the animals at Caherconnell can provide insight into the status of the site and its occupants. The livestock herd of the *bóaire* is meant to include '20 cows, 2 bulls, 6 oxen, 20 pigs, 20 sheep, 4 domestic boars, 2 brood-sows, and a saddle horse' (Binchy 1941; de Paor and de Paor 1960, 78–9; Kelly 1997, 27). The range and quantity of species at Caherconnell follows this pattern. As the dominant species, and a unit of wealth, the high volume of cattle reflects the social standing of the site, indicating it was a site of high status. Although there is a suggested decline in the economic importance of cattle during the late medieval period, their role at Caherconnell appear to remain the same. The number of horses owned was another signifier of status (Kelly 2005, 31). While horses are present in low numbers at Caherconnell, it is possible this animal is not fully represented in an assemblage that primarily comprises of food refuse.

The consumption of piglet meat in a settlement has been suggested to reflect high status residence (McCormick 1997, 831; McCormick and Murray 2017, 205), possibly represented at Caherconnell by the presence of younger individuals. Certain dogs and their roles, including working dogs and lap-dogs, are indicators of high status, but as with horses the full extent of their presence on-site may not be visible in the faunal record. Hens and their eggs were also of high value, whereas domestic fowl were present in only small numbers at Caherconnell. Various activities were reserved for individuals of high status, namely deer hunting, with restrictions on who could hunt deer in both periods. It appears that the Caherconnell habitants did not participate in hunting activities in Anglo-Norman deer parks as there is only evidence for hunting red deer, which further supports the narrative of a separate Gaelic tradition. Finally, some of the artefacts found at Caherconnell also represent high status activities, such as the bone harp-peg, bone gaming piece, and the bone-and-bronze pen.

9.2 The significance of Caherconnell Cashel

Situated in the Burren karst, Caherconnell Cashel is one of many well-preserved enclosures in this landscape that present an opportunity to study a medieval settlement landscape (Comber 2005, 4). This was highlighted by Comber in a landscape study undertaken in 2005–2008, which involved a range of archaeological sites dating to both prehistoric and historic periods. The historic landscape is particularly defined by the large number of cashels, some of which

are clustered; for example, those in the townland of Caherconnell, where Caherconnell Cashel is one of four enclosures (Comber 2008, 9, 31) (Figure 2.2).

The excavations at Caherconnell provide an insight into the role this high-status cashel played in its immediate landscape. With four phases of occupation, this site was occupied during the early and late medieval periods from the 10th to the 16th centuries. With the archaeology of the later period in Ireland generally dominated by urban settlement, western Ireland has produced other evidence of Gaelic rural settlements continuing in use into this period (Horning 2012, 177). Caherconnell is a good example of this and also provides the opportunity for a site-based and local landscape analysis.

Looking at the wider landscape, there are an estimated 450 native enclosed settlements in the Burren, the majority of which are drystone cashels. Historical sources can also expand our understanding of this medieval landscape. This landscape not only displays evidence of the preservation of archaeological sites, but also of the continuation of Gaelic traditions. When compared to areas in the east of Ireland, there is little evidence of Anglo-Norman influence. This resulted in enclosures, such as Caherconnell Cashel remaining as the principal stronghold of important Gaelic families (Comber and Hull 2010; FitzPatrick 2012, 6).

A construction date, of the late 10th century established for Caherconnell by the recent excavation coincides with the time *Uí Thoirdelbaig*, a branch of the *Dál Cais*, established themselves in this landscape over the *Corcu Mruad,* with the king *Máel Sechnaill* as ruler of the chiefdom (Gibson 1990, 382; Comber 2008, 14, 2019, 60). This association further supports the narrative of Caherconnell, not only being a site of high status, but also playing a central role in the politics of the surrounding landscape (Comber 2018a, 6). It is likely that Caherconnell was a settlement that asserted power throughout the area (Comber and Hull 2010, 158). It is possible that the site got its name from Congal, the brother of *Máel Sechnaill* and lord of the *Corcu Mruad* family, with references to Congal in the written records also coinciding with construction (Comber 2019, 60). After the death of *Máel Sechnaill*, his descendants *Uí Conchobar* and *Uí Lochlainn* alternated the kingship, so that by the 14th century the territory split in two. With the latter in the eastern half it is likely Caherconnell functioned as an O'Loughlin settlement (Comber 2008, 14–5). The historical sources record Caherconnell held by the O'Loughlins until the early 17th century, then briefly by the O'Briens before it passed to the Comyns, and finally the O'Davorens in the late 17th and 18th century. The cashel remains in Davoren ownership today (Simmington and MacGiolla Choile 1967; Comber 2008, 16, 2019, 60).

9.3 Future Research

The analysis of the Caherconnell faunal assemblage indicates the valuable contribution Gaelic rural sites can make to the archaeological record of medieval Ireland. To further our understanding of these western cashel settlements, more excavations and analysis of faunal assemblages must be undertaken. This would be particularly useful in respect of the later medieval period, as this record is dominated by urban evidence. Further research on rural sites will advance our understanding of how these cashel settlements operated in a period influenced by the arrival of the Anglo-Normans.

When undertaking this zooarchaeological study, potential areas for further research became apparent. One of these is isotope analysis of the dog remains at Caherconnell. The analysis of these dog bones and examination of dog breeding patterns, as well as the coprolite analysis currently being undertaken by Don O'Meara, there is a possibility to further investigate the significance of dogs at Caherconnell. The coprolite evidence suggests these dogs were roaming and scavenging in the vicinity of the settlement, as there were inclusions of material to indicate they were feeding from a possible midden that contained charcoal and food stuffs (O'Meara 2021, 2–3). Isotope analysis not only has the potential to provide further insight into the life of dogs at Caherconnell, but they can also be used as a possible proxy for human diet in the settlement. A comparison of the Caherconnell animals to those from an urban context would provide the opportunity to assess the treatment of dogs in these different settlement contexts. Strontium and sulphur isotope ratios are analysed to identify non-local animals and patterns of movement' (Madgwick *et al.* 2019, 2). During the early and late medieval periods there were various reasons for the movement of animals, for example with cattle, the practice of transhumance, cattle-raiding, or the trading of these animals. Through the analysis of strontium and sulphur isotope ratios, there is the potential to possibly identify seasonal mobility and other movements of the animals at Caherconnell.

Research has already commenced with a collaboration between the author, Dr Michelle Comber, and Dr Eugene Costello, in a pilot aDNA study using cattle teeth from the Caherconnell assemblage. Samples have been extracted and dated with permission from the National Museum of Ireland, and they are currently being analysed in the aDNA lab at SciLifeLab in Sweden. The initial aim is to see if DNA has survived in the teeth and also to examine how medieval and early modern cattle from this site compare to traditional Irish cattle breeds known today such as the Kerry, Dexter and Droimeann. The funding for dating and sequencing in this pilot aDNA study was provided by Dr Eugene Costello's Swedish Research

Council Project Grant (2020-01948). Results from this study are likely to expand the potential of the Caherconnell material and promote the possibility for further analysis of samples from early phases of activity at the site in order to compare results over the course of the medieval occupation at Caherconnell.

Bayesian analysis was undertaken using the radiocarbon dates from Caherconnell, including those acquired through this research and during the excavations. The potential of further defining the chronology of activity at Caherconnell was displayed in the results. Excavations in the townland of Caherconnell, including the sub-square enclosure (F36) and the ongoing excavations at Feature 31, provide the opportunity to study the relationship between these cashels within this landscape by carrying out further Bayesian analysis.

Appendix

Appendix- Chapter 1

Table A1.1: List of abbreviations used throughout chapter

Abbreviations	
Measurements (after von den Driesch 1976)	
Bd	Greatest breadth of the distal end
Dl	Depth of the lateral half
Dm	Depth of the medial half
GL	Greatest length
GLl	Greatest lateral length
GLm	Greatest medial length
GLP	Greatest length of the processus articulus
SLC	Smallest length of the neck of the scapula
Tooth eruption state (Ewbank *et al.* 1964)	
C	Crypt forming in bone, not tooth not visible
V	Tooth visible in the crypt, but is below the upper margin of the mandibular bone
E	Tooth erupting through the bone of the mandible
½	Cusp of the tooth erupted about halfway into the occlusal plane
U	Very near to full height, but unworn
J	Just worn; wear on the enamel only, without dentine exposed
Other abbreviations	
AL	Axial
CV	Coefficient of variation
D.	Distal end
dP_4	4^{th} deciduous mandibular premolar
EWH	Estimated withers height
L	Left
LMT	Loose mandibular teeth
MN	Teeth in mandible
MNE	Minimum number of elements
MNI	Minimum number of individuals
M_1	1^{st} mandibular molar
M_2	2^{nd} mandibular molar
M_3	3^{rd} mandibular molar
NISP	Number of identified specimens
P.	Proximal end
Ph1/Ph2/Ph3	1^{st}, 2^{nd}, or 3^{rd} phalanx
P_4	4^{th} mandibular premolar
R	Right
SD	Standard deviation
SI	Slenderness index

Table A2.1: Radiocarbon dates from excavations at Caherconnell Cashel (Comber 2019, 59).

10E087 C14 dates

Phase 1	**6th/7th century AD**
c.(92) from 2013, Cutting D1 – Adult female	
UBA-24260 **cal AD 541-645** (2 sigma, 1.000)	
c.(86) from 2013, Cutting D1 – Infant	
UBA-24261 **cal AD 535-649** (2 sigma, 0.972)	
Phase 2	**7th century AD**
c.(42) from 2011, Cutting B – lower fill of fire-pit	
UBA-18915 **cal AD 641-689** (2 sigma, 0.986)	
c.(37) from 2015, Cutting F – under cashel wall	
UBA-30797 **cal AD 666-778** (2 sigma, 0.901)	
Phases 3/4	**10th/11th century AD**
c.(65) from 2007, trial cutting – deposit on bedrock	
UBA-8564 **cal AD 967-1046** (2 sigma, 0.903)	
c.(37) from 2012, Cutting C – levelling/occupation layer	
UBA-24259 **cal AD 950-1053** (2 sigma, 0.761)	
c.(115) from 2014, Cutting E – hazelnut immediately beneath circular-house wall	
UBA-27545 **cal AD 971-1047** (2 sigma, 0.914)	
c.(144) from 2015, Cutting F – lowest fill of rock-cut pit	
UBA-30795 **cal AD 798-972** (2 sigma, 0.915)	
c.(171) from 2016, Cutting G – metalworking hearth	
UBA-33277 **cal AD 876-1015** (2 sigma, 0.994)	
c.(225) from 2017, Cutting H – small circular structure	
UBA-36020 **cal AD 941-1017** (2 sigma, 0.749)	
c.(245) from 2017, Cutting H1 – gryke/drain	
UBA-36023 **cal AD 864-992** (2 sigma, 0.971)	
Phase 5	**10th/11th century AD**
c.(16) from 2011, Cutting B – occupation layer	
UBA-18914 **cal AD 981-1045** (2 sigma, 0.939)	
c.(102) from 2015, Cutting E – immediately beneath rectangular-house wall	
UBA-27544 **cal AD 983-1049** (2 sigma, 0.820)	
Phase 6	**11th–14th century AD**
c.(55) from 2007, trial cutting – pre-house occupation layer	
UBA-9068 **cal AD 1044-1099** (2 sigma, 0.452) and **1147-1210** (2 sigma, 0.401)	
c.(18) from 2010, Cutting A – under Phase 6 entrance slabs	
UBA-18913 **cal AD 1285-1326** (2 sigma, 0.419) and **1344-1395** (2 sigma, 0.581)	
c.(25) from 2011, Cutting B – occupation layer	
UBA-18916 **cal AD 1075-1155** (2 sigma, 0.673)	
c.(190) from 2016, Cutting G – hearth in annexe	
UBA-33278 **cal AD 1063-1154** (2 sigma, 0.676)	
c.(25) from 2016, Cutting G – occupation layer	
UBA-32902 **cal AD 1150-1225** (2 sigma, 0.869)	
c.(222) from 2017, Cutting H – burnt spread	
UBA-36019 **cal AD 1147-1224** (2 sigma, 0.770)	
Phase 7	**15th–17th century AD**
c.(57) from 2007, trial cutting – structure A occupation	
UBA-8562 **cal AD 1442-1525** (2 sigma, 0.653) and **1556-1632** (2 sigma, 0.347)	

Table A2.2: C14 dates from Archaeology Radiocarbon Dates Scheme provided by the Royal Irish Academy in association with Queen's University Belfast.

RIA C14 Dates	
Phase 4	**10th/11th century AD**
c.(36) from 2018, Cutting I – occupation layer (Bone ID: 11629 - Dog radius) UBA-47663 **cal AD 891-995** (2 sigma, 0.966)	
Phase 5	**10th/11th century AD**
c.(16) from 2012, Cutting C – occupation layer (Bone ID: 2815 - Sheep phalanx) UBA-47660 **cal AD 1060-1157** (2 sims 0.782) c.(16) from 2011, Cutting B – occupation layer (Bone ID: 1854 - Dog femur) UBA-47662 **cal AD 988-1047** (2 sigma, 0.918)	
Phase 6	**11th–14th century AD**
c.(25) from 2018, Cutting I – occupation layer (Bone ID: 15825 - Dog phalanx) UBA-47664 **cal AD 1467-1527** (2 sigma, 0.435) and **1551-1634** (2 sigma, 0.553)	
Phase 7	**15th–17th century AD**
c.(127) from 2015, Cutting F – spread of house floor (Bone ID: 20605 - Pig phalanx UBA-47661 **cal AD 1441-1521** (2 sigma 0.790)	

Table A2.3: The radiocarbon dates from Caherconnell. Note that the modelled date probabilities are expressed in italics. Table constructed by Ben Spillane.

Lab No	Context	Material	$\delta^{13}C$ (‰)	Radiocarbon Age (BP)	Unmodelled Date (95% Probability)	Modelled Dates (95% Probability)	Treatment in Model
Cutting A							
UBA-18913	Under Phase 4 Slabs (C18)	Pig Femur	-20.1	640 ± 24	cal AD 1287–1395	*cal AD 1280–1400*	Included as *TPQ*
		After	AD 1370 (68% Probability)			AD 1390 (95% Probability)	
Cutting B							
UBA-18914	Phase 3: Occupation Layer C16	Cattle Rib	-20.0	1010 ± 25	cal AD 991–1149	*cal AD 1010–1120*	Normal
UBA-18915	Phase 2: Stone Depression C40; Primary Fill C42	Pig Metapodial	-19.8	1355 ± 24	cal AD 642–773	*cal AD 640–780*	Included as *TPQ*
		After	AD 668 (68% Probability)			AD 757 (95% Probability)	
UBA-47662	Phase 3: Occupation Layer C16	Dog Femur	N/S	1022 ± 27	cal AD 970–1150	*cal AD 1010–1120*	Normal
Cutting C							
UBA-24259	Phase 2: Occupation Layer C37	Animal Bone	N/S	1016 ± 30	cal AD 899–1158	*cal AD 900–1030*	Normal
UBA-24258	Phase 5: Stoney Occupation Layer C23	Animal Bone	N/S	845 ± 30	cal AD 1159–1267	*cal AD 1150–1270*	Included as *TAQ*
		Before	AD 1221 (68% Probability)			AD 1258 (95% Probability)	
UBA-47660	Phase 3: Occupation Layer C16	Animal Bone	N/S	961 ± 28	cal AD 1027–1158	*cal AD 1020–1120*	Normal
Cutting D							
UBA-24260	Phase 1: Cist C92; Single Fill C90	Human Bone	N/S	1476 ± 31	cal AD 552–645	*cal AD 560–650*	Normal
UBA-24261	Phase 1: Cist C82; Single Fill C84	Human Bone	N/S	1480 ± 35	cal AD 545–647	*cal AD 550–650*	Normal
Cutting E							
UBA-27545	Phase 2: Fill Beneath Structure C115	Charred Hazelnut Shell	N/S	1015 ± 30	cal AD 971–1047	N/A	Excluded
UBA-27544	Phase 4: Fill Beneath House C100	Animal Bone	N/S	1003 ± 28	cal AD 991–1152	*cal AD 1090–1160*	Normal
Cutting F							
UBA-8562	Phase 5: Structure Occupation Layer C57	Sheep Phalanx	N /S	384 ± 33	cal AD 1445–1632	*cal AD 1440–1630*	Normal
UBA-8563	Phase 2: Occupation Layer C62	Charred Hazelnut Shell	N/S	944 ± 44	cal AD 1017–1206	N/A	Excluded
UBA-8564	Phase 2: Basal Occupation Deposit C65	Animal Vertebra	N/S	1021 ± 32	cal AD 903–1152	*cal AD 900–1030*	Normal
UBA-8565	Phase 4: Pre=House Occupation Layer	Charred Hazelnut Shell	N/S	447 ± 51	Not Included	N/A	Excluded
UBA-9068	Phase 4: Pre=House Occupation Layer C55	Animal Bone	N/S	898 ± 18	cal AD 1047–1218	*cal AD 1130–1220*	Normal
UBA-47661	Phase 5: Occupation Layer C127	Animal Bone	N/S	397 ± 28	cal AD 1441–1624	*cal AD 1440–1630*	Normal
UBA-30797	Phase 1: Levelling Layer under Cashel Wall C37	Animal Bone	N/S	1265 ± 33	cal AD 665–874	*cal AD 650–780*	Normal
Cutting G							
UBA-33277	Phase 2: Pit/Hearth C171	Animal Bone	N/S	1111 ± 31			
UBA-33278	Phase 3: Pit C191; Single Fill C190	Animal Bone	N/S	962 ± 30	cal AD 1031–1168	*cal AD 1020–1110*	Normal
UBA-32904	Phase 3: Pit/Hearth C193; Single Fill C186	Animal Bone	N/S	936 ± 26	cal AD 1031–1168	*cal AD 1020–1110*	Normal
UBA-32902	Phase 4: Occupation Layer C25	Animal Bone	N/S	865 ± 25	cal AD 1052–1256	*cal AD 1150–1260*	Normal
Cutting H							
UBA-36019	Phase 2: Burnt Deposit C222	Animal Bone	N/S	872 ± 27	cal AD 1048–1257	*cal AD 1040–1260*	Included as *TAQ*
		Before	AD 1173 (68% Probability)			AD 1062 (95% Probability)	
UBA-36020	Phase 2: Structure Wall C225	Animal Bone	N/S	1078 ± 25	cal AD 893–1023	*cal AD 900–1020*	Normal

