Feeding the city: zooarchaeological perspectives on urban provisioning and consumption behaviours in post-medieval England (AD1500 - AD1900)

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Abstract

Zooarchaeological enquiry of animals and their products in the post-medieval period has largely been disregarded in British archaeology. Yet, there is multitude of ways in which animals can inform upon the profound social and economic changes that took place during this era. This research reveals how fruitful the study of post-medieval animals can be in improving our understanding of: the meat trade; agricultural economies; urban history; industries; livestock 'improvement'; urban culture; and food consumption in England.

The thesis explores the transformations in the production and consumption of animals and animal products by drawing upon primary and secondary faunal data and historical accounts. Primary investigations of animal bones excavated from Chester were analysed along with secondary faunal data from the city, in order to undertake a detailed zooarchaeological analysis of an urban centre, and to consider the potential challenges of undertaking post-medieval faunal analyses. Zooarchaeological data from urban sites in England were also sourced from grey literature and published reports to conduct a regional review of animal bones from the post-medieval period.

These investigations showed that innovations in agriculture and the industrialisation of food production had a considerable effect on the size and shape of livestock, which coincided with the introduction of imported breeds and morphotypes. Animals provisioned to towns and cities reflected regional husbandry practices as well as urban supply and demand for various meat and animal products for consumption, crafts and industries. The diversity of wild mammals and birds on domestic sites demonstrated the increasing wealth generated in industrial Britain and the emergent middle classes' desire to emulate elite tastes. Other evidence points to the environmental repercussions that hunting, urban expansion and industrialisation had on the proportion of wild species.

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1 Chapter One - Introduction: Research context, questions and themes

1.1 Introduction

This thesis presents the investigation of primary and secondary zooarchaeological data to explore the nature of post-medieval animal bones from urban sites in England to understand provisioning systems and consumption behaviours during this period. This research draws upon primary investigations and secondary data from post-medieval animal bones from Chester, as well as secondary faunal data from 148 post-medieval sites in England. Historical accounts concerning the meat trade, animal husbandry, agrarian histories and industrialisation are employed to aid interpretation and contextualise the zooarchaeological data. This project adopts an integrated approach to produce the first synthesis that investigates of the role and importance of animals throughout this period in British history; demonstrating how pivotal animals were in many of the social and economic developments that took place between 1500 and 1900.

The comprehensive study of animal bones can inform upon a vast range of past human activities including provisioning and husbandry strategies, industry, dietary practices, human-animal interactions and religion. Nevertheless, post-medieval animal bone assemblages have been seriously neglected in comparison to animal bones from earlier periods in British archaeology (see Thomas 2009). Although there has been a growing awareness of the importance of post-medieval archaeology in Britain, publications have yet to fully address the significance of animals during this period. Even when archaeologically-recovered animal bones have been studied, the majority tend to discontinue at AD1750 on the grounds that such data are 'modern' and therefore unworthy of study because the information is already documented in texts (Thomas 2009).

There are important advantages to studying the zooarchaeology of the modern era because this was a period that witnessed immense socio-economic transformations including: a shift in the distribution of wealth with the emerging middle classes; the rise of consumerism; a national urban population boom; innovations in agriculture and industrialisation of food production and the emergence of trans-continental food-trade networks. Given the central role that animals played in these developments, zooarchaeology is well placed to explore the transition from the later medieval period to modernity as well as the ecological repercussions of the industrialisation of food production, and innovations in agriculture and the globalisation and trade in animals and their products.

Furthermore, urban bone assemblages can be more easily compared against documentary sources, which can enrich our understandings of past human-animal relationships. The integration of zooarchaeology and history has revealed interesting results (see Thomas 2002, 2005b) and has provided zooarchaeologists with the opportunity to test their models against known historical events (see the 'improvement' of domestic livestock in this chapter). While the integration of archaeology and history does not come without its challenges (see Albarella 1999), collaboration of both disciplines can help to create a more nuanced picture as the more complex and urbanised a society becomes, the harder it is to derive to a conclusion about a society based on a single line of evidence (Grant 1988: 149). As Thomas and Fothergill (2014) rightly state that it is only through an integrated approach that one can develop a comprehensive understanding of animals in the 'modern' era.

The need for a thorough appraisal of post-medieval faunal data from sites in England became apparent during my Master's degree, when I investigated an 18th-century animal bone assemblage from Cannon Street (London) (Gordon 2010). I was struck by the paucity of published faunal data and information regarding animals during the post-medieval period. Although the latter study produced interesting results, the lack of research on post-medieval animals made it difficult to determine whether the patterns and trends I observed were typical or atypical for the period. For this reason, the intention of this thesis is to produce a large body of faunal evidence from this scarcely understood period with the aim of: (1) making a positive contribution to the study of animals and their products in post-medieval England; and (2) to show the potential of the analysis of this type of material to encourage others to engage with this area of research.

1.2 Research question and aims

The core research question to be addressed in this thesis is: what can zooarchaeology reveal about agricultural production and food consumption behaviours in English towns and cities in the period AD1500-1900?

The primary aims of this investigation that will enable this research question to be addressed are as follows:

1) Investigate the extent to which zooarchaeological data can contribute to the debate regarding the timing and the nature of 'improvement' and the industrialisation of agricultural production during the post-medieval period.

2) Explore the nature of provisioning on post-medieval urban sites.
3) Demonstrate the ways in which animal bones can contribute to our understanding of consumption behaviours amongst different social and cultural groups in the post-medieval period.
4) Assess the extent to which animal bones can inform upon urban cultural identities through the analysis of post-medieval faunal remains.

These aims will be achieved by:

1) Synthesising published and grey literature zooarchaeological reports from England.
2) Undertaking primary zooarchaeological analysis of a single city to explore spatial and temporal variation in detail.
3) Assess what we know about provisioning of urban sites with meat and other animal products and meat supply in the post-medieval period using contemporary literature.
4) Present and assess the contribution of zooarchaeological data for shedding new light on urban provisioning and consumption behaviours in the period AD1500-1900.

1.3 Research Context: Background and Justification

1.3.1 Post-medieval archaeology in Britain

Despite the fact that the post-medieval period is now receiving increased attention in archaeology (- as addressed in regional Research Agenda e.g. Campion 2006; Courtney 2006; Edgeworth 2007; Nixon *et al.* 2002; Stoten 2007a, 2007b), this was not always the case. During the 1960s and 1970s major urban re-developments took place which resulted in a significant increase in the number of urban excavations; mainly conducted by archaeological field units (Courtney 1999: 5; Egan 2009: 549). Egan (2009: 549) states that this change had a negative impact on the amount of post-medieval research being conducted as excavations were no longer being carried out by museums in the United Kingdom where there was an appreciation for the period.

Urban archaeology was mainly focused on earlier periods (particularly the Roman) and selective attention was generally only given to medieval and post-medieval rubbish pits and wells that contained 'interesting' deposits of material, which was usually ceramics (Courtney 1999: 5; Davey 1987: 70). It was commonly acknowledged in urban archaeological reports that when post-medieval archaeology was encountered it was while digging down to get to the earlier archaeology which was

deemed more important (Davey 1987: 70). In Davey's (1987) review of urban archaeology he frequently described instances where archaeological reports, monographs and research priorities made little to no reference to the post-medieval period. It was clear that the value of post-medieval archaeology was under appreciated and therefore excluded from routine analysis during archaeological research.

The increase in the amount of urban excavations in the 60s and 70s led to the accumulation of large quantities of archaeological material (Courtney 1999: 6). Nevertheless most of the results were never published and when they were, because of the multi-period nature of British urban sites, typically only the earlier phases (before AD1500) were included in the final publication (Courtney 1999: 2; West 1999: 11).

Academics have also acknowledged the acute lack of published research and expertise in post-medieval archaeology compared to other countries (Egan 2009: 549; West 1999: 2). Although it is now becoming a more widely recognised discipline in Britain, it has been a fairly underappreciated subject with its study often considered as optional (Courtney 1999: 5; Egan 2009: 549; O'Sullivan 1999: 1). Fortunately, attitudes have changed and there has been a recognisable increase in the number of publications on the subject (see Crossley 1990; Gaimster and Stamper 1997; Newman 2001; Tarlow and West 1999; Barker and Cranstone 2004; King and Sayer 2011).

1.3.2 Post-medieval animal bones in Britain

With the launch of the *Society for Post-Medieval Archaeology* (SPMA) in 1967 the first journal had an appeal for post-medieval animal bones to be researched stating that "Surprisingly, little is known about domestic livestock of this period [therefore]…skeletal remains ought to provide more information about their size, conformation and to some extent, pathology" (Noddle 1967: 106). Twenty one years later, the 1988 SPMA research priorities stated that "adequate support is needed" for the advancement of zooarchaeological investigations within the post-medieval period. However, the reprisal of a 'call to arms' for more zooarchaeological analyses demonstrates that these needs have not been met (e.g. Egan 2009; Thomas 2009). The implementation of environmental studies came late to post-medieval archaeology and, unfortunately, zooarchaeological as well as botanical studies have continued to remain inconsistent (Egan 2009: 556); this has not been helped by the slow appreciation of archaeology from this era.

Similarly, in academic literature, there is little to no incorporation of animal bone data in areas where it can contribute. For instance, texts with a strong focus on landscapes and industry (Crossley

1900; Newman 2001) barely make reference to the animals that inhabited the landscape or the animal products that were fundamental to certain industries during this time period (e.g. leather, tallow). Ceramic studies that demonstrate changes in consumption habits fail to discuss the direct evidence from animal bones which represents the food that was being consumed or cooked on/within such ceramics (e.g. Lawrence 2006). The journal of *Post-Medieval Archaeology* itself has also been noted for its lack of papers pertaining to animal bones, particularly from the mid-18th century onwards (Thomas 2009: 134). One explanation for this could be because most zooarchaeological investigations tend to discontinue at AD1750 (Thomas 2009). Even in commercial archaeology there is still a negative fixed notion about the worth of post-medieval animal bone assemblages. For example, analyses of post-medieval animal remains in Ireland are often discounted because 'excavators wrongly assume that … [it] … will not provide meaningful results' (Murphy 2007: 371). Animal bones from the 18th- to 20th-century phases at Stafford Castle were not considered to have any 'archaeological potential' to warrant detailed analysis (Nicholson 1990 cited by Thomas 2011: 1).

It is possible that improvement in urban waste management strategies from the 18th century onwards, has contributed to a paucity of animal bones at sites from the later post-medieval period (Davis and Beckett 1999: 6; Thomas 2005b: 81). In addition, bones were a valuable raw material that were fashioned into objects such as buttons, handles, combs, fans, toothbrushes and toy pieces (Yeomans 2006; Cooper 2006; Atkins 2012b). Bones were also boiled for marrow to make soap and glue and grounded to use as fertiliser (Velis *et al.* 2009; Atkins 2012b; New York State Agricultural Experiment 1891: 1). In the 19th century, it was the occupation of some to collect household waste including bones for this purpose (Cooper 2006; see Mayhew 1968). Therefore, the lack of bones could also reflect their multiple uses causing them to be re-purposed and recycled instead of ending up in the archaeological record.

More recently, a suite of publications have demonstrated the significance of animals in 'modern' Britain, which have been explored within the framework of pet-keeping, animal care, trade and exploitation, commensality, animal translocation, 'improvement' and crafts and industry (e.g. Thomas 2005c; Thomas 2014; Thomas and Fothergill 2014; Fothergill 2012a, 2014; O'Connor 2013; Morris 2014; Thomas *et al.* 2013; Yeomans 2007). Despite this, there are areas of investigation that remained unexplored (i.e. urban animals, the zooarchaeology of ethnicity, international meat trade, etc.) and publications of this nature are still limited to the few scholars that have an appreciation for the study of animals in this era (i.e. Thomas 2009; Fothergill 2014). In 2011, a survey conducted by zooarchaeologists in the United Kingdom showed that the recording and analysis of animal bones

beyond AD1750 was still an issue in some commercial units (Broderick 2014). Survey participants reported that post-medieval animal remains either never got past the assessment stage, were thrown away during the excavation, only reported in grey literature reports, or not reported at all (Broderick 2014). Funding issues were also highlighted as a problem as some companies simply did not have the money to pursue further work on the analysis of these remains (Broderick 2014).

Overall, the routine analysis of post-medieval faunal remains is fairly sporadic across Britain; relevant publications are limited to a select number of cities or individual sites. London has seen an unprecedented scale of excavations which reveal archaeological material from over 2000 years of past activity (Thomas *et al.* 2013). During the 1970s, London also experienced an increase in the number of excavations with the majority of the work undertaken by the Museum of London Archaeological Services (now Museum of London Archaeology) (Thomas *et al.* 2013: 8). From these excavations, animal bones studies from the post-medieval era were frequently conducted (e.g. Armitage 1977; 1982; Armitage *et al.* 1984). Since then the Museum of London Archaeology has continued to regularly publish their own monograph series adopting an integrated approach incorporating specialists' evidence into the chronological narrative. A number of these monographs include the animal bone results from post-medieval phases (e.g. Anthony 2011; Bowsher and Miller 2009; Burch and Treveil 2011; Grainger and Phillpotts 2010). The animal bones are also archived in The London Archaeological Archive and Research Centre (LAARC). Other sites featuring late medieval and post-medieval zooarchaeological analyses include: 25 Bridge Street, Chester (Smith 2008); Colchester (Luff 1993); Dragon Hall, Norfolk (Murray and Albarella 2005); Dudley Castle, West Midlands (Thomas 2005a); Exeter (Maltby 1979); Launceston Castle, Cornwall (Albarella and Davis 1996); Leicester (Gidney 1991a; 1991b; 1991c; 1992; 1993); Lincoln (Dobney *et al.* 1996); Norwich Castle (Albarella *et al.* 2009); Stafford Castle (Thomas 2011); Winchester (Serjeantson and Smith 2009); Worcester Cathedral (Thomas 1999). Archaeological investigation at Hungate in York is one of the few sites that have been involved in the excavation of 19th- and 20th - century levels of what was known to be an industrial slum. The post-excavation work is currently in progress and the animal bones found included the remains of working animals and probably buried pets (Connelly *et al.* 2008; Rainsford pers. comm). Many of the aforementioned sites produced publications of multi-period syntheses or individual site reports; despite this many do not include data beyond the AD1750 threshold. Notwithstanding the publication of regional and temporal syntheses of zooarchaeological data from English sites of prehistoric, Roman, early medieval and medieval date (e.g. Hambleton 1999, 2008; Holmes 2011; Maltby 2010; Sykes 2007a), there is yet to be a synthesis that focuses on the post-medieval period. Hence there is an urgent need to compile these data

together to help raise awareness of the value of post-medieval zooarchaeological enquiry and to evaluate what we know so far and which questions remain outstanding.