UBA-36023	Phase 2: Gryke Fill C245	Animal Bone	N/S	1123 ± 28	cal AD 774–995	*cal AD 890–1000*	Normal
Cutting I							
UBA-43949	Phase 3: Hearth C256; Upper Fill C255	Animal Bone	N/S	913 ± 20	cal AD 1041–1209	*cal AD 1030–1110*	Normal
UBA-43948	Phase 4: Occupation Layer C25	Animal Bone	N/S	800 ± 20	cal AD 1220–1280	*cal AD 1220–1280*	Normal
UBA-47663	Phase 2: Occupation C36	Dog Radius	N/S	1095 ± 27	cal AD 890–1016	*cal AD 900–1020*	Normal
UBA-47664	Phase 4: Occupation Layer C25	Dog Phalanx	N/S	353 ± 22	cal AD 1460–1634	*cal AD 1460–1640*	Included as *TPQ*
		After	AD 1510 (68% Probability)			AD 1475 (95% Probability)	
Cutting K							
UBA-43951	Phase 2: Kiln Deposit C297	Animal Bone	N/S	1024 ± 33	cal AD 901–1152	*cal AD 900–1030*	Normal

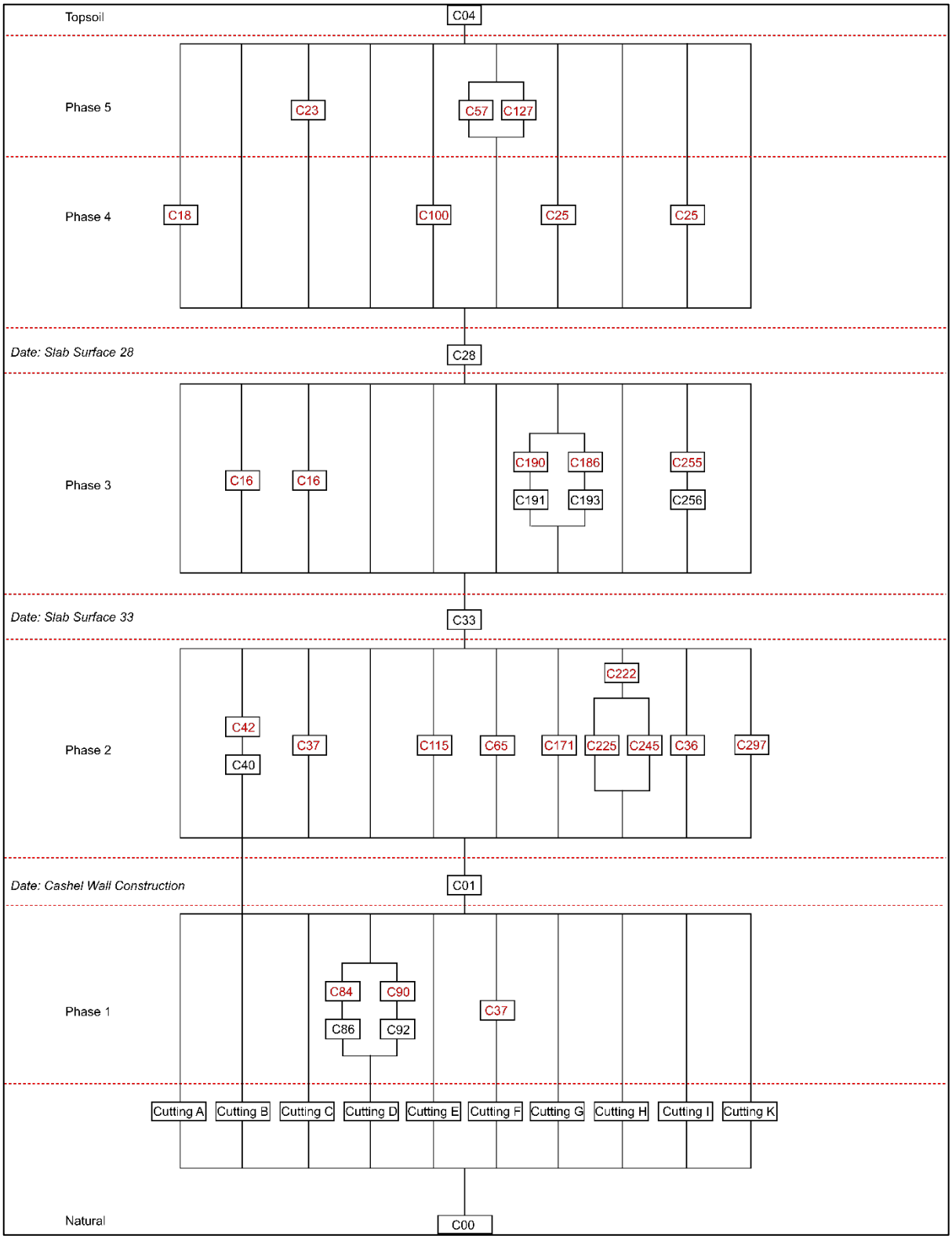
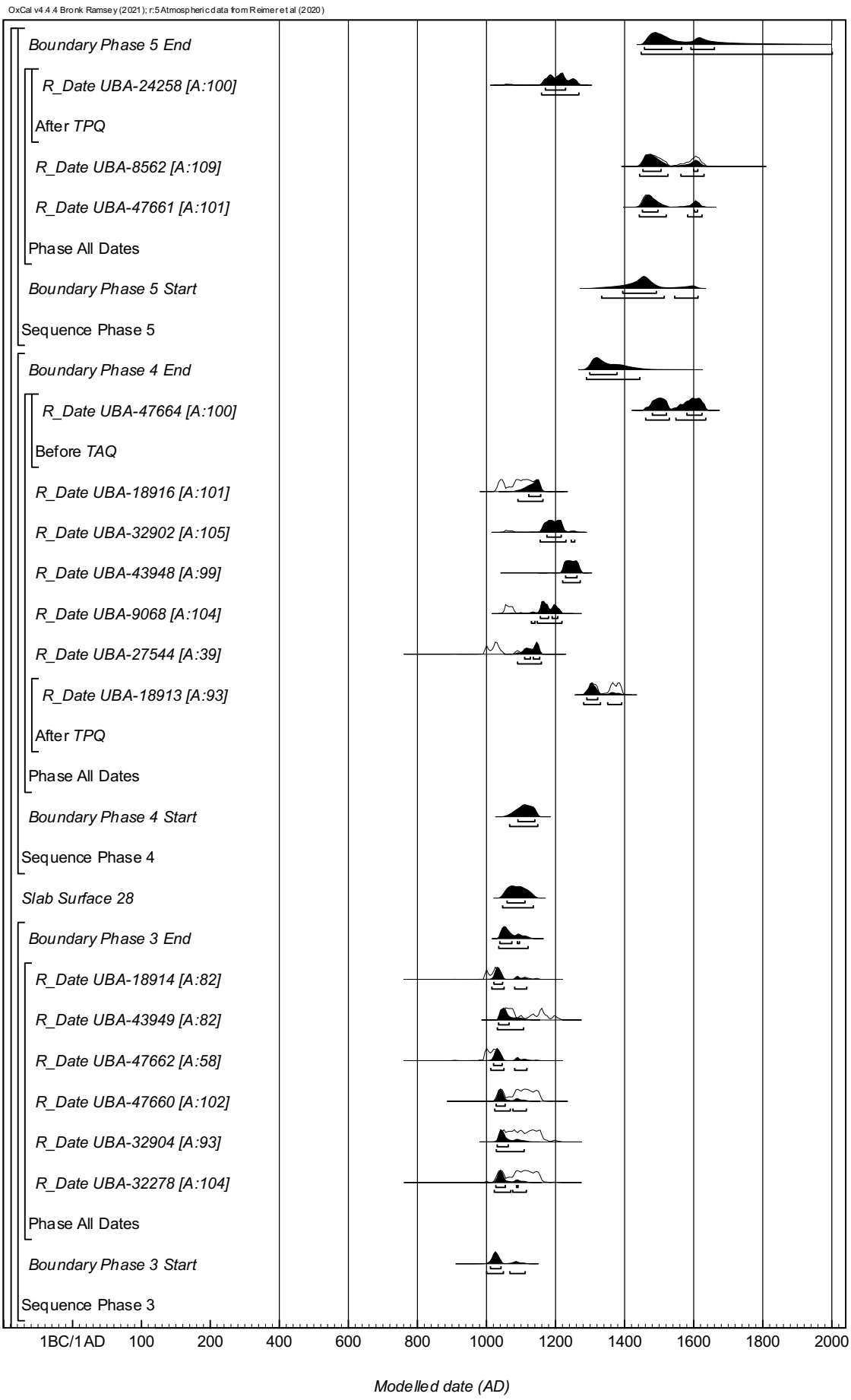


Figure A2.1: Harris matrix for the dated contexts at Caherconnell, outlining the structure of the Bayesian model, created by Ben Spillane.



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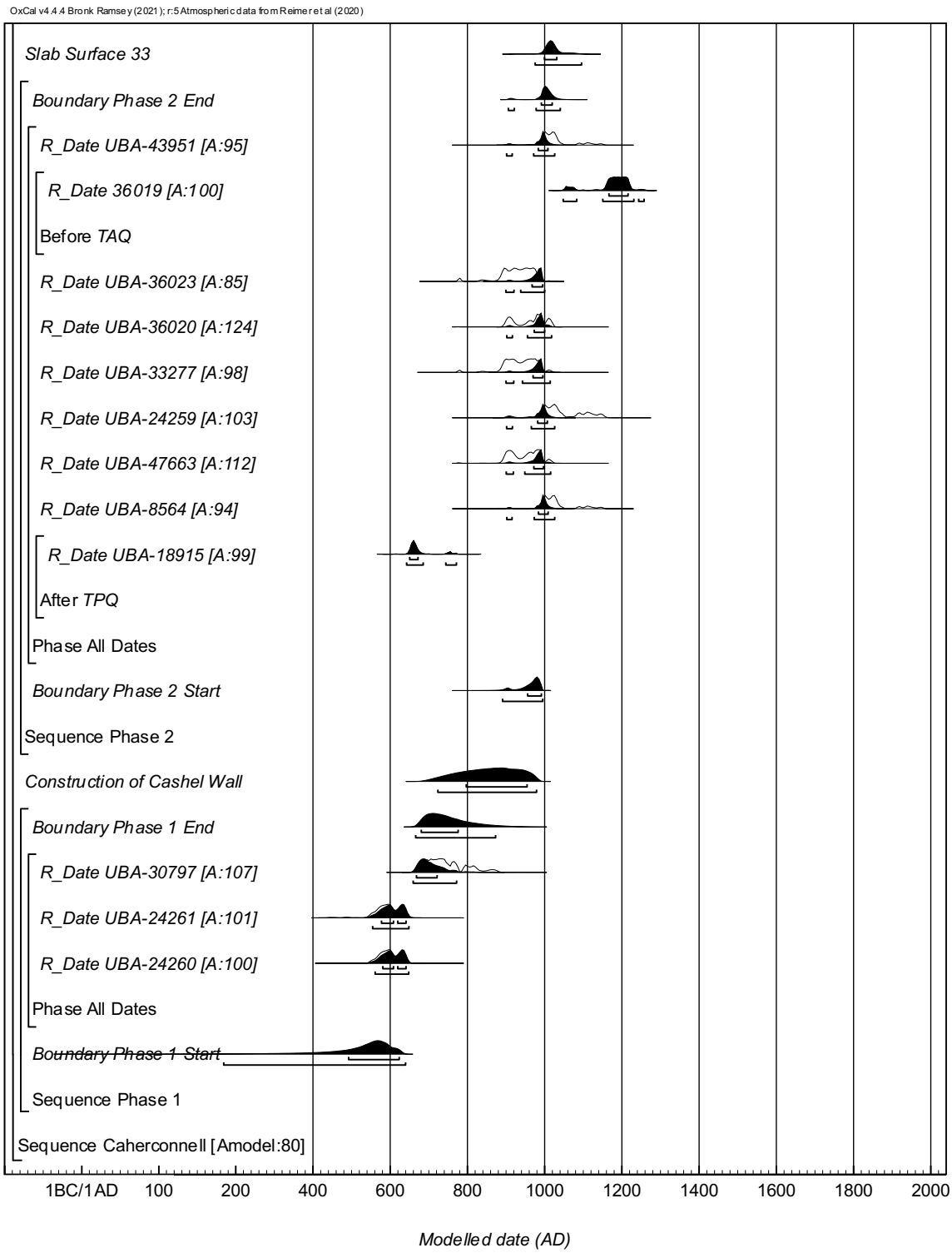

Figure A2.2: Chronological Model for Caherconnell. Each radiocarbon measurement has two distributions, one in outline, which is the result of simple calibration, and one in solid, which is based on the chronological modelling. The posterior distributions for specific events are shown in solid only, as they are produced from the model. Model created by Ben Spillane.

Table A2.4: Results of the Cremation Outlier Model for Berkeley 3, table constructed by Ben Spillane.

Event	***Posterior Density Estimate* (68.3% Probability)**	***Posterior Density Estimate* (95.4% Probability)**	**Span of Dated Activity (68% Probability)**	**Span of Dated Activity (95% Probability)**	**Interval between start and end (68.3% Probability)**	**Interval between start and end (95.4% Probability)**
Phase 1 Start	*cal AD 490–630*	*cal AD 170–650*	*68–148 years*	*33–202 years*	*85–287 years*	*39–627 years*
Phase 1 End	*cal AD 680–780*	*cal AD 660–880*	Ibid	Ibid	Ibid	Ibid
Cashel Construction	*cal AD 790–960*	*cal AD 720–980*	N/A	N/A	N/A	N/A
Phase 2 Start	*cal AD 950–1000*	*cal AD 890–1000*	*0–35 years*	*0–83 years*	*0–46 years*	*0–106 years*
Phase 2 End	*cal AD 990–1020*	*cal AD 900–1040*	*ibid*	*ibid*	*ibid*	*ibid*
Slab Surface 33	*cal AD 1000–1030*	*cal AD 960–1090*	N/A	N/A	N/A	N/A
Phase 3 Start	*cal AD 1010–1040*	*cal AD 990–1110*	*0–31 years*	*0–59 years*	*0–40 years*	*0–74 years*
Phase 3 End	*cal AD 1030–1070*	*cal AD 1030–1130*	*ibid*	*ibid*	*ibid*	*ibid*
Slab Surface 28	*cal AD 1050–1110*	*cal AD 1040–1140*	N/A	N/A	N/A	N/A
Phase 4: Start	*cal AD 1080–1140*	*cal AD 1060–1150*	*97–148 years*	*77–172 years*	*180–283 years*	*158–354 years*
Phase 4: End	*cal AD 1290–1380*	*cal AD 1280–1450*	*ibid*	*ibid*	*ibid*	*ibid*
Phase 5: Start	*cal AD 1390–1450*	*cal AD 1330–1620*	*0–29 years*	*0–148 years*	*0–180 years*	*0–665years*
Phase 5: End	*cal AD 1450–1670*	*cal AD 1440–2000*	*ibid*	*ibid*	*ibid*	*ibid*

Table A2.5: Summary of Bayesian Model phases and associated phases of activity at Caherconnell Cashel.