1.3.3 Historical zooarchaeology in America

Post-medieval zooarchaeological investigations elsewhere in the world are scanty to say the least. There is growing interest in the study of animals in the modern period in regions such as Canada (e.g. Guiry *et al.* 2012, Tourigny and Noel 2013), Argentina (e.g. Chichkoyan 2013), Australia (e.g. Gibbs 2005, Gibbs 2010) as well as European countries such as Finland (e.g. Puputti 2010), Portugal (e.g. Davis 2009; Moreno-García and Detry 2010) and Belgium (e.g. Thys and Van Neer 2010). However, the best examples of frequently published, post-medieval zooarchaeological research are produced in North America. American historical archaeology is defined by the study of material remains from post-prehistoric cultures and contrary to Britain, North America has a well-established tradition of incorporating faunal studies. From the 1970s, the analyses of faunal remains have continued to rise alongside the development of historical archaeology (Landon 2009: 78). James Deetz's celebrated classic, *In Small Things Forgotten* (1977), was an important catalyst for historical zooarchaeology by encouraging faunal specialists to reconstruct foodways in the historic past (Landon 2009: 78). As the discipline has developed, a great deal of work has been undertaken exploring: diet and subsistence (particularly dietary identities e.g. Miller 1988; Reitz 1991); social and cultural foodways (e.g. Milne and Crabtree 2001; Scott 1996); rural and urban food supply (e.g. Landon 1996; Reitz 1986); and colonial livestock introductions (Cossette and Horad-Herbin 2003; Reitz and Ruff 2004).

Analyses of animal bones from urban and rural sites have thus made a substantive contribution to the understanding of America's past. The question arises, however, whether the dearth of British post-medieval zooarchaeology reflects a cultural disinterest, rather than genuine difficulties associated with the investigation of post-medieval material (e.g. residuality and access to reports). Towns in the United States do not have the same build up deposits like in the United Kingdom; therefore they are less likely to be issues with residuality and multi-period sites to deal with. It has been suggested the reason there is this evident disparity between British and North American zooarchaeology is due to the different manner in which post-medieval archaeology developed in both countries, as there has been no equal event such as colonisation in British history (Courtney 1999; Thomas 2009: 136; West 1999: 7-8). Some scholars view this is a reason why historical archaeology has developed in America (Matthews 1999: 156). Whether this is real or perceived, such

a viewpoint is unfounded and fails to recognise what archaeologists can contribute to the investigation of the later periods.

1.3.4 Residuality and urban assemblages

Nonetheless, there are issues associated with the study of post-medieval animal bones that should be taken into account. Given the fact that numerous urban sites in Britain are deeply-stratified and truncated by later development, residual material, the contamination of contexts with material of a different date - is often a concern that has to be addressed. Archaeologists have long been aware of this issue and the problem it can pose when selecting appropriate material to analyse. Although some attempts have been made to address these concerns (see below) there is a lack of zooarchaeological literature and studies concerning residuality in archaeology (Albarella 2015: 2). Recent works by Albarella (2015) has highlighted inconsistencies in the use and definition of the term residuality. This can create problems when identifying residual material since what might be classified as residual on one site may not be on another depending on the definition of the terminology.

The following explanation has been presented in Albarella (2015: 1), in which residual bone is defined as the vertical (or horizontal) movement of bone from an earlier to later phase; meaning it has moved from the phase it originally belonged to, to one of a later date. It is important to point out here the difference between residual and redeposited bone, as the latter involves the movement of bone from one place to another, which can occur in the same phase. Another crucial difference between residual and redeposited bone is that while the latter represents an 'actual event', the former represents an 'analytical construct', which is defined by the phasing that has been established for the archaeological site (Albarella 2015: 3). For example, sites with broader chronological dates (e.g. medieval) are less likely to have residual bone than those with narrower dates (e.g. AD 1300-1350) purely because of the way the dating has been assigned (Albarella 2015: 4). Therefore, depending on the site's phasing an assemblage will or will not contain residual material.

Pottery has been the primary tool in studies of residuality due to the fact that pottery styles and types change rapidly, making it easier to date. Consequently, it has been used as a proxy for detecting residuality in animal bones (Evans and Millett 1992: 225). Methods to help identify and assess the level of residual material in a deposit can come by noting the past and present levels of

pottery supply, the context type and the present activity on the site (Evans and Millett 1992: 239). Dividing deposits into primary, secondary and tertiary categories and assessing the residuality scores has also been employed (Schofield 1987: 1). The former has been used to select animal bone material to analyse from London sites where only large and well-dated material of refuse, that was collected and disposed of rapidly, was chosen for investigation (Armitage 1982: 94; Thomas *et al.* 2013). A similar strategy has been employed for animal bones from Norwich (Albarella *et al.* 2009), Stafford (Thomas 2011) and York (O'Connor 1989a).

For analysing large amounts of animal bone from Lincoln, a pottery and bone index was devised to identify residual material (Dobney *et al.* 1996: 18-19). The pottery index was established to help determine which contexts would contain the most reliable and well-dated material. This was done in two ways: (1) each context type was classified using a three tier system to assess which deposits were likely to contain primary material and (2) the percentage of residual Roman and medieval pottery was calculated for each context type (Dobney *et al*. 1996: 18). Based on these results it could then be decided which bone assemblages were likely to provide useful information. The bone index was then used to test whether these two sets of data (i.e. pottery and animal bone) could be successfully compared (Dobney *et al*. 1996: 19). The bone index was based on the preservation, angularity and colour of the assemblage, all of which were rated using a scoring system. The idea here is that any noticeable variation in the zooarchaeological assemblage could indicate residual and re-worked material, and therefore should tally with the pottery index (Dobney *et al.* 1996). However, the comparison of the pottery and bone index showed no correlation between the indices, which highlights the problems that exist when using pottery to assess the level of residuality in animal bone assemblages since they may have different depositional histories (Dobney *et al.* 1996: 19). Another issue with the method devised by Dobney *et al*. (1996) was that the measures they used to detect residuality in animal bone were signs associated with redeposition (e.g. weathering, fractures, angularity) (Albarella 2015: 3). This highlights the problems that can arise when confusing or misinterpreting signs of redeposition as residual, especially since residual bone may not necessary show signs of battering and abrasion (Albarella 2015: 3).

This demonstrates the need for zooarchaeologists to understand the movement of bones through the archaeological strata before one can make an informed assessment about the stratigraphic integrity of a site and the potential of the faunal material (Albarella 2015: 2). It also reveals how the practice of using residual pottery to decide what bone assemblages to record is flawed. Furthermore, the curation of old-fashioned, disused material culture from earlier periods could

present a problem when verifying the date and origin of an archaeological context and the material it contains.

Residuality is an inevitable issue with post-medieval animal bones and reflects the nature of most urban contexts. However, the extent to which this problem is real or perceived has yet to be properly established and whether one can measure the level of residuality remains a question that still needs to be addressed.

1.4 Research Themes in Context

This section will highlight the five key themes that will form a major component of this thesis: (1) Britain's urban history and meat trade; (2) urban provisioning and production; (3) innovations in livestock husbandry; (4) food and social status; and (5) urban identity. Each aim will be considered in turn; current knowledge will be described and outstanding questions to be addressed by this research will be highlighted.

1.4.1 Britain's urban history and meat trade

Animals were fundamental to the growth of urbanisation and the industrialisation of food and agriculture in England. Many of the developments observed in Britain today would not have occurred without the aid of animals driving the changes witnessed throughout the post-medieval period. In order to understand the centrality of animals in these processes it is crucial to have background knowledge of urban development in England and how this in turn transformed in the meat industry over the next 400 years.

Between 1500 and 1900, England's towns and cities underwent a profound shift in their number, size and character, driven largely in part by the national population boom, which saw the number of British inhabitants in urban centers soar (Lawless and Brown 1986: 7). This demographic change began in the early 16th century although it differed chronologically and geographically (Dyer 2004a: 344; Glennie and Whyte 2000: 169; Clark and Slack 1976: 85).

Urban population growth started off gradually in the 1500s but began to rise at a faster rate by the 17th century (Dyer 1991:47). During the 1500s to 1700s, approximately 75% of Britons still lived in the countryside but towards the end of the 17th-century, towns and cities were becoming more desirable places to live because of the social, cultural and economic benefits they offered (Clark and

Slack 1976).There was also the establishment of newer industrial and dockyard towns, which also tempted people from the countryside in search of work (Clark and Slack 1976: 83).

Population statistics before the 1801 census are difficult to determine because of the lack of records tracking the constant rise and fall in mortality, birth rates and migration (Ellis 2001: 27). Nevertheless, historians are in agreement that in the early modern period more and more people were migrating to towns (Dyer 1991; Clark and Slack 1976; Lawless and Brown 1986). By the 1700s, about 15% of people lived in provincial towns and cities and England's population had doubled. According to Dyer (1991: 47), Britain's urban population levels between 1525 and 1600 went from 85,000 to 130,000. London witnessed the most urban growth; contributing to about half of the population: by the 1700s it was the largest city in Europe (Black 1996: 182; Clark and Slack 1976: 12, 83; Dyer 1991: 43; Lawless and Brown 1986: 8).

Before the 17th century, urban growth was largely steady and gradual, however, when the Industrial Revolution took off in the late 18th century, it had an enormous effect on the rate of urban and population expansion (Langton 2000: 453). This phase in British history saw the development of new technology and machines for the manufacturing of goods and products as well as advancement in transportation and communications (Morris 1997: 2). This period also witnessed the rise of a fossil fuel based economy, which led to a growing number of people employed in mines, mills and factories (Williamson 2013: 73-74). Inventions such as James Hargreaves' 'Spinning Jenny' (1764) and Richard Arkwright's 'Water Frame' (1769) brought great changes to the manufacturing and production of textiles and cotton and the establishment of cotton mills, which needed a large labour force (Lawless and Brown 1986: 10). Coal 'lay at the heart of the industrial revolution' (Williamson 2013: 77); it provided a fuel which allowed for the manufacturing of products which in turn stimulated the economy and encouraged the development of the railways and steam engines (Williamson 2013: 77). These major technological innovations continued to attract the rural population to urban centers and by the 18th century one in three English people lived in towns as opposed to one in seven in the 1700s (Ellis 2001: 26). In 1840, Britain's population had risen to 18.5 million and by the 1900 the population was 56 million (Wrigley 2004: 57-59).

Williamson (2013: 74) importantly points out that demographic, industrial and agricultural developments were inextricably linked. The rising urban population brought with it a greater demand not only for manufactured products but also food. It was this demand that changed many aspects of agricultural production, making significant contributions to the national economy (Glennie and Whyte 2000: 176; Allen 2004: 96). This included: increased agricultural productivity and surpluses, specialised trade and production, oversea trade in food products, larger farm enterprises,

the establishment of new jobs (see below) and intensive cultivation (Ellis 2001: 34; Glennie and Whyte 2000: 176). In addition, with more urban growth came urban prosperity and those with money could influence the types of food made available on the urban market, in order to meet consumer demand (Ellis 2001: 34; Glennie and Whyte 2000: 176; Spencer 2004: 157-159).

Britain's meat industry was fundamental to sustaining the growing urban population. From the 1500s to 1900s the urban meat trade evolved into intricate networks, which administered and regulated the supply and distribution of animals around the country. Research regarding the meat trade and meat production varies greatly depending on the animal. Scholars have largely been engaged in the study of the trade of beef, veal, mutton, lamb, pork and occasionally poultry. This is because the information regarding these animals is more extensive (see Capie and Perren 1980; Perren 1978; Putnam 1923; Rixson 2000). This following account will mainly concern the trade of cattle, sheep and pig due to the availability of evidence.

The changes witnessed in the meat industry stemmed from the large-scale social and economic developments that took place in British towns and cities (as discussed above). These developments not only increased the availability and production of meat but encouraged innovative farmers to search for new ways to enhance meat yield by the 'improvement' of their livestock (see Innovations in livestock husbandry, in this chapter).