Bayesian Phases	*Caherconnell Phases*
Phase 1	Phase 1 and 2: Pre-Cashel Activity
Phase 2	Phase 3 and 4: Cashel Construction and Early Activity
Phase 3	Phase 5: Middle Occupation
Phase 4	Phase 6: Late Occupation
Phase 5	Phase 7: Final Occupation

Appendix - Chapter 5

Table A5.1: Breakdown of assemblage context by box number, sample number, excavation cutting, date and phase of activity

Box	Contexts	Samples	Cuttings	Date	Phase
1	36, 36*	311, 59, 96, 582, 400, 313, 597, 145, 467,	B, C, D, E, F, G, H	late 10th/early 11th	4
2	36	96, 60, 59, 56, 216, 61, 55,	B, C, D,	late 10th/early 11th	4
3	36, 36*, 102	682, 569, 466, 311, 597, 400, 295, 418, 319, 648	E, F, G, H, H1,	late 10th/early 11th	4
4	36	682, 144, 59, 466, 211	B, D, G, H1	late 10th/early 11th	4
5	148, 37, 181, 211, 152, 116, 224	420, 98, 519, 66, 65, 238, 610, 99, 426, 210, 338, 657, 429, 520	B, C, D, E, F, G, H	late 10th/early 11th	4
6	16	118, 52, 272, 217, 599	B, D, D1, E, H	late 10th/early 11th	5
7	16	272, 52, 118, 674, 391, 274, 199	B, D, E, F, H1	late 10th/early 11th	5
8	64, 35, 52, 66, 58, 57, 51, 60, 63, 110, 64, 58, 57, 104	155, 58, 94, 175, 134, 125, 93, 154, 153, 301, 159, 176, 135, 126, 292	B, C, D, E	late 10th/early 11th	5
9	16	52, 85, 47, 118, 233, 676, 122	B, C, D, D2, H1	late 10th/early 11th	5
10	25, 25H	360, 32, 194, 83, 222, 251, 49, 362, 589	B, C, D1, D2, E, F, H1	11th – 14th	6
11	16, 101, 187	52, 118, 273, 122, 391, 460, 275, 738, 274	B, D, E, F, G, I	late 10th/early 11th	5
12	25, 25/47	83, 49, 106, 90, 91	B, C, D	11th – 14th 47: disregard	6
13	25	32, 49, 252, 446	B, E, G	11th – 14th	6
14	16	118, 52, 272, 224, 198, 214, 122, 86	B, C, D, D1, D2, E	late 10th/early 11th	5
15	30, 32, 31, 25, 29, 28, 179, 26, 36*, 222	35, 40, 37, 83, 360, 34, 36, 252, 362, 522, 446, 437, 25, 33, 569, 649, 521	B,C, E, F, G, H	36*: late 10th/early 11th 11th – 14th	4 6
16	96, 23, 46, 127, 14, 129, 130	261, 31, 77, 103, 44, 215, 262, 351, 74, 11, 357, 355	A, B, C, D, D2, E, F	15th – 16th	7
17	36, 262, 148	399, 466, 763, 420	F, G, I	late 10th/early 11th	4
18	36, 262,	466, 722, 144, 763, 311	D, E, G, I	late 10th/early 11th	4
19	36	144, 399, 311, 466	D, E, F, G	late 10th/early 11th	4
20	262, 36	763, 399, 466, 311	E, F, G, I	late 10th/early 11th	4
21	25, 16, 36	826, 786, 854	K, J	36 & 16: late 10th/early 11th 25: 11-14th	4 & 5 6
22	290, 25, 36	819, 826, 854, 800	K, LA	36: late 10th/early 11th 11th – 14th	4 6
23	36, 16	787, 845	J, K	late 10th/early 11th	4 & 5
24	280, 16, 25, 272, 23, 290, 36	793, 810, 800, 791, 798, 808, 811, 821, 828, 846, 831, 55	J, K, LA	36, 272, 280, 16 : late 10th/early 11th 25, 290: 11th – 14th 23: 15th – 16th	4 & 5 6 7
25	16, 36	845, 787	J, K	late 10th/early 11th	4 & 5
26	36, 23	854, 824, 807	K, LA	36: late 10th/early 11th 15th – 16th	4 7
27	36, 36*, 257	722, 582, 756, 467	G, I	late 10th/early 11th	4

				257: 11th – 14th	6
28	25	360, 251	E, F	11th – 14th	6
29	25	251, 83, 445	C, E, G	11th – 14th	6
30	25, 25H	251, 590, 360, 445, 252	E, F, G, H	11th – 14th	6
31	36	722	I	late 10th/early 11th	4
32	102, 36, 36G, 36*	639, 311, 144, 682, 595, 466, 593, 597, 683, 467, 574	D, E, G, H, H1	late 10th/early 11th	4
33	36	722	I	late 10th/early 11th	4
34	36	722	I	late 10th/early 11th	4
35	36, 102	422, 295, 144	D, E, F	late 10th/early 11th	4
36	36	466, 595, 399, 144	D, F, G, H	late 10th/early 11th	4
37	224, 181, 37, 36	640, 519, 98, 755, 722	C, G, H, I	late 10th/early 11th	4
38	16, 64, 205, 98, 99, 164	118, 155, 600, 305, 294, 481	D, E, G, H	late 10th/early 11th	5
39	187, 102	719, 295	E, I	late 10th/early 11th	4 & 5
40	36	466, 595	G, H	late 10th/early 11th	4
41	186, 179, 25, 222, 190	543, 521, 706, 630, 564, 733, 707	G, H, I	11th – 14th	6
42	16	85, 118, 272, 390, 456, 198	C, D, E, F, G	late 10th/early 11th	5
43	187, 16, 141, 66, 108, 255, 259, 65, 187	549, 711, 408, 296, 719, 298, 741, 712, 744, 166, 555	D, E, F, G, I	late 10th/early 11th	5
44	36, 171, 241, 67, 73, 245, 165, 243	722, 497, 739, 693, 172, 180, 697, 483, 696	D, G, H1, I	late 10th/early 11th	4
45	16	674, 390	F, H1	late 10th/early 11th	5
46	36	722	I	late 10th/early 11th	4
47	16, 101	674, 273, 598, 620, 390, 272, 275	E, F, H, H1	late 10th/early 11th	5
48	16, 25, 125	456, 360, 83, 344, 252	C, E, F, G	16: late 10th/early 11th 11th – 14th	5 6
49	36	466, 722	G, I	late 10th/early 11th	4
50	35, 42, 46, 54, 58, 61, 63, 67, 86, 89, 108, 114, 36, 127, 132, 148, 179, 187, 190, 181, 194, 238, 237, 241, 257, 292, 300, 23, 125, 254	53, 70, 78, 95, 133, 146, 151, 171, 208, 229, 327, 322, 353, 367, 419, 524, 545, 561, 576, 577, 596, 629, 688, 692, 761, 762, 832, 843, 863, 704, XX, 250, 344, 248, 443, 357, 368, 726, 345	E, F, G, I, LA	86: 6th / 7th burial 42: 7th 36, 67, 181, 194, 237, 241, 300, 54, 58, 61, 63, 108, 114, 148, 187, 238: late 10th/early 11th 35, 89, 179, 190, 257, 292: 11th – 14th 23, 46, 125, 127, 132: 15th – 16th 254 : 15th – 16th or modern	1,2 4 & 5 6 7
51	36	722	I	late 10th/early 11th	4

Table A5.2: Total fragment count per box.

Box Number	Fragment Count	Box Number	Fragment Count
1	1047	**27**	1110
2	650	**28**	1074
3	825	**29**	1100
4	556	**30**	858
5	296	**31**	604
6	775	**32**	784
7	753	**33**	331
8	601	**34**	968
9	940	**35**	584
10	789	**36**	844
11	993	**37**	708
12	955	**38**	960
13	628	**39**	675
14	1122	**40**	659
15	824	**41**	907
16	679	**42**	1099
17	703	**43**	983
18	682	**44**	501
19	649	**45**	1022
20	743	**46**	688
21	593	**47**	1064
22	738	**48**	984
23	636	**49**	984
24	715	**50**	1253
25	491	**51**	1085
26	618	**Total: 40830**	

Table A5.3: Total bone count from Phase 4 assemblage, Caherconnell.

Phase 4: late 10th/early 11th century				
Context	**Bone**	**Mandibular Teeth**	**Maxillary Teeth**	**Total**
36	8088	3288	2838	14214
36*	283	109	81	473
36G	21	32	26	79
37	192	77	63	332
67	4	2	1	7
71	0	1	0	1
73	2	0	0	2
102	527	327	260	1114
116	1	3	1	5
148	58	20	23	101
152	2	0	0	2
165	4	0	1	5
170	0	1	0	1
171	5	5	4	14
176	0	1	0	1
181	209	123	113	445
194	1	0	0	1
211	1	0	0	1
224	94	48	34	176
237	2	0	0	2
241	2	0	0	2
243	1	1	0	2
245	3	2	2	7
262	340	70	57	467
272	3	4	7	14
280	82	14	11	107
299	0	2	0	2
300	2	3	0	5
Total	9927	4133	3522	**17582**

Table A5.4: Total bone count from Phase 5 assemblage, Caherconnell.

Phase 5: late 10th/early 11th century				
Context	**Bone**	**Mandibular Teeth**	**Maxillary Teeth**	**Total**
16	4777	2471	2033	9281
51	6	2	1	9
52	34	18	12	64
54	2	0	0	2
57	29	34	33	96
58	39	30	16	85
60	3	2	2	7
61	2	1	0	3
63	15	0	1	16
64	276	140	117	533
65	1	0	0	1
66	104	79	70	253
98	12	8	6	26
99	33	13	3	49
101	504	308	192	1004
103	0	1	0	1
104	1	0	0	1
108	23	3	0	26
110	3	1	0	4
114	1	0	1	2
141	58	21	15	94
164	5	4	1	10
178	0	1	0	1
187	231	158	107	496
205	10	2	3	15
238	1	0	0	1
255	11	3	5	19
259	2	0	2	4
Total	6183	3300	2620	**12103**

Table A5.5: Total bone count from Phase 6 assemblage, Caherconnell.

Phase 6: 11th–14th century				
Context	**Bone**	**Mandibular Teeth**	**Maxillary Teeth**	**Total**
25	3432	2062	1872	7366
25/47	48	9	6	63
25H	49	60	55	164
26	5	0	1	6
28	8	5	1	14
29	24	12	10	46
30	36	15	10	61
31	18	5	4	27
32	16	0	8	24
35	14	5	7	26
89	1	1	0	2
179	275	148	122	545
186	127	26	28	181
190	17	3	1	21
219	0	0	1	1
222	31	16	12	59
257	72	47	24	143
290	142	49	56	247
292	1	0	0	1
Total	4316	2463	2218	**8997**

Table A5.6: Total bone count from Phase 7 assemblage, Caherconnell.

Phase 7: 15th–16th century				
Context	**Bone**	**Mandibular Teeth**	**Maxillary Teeth**	**Total**
14	2	1	0	3
23	745	496	353	1594
46	7	3	4	14
96	36	26	36	98
125	206	80	41	327
127	29	10	3	42
129	1	0	0	1
130	6	1	0	7
132	22	10	7	39
254	5	10	8	23
Total	1059	637	452	**2148**

Table A5.7: Phase 4 (late 10th/early 11th century) cattle bone from Caherconnell: NISP, MNE, MNI, and Survival Rate Percentages.

Phase 4: Late 10th Century							
Element	*NISP*	*NISP%*	*AL*	*R*	*L*	*MNE*	*% survival*
Horncore	51	2.1	-	18	8	14	17.5
Cranium	108	4.5	2	52	48	39	48.8
Mandible	164	6.8	1	87	72	-	-
Atlas	13	0.5	13	-	-	10	12.5
Axis	29	1.2	29	-	-	-	-
Vertebrae	105	4.4	105	-	-	-	-
Scapula	149	6.2	-	81	67	64	80
Humerus	113	4.7	-	50	63	41	51.3
Radius	113	4.7	-	60	53	35	43.8
Ulna	86	3.6	-	46	40	34	42.5
Metacarpal	122	5.1	-	53	46	36	45
Pelvis	97	4	-	43	53	31	38.8
Femur	105	4.4	-	45	59	41	51.3
Patella	31	1.3	-	11	19	19	23.8
Tibia	116	4.8	-	54	62	41	51.3
Astragalus	161	6.7	-	83	78	80	100
Calcaneum	142	5.9	-	74	68	68	85
Carpal/Tarsal	41	1.7	-	-	-	-	-
Metatarsal	113	4.7	-	43	47	36	45
Metapodial	100	4.1	-	3	3	-	-
Phalanx 1	221	9.2	-	116	100	25	31.3
Phalanx 2	155	6.4	-	73	77	19	23.8
Phalanx 3	76	3.2	-	35	37	6	7.5
Total	2411		150	1027	1000	639	
							MNI = 80

Table A5.8: Phase 5 (late 10th/early 11th century) cattle bone from Caherconnell: NISP, MNE, MNI, and Survival Rate Percentages.

Phase 5: 10th – Early 11th Century							
Element	*NISP*	*NISP%*	*AL*	*R*	*L*	*MNE*	*% survival*
Horncore	45	3.3	-	17	14	16	37.2
Cranium	87	6.3	-	38	48	37	86
Mandible	120	8.7	-	60	59	-	-
Atlas	8	0.6	8	-	-	6	14
Axis	8	0.6	8	-	-	-	-
Vertebrae	25	1.8	25	-	-	-	-
Scapula	84	6.1	-	47	37	38	88.4
Humerus	72	5.2	-	32	40	29	67.4
Radius	49	3.5	-	32	17	18	41.9
Ulna	44	3.2	-	26	18	23	53.5
Metacarpal	74	5.3	-	28	33	22	51.2
Pelvis	69	5	-	28	39	23	53.5
Femur	41	3	-	17	24	18	41.9
Patella	15	1.1	-	6	8	8	18.6
Tibia	75	5.4	-	34	41	27	62.8
Astragalus	84	6.1	-	38	45	43	100
Calcaneum	72	5.2	-	32	40	39	90.7
Carpal/Tarsal	17	1.2	-	-	-	-	-
Metatarsal	60	4.3	-	25	26	15	34.9
Metapodial	44	3.2	-	-	-	-	-
Phalanx 1	133	9.6	-	57	76	17	39.5
Phalanx 2	114	8.2	-	57	57	14	32.6
Phalanx 3	44	3.2	-	19	25	5	11.6
Total	1384		41	593	647	398	
							MNI = 43

Table A5.9: Phase 6 (11th–14th century) cattle bone from Caherconnell: NISP, MNE, MNI, and Survival Rate Percentages.

Phase 6: 11th–14th Century							
Element	*NISP*	*NISP%*	*AL*	*R*	*L*	*MNE*	*% survival*
Horncore	21	1.6	-	11	7	10	16.9
Cranium	56	4.4	-	26	30	21	35.6
Mandible	109	8.5	-	63	46	-	-
Atlas	3	0.2	3	-	-	2	3.4
Axis	2	0.2	2	-	-	-	-
Vertebrae	16	1.3	16		-	-	-
Scapula	63	4.9	-	30	33	26	44.1
Humerus	54	4.2	-	26	28	22	37.3
Radius	58	4.5	-	24	34	24	40.7
Ulna	41	3.2	-	12	29	22	37.3
Metacarpal	70	5.5	-	25	32	16	27.1
Pelvis	66	5.2	-	37	29	27	45.8
Femur	44	3.5	-	21	22	16	27.1
Patella	14	1.1	-	8	6	8	13.6
Tibia	51	4	-	24	26	20	33.9
Astragalus	121	9.5	-	59	62	59	100
Calcaneum	88	6.9	-	42	46	43	72.9
Carpal/Tarsal	22	1.7	-	-	-	-	-
Metatarsal	50	3.9	-	18	23	16	27.1
Metapodial	51	4	-	-	-	-	-
Phalanx 1	113	8.9	-	60	53	13	22
Phalanx 2	108	8.5	-	51	57	14	23.7
Phalanx 3	54	4.2	-	25	29	5	8.5
Total	1275		21	562	592	364	
							MNI = 59

Table A5.10: Phase 7 (15th–16th century) cattle bone from Caherconnell: NISP, MNE, MNI, and Survival Rate Percentages.

Phase 7: 15th –16th Century							
Element	*NISP*	*NISP%*	*AL*	*R*	*L*	*MNE*	*% survival*
Horncore	5	2.2	-	1	3	3	33.3
Cranium	5	2.2	-	2	3	2	22.2
Mandible	11	4.8	-	3	8	-	-
Atlas	1	0.4	1	-	-	1	11.1
Axis	4	1.7	5	-	-	-	-
Vertebrae	6	2.6	6	-	-	-	-
Scapula	13	5.7	-	4	9	7	77.8
Humerus	15	6.6	-	10	5	8	88.9
Radius	14	6.1	-	7	7	4	44.4
Ulna	6	2.6	-	3	3	3	33.3
Metacarpal	11	4.8	-	4	4	3	33.3
Pelvis	8	3.5	-	4	4	3	33.3
Femur	5	2.2	-	3	2	2	22.2
Patella	2	0.9	-	0	2	2	22.2
Tibia	6	2.6	-	4	2	2	22.2
Astragalus	19	8.3	-	9	10	9	100
Calcaneum	16	7	-	8	8	7	77.8
Carpal/Tarsal	5	2.2	-	-	-	-	-
Metatarsal	10	4.4	-	3	6	3	33.3
Metapodial	17	7.4	-	-	-	-	-
Phalanx 1	20	8.7	-	10	10	3	33.3
Phalanx 2	22	9.6	-	5	17	4	44.4
Phalanx 3	8	3.5	-	5	3	1	11.1
Total	229		6	85	106	67	
							MNI: 9

Table A5.11: Phase 4 (late 10th/early 11th century) sheep bones from Caherconnell: NISP, MNE, MNI, and Survival Rate Percentages.

Phase 4: Late 10th Century							
Element	NISP	NISP%	AL	R	L	MNE	% survival
Horncore	16	1	-	2	7	7	12.7
Cranium	41	2.7	5	19	12	15	27.3
Mandible	112	7.3	-	55	57	-	-
Atlas	10	0.6	10	-	-	8	14.5
Axis	8	0.5	8	-	-	-	-
Vertebrae	48	3.1	48	-	-	-	-
Scapula	124	8.1	-	63	61	53	96.4
Humerus	123	8	-	58	65	55	100
Radius	113	7.3	-	65	49	40	72.7
Ulna	52	3.4	-	22	29	26	47.3
Metacarpal	54	3.5	-	25	21	20	36.4
Pelvis	74	4.8	-	40	33	30	54.5
Femur	87	5.6	-	47	39	31	56.4
Patella	17	1.1	-	6	11	11	20
Tibia	109	7.1	-	52	57	45	81.8
Astragalus	82	5.3	-	41	41	39	70.9
Calcaneum	38	2.5	-	21	15	18	32.7
Carpal/Tarsal	4	0.3	-	-	-	-	-
Metatarsal	40	2.6	-	18	15	17	30.9
Metapodial	86	5.6	-	-	-	-	-
Phalanx 1	151	9.8	-	59	83	17	30.9
Phalanx 2	116	7.5	-	49	63	15	27.3
Phalanx 3	35	2.3	-	17	18	4	7.3
Total	1540		71	659	676	451	
							MNI: 55

Table A5.12: Phase 5 (late 10th/early 11th century) sheep bone from Caherconnell: NISP, MNE, MNI, and Survival Rate Percentages.