The meat trade was an extensive operation that involved a web of individuals who facilitated the exchange of both live and dead animals (figure 1.1). This food network evidently began with farmers. They were the breeders of livestock, who invested time in ensuring that the animal achieved the maximum meat weight in a short period of time (Metcalfe 2012: 17, 20). Many farmers either fattened their livestock before selling them on or kept them as 'lean stock' to be sold and then fattened by someone else. Graziers took on the role of fattening up livestock on their land, which added value to the animal earning them a profit (Metcalfe 2012: 20; Rixson 2000: 200). Drovers transported live animals to the market, traveling with them on connecting roads (i.e. drove roads) to towns and cities and took animals from as far as Scotland (Metcalfe 2012: 23). Drovers often worked for farmers and graziers by transporting their animals in large numbers to get a cut of the profit. A drove could have as little as 100 or as many as 1000 animals (Metcalfe 2012: 23). The expanding meat trade also created a niche market for opportunists that sought to make money from the trade and begin their own economic ventures. These entrepreneurs were referred to as middlemen, who brought animals to the market and sold them at profitable prices (Rixson 2000: 168; Metcalfe 2012: 21). These individuals understood the inner working of the market and pricing, which allowed them to control the rate and availability of livestock (Metcalfe 2012). The 17th and 18th centuries saw the

rise in the number of middlemen and by the 1750s most of the meat was exchanged and sold by them. Although middlemen received severe penalties in the medieval period, by the 19th century they were largely accepted as key players of the meat trade as they kept prices competitive (Metcalfe 2012: 19, 22).

There were different types of middlemen which included: forestallers, engrossers/regrators, badgers and jobbers (Metcalfe 2012: 21; Rixson 2000: 200). They were each involved in the buying and selling of livestock but in different ways. For instance, forestallers purchased and held onto livestock until the prices rose and engrossers/regrators purchased small groups of animals and sold them as one collective group (Metcalfe 2012: 21). Badgers were travelling meat traders and jobbers were unique to the London market who manipulated the prices of meat as they attempted to sell animals at a profit (Rixson 2000: 202). There were also salesmen who were employed by farmers and graziers who bought and sold animals on commission from other markets (Metcalfe 2012: 21; Rixson 2000: 200). Further down the line of this food network were butchers that purchased live or dead animals to sell directly to the public. There were generally two types of butchers: retail and wholesale (Metcalfe 2012: 34). Retail butchers would buy dead carcasses to sell in their premises and wholesale butchers bought live animals to kill and then sell (Metcalfe 2012: 34). Last but not least, there were the buyers and consumers who could ultimately dictate the supply and demand of meat on the urban market. Those involved in the meat industry were particularly attuned with consumer demand and went out of their way to 'feed' their consumer habits (Metcalfe 2012). Meat was a luxury commodity that very few people could afford unless they had the capital. The Industrial Revolution gave the opportunity for those from humble beginnings to become prosperous from their jobs in trade and merchandise (Spencer 2004: 158). This new found wealth saw the rise of the middle classes who sought to display and enjoy their income through food. The increasing wealth in England acted as a catalyst for consumerism, which strongly influenced the quality and variety of meat that could be bought (Spencer 2004: 158; Metcalfe 2012: 41).

The early 19th century saw further developments in the meat industry with the arrival of the railways and steamboats (1830s). These sped up the process of provisioning; bringing food directly to the source of the demand (Perren 1978: 216). However, by the mid-19th century British farmers were struggling to keep up with the growing demand for food, which caused the 'mid Victorian meat famine' (Perren 2006: 8). This crisis, along with technological innovations and the relaxation on trade restrictions (i.e. the free trade era), opened up the market for the international trade of live animals and chilled/frozen meat from North America, South America (Argentina and Uruguay), Australia and New Zealand (Perren 2006; Perren 1978; Capie and Perren 1980; Huttman 1978). Advances in

preservation allowed for chilled and frozen meat to be transported over long voyages, which arrived to the country as fresh and palatable meat. This was achieved using freezing techniques, refrigeration and employing the use of cold storage facilities (Oddy 2007). Experiments with freezing and chilling began in 1860, however, these techniques were not fully employed in the meat industry until the 1870s (Perren 2006: 47). The trade in chilled meat largely came from the US market while frozen meat came from Australia, New Zealand and Argentina. Canned meat was the last method of preservation, which was popular among the poor (Perren 2006: 47; Rixson 2000: 322; Huttman 1978: 251). From the 1870s, the exportation of beef from North America dominated the international meat trade in Britain and by 1890, 30% of British beef came from the United States (Huttman 1978: 254). This trade completely collapsed by 1914 due to the population pressure in North America, whose growing populace also required food. However, beef was still supplied from Argentina as well as mutton from New Zealand (Capie and Perren 1980: 508; Huttman 1978: 262). World War I (1914-1918) had a major impact on the supply of meat as its demand during the war affected its availability for British consumers and placed restrictions on its exportation by overseas producers (Perren 2005). By 1917, meat imports to Britain were lower in comparison to 1914 and the populations' consumption of beef and mutton decreased to roughly one-sixth (Perren 2005: 214). Inevitably, the demand for meat resulted in price increases, which included a rise in the price of cheaper cuts as these parts were favored for military rations (Perren 214-215). Furthermore, during the war overseas meat suppliers and farmers from South America, Australia and New Zealand faced meat production pressures. This was caused by a rise in freight prices, the collapse in the international payment system and shortages of shipping space due to German surface raiders (Perren 2005). As a consequence, this placed constraints on the selling and exportation of meat, thus resulting in financial losses for South American, New Zealand and Australian farmers (Perren 2005). Live animals were shipped to Britain from abroad, largely from European countries such as Holland and Germany (Capie and Perren 1980: 506; Perren 1978: 218). Unfortunately, livestock from these European countries also came from areas where disease was widespread, which infected British livestock with cattle plague and sheep pox (Capie and Perren 1980: 506; Rixson 2000: 300). As an aftermath of the spread of disease from foreign livestock, The Cattle Diseases Prevention Act (1866) and the Contagious Diseases Animals Act (1869) were established to prevent and control the spread of infection amongst native livestock (Rixson 2000: 300).

It is not possible to discuss Britain's meat trade without paying some attention to how it contributed to the sanitation reform in the 19th century and how this transformed the way animals were killed for meat in modern Britain. In the Victorian period, the government became increasingly aware of the relationship between poor sanitation and the spread of disease in urban Britain. Due to the

noise, waste, smells and congestion created by the butchers' trade, many reformers targeted butchers, blaming them for the unsanitary chaos they brought to urban areas (Metcalfe 2012: 33; Atkins 2012). In London, there was an outcry over the number of slaughter-houses based in the city, as the majority of butchers killed animals on their premises and failed to get rid of the waste, which remained on the streets to putrefy (MacLachlan 2007; Atkins 2012b: 84).The concerns over the smell and the potential health hazards associated with slaughter-houses eventually led to the creation of The Nuisances Removal Act (1855), which gave local authorities the permission to demand the removal of waste from residential and business areas (MacLachlan 2007: 241). Slaughter-houses were eventually replaced by public abattoirs, which allowed for improved hygiene and marked the beginning of a 'new [and cleaner] industrial process' for the meat industry (Atkins 2012b: 88). The number of abattoirs increased in the later 19th century and the number of slaughter-houses declined until their eventual removal from the 20th-century cityscape (Atkins 2012b: 88; MacLachlan 2007: 253).

1.4.1.1 Potential for future research

Taking into consideration the role animals and the meat industry played during this dynamic time period, it is impossible to ignore animals when investigating aspects of urbanisation and industrialisation in the post-medieval period. Animals affected many aspects of social and economic life, such as commercialisation, consumerism, trade and industries; they were at the core of change in post-medieval England. By using of primary and secondary faunal data and secondary sources, it will present an opportunity to understand more about the nature of animal production and the trade. Therefore, the zooarchaeological enquiry of post-medieval animals will undoubtedly lead to the advancement in knowledge the meat trade and industry during this progressive and complex time in British history.

1.4.2 Feeding the city: urban provisioning and production

Post-medieval urban cities and towns were net consumers of animals and their products; therefore, a distributive relationship between the rural and urban communities was paramount in order to ensure a constant supply of animal resources to the town or city (O'Connor 1992: 101). However, towns, not being passive recipients to the rural producers, would have developed the purchasing power to influence what was sold on the urban market (O'Connor 1992: 103). This obviously

becomes more important during the post-medieval period as commercialisation and consumerism increased alongside the growth in capitalism and rising living standards amongst particular social groups. O'Connor (1989a: 14) identifies three routes by which towns would have obtained their food: (1) from farms and estates in the hinterland; (2) from small scale production of livestock in towns; and (3) from hunting and fishing. As noted above, urban communities would have had to develop their own mechanisms to control what animal resources were available to use and purchase, which would have been essential to feed and clothe the urban population (Allentuck and Greenfield 2010: 12; O'Connor 1992: 102). The methods used to ensure the availability of such resources would have been intertwined in the social, economic and political dynamics that existed during that time (Costin 1991: 2; O'Connor 1989b: 21).

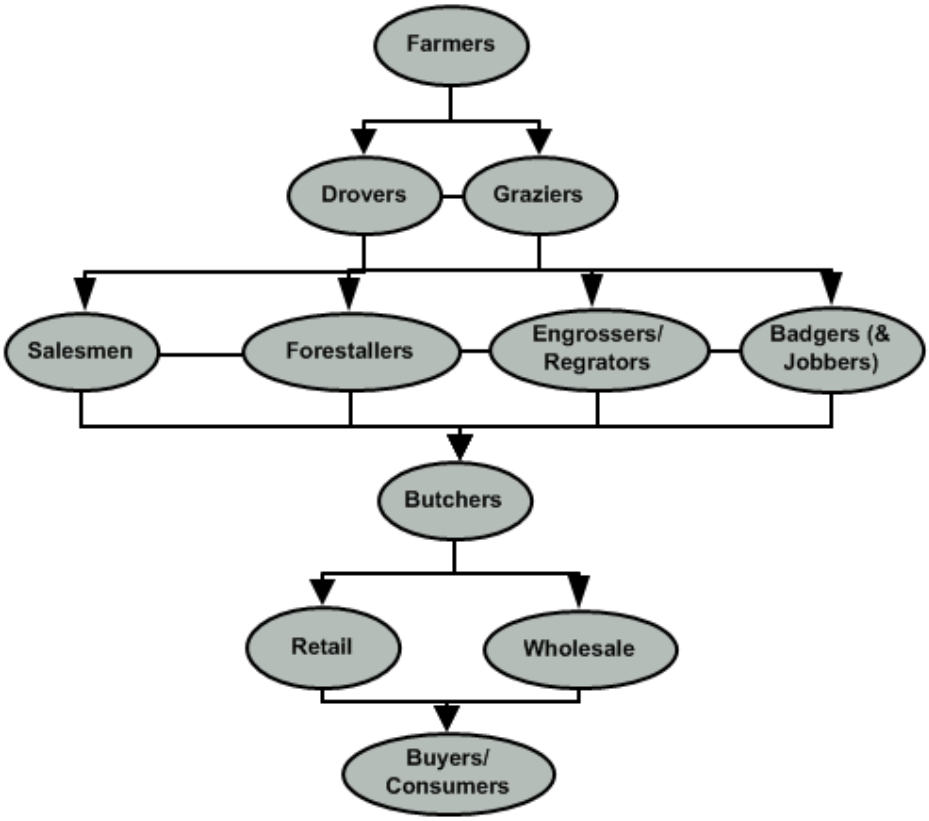

Figure 1.1: Flow diagram demonstrating the network of suppliers responsible for the urban meat market.

Animal bones are extremely beneficial in enhancing our understanding about how urban communities were provisioned with food because they can (depending on their depositional context) reflect the animal resources that were procured by consumers and supplied by the

producer and thus provide an insight into these complex socio-political and socio-economic dimensions. Zooarchaeological investigations of urban provisioning have been limited, although a few examples that exist deal with or focus on the how cities and towns obtained their food (e.g. Allentuk and Greenfield 2010; Maltby 1979; O'Connor 1989b; O'Connor 2000a; Zeder 1991). These investigations have identified three forms of evidence that can inform upon the distribution of animals: species diversity and proportions; mortality profiles (the age of the animal when it was killed); and body part distributions. As the majority of the meat in urban sites would have been acquired from the countryside, the species present as well as their abundance, body parts and age will provide insight into husbandry practices employed in the hinterland as well as that were desired by the consumer (Landon 1997: 55; O'Connor 2000a). For instance, whether there was a focus on the production of meat, milk, wool, manure or traction power, would have had a bearing on the age of the animals that arrive in the town. The availability of species would be influenced by what was being raised in the hinterland, environmental conditions and consumer demand. In addition, the distribution of body parts and the standardisation of butchery can reflect the specialisation and utilisation of the animals that arrived in the town which is a common characteristic of specialised economies (Allentuk and Greenfield 2010: 12).

Species representation/abundance, mortality profiles and body parts have been utilised when investigating urban and rural supply of animals on sites in North America, to understand the movement of animals and food supply systems. Two 17th to 19th century urban and rural animal bone assemblages from Boston were compared to explore whether there were distinct differences between the deposits (Landon 1996, 1997). The urban assemblage had less cattle and wild animals but more juvenile caprine and body parts that indicated a preference for carcass elements with more meat (Landon 1996, 1997). A review of faunal data from the 16th, and 18th - 19th century archaeological sites from the Southern Atlantic showed similar differences between urban and rural assemblages (Reitz 1986). For example, urban households showed that fewer wild animals were consumed compared to their rural counterparts (Reitz 1986).

Animals and their products would have been utilised in a multitude of ways in post-medieval urban centres including: meat; marrow; transportation; wool; hides and tallow. Certain signatures in the faunal assemblage can represent either one of these uses that took place during one event or over a period of time (Sapir-Hen *et al.* 2012: 591). Therefore, having an understanding of the trajectories by which animal bones arrived in a specific depositional context can allow for a better understanding of past human behaviours, lifestyles and practices and provisioning strategies (Wilson 1996). When an animal carcass arrived on site it will be utilised to provide a number of commodities including leather

shoes, candles, drinking vessels, bone handles, combs and playing pieces (Yeomans 2004: 69). Therefore different parts of the animal will be redistributed to various parts of the city and utilised for specific purposes, which will result in distinct faunal deposits associated with those activities (see Armitage 1982; García 2009; O'Connor 1993, figure 1: 64). A good example of this can be seen in Yeomans's (2004) use of zooarchaeological and historical evidence showing the supply and distribution networks of animal carcasses and how this influenced the layout of London's local neighbourhoods.

1.4.2.1 Potential for further research

The investigation of provisioning of post-medieval urban centres has yet to be carried out on a large scale as most of the studies on provisioning tend to focus on individual sites (O'Connor 1989b: 13). Urban provisioning is a complex process which involves a string of social and economic factors that will continually change over time (O'Connor 1992: 105). The communication, trade and exchange of animal resources are a two-way process which will be controlled both by the consumers and the producers. Therefore, urban provisioning will be dictated by what is supplied from the hinterland and by consumer demand, which will influence what animals and animal products are sold on the urban market. Zooarchaeology is well placed to explore the trade and distribution of animals and their products at different kinds of site. Therefore, through the use of animal remains it is possible to recognise these processes archaeologically and contribute to our understanding of the complexity and scale of urban provisioning. In addition, zooarchaeological enquiry can explore repercussions of the industrialisation of animals and animal products from the later medieval period to modernity by investigating the shift from small-scale family run farms and large-scale commercial farms. Furthermore, the manner in which animal bones arrive on site will not be uniform and can reflect peoples' behaviour towards specific animal parts and therefore increase our understanding of carcass distribution and to a certain extent site formation processes. Therefore, only with the compilation of large amounts of faunal data will it be possible to investigate these aspects of human existence (Thomas 2009: 142).

1.4.3 Innovations in livestock husbandry

During the late 18th century, Britain experienced major technological innovations, which resulted in the transformation of agricultural and livestock husbandry practices. This was partly fuelled by the population boom which required farmers to produce more food to meet the demands of the

growing populace (Beckett 1990: 15; Davis and Beckett 1999: 415; Overton 1996: 7; Thomas 2009: 136). Thus, new agricultural machinery was introduced which enabled increased crop yields and productivity (Overton 1996: 7). This period became known as the Agricultural Revolution and is associated with several notable changes that included: (1) the introduction of new crops and crop rotation; (2) new machinery and technologies (e.g. seed drill); (3) parliamentary enclosure of land; (4) land drainage; and (5) 'improvement' of livestock breeds (Beckett 1990: ix; Davis 1997: 415; Overton 1996: 7).

There have been extensive debates regarding the timing of the Agricultural Revolution. Many historians believed that these changes occurred between 1760 and 1830 as an onset of the Industrial Revolution (e.g. Chambers and Mingay 1966). It was Lord Ernle, in his book *English Farming Past and Present* (1912), who first advocated this time range and stated this was a Georgian phenomenon between 1760 and 1840 (cf Davis 1997: 414). Doubts exist regarding the reliability of Ernle's sources which were largely farming textbooks that often contained incorrect information (Fussell 1961). In the 1960s historians began to challenge this proposed date (Beckett 1990; Fussell 1961). In particular, Kerridge - in *The Agricultural Revolution* (1967) - argued that the phenomenon occurred earlier, during the 16th and 17th centuries with most changes having taken place already by 1750 (Kerridge 1967). Kerridge (1967) argued that the changes that took place from 1750 to 1850 were as not revolutionary as originally proposed and states that: changes regarding the introduction of new and replacement crops were exaggerated; technology only changed gradually and slightly; land was exploited before enclosures began; and traditional methods were already used for land drainage. Chambers and Mingay (1966) agreed with Kerridge, stating that 'developments of modern farming [began from as early as the 16th-17th century], gathering pace in the 18th and 19th centuries'. There have also been concerns about the implication of the term 'revolution': some historians (and zoorchaeologists) instead argue that this process was long and gradual rather than abrupt, and varied depending on the region and terrain (Beckett 1990: x; Thirsk 1987: 59-61; Thomas *et al.* 2013; Davis and Beckett 1999).

Zooarchaeology has already begun to contribute a great deal to this debate. While historical evidence has tended to focus on the land management histories and crop husbandry regimes, animal bones and teeth can provide the direct evidence for the 'improvement' of breeds through size and shape change. The selective breeding of animals was a high priority for farmers in the past; this commonly involved creating new breeds and cross breeding with newer varieties to increase the meat weight and quality of the animal (Davis and Beckett 1999: 2). Kerridge (1967) states that improvement of cattle and sheep was taking place from the 17th century and that sheep were

already being reared on new pasture for fattening. Historians make reference to selective breeding for the purpose of rearing larger animals for more meat because the growing population demanded more food. Efforts were therefore directed towards producing larger animals with a higher meat and fat content in a shorter period of time. For instance, from 1745, Robert Bakewell, the Leicestershire farmer, was famed for his method of the selective breeding and improvement of his "New Longhorn" cattle and "New Leicester" sheep which fattened quickly. His fame led to many admirers who attempted to repeat his methods for themselves (Beckett 1900: 24; Trow-Smith 1959). In the 16th and 17th century, it is well-attested that Dutch cattle, which were good producers of milk and were of a substantial size, where imported to Britain and apparently had their blood 'injected in south-west Midland red stock' (Trow-Smith 1957: 208-209; Trow-Smith 1959: 27-28; Russell 1986).

Through the use of measurements, zooarchaeologists use the size and shape change in animal bones to identify a shift in husbandry strategies as an indicator for the start of the Agricultural Revolution. The first study of this kind was carried out by Philip Armitage (1980) on an assemblage of cattle bones from London; this showed an increase in size from the 13th to 16th century (Davis and Beckett 1999: 14). Davis (1997) compared measurement data for cattle and sheep bones from medieval and post-medieval sites around England, showing that size variation for both species differed by region. The evidence also show that cattle bones from Exeter increased in size during the 15th century and cattle bones from Launceston also showed a noticeable increase in size and shape from the 15th to 17th century (Albarella and Davis 1996; Maltby 1979). Albarella (1997b) presents the results of similar findings which show a size increase in animals by the 16th century.

Investigations of faunal measurements conducted on animal bones and teeth from Dudley Castle revealed an earlier size increase during the later 14th-century in the post-cranial bones for cattle, sheep, pig and chicken (Thomas 2002, 2005b). While it should be noted that these changes can occur as a result of environmental factors and changes in the sexual composition of herd flocks (Thomas 2005b), the fact that for pigs there was an increase in teeth size indicates that this change had a genetic basis as teeth are less effected by environmental conditions (see Chapter Two). It was concluded that these size changes may have been influenced by the effects of the Black Death (1348-1352) rather than the Agricultural Revolution. The Bubonic Plague caused major population decrease, which led to a reduction in the number of labourers that could work on agricultural farmland which required a large work force. Consequently, this led to a shift towards livestock farming, which was less labour intensive and resulted in the movement of cattle and sheep from arable to better pastures and enclosed land allowing them to increase in size (Thomas 2002: 24, 2005b: 83). The size increase for pigs was attributed to the woodland destruction across the 12th

and 14th centuries which led to an increase in the number of pigs living in sties. This allowed farmers to have greater control over their food and breeding enabling them to obtain the optimal size that was ideal for slaughter (Thomas 2002: 23; Thomas 2005b: 84). This claim has been further supported by recent isotopic analysis (Hamilton and Thomas 2012). More recently, analysis for cattle, sheep, pig and chicken measurements from London (AD1220-1900) has shown statistically significant increases in the size and shape of post-cranial bones for all species (Thomas *et al.* 2013). These results also showed a possible decrease in size towards the later post-medieval period and might attest to a shift in emphasis away from rearing animals with a high meat: bone ratio (Thomas *et al.* 2013: 2234). The timing of the size increase varied for each species but overall the results showed that this happened throughout the medieval and post-medieval period and not during one phase of time (Thomas *et al.* 2013). Together, the zooarchaeological evidence supports Kerridge's reservations about the Agricultural Revolution beginning only in 18th-and 19th-century and confirms that 'improvement' of domestic livestock started from the late medieval period.

The regional differences in the size variation of livestock as well as the timing of 'improvement' (also see Thomas 2009, table 1: 138) illustrate how complex the picture is. The evidence from Dudley Castle shows that change in size does not necessarily point towards a 'revolution' and this raises questions concerning the nature of size change on other sites. However, more data are needed to fill in the 'regional blanks' before this picture becomes clearer.

'Improvement' can also be tentatively identified through non-biometric methods such as the presence of non-metric traits, age data and pathologies (see Gordon *et al.* 2015). For example, the third molars of cattle at Launceston Castle showed a decrease in the number of molars with a reduced or missing hypoconulid (third cusp) by the mid to late 15th century; this is a congenital trait that is dominant within a particular gene pool (Albarella and Davis 1996: 15-16; Davis 1997: 425; Thomas 2005b: 74). Therefore, it is hypothesised that the more cross breeding that took place, the more genetic variation there was resulting in a reduction of this genetic abnormality.

The analysis of the age of animals can help identify an increase in the intensification and specialisation of livestock. The growing urban population meant that production of bigger animals with more meat became even more important. Therefore, fattening animals as quickly as possible became a priority which would result in a higher number of juvenile animals; since if the muscle mass growth occurs at a faster rate than bone growth that animal can then be culled at a younger age (Thomas 2005b). This pattern has been noticed in the archaeological record with the appearance of a higher proportion of young animals - in particular calves - in later medieval and post-medieval deposits (Dobney *et al.* 1996; Grant 1988; Maltby 1979). However, it is possible that changes in

consumption habits also resulted in the culling of more calves as there was a higher demand for young animals and dairy products which was required by a growing urban population (Albarella 1997b; Davis and Beckett 1999; Thomas 2005b). Furthermore, the widespread adoption of the horse harness in agriculture released cattle from their traction role and may have paved the way for the development of the veal/dairy industry (Thomas *et al.* 2013).

1.4.3.1 Potential for further research

It is clear that zooarchaeology has contributed a great deal to the debate of the timing and nature of the Agricultural Revolution, however, this debate is still ongoing. Kerridge (1969: 463) states that many of the changes witnessed by the Agricultural Revolution were completed by c. 1750. However, the results from Stafford Castle (Thomas 2011) and London (Thomas *et al.* 2013) indicate that the 'improvement' of animals was still taking place by the 19th century. Additional biometrical data are needed to provide a better picture of temporal variations from later post-medieval sites to assess the extent to which this pattern occurs on a national scale.

With more biometric data it will be possible to confirm whether there are other sites that show similar patterns to Dudley Castle, London and Stafford Castle. Furthermore, additional ageing data can help formulate a better picture of regional variations for the intensification and specialisation of livestock. Lastly, since much of the previous work done on the 'improvement' of breeds has focused largely on cattle and sheep, gathering more data for pig and chicken will greatly contribute to this argument. Collectively, all these different independent forms of evidence will strengthen and complement the Agricultural Revolution debate for the benefit of archaeologists and historians.

1.4.4 Food and social status

Food is a powerful device through which people express their identity (Twiss 2007). In the past, most zooarchaeological investigations of food focused on diet and subsistence or the economics of food production and distribution (Curet and Pestle 2010: 414; Twiss 2012). However, there is a growing appreciation of the ways in which zooarchaeological data can inform upon past foodways and the way in which food was used to articulate identity (see deFrance 2009; Gumerman 1997; Twiss 2012). This has stemmed from a desire to understand the underlying cultural factors that dictate food choice such as politics, economy, ideology, and status. The latter has been particularly subject to

much attention within zooarchaeological research which focuses on a set of characteristics to identify status (Curet and Pestle 2010; deFrance 2009; Ervynck *et al.* 2003b; Twiss 2012).

High-status food is one characteristic commonly used to identify status. Members of the elite are more likely to associate themselves with more high-priced food items as a way to display and negotiate their position within society (Curet and Pestle 2010: 415-417). This practice is a common trait within complex societies (Gumerman 1997: 106). Van der Veen (2003) defines luxury foods as items that offer refinement from everyday food staples, which are desirable because of their rarity and are unnecessary and indulgent. Such food items have been found in medieval England: for example the peafowl was a high status bird that found itself on the tables of the nobility and aristocrats, being favoured for its plumage, it would have made an eye-catching centre piece on the dinner table (Thomas 2007: 140). However, it is important to note that what is considered as luxury, high-status food is socially and culturally contingent. Furthermore, the status of certain food items is mobile; the declining status of the rabbit and turkey in Britain provide perfect examples of this (Sykes and Curl: 2010: 125; Poole 2010: 161; see Chapter Six).