Phase 5: 10th–Early 11th Century							
Element	*NISP*	*NISP%*	*AL*	*R*	*L*	*MNE*	*% survival*
Horncore	11	1.2	-	3	5	5	13.2
Cranium	16	1.7	-	7	9	6	30
Mandible	86	9.2	-	42	43	-	-
Atlas	0	-	-	-	-	-	-
Axis	5	0.5	5	-	-	-	-
Vertebrae	14	1.5	14	-	-	-	-
Scapula	69	7.4	-	36	33	31	81.6
Humerus	90	9.7	-	42	48	38	100
Radius	56	6	-	28	27	20	52.6
Ulna	28	3	-	10	18	15	39.5
Metacarpal	30	3.2	-	13	13	12	31.6
Pelvis	37	4	-	22	15	15	39.5
Femur	44	4.7	-	17	27	17	44.7
Patella	10	1.1	-	2	7	7	18.4
Tibia	65	7	-	36	29	31	81.6
Astragalus	56	6	-	28	28	28	73.7
Calcaneum	26	2.8	-	12	11	11	28.9
Carpal/Tarsal	-	-	-	-	-	-	-
Metatarsal	27	2.9	-	7	17	13	34.2
Metapodial	56	6	-	-	-	-	-
Phalanx 1	102	10.9	-	48	55	12	31.6
Phalanx 2	72	7.7	-	32	40	9	23.7
Phalanx 3	32	3.4	-	15	17	4	10.5
Total	932		19	400	442	274	
							MNI = 38

Table A5.13: Phase 6 (11th –14th century) sheep bone from Caherconnell: NISP, MNE, MNI, and Survival Rate Percentages.

Phase 6: 11th– 14th Century							
Element	*NISP*	*NISP%*	*AL*	*R*	*L*	*MNE*	*% survival*
Horncore	5	0.8	-	-	2	2	6.7
Cranium	4	0.6	-	1	3	2	6.7
Mandible	53	8.6	-	35	17	-	-
Atlas	5	0.8	5	-	-	5	16.7
Axis	5	0.8	5	-	-	-	-
Vertebrae	13	2.1	13	-	-	-	-
Scapula	50	8.1	-	23	27	21	70
Humerus	58	9.4	-	33	25	30	100
Radius	42	6.8	-	22	20	15	50
Ulna	17	2.8	-	9	8	8	26.7
Metacarpal	21	3.4	-	8	11	9	30
Pelvis	34	5.5	-	14	20	16	53.3
Femur	25	4.1	-	7	18	15	50
Patella	9	1.5	-	4	4	4	13.3
Tibia	51	8.3	-	29	22	21	70
Astragalus	38	6.2	-	22	16	22	73.3
Calcaneum	19	3.1	-	7	8	7	23.3
Carpal/Tarsal	-	-	-	-	-	-	-
Metatarsal	19	3.1	-	12	5	12	40
Metapodial	39	6.3	-	-	-	-	-
Phalanx 1	52	8.4	-	21	31	7	23.3
Phalanx 2	46	7.5	-	23	23	6	20
Phalanx 3	12	1.9	-	5	8	6	20
Total	617		23	275	268	208	
							MNI = 30

Table A5.14: Phase 7 (15th – 16th century) sheep bone from Caherconnell: NISP, MNE, MNI, and Survival Rate Percentages.

Phase 7: 15th – 16th Century							
Element	*NISP*	*NISP%*	*AL*	*R*	*L*	*MNE*	*% survival*
Horncore	6	2.5	-	1	2	2	22.2
Cranium	5	2.1	-	2	6	2	22.2
Mandible	24	9.9	-	15	9	-	-
Atlas	-	-	-	-	-	-	-
Axis	4	1.6	4	-	-	-	-
Vertebrae	17	7	17	-	-	-	-
Scapula	16	6.6	-	8	8	6	66.7
Humerus	17	7	-	9	8	9	100
Radius	16	6.6	-	6	10	6	66.7
Ulna	5	2.1	-	3	2	3	33.3
Metacarpal	8	3.3	-	1	5	3	33.3
Pelvis	9	3.7	-	2	7	4	44.4
Femur	6	2.5	-	3	3	3	33.3
Patella	1	0.4	-	-	1	1	11.1
Tibia	12	4.9	-	6	6	5	55.6
Astragalus	8	3.3	-	4	4	4	44.4
Calcaneum	8	3.3	-	4	3	4	44.4
Carpal/Tarsal	3	1.2	-	-	-	-	-
Metatarsal	6	2.5	-	3	-	3	33.3
Metapodial	22	9.1	-	-	-	-	-
Phalanx 1	17	7	-	5	12	3	33.3
Phalanx 2	21	8.6	-	11	10	3	33.3
Phalanx 3	12	4.9	-	8	4	2	22.2
Total	243		21	91	100	63	
							MNI: 9

Table A5.15: Phase 4 (late 10th/early 11th century) pig bone from Caherconnell: NISP, MNE, MNI, and Survival Rate Percentages.

Phase 4: Late 10th Century							
Element	*NISP*	*NISP%*	*AL*	*R*	*L*	*MNE*	*% survival*
Cranium	22	1.5	1	9	12	9	20
Mandible	34	2.4	1	20	13	-	-
Atlas	15	1	15	-	-	9	20
Axis	4	0.3	4	-	-	-	-
Vertebrae	39	2.7	39	-	-	-	-
Scapula	92	6.4	-	54	38	45	100
Humerus	43	3	-	18	24	15	33.3
Radius	55	3.8	-	24	30	20	44.4
Ulna	77	5.4	-	36	40	35	77.8
Metacarpal	85	5.9	-	36	45	15	33.3
Pelvis	38	2.7	-	13	25	23	51.1
Femur	15	1	-	5	10	8	17.8
Patella	14	1	-	6	5	5	11.1
Tibia	28	2	-	15	13	10	22.2
Fibula	27	1.9	-	11	12	10	22.2
Astragalus	47	3.3	-	23	24	24	53.3
Calcaneum	84	5.9	-	46	38	42	93.3
Metatarsal	63	4.4	-	27	35	11	24.4
Metapodial	106	7.4	-	-	-	-	-
Phalanx 1	190	13.3	-	84	95	11	24.4
Phalanx 2	204	14.3	-	92	107	13	28.9
Phalanx 3	149	10.4		70	75	7	15.6
Total	1431		60	589	641	312	
							MNI = 45

Table A5.16: Phase 5 (late 10th/early 11th century) pig bone from Caherconnell: NISP, MNE, MNI, and Survival Rate Percentages.

Phase 5: 10th – Early 11th Century							
Element	*NISP*	*NISP%*	*AL*	*R*	*L*	*MNE*	*% survival*
Cranium	24	2.7	2	15	7	10	30.3
Mandible	21	2.3	2	9	10	-	-
Atlas	7	0.8	7	-	-	6	18.2
Axis	2	0.2	2	-	-	-	-
Vertebrae	17	1.9	17	-	-	-	-
Scapula	66	7.4	-	34	32	33	100
Humerus	38	4.2	-	20	18	18	54.5
Radius	34	3.8	-	18	16	11	33.3
Ulna	50	5.6	-	16	32	30	90.9
Metacarpal	57	6.4	-	25	32	12	36.4
Pelvis	23	2.6	-	9	14	13	39.4
Femur	3	0.3	-	1	2	1	3
Patella	9	1	-	7	2	7	21.2
Tibia	18	2	-	9	9	7	21.2
Fibula	18	2	-	6	8	8	24.2
Astragalus	25	2.8	-	6	19	18	54.5
Calcaneum	38	4.2	-	12	26	25	75.8
Metatarsal	45	5	-	25	18	10	30.3
Metapodial	56	6.3	-	-	-	-	-
Phalanx 1	138	15.4	-	66	72	8	24.2
Phalanx 2	125	14	-	63	62	8	24.2
Phalanx 3	81	9.1	-	41	40	4	12.1
Total	895		30	382	419	229	
							MNI = 33

Table A5.17: Phase 6 (11th–14th century) pig bone from Caherconnell: NISP, MNE, MNI, and Survival Rate Percentages.

Phase 6: 11th – 14th Century							
Element	*NISP*	*NISP%*	*AL*	*R*	*L*	*MNE*	*% survival*
Cranium	11	1.8	-	11	-	7	29
Mandible	14	2.3	1	5	8	-	-
Atlas	5	0.8	5	-	-	4	17
Axis	1	0.2	1	-	-	1	4
Vertebrae	7	1.1	7	-	-	-	-
Scapula	52	8.4	-	28	24	24	100
Humerus	19	3.1	-	8	11	8	33
Radius	34	5.5	-	20	14	17	71
Ulna	47	7.6	-	20	27	24	100
Metacarpal	30	4.8	-	12	18	10	42
Pelvis	26	4.2	-	13	13	13	54
Femur	6	1	-	3	3	3	13
Patella	8	1.3	-	4	3	3	13
Tibia	19	3.1	-	10	9	7	29
Fibula	6	1	-	2	4	3	13
Astragalus	27	4.4	-	20	7	20	83
Calcaneum	40	6.5	-	18	22	21	88
Metatarsal	28	4.5	-	12	16	5	21
Metapodial	40	6.5	-	-	1	-	-
Phalanx 1	79	12.8	-	38	41	5	21
Phalanx 2	73	11.8	-	34	39	5	21
Phalanx 3	47	7.6	-	25	22	3	13
Total	619		14	283	282	183	
							MNI = 24

Table A5.18: Phase 7 (15th–16th century) pig bone from Caherconnell: NISP, MNE, MNI, and Survival Rate Percentages.

Phase 7: 15th – 16th Century							
Element	*NISP*	*NISP%*	*AL*	*R*	*L*	*MNI*	*% survival*
Cranium	-	-	-	-	-	-	-
Mandible	3	2.7	-	-	-	1	14
Atlas	1	0.9	1	-	-	1	14
Axis	-	-	-	-	-	-	-
Vertebrae	3	2.7	3	-	-	-	-
Scapula	4	3.6	-	3	1	3	43
Humerus	8	7.2	-	5	3	5	71
Radius	6	5.4	-	3	3	2	29
Ulna	4	3.6	-	2	2	2	29
Metacarpal	2	1.8	-	2	0	1	14
Pelvis	2	1.8	-	1	1	1	14
Femur	5	4.5	-	2	3	2	29
Patella	1	0.9	-	1	0	1	14
Tibia	2	1.8	-	2	0	1	14
Fibula	1	0.9	-	0	1	1	14
Astragalus	4	3.6	-	1	3	3	43
Calcaneum	9	8.1	-	7	2	7	100
Metatarsal	2	1.8	-	0	2	1	14
Metapodial	4	3.6	-	-	-	-	-
Phalanx 1	23	20.7	-	9	14	2	29
Phalanx 2	14	12.6	-	7	7	1	14
Phalanx 3	13	11.7	-	4	8	1	14
Total	111		4	49	50	35	
							MNI = 7

Table A5.19: Phase 4 horse bone from Caherconnell: NISP, MNE, MNI, and Survival Rate Percentages.

Phase 4: Late 10th – early 11th Century							
Element	*NISP*	*NISP%*	*AL*	*R*	*L*	*MNE*	*% survival*
Cranium	1	1.8	1	-	-	1	33
Mandible	1	1.8	-	-	1	1	33
Atlas	0	0	-	-	-	-	-
Axis	1	1.8	1	-	-	1	33
Vertebrae	2	3.5	2	-	-	2	67
Scapula	1	1.8	-	1	-	1	33
Humerus	0	0	-	-	-	-	-
Radius	2	3.5	-	1	1	1	33
Ulna	1	1.8	-	-	1	1	33
Metacarpal	6	10.5	-	3	3	3	100
Pelvis	1	1.8	-	-	1	1	33
Femur	0	0	-	-	-	-	-
Patella	0	0	-	-	-	-	-
Tibia	4	7	-	2	2	2	67
Fibula	1	1.8	-	-	1	1	33
Astragalus	3	5.3	-	-	3	3	100
Calcaneum	4	7	-	2	2	2	67
Cuneiform Magnum	2	3.5	-	1	1	1	33
Sesamoid	1	1.8	-	-	-	1	33
Metatarsal	6	10.5	-	1	3	3	100
Metapodial	4	7	-	-	-	-	-
Phalanx 1	7	12.3	-	1	6	3	100
Phalanx 2	5	8.8	-	1	2	1	33
Phalanx 3	4	7	-	-	3	2	67
Phalanx	0	0	-	-	-	-	-
TOTAL	57		25	13	26	26	
							MNI = 3

Table A5.20: Phase 5 horse bone from Caherconnell: NISP, MNE, MNI, and Survival Rate Percentages.

Phase 5: Late 10th– early 11th Century							
Element	NISP	NISP%	AL	R	L	MNE	% survival
Cranium	-	-	-	-	-	-	-
Mandible	-	-	-	-	-	-	-
Atlas	-	-	-	-	-	-	-
Axis	1	3.3	1	-	-	1	20
Vertebrae	1	3.3	1	-	-	1	20
Scapula	1	3.3	-	-	1	1	20
Humerus	-	-	-	-	-	-	-
Radius	1	3.3	-	-	1	1	20
Ulna	-	-	-	-	-	-	-
Metacarpal	-	-	-	-	-	-	-
Pelvis	-	-	-	-	-	-	-
Femur	1	3.3	-	1	-	1	20
Patella	1	3.3	-	-	1	1	20
Tibia	1	3.3	-	-	1	1	20
Fibula	-	-	-	-	-	-	-
Astragalus	7	23.3	-	5	2	5	100
Calcaneum	3	10	-	2	1	2	40
Cuneiform Magnum	-	-	-	-	-	-	-
Sesamoid	1	3.3	-	-	-	1	20
Metatarsal	3	10	-	1	2	2	40
Metapodial	2	6.7	-	-	-	-	-
Phalanx 1	2	6.7	-	1	1	1	20
Phalanx 2	2	6.7	-	1	1	1	20
Phalanx 3	3	10	-	1	2	1	20
Phalanx	-	-	-	-	-	-	-
TOTAL	30		2	12	13		
							MNI = 5

Table A5.21: Phase 6 horse bone from Caherconnell: NISP, MNE, MNI, and Survival Rate Percentages.

Phase 6: 11th–14th Century							
Element	NISP	NISP%	AL	R	L	MNE	% survival
Cranium	-	-	-	-	-	-	-
Mandible	-	-	-	-	-	-	-
Atlas	-	-	-	-	-	-	-
Axis	-	-	-	-	-	-	-
Vertebrae	-	-	-	-	-	-	-
Scapula	2	7.1	-	1	1	1	25
Humerus	-	-	-	-	-	-	-
Radius	1	3.6	-	1	-	1	25
Ulna	1	3.6	-	1	-	1	25
Metacarpal	6	21.4	-	2	1	2	50
Pelvis	-	-	-	-	-	-	-
Femur	1	4	-	1	-	1	25
Patella	-	-	-	-	-	-	-
Tibia	2	7	-	1	1	1	25
Fibula	-	-	-	-	-	-	-
Astragalus	4	14.3	-	4	-	4	100
Calcaneum	3	11	-	1	2	2	50
Cuneiform Magnum	-	-	-	-	-	-	-
Sesamoid	-	-	-	-	-	-	-
Metatarsal	1	3.6	-	1	-	1	25
Metapodial	1	4	-	-	-	-	-
Phalanx 1	3	10.7	-	-	3	2	50
Phalanx 2	3	10.7	-	1	2	1	25
Phalanx 3	-	-	-	-	-	-	-
Phalanx	-	-	-	-	-	-	-
TOTAL	28		-	14	10	18	
							MNI = 4

Table A5.22: Phase 7 horse bone from Caherconnell: NISP, MNE, MNI, and Survival Rate Percentages.

Phase 7: 15th–16th Century							
Element	NISP	NISP%	AL	R	L	MNE	% survival
Cranium	-	-	-	-	-	-	-
Mandible	-	-	-	-	-	-	-
Atlas	-	-	-	-	-	-	-
Axis	-	-	-	-	-	-	-
Vertebrae	2	11.8	2	-	-	2	100
Scapula	-	-	-	-	-	-	-
Humerus	-	-	-	-	-	-	-
Radius	-	-	-	-	-	-	-
Ulna	-	-	-	-	-	-	-
Metacarpal	-	-	-	-	-	-	-
Pelvis	-	-	-	-	-	-	-
Femur	8	47	-	6	2	2	100
Patella	-	-	-	-	-	-	-
Tibia	1	6	-	1	-	1	50
Fibula	-	-	-	-	-	-	-
Astragalus	2	11.8	-	2	-	2	100
Calcaneum	1	6	-	1	-	1	50
Cuneiform Magnum	-	-	-	-	-	-	-
Sesamoid	-	-	-	-	-	-	-
Metatarsal	-	-	-	-	-	-	-
Metapodial	1	5.9	-	-	-	-	-
Phalanx 1	1	5.9	-	-	1	1	50
Phalanx 2	1	5.9	-	-	1	1	50
Phalanx 3	-	-	-	-	-	-	-
Phalanx	-	-	-	-	-	-	-
TOTAL	17		2	10	4	10	
							MNI = 2

Table A5.23: Phase 4 dog bone from Caherconnell: NISP, MNE, MNI, and Survival Rate Percentages.

Phase 4: Late 10th/early 11th Century							
Element	NISP	NISP%	AL	R	L	MNE	% survival
Cranium	-	-	-	-	-	-	-
Mandible	2	4.9	-	1	1	-	-
Atlas	-	-	-	-	-	-	-
Axis	-	-	-	-	-	-	-
Vertebrae	2	4.9	2	-	-	1	50
Scapula	-	-	-	-	-	-	-
Humerus	2	4.9	-	-	2	2	100
Radius	1	2.4	-	-	-	-	-
Ulna	-	-	-	-	-	-	-
Metacarpal	2	4.9	-	-	2	1	50
Pelvis	2	4.9	-	2	-	2	100
Femur	2	4.9	-	-	2	2	100
Patella	-	-	-	-	-	-	-
Tibia	1	2.4	-	1	-	1	50
Fibula	-	-	-	-	-	-	-
Astragalus	-	-	-	-	-	2	-
Calcaneum	4	9.8	-	2	2	1	100
Metatarsal	2	4.9	-	-	2	1	50
Metapodial	4	9.8	-	-	-	-	-
Phalanx 1	12	29.3	-	3	5	1	50
Phalanx 2	3	7.3	-	2	-	1	50
Phalanx 3	1	2.4	-	1	-	1	50
Phalanx	1	2.4	-	-	-	-	-
TOTAL	41		2	12	16	14	
							MNI = 2

Table A5.24: Phase 5 dog bone from Caherconnell: NISP, MNE, MNI, and Survival Rate Percentages.