Rare species are good examples of luxury food because they are either expensive and/or not widely available (Curet and Pestle 2010: 417; Ervynck *et al.* 2003b: 431). Their presence in the archaeological record is generally lower, compared to the more common domestic species and tends to be found in contexts that are associated with members of the elite (Curet and Pestle 2010: 417). Deer, for instance, have been found on high-status medieval sites in England; these animals could not be bought. There were caught and eaten by the elite after being hunted or received as gifts (Thomas 2007: 138). The presence of rare animals also reveals a great deal about how they were acquired. Some species would have required assistance from an external labour force to obtain from their natural habitat such as hunting or fishing (Curet and Pestle 2010: 418) and others may have been obtained from land with controlled access (e.g. hunting parks). This would have offered a much wider diversity of foodstuffs than ordinary people would have been able to attain. This could be seen in the faunal assemblage of two 18th century households in Annapolis (belonging to the Calverts and the Greens). The Calvert family was among the founders and political leaders of Annapolis and the Green family had no fixed social position and entertained in many social circles. They had a middle class income (Lev-Tov 1998: 123-124).The results respectively showed that different species of wild animals and fish found in the assemblages were attributed to the family's status (Lev-Tov 1998). The Calverts had a wider range of wild species and fish compared to the Greens, which included bird and fish species not locally available (Lev-Tov 1998). The acquisition of wild birds has also been seen in

high-status sites in medieval Britain (Thomas 2005a; Albarella and Davis 1996; Thomas and Vann 2015).

As well as the rarity of certain species the greater abundance of similar species and specific cuts of meats or body parts can indicate status (Curet and Pestle 2010: 418). Archaeological investigations in Britain have shown a higher proportion of pigs occurring in the medieval period at high-status sites (Grant 2002: 18; Thomas 2007). Pigs have limited use and are mainly kept for their meat and manure (Grant 2002: 18). Therefore, there is less incentive for the farmer to keep as many in comparison to sheep and cattle which have secondary uses such as milk and wool production. Consequently, the occurrence of large proportions of pigs on archaeological sites is attributed to consumer demand from the rich and wealthy rather than a reflection of husbandry practices (O' Connor 1992: 103 Thomas 2007: 138). In the medieval period, suckling pig was also considered to be a delicacy that was favoured by the elite; this was also true for the post-medieval period (Hammond 2005: 60; Holderness 1989: 154; Brears 1985a: 6). The abundance of prime quality body parts is considered a high-status marker as it suggests the selection of these parts for consumption (Ervynck *et al.* 2003b: 432). Certain parts of an animal will have more meat on the bone: for example, the upper limbs will have more meat compared to the lower limbs, and so the presence of a high proportion of meat-bearing bones can thus indicate a preference for better quality joints (Grant 2002: 21), although the value attributed to different body parts is culturally specific (see Britain's urban cultural Identity below).

Lastly, evidence for banqueting/ceremonies can be proof of high-status consumption, as they are used to display wealth, power and control, reinforce social exclusions, create alliances, celebrate an event and consolidate social cohesion (deFrance 2009; Hayden 1996). Feasts tend to involve the consumption of large quantities of food and drink and sometimes have 'special' food items and the use of special vessels or prestige items, especially in hierarchical societies (Hayden 1996: 137-138). The presence of faunal remains can provide direct evidence for the feasting event and has proven to be particularly useful when trying to identify feasting in the past, along with artefactual and historical evidence (see Thomas 1999; Chapter Four).

There are a number of caveats associated with the archaeological identification of social status as there are countless interrelated variables such as environment, the availability of resources and costs which would have influenced peoples' food choices in the past (Reitz 1987: 105). For example, wealthy households might choose to acquire food at a reduced expense. In contrast, lower status households may aspire to a more refined lifestyle and may display this through the consumption of high-status food items (e.g. poaching) (Grant 2002: 20; Reitz 1987: 105). Past societies were complex

and would be continuously changing and therefore it is crucial to bear in mind many would not have followed a dichotomous model (i.e. upper class versus lower class). There is also the potential as an archaeologist to impose our contemporary, preconceived ideas about what would represent high-status or valuable food (Curet and Pestle 2010: 421), particularly when dealing with the more recent past. For these reasons, care must be taken when associating certain animals with high-status consumption as there may also be luxury food items that are culturally specific rendering them invisible to archaeologists (Curet and Pestle 2010: 422). However, this is not to say that archaeologists cannot identify social status; in fact there are a number of successful studies that show the potential of zooarchaeology to identity status (e.g. Armitage 1991; deFrance 2009; Grant 2002; Thomas 2007; Thomas and Vann 2015; Albarella and Thomas 2002; Albarella and Davis 1996).

1.4.4.1 Potential for further research

Although zooarchaeology has demonstrated the ways in which animal bones can be used to explore the social dimensions of past life, there is still an acute lack in understanding of consumption behaviours among social groups in the post-medieval period (see Thomas 2015). It is suggested that the 16th century saw significant changes in peoples' diet (Mennell 1985: 40). As the population increased, more land was being converted into pasture for livestock and the expansion of industry and growth in commerce provided many with newfound wealth that they could spent on food (Spencer 2004: 109, 127). In addition, the traditional customs of buying and selling food changed because the distance between the producers and the consumers had grown. As a result, food prices began to rise because carriers were needed to bridge the gap (Spencer 2004: 129). By the 19th century, growing urbanisation, industrialisation and overseas commerce brought significant changes to the English diet and the way in which food was used to articulate social class (Thomas 2015) and this investigation can help to understand those changes further.

1.4.5 Britain's urban cultural identity

Food is central to our sense of self and it is an essential means through which we define who we are (Counihan and Esterik 1997: 1). As the well-known saying goes 'we are what we eat' but more specifically we are also, 'where we eat, how we eat, and with whom we eat' (Twiss 2007: 1). Food is also a powerful tool through which people define their sense of identity to themselves, to their community, to society and the outside world (Twiss 2007: 3; Gumerman 1997: 109). The famous anthropologist Claude Lévi Strauss has argued how food acts as an 'identity builder' (Scholliers 2001:

7). The definition of identity is defined in a multitude of ways (e.g. Díaz-Andreu García 2005; Insoll 2007; Grave-Brown, Jones and Gamble 1996; Scholliers 2001: 5). However, for the purpose of this investigation the Twiss (2007) definition of identity, as the rapport between an individual or group within a wider community, will be employed.

Investigations of food in archaeology have branched off into two approaches: processual and post-processual. The processual approach takes on a more simplistic view towards food consumption; food is seen as a means to only replenish and sustain the human body and maintain optimal health (Twiss 2007: 4). This is not to say that nutrition is not important when it comes to consumption; however, the reasoning behind peoples' food habits is far more complex. For instance, there are many people who decide to be vegetarians, although animal protein is more easily absorbed into the body than plant protein. This fact means there is a higher risk of vegetarians becoming malnourished; despite this, there are many that still choose to not eat meat and animal products (Simoons 1994: 3). If people ate food for the sole purpose of nutrition there would be no reason for individuals to restrict what they eat. As Sherratt (1991) rightly says "people do not eat species, they eat meals" and the creation of those meals is the embodiment of the cultural and social construct within a particular society and how that society defines their identity. Post-processual approaches take into consideration the multi-dimensional aspects that influence peoples' identity which in turn affects their food choices. This includes gender, religion, ethnicity, politics, economics, status and age (to name a few) (Twiss 2007; Fischler 1988).

Food preparation and cooking is just as important as consumption (Scholliers 2001: 7; Graff 2012). How food is prepared can have symbolic, religious, social and cultural meaning (Graff 2012: 2). Food preparation can include a range of processes and techniques such as butchering, cutting, serving, salting and pickling (Graff 2012: 2). There are very few archaeological studies which focus solely on cooking and food preparation. An explanation for this has been posed by Graff (2012: 4) who states it is because people believe it to have little importance beyond household and daily routines. However, this viewpoint undermines the importance of food preparation as it can provide insight into social relations and change, cultural identity, economics and politics (Graff 2012: 1-2). It can also be attributed to 'the distribution of power and authority in the economic sphere, that is, to the system of class or stratification' (Goody 1982: 37, as cited by Graff 2012: 6).
Animal bones can act as a powerful investigative tool which can be used to identify whether the animals consumed at urban sites point to a British urban identity. Zooarchaeological studies carried out by Sykes (2007a) and Holmes (2011) have already demonstrated the potential of animal bones in

identifying cultural differences in the Norman and Saxon periods. This was been attempted by focusing on distinct faunal signatures such as: the presence/absence of species; butchery marks; and the preference for certain body parts.

A number of studies in North America have focused on colonial diets to gain a better understanding of how different colonial groups modified or attempted to maintain their consumption habits in a new environment (e.g. Reitz 1991; Reitz & Cumbaa 1983). Fort Michilimackinac, located between Lake Michigan and Lake Huron, was established around 1715 by the French and then was recolonised by the British in 1760. Investigations of the animal bone assemblage from the fort revealed how French and British colonists had varied diets: while the French consumed more local food resources (e.g. beaver, wild birds and fish), the British were more reliant on European domestic mammals, in particular cattle and pig; very few wild animals were consumed (Scott 1996). It is also important to stress that identity is not fixed; it continually changes and evolves (Lloyd 2009: 51). For instance, cultural identity and social status can be closely related (Reitz 1987: 105). A good example of this can be seen in the analysis of faunal remains from an 1840s household deposit in Washington. This household belonged to a prominent Jewish family, however the meat they consumed included cattle, deer, domestic fowl and pig, a non-kosher meat. What they were eating was no different from their affluent neighbours and reflected a typical diet of a contemporary high-status household of that time (Stewart-Abernathy and Ruff 1989: 103). In this case, it was their social status that was the dominant factor influencing their choice of food and not their Jewish faith.

There are undeniable challenges when it comes to disentangling identity using food, as identity is an interchangeable concept that is driven by a number of external factors making the relationship between food and identity complex (Scholliers 2001: 3-5). Regardless, food is a powerful device through which people choose to articulate their identity and animal bones can make a significant contribution towards the understanding this process.

1.4.5.1 Potential for further research

There have been a number of publications which focus on the history of British food (Spencer 2004; Drummond and Wilbraham 1939; Mennell 1985; Wilson 1973; Brears 1985a, 1985b; Stead 1985; Stead 1993; Black 1985; Brears 1993). British food was defined by roasted, boiled and dressed meats as well as pies, stews and puddings. With the improvement of literacy from the late 17th century, cookery books became increasingly popular (Stead 1985: 13; Spencer 2004). Between the 18th and 19th century there were over 300 published cookery books, which were mainly used by the gentry,

middle classes and wealthy tradesmen (or rather their cooks) (Stead 1985: 13). Many of these books contained the recipes used by the elite and nobility as well as instructions for proper dinning etiquette (e.g. how to set a dinner, how to carve meat) (Spencer 2004: 117). These books not only communicated British identity but how people strived to change their identity through food. In the 19th century, new dietary habits were beginning to form; French food was all the rage among the wealthy and French cooks were highly sought after (Burnett 1966: 54; James 1997: 75; Spencer 2004: 289). The end of the 19th century saw a decline in British cooking as Britons began to develop a taste for foreign foods (James 1997: 71; Panayi 2007).

At present British zooarchaeological work on cultural identity has mainly been applied to earlier periods including Roman (e.g. Dobney 2001: 36-37), Anglo Saxon (e.g. Holmes 2011) and Norman (e.g. Sykes 2007a). There are currently no studies that focus on post-medieval urban identity in Britain; however, given that the post-medieval period benefits from a diverse range of historical sources, it is perhaps one of the best time periods to investigate urban identity. As cultural diversity is present in many complex societies, past or present, it therefore merits exploration (Crabtree 1990: 177). Now is a unique opportunity to use faunal data to explore questions such as: can the temporal differences in urban identities be detected from the food remains and to what extent will a collaborative approach facilitate the study of urban identities?

1.5 Structure of the Thesis

Chapter One has outlined the importance and the justification for the zooarchaeological investigation of post-medieval animals and has shown how this research can add to our limited knowledge of the zooarchaeological enquiry of animals from the late medieval period to modernity. It has presented the overarching research question, which provides the framework for the thesis as well as the aims of the project. Furthermore, it has identified the main themes of the investigation and areas for potential research.

Chapter Two presents the details of the materials, introducing Chester and providing a historical narrative of the city and the site histories of the primary and secondary faunal data that has formed the analysis and discussion of chapters three and four. It also provides a detailed explanation of the methods that were employed to conduct the analyses of the primary investigation as well as the inter-site and regional site comparisons (see Chapter Five, Six and Appendix One).

Chapter Three presents the results of the Chester inter-site analysis, comparing the findings from the primary investigations of Chester's Roman Amphitheatre, Hamilton Place and Nicholas Street Mews with the published secondary faunal data for other post-medieval Chester sites.

Chapter Four discusses the findings from Chapters Three, examining the temporal and spatial differences in the role and use of animals in Chester city throughout the post-medieval period. It reviews the results drawing upon Chester's urban and demographic history and explores the husbandry and provisioning strategy of the region as well as social status and the urban identity of the inhabitants.

Chapter Five is the regional site comparison which describes the zooarchaeological results from over 140 urban sites in England. It covers the background information of the sites used for this investigation and describes the results according to the following themes: species representation, butchery and body parts distribution, slaughter profiles, livestock size and shape and pathologies.

Chapter Six interprets the results from Chapter Five using an integrated approach to contextualise the zooarchaeological data between the 1500s and 1900s. This chapter considers the role of animals in light of major developments such as urbanisation, industrialisation, commercialisation, consumerism and population increase. In addition, it considers the environmental repercussions of these events and its effect on British wild fauna.

Chapter Seven includes a summary of the discussions in Chapters Four and Six, highlighting the key trends and characteristics of post-medieval urban assemblages. It also considers the potential benefits and problems with analysing post-medieval animal bones using Chester as an example. In addition, it demonstrates the contributions that the study of post-medieval animals can bring to our understanding of urban life from the early modern to modern period. Finally, the chapter presents recommendations for future research.

2 Chapter Two - Materials and Methods

2.1 Introduction

In this chapter I will detail the materials and methods that were developed in order to address the research question and fulfil the aims outlined in Chapter One. This research can be viewed as having two parts. The first part involves undertaking zooarchaeological investigations using faunal remains from Chester and the second entails conducting a regional synthesis of post-medieval animal bones from urban sites in England.