Phase 5: Late 10th/Early 11th Century							
Element	NISP	NISP%	AL	R	L	MNE	% survival
Cranium	-	-	-	-	-	-	-
Mandible	1	3.8	-	-	1	-	-
Atlas	-	-	-	-	-	-	-
Axis	1	3.8	1	-	-	-	-
Vertebrae	2	7.7	2	-	-	1	33.3
Scapula	1	3.8	-	1	-	1	33.3
Humerus	-	-	-	-	-	-	-
Radius	-	-	-	-	-	-	-
Ulna	1	3.8	-	-	1	1	33.3
Metacarpal	1	3.8	-	-	1	1	33.3
Pelvis	-	-	-	-	-	-	-
Femur	3	11.5	-	1	2	2	66.7
Patella	-	-	-	-	-	-	-
Tibia	3	11.5	-	3	-	3	100
Fibula	-	-	-	-	-	-	-
Astragalus	-	-	-	-	-	-	-
Calcaneum	1	3.8	-	1	-	1	33.3
Metatarsal	5	19.2	-	2	3	2	66.7
Metapodial	-	-	-	-	-	-	-
Phalanx 1	5	19.2	-	4	-	1	33.3
Phalanx 2	1	3.8	-	-	1	1	33.3
Phalanx 3	1	3.8	-	-	1	1	33.3
Phalanx	-	-	-	-	-	-	-
TOTAL	26		3	8	9	9	
							MNI = 3

Table A5.25: Phase 6 dog bone from Caherconnell: NISP, MNE, MNI, and Survival Rate Percentages.

Phase 6: 11th–14th Century							
Element	NISP	NISP%	AL	R	L	MNE	% survival
Cranium	-	-	-	-	-	-	-
Mandible	1	9.1	-	1	-	-	-
Atlas	-	-	-	-	-	-	-
Axis	-	-	-	-	-	-	-
Vertebrae	-	-	-	-	-	-	-
Scapula	-	-	-	-	-	-	-
Humerus	-	-	-	-	-	-	-
Radius	-	-	-	-	-	-	-
Ulna	1	9.1	-	-	1	1	100
Metacarpal	-	-	-	-	-	-	-
Pelvis	1	9.1	-	-	1	1	100
Femur	2	18.2	-	-	2	1	100
Patella	-	-	-	-	-	-	-
Tibia	-	-	-	-	-	-	-
Fibula	-	-	-	-	-	-	-
Astragalus	-	-	-	-	-	-	-
Calcaneum	-	-	-	-	-	-	-
Cuneiform Magnum	-	-	-	-	-	-	-
Sesamoid	-	-	-	-	-	-	-
Metatarsal	-	-	-	-	-	-	-
Metapodial	1	9.1	-	-	-	-	-
Phalanx 1	4	36.4	-	1	1	1	100
Phalanx 2	1	9.1	-	1	-	1	100
Phalanx 3	-	-	-	-	-	-	-
Phalanx	-	-	-	-	-	-	-
TOTAL	11		-	3	5	5	
							MNI = 1

Table A5.26: Phase 7 dog bone from Caherconnell: NISP, MNE, MNI, and Survival Rate Percentages.

Phase 7: 15th–16th Century							
Element	NISP	NISP%	AL	R	L	MNE	% survival
Cranium	-	-	-	-	-	-	-
Mandible	-	-	-	-	-	-	-
Atlas	-	-	-	-	-	-	-
Axis	1	100	1	-	-	1	100
Vertebrae	-	-	-	-	-	-	-
Scapula	-	-	-	-	-	-	-
Humerus	-	-	-	-	-	-	-
Radius	-	-	-	-	-	-	-
Ulna	-	-	-	-	-	-	-
Metacarpal	-	-	-	-	-	-	-
Pelvis	-	-	-	-	-	-	-
Femur	-	-	-	-	-	-	-
Patella	-	-	-	-	-	-	-
Tibia	-	-	-	-	-	-	-
Fibula	-	-	-	-	-	-	-
Astragalus	-	-	-	-	-	-	-
Calcaneum	-	-	-	-	-	-	-
Cuneiform Magnum	-	-	-	-	-	-	-
Sesamoid	-	-	-	-	-	-	-
Metatarsal	-	-	-	-	-	-	-
Metapodial	-	-	-	-	-	-	-
Phalanx 1	-	-	-	-	-	-	-
Phalanx 2	-	-	-	-	-	-	-
Phalanx 3	-	-	-	-	-	-	-
Phalanx	-	-	-	-	-	-	-
TOTAL	1		1	-	-	1	
							MNI = 1

Table A5.27: Phase 4 cat bones from Caherconnell: NISP, MNE, MNI, and Survival Rate Percentages.

Phase 4: Late 10th – early 11th Century							
Element	NISP	NISP%	AL	R	L	MNE	% survival
Cranium	-	-	-	-	-	-	-
Mandible	-	-	-	-	-	-	-
Atlas	-	-	-	-	-	-	-
Axis	-	-	-	-	-	-	-
Vertebrae	6	12.2	6	-	-	1	20
Scapula	-	-	-	-	-	-	-
Humerus	1	2	-	-	1	1	20
Radius	6	12.2	-	4	2	4	80
Ulna	2	4.1	-	2	-	2	40
Metacarpal	5	10.2	-	3	2	2	40
Pelvis	3	6.1	-	2	1	1	20
Femur	3	6	-	1	2	2	40
Patella	-	-	-	-	-	-	-
Tibia	9	18	-	4	5	5	100
Fibula	-	-	-	-	-	-	-
Astragalus	3	6.1	-	1	2	2	40
Calcaneum	4	8	-	2	2	2	40
Metatarsal	5	10.2	-	4	1	2	40
Metapodial	1	2	-	-	-	-	-
Phalanx 1	1	2	-	-	1	1	20
Phalanx 2	-	-	-	-	-	-	-
Phalanx 3	-	-	-	-	-	-	-
Phalanx	-	-	-	-	-	-	-
TOTAL	49		6	23	19		
							MNI = 5

Table A5.28: Phase 5 cat bones from Caherconnell: NISP, MNE, MNI, and Survival Rate Percentages.

Phase 5: Late 10th – early 11th Century							
Element	NISP	NISP%	AL	R	L	MNE	% survival
Cranium	1	1.9	-	-	1	1	33
Mandible	1	1.9	-	1	-	1	33
Atlas	2	3.8	2	-	-	2	67
Axis	2	3.8	2	-	-	2	67
Vertebrae	8	15.1	8	-	-	1	33
Scapula	1	1.9	-	-	1	1	33
Humerus	3	5.7	-	-	3	3	100
Radius	2	3.8	-	2	-	2	67
Ulna	5	9.4	-	2	3	3	100
Metacarpal	4	7.5	-	2	2	1	33
Pelvis	3	5.7	-	2	1	2	67
Femur	5	9.4	-	3	2	2	67
Patella	-	-	-	-	-	-	-
Tibia	3	5.7	-	2	1	2	67
Fibula	-	-	-	-	-	-	-
Astragalus	2	3.8	-	1	1	1	33
Calcaneum	3	5.7	-	2	1	2	67
Metatarsal	7	13.2	-	4	2	2	67
Metapodial	1	1.9	-	-	-	-	-
Phalanx 1	-	-	-	-	-	-	-
Phalanx 2	-	-	-	-	-	-	-
Phalanx 3	-	-	-	-	-	-	-
Phalanx	-	-	-	-	-	-	-
TOTAL	53		12	21	18		
							MNI = 3

Table A5.29: Phase 6 cat bone from Caherconnell: NISP, MNE, MNI, and Survival Rate Percentages.

Phase 6: 11th–14th Century							
Element	NISP	NISP%	AL	R	L	MNE	% survival
Cranium	-	-	-	-	-	-	-
Mandible	1	4.8	-	1	-	1	100
Atlas	1	4.8	1	-	-	1	100
Axis	-	-	-	-	-	-	-
Vertebrae	12	57.1	12	-	-	1	100
Scapula	-	-	-	-	-	-	-
Humerus	1	4.8	-	1	-	1	100
Radius	-	-	-	-	-	-	-
Ulna	2	9.5	-	1	1	1	100
Metacarpal	-	-	-	-	-	-	-
Pelvis	1	4.8	-	1	-	1	100
Femur	1	4.8	-	-	1	1	100
Patella	-	-	-	-	-	-	-
Tibia	1	4.8	-	1	-	1	100
Fibula	-	-	-	-	-	-	-
Astragalus	1	4.8	-	1	-	1	100
Calcaneum	-	-	-	-	-	-	-
Metatarsal	-	-	-	-	-	-	-
Metapodial	-	-	-	-	-	-	-
Phalanx 1	-	-	-	-	-	-	-
Phalanx 2	-	-	-	-	-	-	-
Phalanx 3	-	-	-	-	-	-	-
Phalanx	-	-	-	-	-	-	-
TOTAL	21		13	6	2		
							MNI = 1

Table A5.30: Phase 7 cat bone from Caherconnell: NISP, MNE, MNI, and Survival Rate Percentages.

Phase 7: 15th–16th Century							
Element	NISP	NISP%	AL	R	L	MNE	% survival
Cranium	-	-	-	-	-	-	-
Mandible	-	-	-	-	-	-	-
Atlas	-	-	-	-	-	-	-
Axis	-	-	-	-	-	-	-
Vertebrae	-	-	-	-	-	-	-
Scapula	-	-	-	-	-	-	-
Humerus	-	-	-	-	-	-	-
Radius	-	-	-	-	-	-	-
Ulna	-	-	-	-	-	-	-
Metacarpal	4	100	-	4	-	1	100
Pelvis	-	-	-	-	-	-	-
Femur	-	-	-	-	-	-	-
Patella	-	-	-	-	-	-	-
Tibia	-	-	-	-	-	-	-
Fibula	-	-	-	-	-	-	-
Astragalus	-	-	-	-	-	-	-
Calcaneum	-	-	-	-	-	-	-
Metatarsal	-	-	-	-	-	-	-
Metapodial	-	-	-	-	-	-	-
Phalanx 1	-	-	-	-	-	-	-
Phalanx 2	-	-	-	-	-	-	-
Phalanx 3	-	-	-	-	-	-	-
Phalanx	-	-	-	-	-	-	-
TOTAL	4		-	4	-		
							MNI = 1

Table A5.31: Total MNI counts for the domestic and wild species from all phases of activity at Caherconnell.

Species	Phase 4		Phase 5		Phase 6		Phase 7	
	MNI	%	MNI	%	MNI	%	MNI	%
Cattle	80	39.8	43	32.8	59	46.1	9	28.1
Sheep/Goat	55	27.4	38	29	30	23.4	9	28.1
Pig	45	22.4	33	25.2	24	18.8	7	21.9
Horse	3	1.5	5	3.8	4	3.1	2	6.3
Dog	2	1	3	2.3	1	0.8	1	3.1
Cat	5	2.5	3	2.3	1	0.8	1	3.1
Red deer	2	1	2	1.5	3	2.3	1	3.1
Hare	3	1.5	3	2.3	2	1.6	1	3.1
Rabbit	1	0.5	-	-	1	0.8	1	3.1
Fox	1	0.5	1	0.8	2	1.6	-	-
Badger	3	1.5	-	-	1	0.8	-	-
Red Squirrel	1	0.5	-	-	-	-	-	-
Total MNI	201		131		128		32	
MNI%	40.9		26.6		26		6.5	

Table A5.32: Tooth Wear Stages of mandibular cattle teeth from Caherconnell (counts of mandibular and loose teeth are combined).

Phase/Tooth	Tooth-Wear Stage																				Total
	C	V	E	1/2	U	J	a	b	c	d	e	f	g	h	j	k	l	m	n	o	
PHASE 4																					
dP4	–	–	1	–	8	–	2	12	12	6	–	4	2	18	49	33	7	1	–	–	**155**
P4	–	2	–	–	2	–	6	5	8	6	3	20	22	8	2	–	–	–	–	–	**84**
M1	–	–	8	–	–	–	4	7	9	7	5	22	19	8	15	53	21	2	–	–	**180**
M2	1	1	5	–	–	–	3	14	13	17	5	25	20	14	16	38	7	–	–	–	**179**
M3	–	–	–	–	–	–	2	1	1	4	5	9	24	–	29	19	2	–	–	–	**96**
PHASE 5																					
dP4	-	-	1	-	-	-	2	14	15	6	0	2	1	15	35	19	2	1	0	0	**113**
P4	-	-	-	-	-	-	9	8	5	2	2	29	12	10	0	0	0	0	0	0	**77**
M1	-	-	3	-	1	-	4	6	3	4	6	16	17	19	13	42	12	2	0	0	**148**
M2	-	-	1	-	1	-	6	14	11	15	9	10	15	5	11	17	8	1	0	0	**124**
M3	-	1	-	-	-	-	1	0	1	6	3	3	13	1	16	14	1	0	0	0	**60**
PHASE 6																					
dP4	-	-	-	-	-	-	2	9	10	3	-	2	1	13	35	17	6	2	-	-	**100**
P4	-	1	1	-	-	-	2	5	3	5	1	27	14	3	2	-	-	-	-	-	**62**
M1	-	-	-	-	-	-	2	9	5	3	7	10	18	11	13	33	12	1	-	-	**124**
M2	-	-	1	-	-	-	4	13	10	8	9	14	11	5	13	26	6	1	-	-	**120**
M3	-	-	-	-	-	-	-	-	1	6	1	2	10	3	12	6	1	-	-	-	**42**
PHASE 7																					
dP4	-	-	-	-	-	-	1	4	2	0	0	1	0	1	5	3	0	0	0	0	**17**
P4	-	-	-	-	-	-	0	2	0	0	1	7	2	1	0	0	0	0	0	0	**13**
M1	-	-	-	-	-	-	1	0	0	0	2	2	6	4	5	8	1	0	0	0	**29**
M2	-	-	-	-	-	-	1	4	0	1	1	0	6	1	3	6	0	0	0	0	**23**
M3	-	-	-	-	-	-	0	0	1	0	1	0	2	1	3	1	0	0	0	0	**9**

Table A5.33: Tooth Wear Stages of mandibular sheep teeth from Caherconnell (counts of mandibular and loose teeth are combined).

Tooth	Tooth-Wear Stage																										TOTAL
	C	V	E	1/2	U	J	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
PHASE 4																															
dP4	1	-	-	-	-	1	4	1	0	0	0	3	1	3	0	2	3	4	1	15	48	42	21	4	1	8	4	1	0	0	**168**
P4	3	1	-	-	-	2	3	3	14	0	2	5	3	15	41	12	0	27	14	0	9	1	0	0	0	0	0	0	0	0	**155**
M1	-	-	1	-	-	1	6	1	13	8	9	16	31	33	44	93	46	8	13	1	3	2	0	0	0	0	0	0	0	0	**329**
M2	1	-	1	-	-	-	0	2	5	2	4	6	9	29	20	79	42	2	10	0	0	0	0	0	0	0	0	0	0	0	**212**
M3	-	-	4	-	-	-	4	1	18	5	17	12	9	8	9	16	9	48	11	1	2	0	0	0	1	0	1	0	0	0	**176**
PHASE 5																															
dP4	-	-	-	-	2	-	1	0	4	0	2	1	0	2	0	0	5	4	0	24	43	0	56	7	3	3	5	0	0	0	160
P4	3	-	4	-	-	-	6	2	8	1	5	0	0	5	28	19	0	26	14	0	8	1	0	0	0	0	0	0	0	0	123
M1	-	-	3	-	-	-	3	4	10	10	12	14	13	30	43	67	38	6	6	3	2	6	0	0	0	0	0	0	0	0	267
M2	-	-	-	-	-	-	1	1	8	3	4	3	6	24	15	59	30	2	8	2	0	0	0	0	0	0	0	0	0	0	166
M3	4	-	1	-	-	-	6	4	11	6	13	8	10	2	4	9	10	17	2	5	3	1	2	1	0	1	0	0	0	0	115
PHASE 6																															
dP4	-	-	-	-	1	-	1	0	0	2	0	0	0	2	1	1	0	0	0	12	29	0	32	3	4	2	0	0	2	1	93
P4	1	-	1	-	-	-	4	3	4	1	1	0	2	6	14	14	0	18	15	0	5	0	0	0	0	0	0	0	0	0	89
M1	-	-	-	-	-	-	3	2	5	6	3	7	12	23	40	65	14	2	4	0	3	2	0	0	0	0	0	0	0	0	191
M2	-	-	-	-	-	-	0	1	2	1	6	2	6	13	24	59	27	2	2	1	0	1	0	0	0	0	0	0	0	0	147
M3	-	-	2	-	-	-	1	1	8	2	10	8	12	7	11	1	3	14	7	0	1	1	0	1	0	0	0	0	0	0	90
PHASE 7																															
dP4	-	-	-	-	-	-	1	0	0	0	0	0	0	0	0	0	0	2	0	6	10	0	10	2	0	2	0	0	1	0	34
P4	-	1	-	-	-	-	2	0	1	0	0	0	1	1	2	6	0	3	2	0	1	1	0	0	0	0	0	0	0	0	21
M1	-	-	-	-	-	-	0	0	3	0	3	2	4	7	9	17	2	1	0	0	0	2	0	0	0	0	0	0	0	0	50
M2	-	-	-	-	-	-	1	0	0	3	3	2	1	4	5	14	2	0	1	0	0	1	0	0	0	0	0	0	0	0	37
M3	-	-	1	-	-	-	0	1	5	1	2	2	0	2	2	3	0	7	4	0	0	1	0	1	0	0	0	0	0	0	32

Table A5.34: Tooth Wear Stages of mandibular pig teeth from Caherconnell (counts of mandibular and loose teeth are combined).