The chapter will begin by providing background information about the excavation of post-medieval sites in Chester, the history of the city and the site information for each of the faunal assemblages. Primary investigations of three Chester animal bone assemblages were compared along with secondary faunal data from published and grey literature reports. The methods used for analysing the primary and secondary animal bones from Chester will be outlined here, in addition to the approach for selecting data to conduct the regional synthesis of post-medieval urban faunal assemblages. The latter forms the second part of this thesis. As there has been no regional zooarchaeological synthesis for the post-medieval period, a key aspect of this investigation will be the compilation of faunal data from this era which will fill a gap in British archaeology.

2.2 Chester's Archaeology

What is unusual about archaeology in Chester is that in recent years post-medieval deposits were targeted because Chester City Council's Archaeological Services had a particular interest in investigating marginalised social groups in the city (Matthews 1999: 158). This has resulted in the accumulation of large amounts of post-medieval data including substantial quantities of animal bone (Matthews 1999: 158; Morris pers. comm). However, most of these data are yet to be analysed, synthesised and published and there are currently no plans to do so in the foreseeable future (Matthews 1999: 158; Morris pers. comm.). There have been a small number of publications with late medieval and post-medieval data which highlights the potential and quality of Chester's archaeology from this time period (e.g. Smith 2008; Sykes *et al.* n.d; Sykes and Wan n.d.; Matthews 1999). Despite this, issues have been raised pertaining to the lack of comparative data for Chester's post-medieval faunal assemblages (Smith 2008: 355), which this investigation aims to address.

Thus far, there have been no studies of faunal assemblages from a single city during the post-medieval period in Britain; therefore this investigation will fill an important gap in our knowledge of urban provisioning, procurement and consumption behaviours by means of site comparison. The primary zooarchaeological analyses will also act as a case study for the investigations of post-medieval faunal assemblages. This will provide a rare opportunity to explore the real and perceived problems posed in studying animal bones from this period (e.g. residuality) and how this impacts on the interpretation of faunal material from an urban context.

2.3 Chester's Urban History

Medieval and Tudor Chester

During the Middle Ages, Chester remained a moderately small market town and never developed into a major regional capital. The city's population was estimated at 2,500 to 3,000 during the Norman period, which was small in comparison to other regional centres like York (Carrington 1994: 64; Laughton 2008: 11; Ward 2009: 43). This was mainly because Cheshire's hinterland had heavy clay soil which made it difficult to farm and produce enough agricultural produce required to support a large population.

The city's hub was enclosed inside the walls which could be entered through six main gates: Bridge Gate; North Gate; New Gate; Water Gate; Ship Gate; and East Gate (figure 2.1). The latter was the most important entrance into the city (Ward 2009: 38-39). The city walls and layout were largely based on previous Roman and Saxon town planning; however, there were prominent medieval features in the city including the castle and a number of religious buildings (Carrington 1994: 65). In Chester, religion dominated medieval life as well as the cityscape, evidenced by the presence of eight parish churches, an Abbey, nunnery and three friaries (Carrington 1994: 72; Ward 2009: 51-52). One of the city's most acclaimed medieval architectural feature is the Rows, which are two-storey, black and white timber framed properties. These are unique to the city and can still be seen today. The Rows consist of galleries that run along the front of the building which could be seen from four main streets: Lower Bridge Street, Watergate Street, Eastgate Street and Northgate Street (Ward 2009: 50). These properties had shops and accommodation and behind them were yards and gardens, many of them were built during the 13th century (Carrington 1994: 77; Ward 2009: 51).

Chester was a socially hierarchical city, inhabited by the local gentry, merchants, craftsmen, ecclesiastical members and the urban poor (Laughton 2008). The wealthier inhabitants lived in

private houses and properties like the Rows while the poor would have lived in smaller cottages (Laughton 2008: 78-81; Carrington 1994: 78).

The poor went largely undocumented in Chester (Laughton 2008: 106). They would have lived in destitution and some would have relied on charitable donations given by the church and wealthy townspeople who left gifts for the less fortunate in their wills (Laughton 2008: 107).

During the later medieval period, large numbers of Welsh immigrants settled in Chester and although they resided throughout the city, many settled in Handbridge and Bridge Street (Laughton 2008: 103; Laughton 2011: 171; see figure 2.1). The majority found it difficult to gain employment and was poor, although some that did manage to find jobs became freemen and members of the middle class (Laughton 2008: 104; Laughton 2011: 170). Manx immigrants also settled in Chester and struggled to make a living (Laughton 2008: 105-106). The number of Manx migrants started to rise during the 15th century and because Chester had trade links with the Isle of Man, many lived around the harbour at Watergate Street and worked in the fish trade (Laughton 2011: 175). Others worked as carpenters and tailors and some made their fortune as fishmongers and ship-owners (Laughton 2011: 175).

The city had a range of local services and businesses which included bakers, butchers, fishmongers, brewers and vintners and produced goods such as cloth, salt and leather (Laughton 2008 134-141, 145). Leather production was one of the city's most thriving industries and continued up until the 19th century (Carrington 1994: 82). Many of the residents worked in the trade as curriers, glovers, saddlers, skinners, cobblers, shoemakers, tanners and tawyers (Ward 2009: 49). While the majority of these trades took place in different parts of the city, tanneries were located outside the city's walls because of the smells produced from processing the skins (Ward 2009: 49). Most of the skins were bought from butchers, traders and imported mainly from Ireland or the Isle of Man (Carrington 1994: 81). Markets and fairs were common features of life in Chester and residents from the county would go to the markets to sell foodstuff and livestock (Laughton 2008: 163). Chester's countryside was abundant in livestock and fish although the climate and the soil were better suited for rearing cattle (Hewitt 1967: 30).

Chester had a port that was established during the Middle Ages and was the most important port in the North West (Walton 2000: 122).The city's trade extended to European countries such as France and Spain, although most of its trade focused on Ireland and the Isle of Man (Carrington 1994: 79; Laughton 2008: 106; Sacks and Lynch 2000: 403).

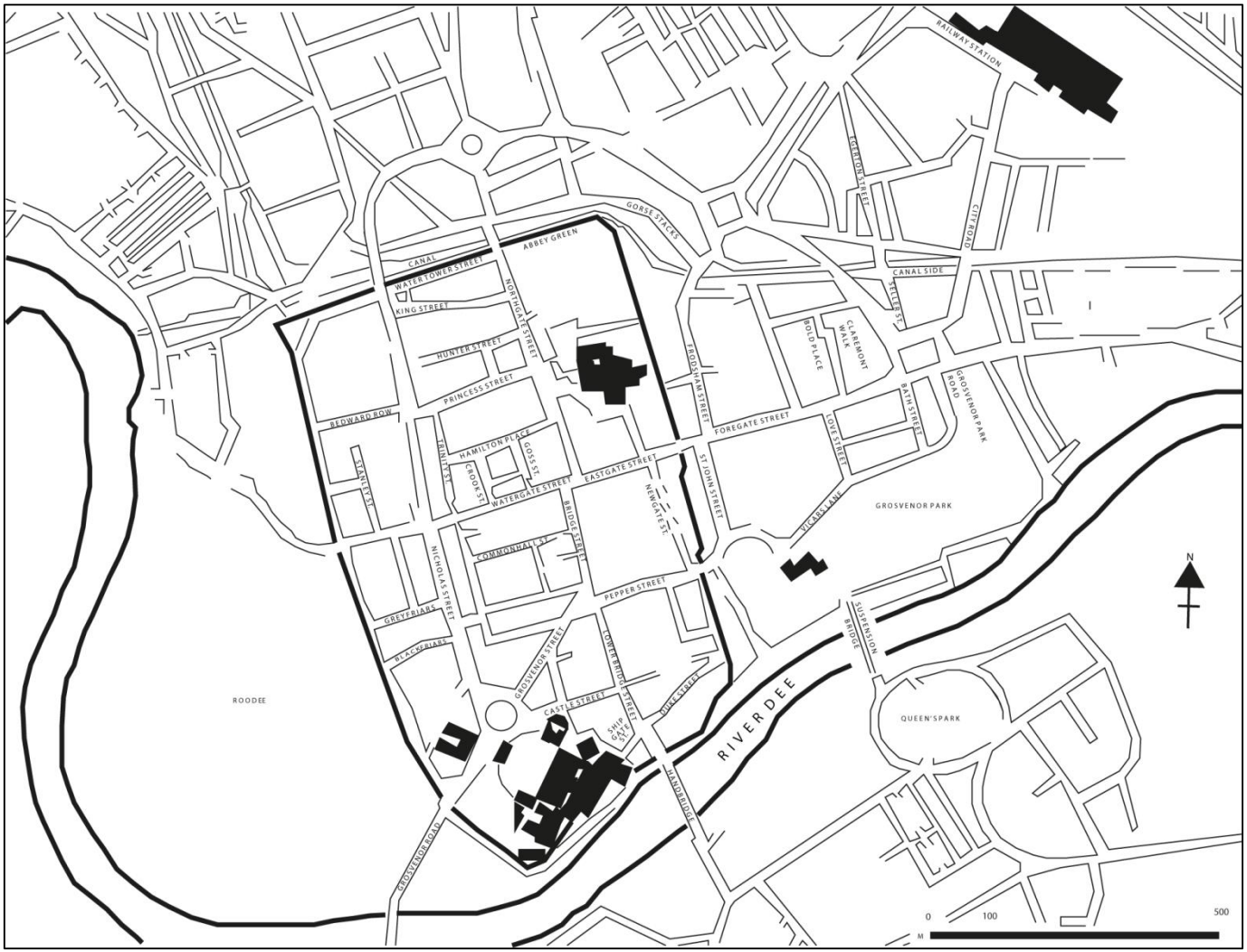

Figure 2.1: Plan of Chester city, drawing by Rebecca Gordon (after Carrington 1994). The black border is Chester city wall

Goods such as iron, oil, wine, and various food stuffs were imported while clothes, leather and hides were exported (Beck 1969: 55; Knowles 2001: 14 Carrington 1994: 79). During the 16th and 17th century, calf skins were a popular export for the city. For the most part, trade remained on a modest scale during this period. This was mainly due to the continual silting problems with the river Dee which made it difficult to navigate and access the port and because of the lack of resources to export. Wool was an invaluable commodity during the medieval period and it is believed that Cheshire only produced enough wool to clothe the population, plus a little extra for export. Therefore, the city did not capitalise on exporting wool like regions such as Exeter, Hull, Lincoln, London, Southampton and Winchester (Carrington 1994: 79; Hewitt 1967: 37; Platt 1976: 86).

Since the Norman period there was political unrest with the borders of Wales; this was a blessing to Chester's economy (Ward 2009: 41; Laughton 2008: 19, 29). The 13th and 14th century was a period when the city was heavily involved in military activity. Chester's location made it an important military base for Edward I who wanted to end the political disputes with Wales. Military equipment, personnel and food supplies were sent to the city and armies assembled in the city on their way to Wales (Laughton 2008: 11). Edward I ordered a number of castles to be built to enforce control over Wales which required a huge labour force as well as building supplies and resources. This brought wealth to the city's residents and resulted in the construction of new buildings (Ward 2009: 41). However, the Black Death (1348 – 1350) brought with it the decline in the city's economy, during which building work stopped and the population was reduced to about a third (Carrington 1994: 64; Ward 2009: 55). Chester became less involved in military activity during the later medieval period. However, continuing political unrest during the reign of King Edward II as well as the city's support of Richard II, hindered Chester's economic progress (Laughton 2008: 24, 29; Ward 2009: 42).

By the 15th century, prosperity returned to the city. The population returned to pre-Black Death levels and redevelopment and rebuilding continued (Ward 2009: 57, 59). The Dissolution of the monasteries came and went without many local objections (Carrington 1994: 77). Although ecclesiastical members were popular and influential people in the community, people were starting to lose interest in religion before the Dissolution. The friaries were struggling financially and had to rent out land in order to ensure their survival (Carrington 1994: 77). After the Dissolution, land previously occupied by religious buildings was bought by the rich who built expensive townhouses (Carrington 1994: 77). On the whole, the medieval and Tudor period was a time of peace and prosperity for the city until the outbreak of the English Civil War.

The Civil War and Restoration in Chester

Chester was greatly involved in the English Civil War (1642 – 1646) and for a longer period of time compared to other places in England (Ward 2009: 64). Disagreement between Charles I and Parliament resulted in the war which aimed to put a stop to the Catholic rebellion which began in Ireland. As Chester had established trading links with Ireland, the port became the main point of travel to and from Ireland from which soldiers and supplies were sent (Ward 2009: 64). Many of the local residents were Royalists and had strong relations with Ireland and North Wales (a crucial Royalist recruitment base); therefore the city was very important throughout the war (Ward 2009: 64). During this time of political upheaval the city was subjected to a series of raids and sieges and there were food shortages. Many buildings were damaged and destroyed and the suburbs were almost completely obliterated (Ward 2009: 70). The war had a devastating effect on the local economy and trade had ceased. Unsurprisingly, residents suffered greatly; many were impoverished and struggled to get by. After the King and his Royalists lost the war, many his followers had to pay fines and were disgraced for their support of him and the war (Carrington 1994: 91; Ward 2009: 70). Unfortunately, the end of the war was also followed by an outbreak of plague from 1647-8 and which resulted in 2,000 fatalities (Ward 2009: 71).

The latter half of the 17th century witnessed the revival of the city. Buildings destroyed during the war began to be rebuilt, although progress was slow and continued after the Restoration (Carrington 1994: 93). New architectural styles started to develop and after The Great Fire of London in 1666 bricks were used instead of timber (Carrington 1994: 93). The Rows began to disappear from some of the streets as wealthy residents favoured the new architectural style (Carrington 1994: 94). Wealthy residents in Lower Bridge Street petitioned to get rid of their Rows and replace them with this new architectural design, for which permission was eventually granted (Carrington 1994: 94). The Rows slowly started to disappear from Lower Bridge Street and only remained on the eastern side of the street. Markets and fairs continued to trade and the port re-established its trading links with Ireland (Carrington 1994: 91, 92; Ward 2009: 70, 71). Merchants continued to trade and sold a range of goods and agricultural products at markets (Carrington 1994: 91). Chester's main industry continued to be leather production; however, a small number of new industries such as tobacco, pipe-making and ship-building were established by the end of the 17th century (Carrington 1994: 92). With the revitalisation of Chester's port it soon continued to play a crucial role in the local economy which was largely sustained due to trade with Ireland. Chester's most consistent and lucrative export continued to be leather. Leather was sold to Ireland and tanned hides were exported to France and Spain (Beck 1969: 55; Knowles 2001: 14). Other commodities exported

included coal, cheese, calamine, food and drink, lead, oak bark, salt, shovels, tobacco pipes, and wine (Hodson 1978: 117; Knowles 2001: 17; Ward 2009: 95). Imports to Chester included: cattle, hides, sheep, wool, linen and woollen clothes from Ireland. Flax, hemp, iron, naval stores and timber were also imported from Scandinavia and the Baltics as well as Spanish and Portuguese wine (Hodson 1978: 117). Although the port was doing well during this period, silting problems with the river Dee persisted.

Georgian Chester

After the Civil War, Chester obtained the status of a wealthy market town and the population increased from 9,000 at the beginning of the 18th century to c. 15,000 by 1801 (Carrington 1994: 96; Ward 2009: 74). Chester's economic prosperity improved mainly because of the retail and service industries it provided. Although industries such as leather production, glove-making and shipbuilding were on the decline, new professions like clock-making and silversmithing became very notable (Carrington 1994: 96, 97). By 1780, the city was involved in over 100 different trades and crafts and offered specialist services (Carrington 1994: 96). As the city's population and prosperity grew, so did its range of leisure and entertainment facilities (Carrington 1994: 96). Concerts, balls, lectures, card evenings and theatre shows were regularly run throughout the year to cater to Chester's gentry and professional classes (Carrington 1994: 99).

Building continued apace in the 18th century and houses were being constructed on open land, gardens and empty plots inside the city walls (Carrington 1994: 96). Members of the elite took to building new townhouses in and around the city in the new neo-classical style (Ward 2009: 75; Matthews 1999: 159). Within the city centre, development took place in Lower Bridge Street, King Street and Stanley Place, however due to limited space the rich expanded out and began building outside the city (Matthews 1999: 159 Ward 2009: 74). Georgian mansions and houses built in suburbs which had spacious gardens and outbuildings providing comfortable homes for bishops, merchants and professional gentlemen, who wanted to get away from the stale air of the city (Ainsworth and Wilmott 2005: 17; Carrington 1994: 100; Ward 2009: 75-76).

Although Chester's port was still successful during the early 18th century, the port never truly thrived beyond a local scale. This was partly because the city lost business to other neighbouring cities and lacked commodities to export (Knowles 2001: 12, 32; Herson 1996: 16; Hodson 1978: 139, 178; Ward 2009; 59, 82, 95). By the end of the 18th century, Chester established a canal port which

proved to be successful. Trade between Chester and Liverpool was popular and new businesses and services developed along the bank following this trade route (Carrington 1994: 98).

Victorian Chester

The transformations and prosperity brought by the Industrial Revolution generally passed Chester by (Carrington 1994: 106; Herson 1996: 13). The city continued to enjoy its status as a wealthy market town and remained quietly prosperous during the 19th century. By the end of the century the population reached c. 38,000, which resulted in major development in the suburbs (Carrington 1994: 106; Ward 2009: 92). This population increase was partly due to the large number of rural labourers that came into the city in hope of gaining employment (Hulme 1997: 82).

During the Victorian era, Chester became a popular tourist destination, facilitated by the development of the railways which brought visitors in large numbers (Jeffes 1996: 30). People would visit Chester on the way to Ireland and Wales and tourists also came from abroad; Americans who arrived at Liverpool by boat would visit and explore the city before journeying on to London (Carrington 1994: 107). The money received from tourism resulted in the growth and re-development of retail and service industries, hotels and public buildings (Herson 1996: 30; Ward 2009: 88). In addition to Chester's leisure and retail services, travellers were attracted to the city's ancient Roman past and activities such as the horse racing. Horse racing had been held at the Roodee since the 16th century and many travelled across England to attend the Chester Races (Matthews 1999: 161; Ward 2009: 100). Not only did the city become a commercial and retail hub for the rich and wealthy but it was also an appealing place for the gentry and professional classes to live. People with businesses in Liverpool and Manchester lived in Chester and commuted to work (Jeffes 1996: 37). The money brought by the rich residents also helped Chester to flourish and maintain its range of commercial and retail services (Jeffes 1996: 37; Ward 2009: 87).

By the 19th century, the majority of Chester's traditional industries no longer existed and new ones that were established ended up failing. Therefore, employment opportunities were limited for many of Chester's working class who struggled to make ends meet (Ward 2009: 98). The urban poor were ever present in Chester, and behind the fashionable shops and eateries they lived in cramped, poorly constructed back-to-back housing in slum 'courts'. Between the 1860s and 1870s, there were 178 courts in Chester; many of which were situated behind the main streets and could be accessed through narrow alleyways (Carrington 1994: 112; Ward 2009: 93; Thacker 2003b: 229). These places were dismal; they lacked light, ventilation, basic sanitation and a running water supply (Hulme 1997:

85; Ward 2009: 93). Lodging-houses provided temporary accommodation for the poor and also lacked basic sanitation and water (Glazier 1996: 54). The upper classes viewed these places as immoral and corrupt, where drunks, thieves and prostitutes resided (Glazier 1996: 55; Thacker 2003b: 235). Due to these unpleasant living conditions it is not surprising that these areas harboured diseases. This resulted in a series of cholera outbreaks during the 19th century, in addition to problems with typhoid (Ward 2009: 94-95). Other forms of accommodation included cellar dwellings, which were occupied by those living in extreme poverty, and the slightly better 'through-terraced housing' (Hulme 1997: 83). The Public Health Act (1875) led to the clearance of slum courts and the people who resided in them were re-housed in social housing (Thacker 2003b: 235).

Taking into consideration Chester's strong trading links with Ireland it is not surprising that many Irish people immigrated to Chester. The 18th and 19th centuries witnessed large number of Irish immigrants settling in the city to escape the famines in Ireland (Jeffes 1996: 86; Ward 2009: 100). Many were concentrated in certain areas in Chester such as Boughton, Canal Side and Steven Street (Ward 2009: 100). Life was difficult for Irish immigrants; the majority were poor and were subjected to prejudices by the locals. Most had low paid jobs and a number of Irish men worked as agricultural labourers (Jeffes 1996: 90, Table 3.4). In the poorer areas, disorderly behaviour, drunkenness, fights and gambling were blamed on the Irish and such behaviours were commonly reported in the local newspaper with Steven Street identified as the place where these immoral acts took place (Ward 2009: 100).

2.4 Chester sites: primary investigations

Primary analyses were undertaken on the animal bones from Chester's Roman Amphitheatre, Nicholas Street Mews and 12 Hamilton Place. The site descriptions and histories will be presented below. The full faunal reports for these sites can been found in Appendix One.

2.4.1 Chester's Roman Amphitheatre

Site introduction

The remains of the Roman amphitheatre can be seen east of Chester's city walls on the bank of the River Dee (figure 2.3). They were first discovered in 1929 by W. J. Williams, while heating was being installed in the convent school Dee House which is located south-west of the amphitheatre. After its

discovery, the amphitheatre was excavated by R. N. Newstead and J. P. Droop and then from 1965, large scale excavations were carried out in the northern quarter of the amphitheatre for four years by F. H. Thomas (Wilmott *et al.* 2006: 7). Within the last two decades many discussions have arisen regarding the future of the amphitheatre which resulted in a number of archaeological interventions, including site evaluations and small-scale excavations (Wilmott *et al.* 2006: 9). In 2002, discussions between English Heritage and Chester City Council led to a collaborative investigation of the site. The aims were to: (1) develop an archaeological framework; (2) conduct an invasive survey of the site and the surrounding area; and (3) carry out excavations of the amphitheatre (Wilmott *et al.* 2006: 4). In 2004 to 2005, the excavation took place, during which three areas were opened up to understand the development and use of the site (figure 2.2). Area A was excavated to investigate part of the site that was dug by Thompson and reassess his phasing and the dating. Area B was chosen to examine the post-Roman archaeology of the site. During Thompson's excavation the post-Roman levels were lost as the arena was machined down to the proposed 'Roman levels' (Wilmott *et al.* 2006: 7). In addition, as Area B was the nearest location to St John's church, first established in the 7th century, it was excavated to explore the area's connection with the religious community. Area C was chosen to understand the infilling of the arena causing the amphitheatre to disappear from the surrounding area (Wilmott *et al.* 2006: 5).

Post-medieval bones were found in all three areas; however, only animal bones from Area B and C were analysed as faunal remains from Area A were subjected to high levels of residuality following Thompson's clearance of the post-Roman archaeology (pers. comm. Julie Edwards). Most of the bones were excavated from pit fills, layers, deposits, garden soils and various negative features (see table 2.1 for phasing).

Site history

Following early medieval occupation, Areas B and C were gradually covered with garden soil which eventually led to the disappearance of the arena wall (Wilmott *et al.* 2006: 16). In the 11th century, St John's church became a cathedral and because ecclesiastical members resided in and around the area this limited development in the vicinity (Ward 2009: 43; Wilmott *et al.* 2006: 15). However, following the Dissolution, buildings that once belonged to the ecclesiastical community soon became residences for the local gentry and the church was reduced to a modest parish (Ainsworth and Wilmott 2005: 13; Wilmott *et al.* 2006: 17). The high-status presence on site was notable in Area C where a large 16th century rectangular pit was excavated, containing artefacts and animal bones indicative of a feasting event. High-status artefacts found included an impressive gold ring and a near-complete tin-glazed owl cup (Edwards 2006a: 25-26).

Phase	Date	Comments
XIV	mid-late 16th/early 17th century	The feasting pit in Area C dates from the mid-16th century. Animal bones from Area B dates from the late 16th century.
XV	early/mid-17th century	
XVI	late 17th/early 18th century	
XVII	mid-late 18th century	
XVIII	Demolition and robbing of cellared building	This phase is associated with the demolition and wall robbing of cellared Building XX and backfilling of the cellar from Phase XVII (Gardner 2011: 28)
XIX	19th century	This phase represents the alterations to the boundary wall with St. Johns and associated garden features (Gardner 2011: 30).

Table 2.1: Post-medieval phasing for Area B and C. Area C only produced animal bones from phases XIV-XVI and Area B produced bones animal bones phases XIV-XIX. [Dating is provisional]

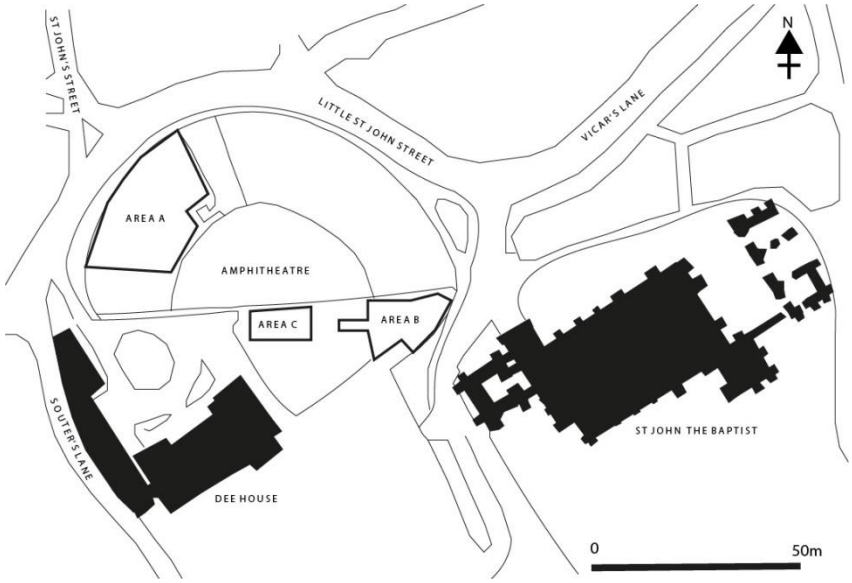

Figure 2.2: Plan of Chester's Roman Amphitheatre site showing excavated areas A, B and C, drawing by Rebecca Gordon (after Wilmott *et al.* 2006: 9).

Lead shots and building material were found in Area B which dated around the Civil War period. The suburbs were badly destroyed during the Civil War and many buildings were demolished by firing

ammunition (Ainsworth and Wilmott 2005: 16; Forster 2003: 117, 118; Wilmott *et al.* 2006: 18). After the war, the area continued to be occupied by members of the upper class who built new Georgian mansions (Ainsworth and Wilmott 2005: 16; Wilmott *et al.* 2006: 19).