Tooth	Tooth Wear Stage																					Total
	C	V	E	1/2	U	J	a	b	c	d	e	f	g	h	j	k	l	m	n	o		
PHASE 4																						
dP4	-	0	2	-	-	-	0	1	4	7	10	10	4	1	2	2	0	0	0	0		**43**
P4	-	2	4	-	-	-	9	27	20	9	11	0	0	0	0	0	0	0	0	0		**82**
M1	-	0	1	-	-	-	7	4	8	24	35	22	8	8	2	1	2	0	0	0		**122**
M2	-	1	3	-	-	-	6	9	16	20	33	3	4	0	0	1	0	0	0	0		**96**
M3	-	1	8	-	-	-	20	18	9	11	4	1	0	1	0	0	0	0	0	0		**73**
PHASE 5																						
dP4	-	-	2	-	1	-	1	2	3	4	6	6	9	4	2	1	0	0	0	0		**41**
P4	-	-	1	-	1	-	9	21	23	5	2	1	1	0	1	0	0	0	0	0		**65**
M1	-	-	-	-	0	-	9	4	10	18	32	22	8	6	0	2	0	0	0	0		**111**
M2	-	1	2	-	2	-	6	5	13	16	17	3	2	0	0	0	0	0	0	0		**67**
M3	-	2	3	-	1	-	18	9	7	0	0	0	1	1	0	0	0	0	0	0		**42**
PHASE 6																						
dP4	-	-	-	-	-	-	0	1	2	9	9	6	1	3	4	2	0	1	0	0		**38**
P4	-	1	1	-	-	-	5	10	14	7	3	3	0	0	0	0	0	0	0	0		**44**
M1	-	0	2	-	-	-	5	1	4	8	37	13	3	0	2	5	1	0	0	0		**81**
M2	-	0	2	-	-	-	2	2	10	15	17	7	3	2	1	0	0	1	0	0		**62**
M3	-	3	3	-	-	-	13	10	15	7	1	1	0	3	0	0	0	0	0	0		**56**
PHASE 7																						
dP4	-	-	-	-	-	-	1	0	0	1	0	4	3	0	0	0	0	0	0	0		**9**
P4	-	-	-	-	-	-	1	3	3	2	0	0	0	0	0	0	0	0	0	0		**9**
M1	-	-	-	-	-	-	0	0	1	6	4	4	1	0	0	1	0	0	0	0		**17**
M2	-	-	-	-	-	-	0	0	1	4	2	3	0	1	0	0	0	0	0	0		**11**
M3	-	1	-	-	-	-	0	0	2	3	0	0	0	0	0	0	0	0	0	0		**6**

Table A5.35: Epiphyseal fusion of Phase 4 cattle bone from Caherconnell.

Phase 4: Late 10th Century				
CATTLE		Age in months	No. fused	No. unfused
	metapodium p.	fused before birth	154	6
	scapula d.	7-10	61	7
Early	humerus d.	12-18	53	8
Fusing	radius p.	12-18	79	2
	phalanx 1&2 p.	18-24	276	66
	Total early fusing		**623**	**89**
	%		**87.5**	**12.5**
	tibia d.	24-30	70	14
Middle	metapodium d.	24-36	55	16
Fusing	calcaneum p.	36-42	62	12
	Total mid fusing		**187**	**42**
	%		**81.7**	**18.3**
	humerus p.		19	8
	radius d.		17	11
Late	ulna p. & d.	42-48	5	8
Fusing	femur p. & d.		66	30
	tibia p.		20	8
	Total late fusing		**127**	**65**
	%		**66.1**	**33.9**

Table A5.36: Epiphyseal fusion of Phase 5 cattle bone from Caherconnell.

Phase 5: 10th–Early 11th Century				
CATTLE		Age in months	No. fused	No. unfused
	metapodium p.	fused before birth	89	2
	scapula d.	7-10	50	3
Early	humerus d.	12-18	26	9
Fusing	radius p.	12-18	33	0
	phalanx 1&2 p.	18-24	186	37
	Total early fusing		**384**	**51**
	%		**88.3**	**11.7**
		24-30		
	tibia d.	24-36	50	5
Middle	metapodium d.	36-42	30	5
Fusing	calcaneum p.		27	6
	Total mid fusing		**107**	**16**
	%		**87**	**13**
	humerus p.		13	2
	radius d.	42-48	7	7
Late	ulna p.		0	0
Fusing	femur p. & d.		28	10
	tibia p.		13	3
	Total late fusing		**61**	**22**
	%		**73.5**	**26.5**

Table A5.37: Epiphyseal fusion of Phase 6 cattle bone from Caherconnell.

Phase 6: 11th–14th Century				
CATTLE		Age in months	No. fused	No. unfused
	metapodium p.	fused before birth	70	1
	scapula d.	7-10	39	2
Early	humerus d.	12-18	29	6
Fusing	radius p.	12-18	42	0
	phalanx 1&2 p.	18-24	186	21
	Total early fusing		**366**	**30**
	%		**92.4**	**7.6**
		24-30		
	tibia d.	24-36	29	10
Middle	metapodium d.	36-42	38	8
Fusing	calcaneum p.		36	8
	Total mid fusing		**103**	**26**
	%		**79.8**	**20.2**
	humerus p.		3	0
	radius d.	42-48	4	10
Late	ulna p.		1	3
Fusing	femur p. & d.		33	10
	tibia p.		9	2
	Total late fusing		**50**	**25**
	%		**66.7**	**33.3**

Table A5.38: Epiphyseal fusion of Phase 7 cattle bone from Caherconnell.

Phase 7: 15th–16th Century				
CATTLE		Age in months	No. fused	No. unfused
	metapodium p.	fused before birth	8	4
	scapula d.	7-10	5	0
Early	humerus d.	12-18	2	5
Fusing	radius p.	12-18	7	1
	phalanx 1&2 p.	18-24	26	10
	Total early fusing		**48**	**20**
	%		**70.6**	**29.4**
		24-30		
	tibia d.	24-36	3	0
Middle	metapodium d.	36-42	4	2
Fusing	calcaneum p.		3	8
	Total mid fusing		**10**	**10**
	%		**50**	**50**
	humerus p.		3	1
	radius d.	42-48	2	1
	ulna p.		0	1
Late	femur p. & d.		2	2
Fusing	tibia p.		2	0
	Total late fusing		**9**	**5**
	%		**64.3**	**35.7**

Table A5.39: Epiphyseal fusion of Phase 4 sheep bone from Caherconnell.

Phase 4: Late 10th Century				
SHEEP		Age in months	No. fused	No. unfused
	metapodium p.	fused before birth	69	2
	scapula d.	6–8	34	10
Early	humerus d.	3–10	60	11
Fusing	radius p.	3–10	37	1
	phalanx 1 p.	6–16	66	46
	phalanx 2 p.	6–16	86	22
	Total early fusing		**352**	**92**
	%		**79.3**	**20.7**
Middle	tibia d.	15–24	61	16
Fusing	metapodium d.	18–28	34	51
	calcaneum p.	30–36	11	16
	Total mid fusing		**106**	**83**
	%		**56.1**	**43.9**
	humerus p.		1	9
	radius d.	36–42	9	34
Late	ulna p.		6	7
Fusing	ulna d.	42	0	0
	femur p.	30–42	35	27
	femur d.	36–42	8	15
	tibia p.	36–42	7	17
	Total late fusing		**66**	**109**
	%		**37.7**	**62.3**

Table A5.40: Epiphyseal fusion of Phase 5 sheep bone from Caherconnell.

Phase 5: 10th – Early 11th Century				
SHEEP		Age in months	No. fused	No. unfused
	metapodium p.	fused before birth	40	4
	scapula d.	6–8	21	8
Early	humerus d.	3–10	49	8
Fusing	radius p.	3–10	19	2
	phalanx 1 p.	6–16	48	37
	phalanx 2 p.	6–16	45	19
	Total early fusing		**222**	**78**
	%		**74**	**26**
		15–24		
Middle	tibia d.	18–28	50	7
Fusing	metapodium d.	30–36	17	33
	calcaneum p.		10	9
	Total mid fusing		**77**	**49**
	%		**61.1**	**38.9**
	humerus p.	36–42	2	3
	radius d.		7	9
Late	ulna p.	42	2	6
Fusing	ulna d.	30–42	0	0
	femur p.	36–42	12	18
	femur d.	36–42	6	9
	tibia p.		1	4
	Total late fusing		**30**	**49**
	%		**38**	**62**

Table A5.41:Epiphyseal fusion of Phase 6 sheep bone from Caherconnell.

Phase 6: 11th – 14th Century				
SHEEP		Age in months	No. fused	No. unfused
	metapodium p.	fused before birth	30	0
	scapula d.	6–8	20	8
Early	humerus d.	3–10	26	10
Fusing	radius p.	3–10	14	0
	phalanx 1 p.	6–16	27	15
	phalanx 2 p.	6–16	36	7
	Total early fusing		**153**	**40**
	%		**79.3**	**20.7**
		15–24		
Middle	tibia d.	18–28	35	5
Fusing	metapodium d.	30–36	20	23
	calcaneum p.		5	6
	Total mid fusing		**60**	**34**
	%		**63.8**	**36.2**
	humerus p.	36–42	0	3
	radius d.		3	14
Late	ulna p.	42	1	4
Fusing	ulna d.	30–42	0	0
	femur p.	36–42	11	9
	femur d.	36–42	2	2
	tibia p.		1	8
	Total late fusing		**18**	**40**
	%		**31**	**69**

Table A5.42: Epiphyseal fusion of Phase 7 sheep bone from Caherconnell.

Phase 7: 15th – 16th Century				
SHEEP		Age in months	No. fused	No. unfused
	metapodium p.	fused before birth	5	1
	scapula d.	6–8	7	3
Early	humerus d.	3–10	0	0
Fusing	radius p.	3–10	6	1
	phalanx 1 p.	6–16	5	6
	phalanx 2 p.	6–16	16	4
	Total early fusing		**39**	**15**
	%		**72.2**	**27.8**
		15–24		
Middle	tibia d.	18–28	3	4
Fusing	metapodium d.	30–36	7	12
	calcaneum p.		0	5
	Total mid fusing		**10**	**21**
	%		**32.3**	**67.7**
	humerus p.	36–42	2	0
	radius d.		3	3
Late	ulna p.	42	2	0
Fusing	ulna d.	30–42	0	0
	femur p.	36–42	2	5
	femur d.	36–42	0	2
	tibia p.		1	5
	Total late fusing		**10**	**15**
	%		**40**	**60**

Table A5.43: Epiphyseal fusion of Phase 4 pig bone from Caherconnell.

Phase 4: Late 10th – Century				
PIG		Age in months	No. fused	No. unfused
	metapodium p.	fused before birth	147	7
	scapula d.	12	42	12
Early	humerus d.	12-18	11	10
Fusing	radius p.	12	33	4
	phalanx 1 p.	24	32	134
	phalanx 2 p.	12	129	72
	Total early fusing		**394**	**239**
	%		**62.2**	**37.8**
Middle	tibia d.	24	10	7
Fusing	fibula d.	30	0	14
	metapodium d.	24-27	25	144
	calcaneum p.	24-30	5	49
	Total mid fusing		**40**	**214**
	%		**15.7**	**84.3**
	humerus p.	42	0	2
Late	radius d.	42	0	11
Fusing	ulna p. & d.	36-42	0	13
	femur p. & d.	42	4	10
	tibia p.	42	0	3
	fibula p.	42	0	0
	Total late fusing		**4**	**39**
	%		**9.3**	**90.7**

Table A5.44: Epiphyseal fusion of Phase 5 pig bone from Caherconnell.

Phase 5: 10th – Early 11th Century				
PIG		Age in months	No. fused	No. unfused
	metapodium p.	fused before birth	103	3
	scapula d.	12	23	8
Early	humerus d.	12-18	14	5
Fusing	radius p.	12	17	5
	phalanx 1 p.	24	20	93
	phalanx 2 p.	12	76	44
	Total early fusing		**253**	**158**
	%		**62**	**38**
Middle	tibia d.	24	8	5
Fusing	fibula d.	30	0	7
	metapodium d.	24-27	14	90
	calcaneum p.	24-30	2	15
	Total mid fusing		**24**	**117**
	%		**17**	**83**
	humerus p.	42	0	2
Late	radius d.	42	1	11
Fusing	ulna p. & d.	36-42	2	9
	femur p. & d.	42	1	2
	tibia p.	42	0	3
	fibula p.	42	0	0
	Total late fusing		**4**	**27**
	%		**13**	**87**

Table A5.45: Epiphyseal fusion of Phase 6 pig bone from Caherconnell.

Phase 6: 11th – 14th Century				
PIG		Age in months	No. fused	No. unfused
	metapodium p.	fused before birth	57	0
	scapula d.	12	22	8
Early	humerus d.	12-18	4	6
Fusing	radius p.	12	26	2
	phalanx 1 p.	24	13	51
	phalanx 2 p.	12	49	24
	Total early fusing		**171**	**91**
	%		**65.3**	**34.7**
Middle	tibia d.	24	8	4
Fusing	fibula d.	30	0	2
	metapodium d.	24-27	12	50
	calcaneum p.	24-30	3	21
	Total mid fusing		**23**	**77**
	%		**23**	**77**
Late	humerus p.	42	1	0
Fusing	radius d.	42	1	3
	ulna p. & d.	36-42	0	12
	femur p. & d.	42	3	3
	tibia p.	42	0	4
	fibula p.	42	0	0
	Total late fusing		**5**	**22**
	%		**18.5**	**81.5**

Table A5.46: Epiphyseal fusion of Phase 7 pig bone from Caherconnell.

Phase 7: 15th – 16th Century				
PIG		Age in months	No. fused	No. unfused
	metapodium p.	fused before birth	4	0
	scapula d.	12	1	0
Early	humerus d.	12-18	5	1
Fusing	radius p.	12	3	1
	phalanx 1 p.	24	1	22
	phalanx 2 p.	12	4	10
	Total early fusing		**18**	**34**
	%		**34.6**	**65.4**
		24		
Middle	tibia d.	30	1	0
Fusing	fibula d.	24-27	0	0
	metapodium d.	24-30	2	4
	calcaneum p.		1	5
	Total mid fusing		**4**	**9**
	%		**30.2**	**69.2**
		42		
	humerus p.	42	1	0
Late	radius d.	36-42	0	3
Fusing	ulna p. & d.	42	0	1
	femur p. & d.	42	1	4
	tibia p.	42	0	0
	fibula p.		0	0
	Total late fusing		**2**	**8**
	%		**20**	**80**

Table A5.47: Epiphyseal fusion of Phase 4 horse bone from Caherconnell.

Phase 4: Late 10th–Early 11th Century			
Horse	Age in months	No. fused	No. unfused
Scapula	20 months	-	-
Humerus p.	3–3.5 years	-	-
Humerus d.	15–18 months	-	-
Radius p.	15–18 months	-	-
Radius d.	3.5 years	2	0
Ulna olecranon	3.5 years	-	-
Ulna d.	Before 2 birth mo.	-	-
Metacarpal p.	Before birth	6	0
Metacarpal d.	15–18 months	2	0
1st Phalanx p.	Before birth	7	0
1st Phalanx d.	13–15 months	6	0
2nd Phalanx p.	Before birth	5	0
2nd Phalanx d.	9–12 months	5	0
3rd Phalanx	Partly ossified at birth	4	0
Pelvis	1.5–2 years	-	-
Femur p.	3–3.5 years	-	-
Femur d.	3–3.5 years	-	-
Tibia p.	3–3.5 years	-	-
Tibia d.	20–24 months	3	1
Fibula p.	2-3 years	1	0
Fibula d.	Fuses with tibia 1-3 months	1	0
Calcaneum	3 years	2	1
Metatarsal p.	Before birth	3	0
Metatarsal d.	16–20 months	3	0
Metapodial p.	Before birth	1	0
Metapodial d.	15–20 months	3	0
Total fusing		**54**	**2**
%		**96.4**	**3.6**

Table A5.48: Epiphyseal fusion of Phase 5 horse bone from Caherconnell.

Phase 5: 10th – Early 11th Century			
Horse	Age in months	No. fused	No. unfused
Scapula	20 months	1	0
Humerus p.	3–3.5 years	-	-
Humerus d.	15–18 months	-	-
Radius p.	15–18 months	-	-
Radius d.	3.5 years	1	0
Ulna olecranon	3.5 years	-	-
Ulna d.	Before 2 birth mo.	-	-
Metacarpal p.	Before birth	-	-
Metacarpal d.	15–18 months	-	-
1st Phalanx p.	Before birth	1	0
1st Phalanx d.	13–15 months	2	0
2nd Phalanx p.	Before birth	2	0
2nd Phalanx d.	9–12 months	2	0
3rd Phalanx	Partly ossified at birth	3	0
Pelvis	1.5–2 years	-	-
Femur p.	3–3.5 years	1	0
Femur d.	3–3.5 years	-	-
Tibia p.	3–3.5 years	1	0
Tibia d.	20–24 months	-	-
Fibula p.	2-3 years	-	-
Fibula d.	Fuses with tibia 1-3 months	-	-
Calcaneum	3 years	2	1
Metatarsal p.	Before birth	2	0
Metatarsal d.	16–20 months	1	0
Metapodial p.	Before birth	-	-
Metapodial d.	15–20 months	2	0
Total fusing		**21**	**1**
%		**95.5**	**4.5**

Table A5.49: Epiphyseal fusion of phase 6 horse bone from Caherconnell.

Phase 6: 11th–14th Century			
Horse	Age in months	No. fused	No. unfused
Scapula	20 months	2	0
Humerus p.	3–3.5 years	-	-
Humerus d.	15–18 months	-	-
Radius p.	15–18 months	-	-
Radius d.	3.5 years	0	1
Ulna olecranon	3.5 years	0	1
Ulna d.	Before 2 birth mo.	-	-
Metacarpal p.	Before birth	2	0
Metacarpal d.	15–18 months	0	3
1st Phalanx p.	Before birth	3	0
1st Phalanx d.	13–15 months	3	0
2nd Phalanx p.	Before birth	3	0
2nd Phalanx d.	9–12 months	1	0
3rd Phalanx	Partly ossified at birth	-	-
Pelvis	1.5–2 years	-	-
Femur p.	3–3.5 years	0	1
Femur d.	3–3.5 years	-	-
Tibia p.	3–3.5 years	-	-
Tibia d.	20–24 months	2	0
Fibula p.	2-3 years	-	-
Fibula d.	Fuses with tibia 1-3 months	-	-
Calcaneum	3 years	2	1
Metatarsal p.	Before birth	-	-
Metatarsal d.	16–20 months	1	0
Metapodial p.	Before birth	-	-
Metapodial d.	15–20 months	1	0
Total fusing		**18**	**7**
%		**72**	**28**

Table A5.50: Epiphyseal fusion of Phase 7 horse bone from Caherconnell.

Phase 7: 15th–16th Century			
Horse	Age in months	No. fused	No. unfused
Scapula	20 months	-	-
Humerus p.	3–3.5 years	-	-
Humerus d.	15–18 months	-	-
Radius p.	15–18 months	-	-
Radius d.	3.5 years	-	-
Ulna olecranon	3.5 years	-	-
Ulna d.	Before 2 birth mo.	-	-
Metacarpal p.	Before birth	-	-
Metacarpal d.	15–18 months	-	-
1st Phalanx p.	Before birth	1	0
1st Phalanx d.	13–15 months	-	-
2nd Phalanx p.	Before birth	1	0
2nd Phalanx d.	9–12 months	1	0
3rd Phalanx	Partly ossified at birth	-	-
Pelvis	1.5–2 years	-	-
Femur p.	3–3.5 years	3	2
Femur d.	3–3.5 years	2	0
Tibia p.	3–3.5 years	-	-
Tibia d.	20–24 months	0	1
Fibula p.	2-3 years	-	-
Fibula d.	Fuses with tibia 1-3 months	-	-
Calcaneum	3 years	1	0
Metatarsal p.	Before birth	-	-
Metatarsal d.	16–20 months	-	-
Metapodial p.	Before birth	-	-
Metapodial d.	15–20 months	1	0
Total fusing		**10**	**3**
%		**77**	**23**

Table A5.51: Epiphyseal fusion of Phase 4 dog bone from Caherconnell.

Phase 4: Late 10th Century			
Dog	Age in months	No. fused	No. unfused
Scapula	6-7 months	-	-
Humerus p.	15	-	-
Humerus d.	8-9	2	0
Radius p. & d.	11-12	1	0
Ulna olecranon	9-10	-	-
Ulna d.	11-12	-	-
Metacarpal p.	fused before birth	1	0
Metacarpal d.	8	2	0
1st & 2nd Phalanx p.	7	13	0
1st & 2nd Phalanx d.	fused before birth	13	0
Pelvis	6	-	-
Femur p. & d.	18	2	0
Tibia p.	18	-	-
Tibia d.	13-16	1	0
Fibula p.	15-18	-	-
Fibula d.	15	-	-
Calcaneum	13-16	4	0
Metatarsal p.	fused before birth	2	0
Metatarsal d.	10	1	0
Metapodial p.	fused before birth	-	-
Metapodial d.	8-10	3	0

Table A5.52: Epiphyseal fusion of Phase 5 dog bone from Caherconnell.

Phase 5: 10th Century–Early 11th Century			
Dog	Age in months	No. fused	No. unfused
Scapula	6-7 months	1	0
Humerus p.	15	-	-
Humerus d.	8-9	-	-
Radius p. & d.	11-12	-	-
Ulna olecranon	9-10	1	0
Ulna d.	11-12	-	-
Metacarpal p.	fused before birth	1	0
Metacarpal d.	8	1	0
1st & 2nd Phalanx p.	7	6	0
1st & 2nd Phalanx d.	fused before birth	5	0
Pelvis	6	-	-
Femur p. & d.	18	2	1
Tibia p.	18	2	0
Tibia d.	13-16	3	0
Fibula p.	15-18	-	-
Fibula d.	15	-	-
Calcaneum	13-16	1	0
Metatarsal p.	fused before birth	5	0
Metatarsal d.	10	3	0
Metapodial p.	fused before birth	-	-
Metapodial d.	8-10	-	-

Table A5.53: Epiphyseal fusion of Phase 6 dog bone from Caherconnell.

Phase 6: 11th–14th Century			
Dog	Age in months	No. fused	No. unfused
Scapula	6-7 months	-	-
Humerus p.	15	-	-
Humerus d.	8-9	-	-
Radius p. & d.	11-12	-	-
Ulna olecranon	9-10	1	0
Ulna d.	11-12	-	-
Metacarpal p.	fused before birth	-	-
Metacarpal d.	8	-	-
1st & 2nd Phalanx p.	7	4	0
1st & 2nd Phalanx d.	fused before birth	5	0
Pelvis	6	-	-
Femur p. & d.	18	2	0
Tibia p.	18	-	-
Tibia d.	13-16	-	-
Fibula p.	15-18	-	-
Fibula d.	15	-	-
Calcaneum	13-16	-	-
Metatarsal p.	fused before birth	-	-
Metatarsal d.	10	-	-
Metapodial p.	fused before birth	-	-
Metapodial d.	8-10	1	0

Table A5.54: Epiphyseal fusion of Phase 4 cat bone from Caherconnell.

Phase 4: Late 10th – Early 11th Century			
Cat	Age in months	No. fused	No. unfused
Scapula		1	0
Humerus d.		0	1
Radius p.		5	1
Acetabulum	8.5 months	0	0
Femur p.		1	2
Calcaneum p.		4	0
Total		**11**	**4**
%		**73.3**	**26.7**
Ulna p.		1	1
Phalanges p.	10–11 months	1	0
Total		**2**	**1**
%		**66.7**	**33.3**
Humerus p.		0	1
Radius d.		0	0
Femur d.		0	1 (FO)
Tibia p.	11.5–20 months	2	6 (2 FO)
Tibia d.		4	3 (1 FG)
Metapodials d.		4	5
Total		**10**	**16**
%		**38.5**	**61.5**

Table A5.55: Epiphyseal fusion of Phase 5 cat bone from Caherconnell.

Phase 5: Late 10th – Early 11th Century			
Cat	Age in months	No. fused	No. unfused
Scapula		1	0
Humerus d.		3	0
Radius p.	8.5 months	1	0
Acetabulum		1	0
Femur p.		3	1
Calcaneum p.		2	1
Total		**11**	**2**
%		**84.6**	**15.4**
Ulna p.		3	0
Phalanges p.	10–11 months	0	0
Total		**3**	**0**
%		**100**	**-**
Humerus p.		1	0
Radius d.		2	0
Femur d.		2	2
Tibia p.	11.5–20 months	1	1
Tibia d.		1	1
Metapodials d.		3	3
Total		**10**	**7**
%		**58.8**	**41.2**

Table A5.56: Epiphyseal fusion of Phase 6 cat bone from Caherconnell.

Phase 6: 11th – 14th Century			
Cat	Age in months	No. fused	No. unfused
Scapula		0	0
Humerus d.		1	0
Radius p.		0	0
Acetabulum	8.5 months	0	0
Femur p.		0	0
Calcaneum p.		0	0
Total		**1**	**0**
%		**100**	**-**
Ulna p.		2	0
Phalanges p.	10–11 months	0	0
Total		**2**	**0**
%		**100**	**-**
Humerus p.		0	0
Radius d.		0	0
Femur d.		0	1
Tibia p.	11.5–20 months	0	0
Tibia d.		1	0
Metapodials d.		0	0
Total		**1**	**1**
%		**50**	**50**

Table A5.57: Epiphyseal fusion of Phase 7 cat bone from Caherconnell.

Phase 7: 15th – 16th Century			
Cat	Age in months	No. fused	No. unfused
Scapula		0	0
Humerus d.		0	0
Radius p.		0	0
Acetabulum	8.5 months	0	0
Femur p.		0	0
Calcaneum p.		0	0
Total		**0**	**0**
%		**-**	**-**
Ulna p.		0	0
Phalanges p.	10–11 months	0	0
Total		**0**	**0**
%		**-**	**-**
Humerus p.		0	0
Radius d.		0	0
Femur d.		0	0
Tibia p.	11.5–20 months	0	0
Tibia d.		0	0
Metapodials d.		4	0
Total		**4**	**0**
%		**100**	**-**

Table A5.58: Cattle astragalus measurements for all phases of activity at Caherconnell.

Cattle Measurements (Astragalus)							
	Measurements	**No.**	**Mean**	**Minimum**	**Maximum**	**SD**	**CV**
Phase 4 no.: 161	*GLl*	118	58.72	46.9	65.9	3.16	5.3%
	GLm	124	53.35	30	61.8	4.04	7.6%
	Dl	130	34.21	25.4	40.1	2.65	7.8%
	Dm	129	31.65	20.2	51.1	3.55	11.2%
	Bd	132	37.29	28.2	46.9	2.57	6.9%
Phase 5 no.: 84	*GLl*	61	58.28	40.2	64.4	4.59	7.9%
	GLm	65	53.12	36	58.9	4.14	7.8%
	Dl	67	34.02	20.8	41	3.36	9.9%
	Dm	67	31.8	19.4	37	3.24	10.1%
	Bd	69	37.2	27.1	43.1	3.34	9%
Phase 6 no.:121	*GLl*	89	59.04	53.1	66	2.53	4.3%
	GLm	95	54.03	31.9	61.4	3.11	5.8%
	Dl	98	33.43	25.1	39	2.29	6.8%
	Dm	100	31.03	22	36.4	2.64	8.5%
	Bd	103	37.3	33.1	42.9	1.82	4.9%
Phase 7 no.: 19	*GLl*	12	62	50	88	8.53	14.4%
	GLm	15	55.23	47	80.8	7.58	13.7%
	Dl	13	35.07	29.1	47	4.87	13.9%
	Dm	14	31.22	26	43	4.1	13.1%
	Bd	15	37.76	31	54.2	5.37	14.2%

Table A5.59: Statistical comparison of log-scaled measurements by phase of activity at Caherconnell. Shaded boxes indicate statistically-significant differences.

		Phase 4–5	Phase 5–6	Phase 6–7
Cattle	*U*	90588.5	65035.5	11006.5
	P	0.8163	0.8947	0.8518
Sheep	*U*	48214.5	23894	2672
	P	0.04569	0.8794	0.1051
Pig	*U*	3369.5	2306	348.5
	P	0.007275	0.05807	0.6319

Table A5.60: Sheep estimated withers heights for all phases of activity at Caherconnell.

Sheep Measurements							
	Measurement	No.	Mean	Minimum	Maximum	SD	CV
Phase 4	Estimated Withers Height	86	52.3	33	61	4.52	8.6%
Phase 5		63	51.9	36	63	4.67	9%
Phase 6		37	52.7	40	68	5.33	10.1%
Phase 7		6	55	50	62	5.33	9.7%

Table A5.61: Pig estimated withers heights for all phases of activity at Caherconnell.

Pig Measurements							
	Measurement	No.	Mean	Minimum	Maximum	SD	CV
Phase 4	Estimated Withers Height	38	62.13	38	74	7.89	12.7%
Phase 5		20	62.8	43	73	7.59	12.1%
Phase 6		25	63.36	30	73	8.26	13%
Phase 7		3	66.67	63	74	6.35	9.5%

Table A5.62: Pig M_3 width measurements for all phases of activity at Caherconnell.

Pig Measurements (M_3)							
	Measurement	No.	Mean	Minimum	Maximum	SD	CV
Phase 4	Width (B)	55	14.59	12.1	18.9	1.23	8%
Phase 5		33	14.75	11.8	19.1	1.28	9%
Phase 6		45	14.46	12	19.9	1.19	8%
Phase 7		5	14.3	13	14.9	0.75	5%

Table A5.63: von den Driesch and Boessneck (1974) multiplication factors for estimating withers heights from greatest length measurements of horse bones.

Element	***Multiplication Factor***	***Measurement***
Scapula	4.28	Greatest length along the spine (HS)
Humerus	4.87	Greatest length of the lateral part (GLl)
Radius	4.34	Length of the lateral part (Ll)
Radius and Ulna	3.40	Greatest length of the lateral part (GLl)
Metacarpus	6.41	Lateral length (Ll)
Femur	3.51	Lateral length (GL/Ll)
Tibia	4.36	Lateral length (Ll)
Metatarsus	5.33	Lateral length (Ll)

Table A5.64: Harcourt (1974) and Koudelka (1885) multiplication factors for estimating withers heights from the greatest length (GL) of long bones.

Element	***Harcourt (1974) Multiplication Factor***	***Koudelka (1885) Multiplication Factor***
Humerus	(3.43 x GL) – 26.54	3.37
Radius	(3.18 x GL) + 19.51	3.32
Ulna	(2.78 x GL) + 6.21	2.67
Humerus and Radius	(1.65 x GL) – 4.32	-
Femur	(3.14 x GL) – 12.96	3.01
Tibia	(2.92 x GL) + 9.41	2.92
Femur and Tibia	(1.52 x GL) – 2.47	-

Table A5.65: Clark (1995) multiplication factors for estimating withers heights from the greatest length (GL) of metapodia.

Element	***Multiplication Factor***
Metacarpal 2	(0.94 x GL) – 1.56
Metacarpal 3	(0.83 x GL) – 2.03
Metacarpal 4	(0.84 x GL) – 2.60
Metacarpal 5	(0.98 x GL) – 1.56
Metatarsal 2	(0.86 x GL) – 2.04
Metatarsal 3	(0.77 x GL) – 2.26
Metatarsal 4	(0.75 x GL) – 2.68
Metatarsal 5	(0.83 x GL) – 1.75

Table A5.66: Hasebe (1952) dog long-bone size classification.

Element	Von den Driesch Measurement	Dog Type				
		Small	Small-Medium	Medium	Medium-Large	Large
Humerus	GL (mm)	≤120	121-135	136-150	151-165	166≥
Radius		≤115	116-130	131-145	146-160	161≥
Ulna		≤140	141-155	156-170	171-185	186≥
Femur		≤135	136-150	151-165	166-180	181≥
Tibia		≤130	131-145	146-160	161-175	176≥

Table A5.67: Dressed-out meat weights of cattle, sheep, and pig, from the early medieval assemblage, Caherconnell. Estimates were made assuming a live animal weight of 450kg for cattle (Legge 1981, 99), 23kg for sheep (Boyd et al. 1964, 145), and 80kg for pig ((van Wijngaarden-Bakker 1986, 71), with a dressing-out weight of 50% for cattle and sheep, and 80% for pig (McCormick and Murray 2007, 147).

	Phase 4			Phase 5		
	MNI	Meat Weight (kg)	%	MNI	Meat weight (kg)	%
Cattle	80	18,000	83.7	43	9,675	79.1
Sheep	55	632.5	2.9	38	437	3.6
Pig	45	2,880	13.4	33	2,112	17.3
Total		21,512.5			12,224	

Table A5.68: Dressed-out meat weights of cattle, sheep, and pig, from the late medieval assemblage, Caherconnell. Estimates were made assuming a live animal weight of 450kg for cattle (Legge 1981, 99), 23kg for sheep (Boyd et al. 1964, 145), and 80kg for pig ((van Wijngaarden-Bakker 1986, 71), with a dressing-out weight of 50% for cattle and sheep, and 80% for pig (McCormick and Murray 2007, 147).

	Phase 6			Phase 7		
	MNI	Meat Weight (kg)	%	MNI	Meat weight (kg)	%
Cattle	59	13,275	87.6	9	2,025	78.6
Sheep	30	345	2.3	9	103.5	4
Pig	24	1,536	10.1	7	448	17.4
Total		15,156			2576.5	

Table A5.69: List of cattle pathologies from all phases of activity at Caherconnell.

Cattle Pathology			
Bone ID	*Element*	*Area Affected*	*Comment*
601	1st Phalanx	Proximal end	Osteoarthritis: exostoses
1582	Patella	Anterior surface	Osteoarthritis: exostoses
2235	1st Phalanx	Proximal end	Osteoarthritis: exostoses and eburnation
2298	1st Phalanx	Lateral and plantar surfaces	Osteoarthritis: exostoses
8697	1st Phalanx	Proximal end	Osteoarthritis: exostoses and eburnation (Concretion present of distal end and the dorsal surface at the proximal end)
9262	1st Phalanx	Proximal end	Osteoarthritis: exostoses and eburnation
9868	1st Phalanx	Proximal end	Osteoarthritis: exostoses
11563	Astragalus	Entire bone	Chronic septic arthropathy: extreme exostoses and bone destruction, formation is well remodelled in places
12292	1st Phalanx	Plantar surface	Osteoarthritis: exostoses
12822	Pelvis	Acetabulum	Early stages of osteoarthritis: pitting
13011	1st Phalanx	Proximal end and lateral surface	Osteoarthritis: exostoses
14931	Thoracic vertebrae	Posterior surface of body	Depression
15324	1st Phalanx	Proximal end	Osteoarthritis: exostoses
15605	1st Phalanx	Proximal end	Osteoarthritis: exostoses and eburnation
15606	1st Phalanx	Medial and lateral surfaces	Osteoarthritis: exostoses
16119	1st Phalanx	Proximal end	Osteoarthritis: exostoses and eburnation
17160	1st Phalanx	Proximal end	Osteoarthritis: exostoses
19082	1st Phalanx	Distal end	Osteoarthritis: exostoses
19281	Thoracic vertebrae	Posterior surface of body	Depression
20981	Astragalus	Distal end, medial side	Osteoarthritis: eburnation
21413	Pelvis	Acetabulum	Coxarthrosis/eburnation of the hop joint

Table A5.70: List of sheep pathologies from all phases of activity at Caherconnell.

Sheep Pathology			
Bone/Tooth ID	*Element*	*Area Affected*	*Comment*
3514	1st Phalanx	Proximal end	Exostoses
9511	1st Phalanx	Proximal end	Exostoses
12562	Metacarpal	Proximal end	Exostoses
13642	1st Phalanx	Lateral and medial	Exostoses
13849	Metacarpal	Proximal end	Exostoses
13850	Radius	Distal end	Exostoses
15965	2nd Phalanx	Proximal end & lateral side	Exostoses
2255 (MD)	M_1	Roots	Abnormal tooth roots – chronic low-grade infection
2256 (MD)	M_2	Roots	Abnormal tooth roots – chronic low-grade infection
10081 (MD)	M_1	Roots	Abnormal tooth roots – chronic low-grade infection
10082 (MD)	M_3	Roots	Abnormal tooth roots – chronic low-grade infection
10083 (MD)	M_3	Roots	Abnormal tooth roots – chronic low-grade infection
86 (MX)	P^4	Roots	Abnormal tooth roots – chronic low-grade infection
8491 (MX)	P^3	Roots	Abnormal tooth roots – chronic low-grade infection

Table A5.71: List of pig pathologies from all phases of activity at Caherconnell.

Pig Pathology			
Bone/Tooth ID	*Element*	*Area Affected*	*Comment*
20830	2nd Phalanx (x2)	Entire bone	Syndactyly
20849	3rd Phalanx (x2)	Entire bone	Syndactyly
735 (MD)	M_2	Entire tooth	Rippling grooves
1847 (MX)	M^3	Entire tooth	Pitting enamel hypoplasia (PEH)
10535 (MD)	M_3	Entire tooth	Possible infection in the crypt Gum injury - hypercementosis

Table A6.1: Phase 4 deer bones from Caherconnell: NISP, MNE, MNI, and Survival Rate Percentages.

Phase 4: Late 10th – early 11th Century							
Element	NISP	NISP%	AL	R	L	MNE	% survival
Cranium	8	26.7	-	-	-	1	50
Scapula	1	3.3	-	-	1	1	50
Radius	1	3.3	-	1	-	1	50
Pelvis	2	6.7	-	2	-	2	100
Tibia	1	3.3	-	1	-	1	50
Astragalus	1	3.3	-	1	-	1	50
Calcaneum	1	3.3	-	-	1	1	50
Metatarsal	1	3.3	-	1	-	1	50
Phalanx 1	5	16.7	-	2	3	1	50
Phalanx 2	4	13.3	-	2	2	1	50
Phalanx 3	5	16.7	-	3	1	1	50
TOTAL	30			13	8	11	
						MNI = 2	

Table A6.2: Phase 5 deer bones from Caherconnell: NISP, MNE, MNI, and Survival Rate Percentages.

Phase 5: Late 10th – early 11th Century							
Element	NISP	NISP%	AL	R	L	MNE	% survival
Cranium	1	5.3	-	-	-	1	50
Scapula	1	5.3	-	1	-	1	50
Humerus	1	5.3	-	-	1	1	50
Radius	3	15.8	-	1	2	2	100
Tibia	1	5.3	-	-	1	1	50
Calcaneum	1	5.3	-	-	1	1	50
Metatarsal	1	5.3	-	-	1	1	50
Phalanx 1	5	26.3	-	3	2	1	50
Phalanx 2	2	10.5	-	1	1	1	50
Phalanx 3	3	15.8	-	1	2	1	50
TOTAL	19		-	7	11	11	
						MNI = 2	

Table A6.3: Phase 6 deer bones from Caherconnell: NISP, MNE, MNI, and Survival Rate Percentages.

Phase 6: 11th – 14th Century							
Element	NISP	NISP%	AL	R	L	MNE	% survival
Cranium	1	4.8	-	-	-	1	33
Mandible	1	4.8	-	1	-	1	33
Scapula	2	9.5	-	1	1	1	33
Femur	1	4.8	-	-	1	1	33
Tibia	2	9.5	-	1	1	1	33
Calcaneum	3	14.3	-	-	3	3	100
Phalanx 1	3	14.3	-	2	1	1	33
Phalanx 2	5	23.8	-	2	3	1	33
Phalanx 3	3	14.3	-	1	2	1	33
TOTAL	21		-	8	12	11	
						MNI = 3	

Table A6.4: Phase 7 deer bones from Caherconnell: NISP, MNE, MNI, and Survival Rate Percentages.

Phase 7: 15th – 16th Century							
Element	NISP	NISP%	AL	R	L	MNE	% survival
Scapula	1	25	-	-	1	1	100
Calcaneum	1	25	-	1	-	1	100
Phalanx 1	2	50	-	1	1	1	100
TOTAL	4		-	2	2	3	
						MNI = 1	

Table A6.5: Phase 4 hare/rabbit bones from Caherconnell: NISP, MNE, MNI, and Survival Rate Percentages.

Phase 4: Late 10th – early 11th Century								
	Element	NISP	NISP%	AL	R	L	MNE	% survival
Hare	Vertebrae	1	3	1	-	-	1	33
	Scapula	3	9.1	-	-	3	3	100
	Humerus	5	15.2	-	3	2	3	100
	Radius	2	6.1	-	2	-	2	67
	Ulna	1	3	-	-	1	1	33
	Pelvis	2	6.1	-	-	2	2	67
	Femur	4	12.1	-	4	-	3	100
	Tibia	2	6.1	-	-	2	2	67
	Astragalus	2	6.1	-	1	1	1	33
	Calcaneum	3	9.1	-	-	3	3	100
	Metapodial	1	3	-	-	-	1	33
	Phalanx 1	3	9.1	-	-	1	1	33
	Rib	4	12.1	-	-	-	1	33
	TOTAL	33		1	10	15	24	
							MNI = 3	
Rabbit	Axis	1	6.3	1	-	-	1	100
	Vertebrae	2	12.5	2	-	-	1	100
	Scapula	2	12.5	-	1	1	-	100
	Humerus	1	6.3	-	-	1	1	100
	Ulna	1	6.3	-	1	-	1	100
	Femur	1	6.3	-	-	1	1	100
	Tibia	1	6.3	-	1	-	1	100
	Metatarsal	2	12.5	-	1	1	1	100
	Metapodial	2	12.5	-	-	-	1	100
	Phalanx 2	1	6.3	-	1	-	1	100
	Phalanx	2	12.5	-	-	-	1	100
	TOTAL	16		3	5	4	10	
							MNI = 1	
Hare/Rabbit	Humerus	2	18.2	-	-	2	2	100
	Ulna	1	9.1	-	1	-	1	50
	Pelvis	3	27.3	-	1	2	2	100
	Femur	1	9.1	-	-	1	1	50
	Tibia	1	9.1	-	-	1	1	50
	Phalanx 1	3	27.3	-	1	2	1	50
	TOTAL	11		-	3	8	8	
							MNI = 2	

Table A6.6: Phase 5 hare/rabbit bones from Caherconnell: NISP, MNE, MNI, and Survival Rate Percentages.

Phase 5: Late 10th – early 11th Century								
	Element	NISP	NISP%	AL	R	L	MNE	% survival
Hare	Scapula	2	7	-	-	2	2	67
	Humerus	4	13.3	-	-	4	2	67
	Radius	1	3.3	-	1	-	1	33
	Ulna	3	10	-	3	-	3	100
	Pelvis	4	13	-	2	1	2	67
	Femur	3	10	-	2	1	1	33
	Tibia	2	6.7	-	-	2	1	33
	Astragalus	5	16.7	-	2	3	3	100
	Calcaneum	4	13.3	-	3	1	3	100
	Phalanx 1	2	6.7	-	1	-	1	33
	TOTAL	30		-	14	14	19	
							MNI = 3	
Hare/Rabbit	Scapula	1	7.1	-	-	1	1	33
	Humerus	5	35.7	-	3	2	3	100
	Radius	1	7.1	-	-	1	1	33
	Femur	1	7.1	-	1	-	1	33
	Tibia	1	7.1	-	-	1	1	33
	Calcaneum	1	7.1	-	1	-	1	33
	Metapodial	1	7.1	-	-	-	1	33
	Phalanx 1	2	14.3	-	1	1	1	33
	Phalanx	1	7.1	-	-	-	1	33
	TOTAL	14		-	6	6	11	
							MNI = 3	

Table A6.7: Phase 6 hare/rabbit bones from Caherconnell: NISP, MNE, MNI, and Survival Rate Percentages.

Phase 6: 11th – 14th Century								
	Element	NISP	NISP%	AL	R	L	MNE	% survival
Hare	Ulna	2	29	-	-	2	2	100
	Femur	1	14.3	-	1	-	1	50
	Tibia	1	14.3	-	-	1	1	50
	Calcaneum	2	29	-	1	1	1	50
	Phalanx 2	1	14.3	-	1	-	1	50
	TOTAL	7		-	3	4	6	
							MNI = 2	
Rabbit	Humerus	1	50	-	1	-	1	100
	Radius	1	50	-	-	1	1	100
	TOTAL	2						
							MNI = 1	
Hare/Rabbit	Vertebrae	3	12	3	-	-	1	33
	Scapula	1	4	-	-	1	1	33
	Humerus	5	20	-	2	3	3	100
	Ulna	1	4	-	-	1	1	33
	Metacarpal	2	8	-	-	2	2	67
	Femur	3	12	-	-	3	3	100
	Tibia	1	4	-	1	-	1	33
	Calcaneum	1	4	-	-	1	1	33
	Metatarsal	2	8	-	-	1	1	33
	Metapodial	1	4	-	-	-	1	33
	Phalanx 1	5	20	-	-	3	1	33
	TOTAL	25		3	3	15	16	
							MNI = 3	

Phase A6.8: hare/rabbit bones from Caherconnell: NISP, MNE, MNI, and Survival Rate Percentages.

Phase 7: 15th – 16th Century								
	Element	NISP	NISP%	AL	R	L	MNE	% survival
Hare	Humerus	2	28.6	-	1	1	1	100
	Radius	1	14.3	-	-	1	1	100
	Ulna	1	14.3	-	-	1	1	100
	Tibia	1	14.3	-	-	1	1	100
	Calcaneum	1	14.3	-	-	1	1	100
	Phalanx 1	1	14.3	-	-	1	1	100
	TOTAL	7		-	1	6	6	
							MNI = 1	
Rabbit	Humerus	1	25	-	-	1	1	100
	Tibia	1	25	-	1	-	1	100
	Metacarpal	1	25	-	-	1	1	100
	Phalanx 1	1	25	-	-	1	1	100
	TOTAL	4			1	3	4	
							MNI = 1	
Hare/Rabbit	Radius	1	25	-	-	1	1	100
	Femur	1	25	-	-	1	1	100
	Astragalus	1	25	-	1	-	1	100
	Phalanx 1	1	25	-	-	1	1	100
	TOTAL	4			1	3	4	
							MNI = 1	

Table A6.9: Phase 4 fox bones from Caherconnell: NISP, MNE, MNI, and Survival Rate Percentages.

Phase 4: Late 10th – early 11th Century							
Element	NISP	NISP%	AL	R	L	MNE	% survival
Humerus	1	16.7	-	1	-	1	100
Radius	1	16.7	-	1	-	1	100
Pelvis	1	16.7	-	-	1	1	100
Astragalus	1	16.7	-	1	-	1	100
Phalanx	2	33.3	-	-	-	1	100
TOTAL	6		-	3	1	5	
						MNI = 1	

Table A6.10: Phase 5 fox bones from Caherconnell: NISP, MNE, MNI, and Survival Rate Percentages

Phase 5: Late 10th – early 11th Century							
Element	NISP	NISP%	AL	R	L	MNE	% survival
Cranium	1	16.7	1	-	-	1	100
Atlas	1	16.7	1	-	-	1	100
Astragalus	1	16.7	-	-	1	1	100
Calcaneum	2	33.3	-	1	1	1	100
TOTAL	5		2	1	2	4	
						MNI = 1	

Table A6.11: Phase 6 fox bones from Caherconnell: NISP, MNE, MNI, and Survival Rate Percentages.

Phase 6: 11th – 14th Century							
Element	NISP	NISP%	AL	R	L	MNE	% survival
Scapula	2	100	-	-	2	2	100
TOTAL			-	-	2	2	
						MNI = 2	

Table C.1: Codes and descriptions for taxon recorded in catalogues.

Taxon		
Code	*Description*	
ADP	Mallard/Domestic duck	*Anas platyrhynchos*
AMP	Amphibian	*Amphibia*
AN	Frog/toad	*Anuran*
ANC	Teal	*Anas crecca*
ANS	Domestic/Greylag goose	*Anser anser*
AV	Bird species	*Aves*
BO	Cattle	*Bos taurus*
BRB	Brent Goose	*Branta bernicla*
BUB	Buzzard	*Buteo Buteo*
CAF	Dog	*Canis familiaris*
CAH	Goat	*Capra hircus*
CD	Red deer/Fallow deer	*Cervus elaphus/Dama dama*
CEE	Red deer	*Cervus elaphus*
CLL	Rock dove/Feral pigeon	*Columba livia*
COC	Raven	*Corvus corax*
COM	Jackdaw	*Corvus monedula*
CORF	Carrion crow/hooded crow/rook	*Corvus corone/cornix/frugilegus*
CRC	Corncrake	*Crex crex*
CV	Dog/Fox	*Canis familiaris/Vulpes vulpes*
EQC	Horse	*Equus caballus*
FEC	Cat	*Felis catus*
FIS	Fish	*Fish species*
FMHM	Field mouse/House mouse	
FR	Frog	*Rana/Pelophylax sp.*
GAG	Chicken	*Gallus gallus*
GAN	Snipe	*Gallinago gallinago*
GO	Goose	
LAG	Lagomorph	*Lagomorpha*
LAL	Willow/Red grouse	*Lagopus lagopus*
LCA	Common Gull	*Larus canus*
LE	Hare	*Lepus sp.*
LRG	Large Mammal	
MAMM	Mammal	
MED	Medium Mammal	
MEM	Badger	*Meles meles*
O	Sheep/Goat	*Ovis aries/Capra hircus*
ORC	Rabbit	*Oryctolagus cuniculus*
PIP	Magpie	*Pica pica*
PLA	Golden plover	*Pluvialis apricaria*
RAT	Rat	*Rattus sp.*
S	Pig	*Sus domesticus*
SADP	Mallard Size	
SBUB	Buzzard Size	

SCOC	Raven Size	
SCOR	Hooded Crow Size	
SCR	Woodcock	*Scolopax rusticola*
SFCO	Chaffinch Size	
SGAG	Domestic Fowl Size	
SMA	Small mammal	
SRO	Small rodent	
SSTU	Starling Size	
STU	Starling	*Sturnus vulgaris*
STUM	Blackbird Size	
SVU	Red Squirrel	*Sciurus vulgaris*
TPH	Song Thrush	*Turdus philomelos*
VUV	Red fox	*Vulpes vulpes*

Table C.2: Codes and descriptions for skeletal elements recorded in catalogues.

Skeletal Elements	
Code	*Description*
AN	Antler
AS	Astragalus
AT	Atlas
AX	Axis
C1	1st cuneiform (1st tarsal)
CA	Calcaneum
CATA	Carpal/tarsal
CAV	Caudal vertebra
CO	Coracoid
CV	Cervical vertebra
FE	Femur
FI	Fibula
FU	Furculum
HC	Horncore
HU	Humerus
HY	Hyoid
LB	Long Bone
LN	Lunate (Intermediate)
LV	Lumbar vertebra
MC	Metacarpal (Carpometacarpus)
MC1	1st metacarpal
MC2	2nd metacarpal
MC3	3rd metacarpal
MC4	4th metacarpal

MC5	5th metacarpal
MD	Mandible
MP	Metapodial
MT	Metatarsal (Tarsometatarsus)
MT1	1st metatarsal
MT2	2nd metatarsal
MT3	3rd metatarsal
MT4	4th metatarsal
MT5	5th metatarsal
MX	Maxilla
NC	Navicular (Central)
NCC	Navicular (Central) + cuboid (4th tarsal)
NS	Nasal
OC	Occipital
PA	Patella
PE	Pelvis
PET	Petrous
PH1	1st phalanx
PH2	2nd phalanx
PH3	3rd phalanx
PHA	Phalanx
PI	Pisiform (Accessory)
PRM	Premaxilla
RA	Radius (Radio-ulna)
RB	Rib
SA	Sacrum
SC	Scapula
SCP	Scaphoid (Radial)
SE	Sesamoid
SK	Skull
TAR	Tarsal
TI	Tibia (Tibiotarsus, Tibio-fibula)
TRAC	Tracheal ring
TRD	Trapezoid (2nd carpal)
TV	Thoracic vertebra
UL	Ulna
VT	Vertebra

Table C.3: Codes and descriptions for excavation recovery methods recorded in catalogues.

Recovery	
Code	*Description*
HD	Hand
SV	Sieve

Table C.4: Codes and descriptions for level of preservation of faunal material recorded in catalogues.

Preservation	
Code	*Description*
GD	Good
M	Moderate
P	Poor

Table C.5: Codes and descriptions for bone/tooth sides recorded in catalogues.

Side	
Code	*Description*
AL	Axial/both
IND	Indeterminate
R	Left
L	Right

Table C.6: Codes and descriptions for skeletal stages of fusion recorded in catalogues.

Stage of Fusion	
Code	*Description*
FD	Fused
FG	Fusing
U	Unfused

Table C.7: Codes and descriptions for butchery marks recorded in catalogues.

Butchery	
Code	*Description*
P	Chopped
T	Cut
PT	Chopped & Cut

Table C.8: Codes and descriptions for levels of burning recorded in catalogues.

Burning	
Code	*Description*
SC	Scorched
CH	Charred
CA	Calcined

Table C.9: Codes and descriptions for types of gnawing marks recorded in catalogues.

Gnawing	
Code	*Description*
CF	Canid & felid
CN	Canid
CR	Canid & rodent
FL	Felid
RO	Rodent

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