By the 18th century, more members of the local gentry relocated outside the city to build grander properties with their own private gardens. Eight new mansions and their adjoining gardens were built in the area of the amphitheatre such as St John's, and the Groves (the new 18th century riverside walk) (Wilmott *et al.* 2006: 19). One of the few surviving mansions of this era is the grade II listed property Dee House which was believed to have been built for James Comberbach, the mayor and alderman of Chester (Wilmott *et al.* 2006: 19-20). During this period most of the amphitheatre and the surrounding environs were enclosed by gardens belonging to Dee House and the other mansion called St John's House (Wilmott *et al.* 2006: 22).

By the end of the 19th century, many of the Georgian properties were demolished and the area was reclaimed by the ecclesiastical community (Wilmott *et al.* 2006 21). Dee House was obtained by Roman Catholic nuns, after which it became a convent, a boarding school for girls, and an important educational institution for the poor (Menuge and Withey 2006: 27; Wilmott *et al.* 2006: 22).

2.4.2 Nicholas Street Mews

Site introduction

The excavation at Nicholas Street Mews was carried out by Grosvenor Museum between May and August 1988 and took place prior to the development of small terraced town houses in the area (Ward 1988: 1). The site is situated west of the city in a side street which provides access to properties on the western side of Nicholas Street (Ward 2012: 87; see figure 2.3). The mews itself forms a large plot of land which was established during the 18th century when it was previously referred to as Brook's Street (Ward 1988: 1). Publications about the site is limited; one recent excavation report details the Roman archaeology on the site (Ward 2012) and the rest of the site information resides in the archives as paper records. Site phasing was created for the site based on the context dates, which can be seen in table 2.2.

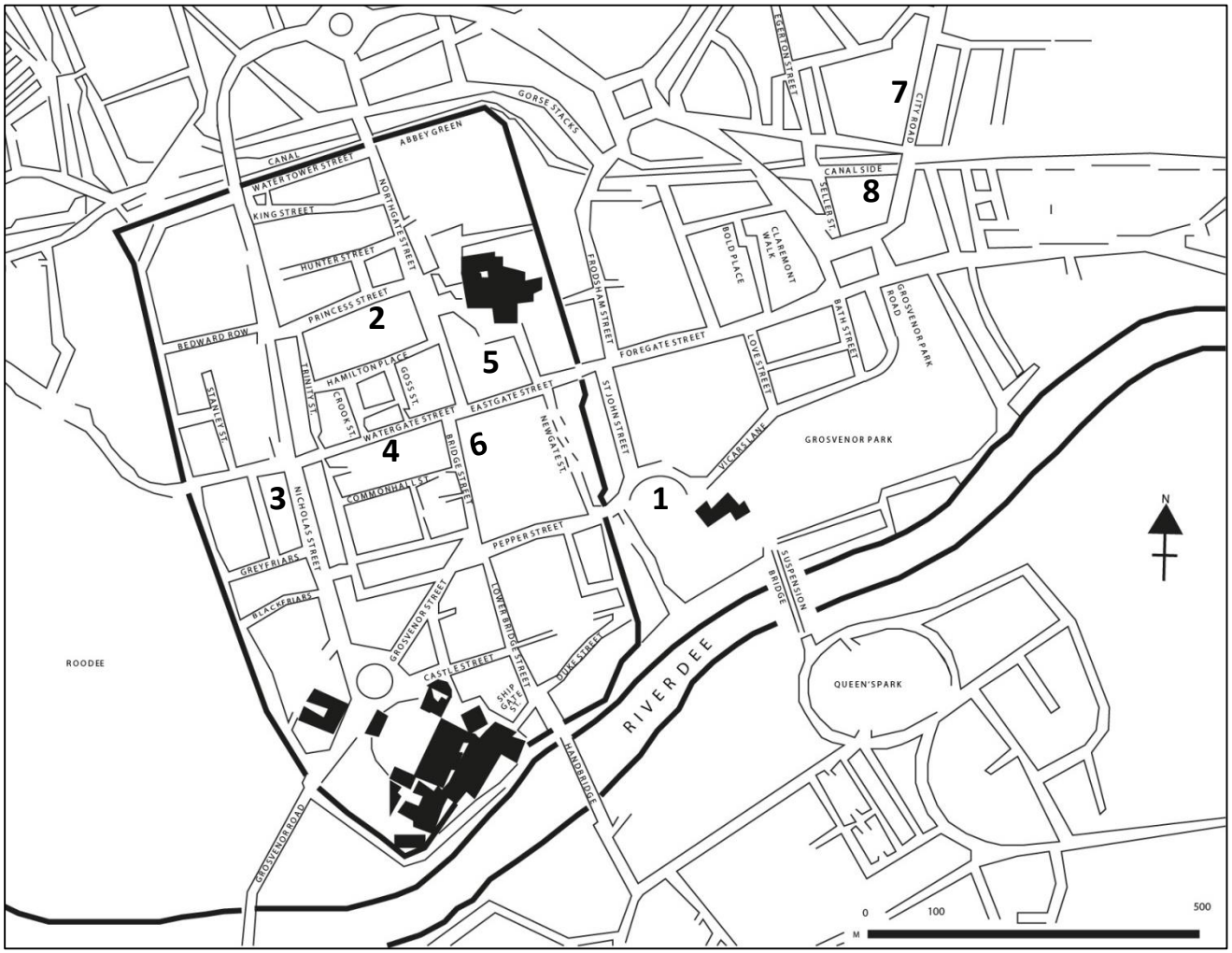

Figure 2.3: Plan of Chester showing the site locations, drawing by Rebecca Gordon (after Carrington)

Site locations:

1: Chester's Roman Amphitheatre
2: Hamilton Place
3: Nicholas Street Mews
4: 10 Commonhall Street
5: 3-15 Eastgate Street
6: 25 Bridge Street
7: City Road
8: Canal side/Witter Place

Phase	Date	Comments
I	14th- 16th century	This phase only included earlier dates which overlapped with the 16th century to maximise the dataset (e.g. 14th- 16th century or 15th- 16th century)
II	16th- 17th century	
III	17th- 18th century	
IV	18th- 19th century	

Table 2.2: Post-medieval phasing for Nicholas Street Mews

Site history

The site was originally located outside the Roman's legionary defenses, situated next to the harbour, and was within the confines of the medieval walls. Throughout the Roman period the area was a thriving civil settlement, however the silting of the harbour made the location less desirable and as a result it was scarcely occupied during the early medieval period (Ward 1988: 1-2). At this time, the site became open land for gardens, orchards and allotments and in 1236-7 a large portion of the land was given to the Black Friars, who established a church and cloister in the area (Ward 1988: 2; Ward 2012: 87). Nicholas Street Mews itself was located north of the friary precinct. The friary ran up until the Dissolution of the Monasteries, after which the land was sold off and over time development intensified on the land. This was largely restricted to the street frontage in the post-medieval period (Ward 1988: 13; Ward 2012: 87).

A late medieval house was uncovered during the excavations, which was believed to have been constructed before the Dissolution. The land became residential property after the dissolution land was leased out by the friars after the Dissolution. The location of the building tentatively suggests that it could have been owned by Ralph Waryne, who leased two chambers and a building with gardens next to his mansion for 27s. 4d. a year (O'Sullivan 2013: 108). In the early 17th century, the late medieval house was destroyed and was hardly used until the 18th century (Ward 1988: 13). Archaeological evidence from the 18th century included a boundary wall and a Victorian cellar (Ward 1988: 13).

2.4.3 12 Hamilton Place

Site introduction

12 Hamilton Place was a slum-courtyard that was excavated in the summer of 1994. The site was under threat due to re-development carried out by the site owners, Scottish Widows Pension Fund and Life Assurance Society, on the stretch of land between Princess Street and Hamilton Place (Matthews n.d.: 1). The site was excavated for Chester City Council's Archaeological Services by a team of archaeologists and volunteers managed by GTMS Ltd and Gifford & Partners Archaeological Consultants. The excavation took place between 4th July to 13th September followed by watching briefs thereafter until August 1995 (Matthews n.d: 1-2).

The excavation produced a large assemblage of medieval and post-medieval artefacts and animal bones consisting of: 93 boxes of pottery, 30 boxes of glass finds, three boxes of clay tobacco pipes, 14 boxes of building material, one box of worked bone (Edwards, n.d) and c.30 boxes of animal bone. However, the main focus of the investigation was the recording of the 19th and 20th century deposits. The material culture largely consisted of 19th- and 20th century domestic objects, as well as flowerpots, souvenirs, ornaments, toys, religious objects and wares that were of an industrial or commercial nature (Matthews 1999: 167-168). Although it was initially hoped to present the results from the site in a monograph, unfortunately this did not come to fruition (Matthews 1999: 158). At present, much of the information about the site and its finds resides in archives and there are no immediate plans to publish the results.

12 Hamilton Place complexities: recording and residuality

The site phasing was based on the stratigraphic data and the spot dating that took place during the excavation. This was also supported by dating evidence from 18th- to 20th century maps which detail the spatial and temporal changes that occurred on site (Matthews, n.d.16; see table 2.3).

Although the site produced a substantial assemblage of medieval and post-medieval artefacts, most of the documentation on the finds was written in the form of short reports, appraisals and working notes for reference purposes (Reid 2012). An appraisal and short assessment of the animal bones were written; however, a full report was never produced (Harrison 1995a; Smith and Ward 1992).

One of the major problems with the site was the level of residual material in the 19th- and 20th century contexts. However, there is a much wider issue that needs to be addressed when identifying 'residual' material in later period contexts. Although some of the backfills on site contained

substantial amounts of material of an earlier date; some of which were two centuries old, the functional nature of the wares suggested that these were antiques or 'out of fashion' objects that were being kept by the urban poor (Matthews 1999: 173). During the 19th century there was a rise in consumerism which is also reflected in the archaeological record as an overall increase in material goods in both rich and poor contexts (Matthews 1999: 173). This desire to acquire vast quantities of material goods may be reflected in the Hamilton Place deposits which clearly pose a problem when using 'residual' pottery as a proxy for dating animal bones from later contexts. Moreover, the dating of 19th- and 20th century wares is not fully understood which can also make it challenging when attributing dates to these contexts (Matthews 1999: 166).

This consequently created a problem when recording the animal bones. Therefore, a very selective recording strategy was implemented. Contexts from the 19th to 20th century were only recorded if they were identified as key deposits in the pottery and animal bone appraisal (i.e. contexts that produced a large amount of material or that were flagged for their research potential) because they were more likely to have derived from securely dated deposits. The dates mentioned in the appraisals were then crossed referenced with the dates in the stratigraphic narrative.

There were some inconsistencies in the dating which were noted for several contexts: 1119, 1130, 1462 and 1337. This was when the dates for the contexts in the pottery and animal bones appraisal do not match the dates in the stratigraphic narrative. In such cases the date in the stratigraphic narrative was the date assigned to those contexts. This was because it was the only complete report for the site and because there were issues with characterising residual material in the 19th- and 20th century contexts. There was also a dating inconsistency for context 1781; an 18th to 19th century context, for which the same approach was adopted.

Phase	**Date**	**Comments**
IV	late 17th/early 18th century	
V	late 18th/early 19th century	
VI	mid-19th/mid-20th century	This phase was subjected to a selective recording strategy

Table 2.3: Post-medieval phasing for 12 Hamilton Place

Site history

12 Hamilton Place was situated in an area that was subjected to major re-development during the 1960s; therefore much of the archaeological evidence was destroyed (Smith and Ward 1992: 7). However, the extent of re-development in the area meant that a large amount of information about the site was gathered. Prior to the 1994 excavation, an evaluation excavation took place in 1992 to assess the site's archaeological value and how much archaeological evidence remained intact (Smith and Ward 1992: 5).

The archaeological evaluation revealed evidence of Roman activity in the form of an 'Elliptical Building' north of the site, although the building's function is unclear (Smith and Ward 1992: 7). It was believed that Saxon buildings were established in the area; however, during the Middle Ages the area functioned as open land as it was situated away from the major streets (Smith and Ward 1992: 7). The site was intensively occupied in the 18th century and when housing was built (Matthews 1999: 162; Smith and Ward 1992: 7). Cartographic and documentary evidence revealed that from the mid-19th to mid-20th century on the north side of the site there was court-yard type housing and to the south of the site there were terraced cottages and a Baptist chapel (Matthews 1999: 162). Throughout this time the name of the area changed from Herbert's Yard, Herbert's Courts and then finally Cathcart's Square (Matthews 1999: 162). In January 1939, the buildings were demolished as part of the scheme to clear slum courtyards and the families were relocated to council houses (Matthews 1999: 162-163).

The living conditions for the occupants were unfavourable as none of the houses appeared to have a water supply until 1874 which came from a stand-pipe located in the courtyard (Matthews 1999: 163). The houses were not connected with sewers and did not have flushing toilets until the early 1900s (Matthews 1999: 165).

The inhabitants were among the poorest residents of Chester. Many of those living north of the site were unskilled workers although those living in the southern terraced houses were more skilled and lived in bigger houses (Matthews 1999: 165-166). There was evidence of on-site industrial activity which was found with the discovery of three smithies backfilled with domestic refuse when the housing in the area was demolished (Matthews 1999: 165). In addition to metal-working, small scale button-making was taking place in homes (Matthews 1999: 168; Edwards 2003).

2.5 Chester sites: secondary investigations

Secondary post-medieval faunal data came from the following excavations: 25 Bridge Street, Canal Side/Witter Place, City Road, 10 Commonhall Street and 3-15 Eastgate Street. A brief description of each of the sites can be seen below. All site locations can been seen in figure 2.2.

2.5.1 25 Bridge Street

Excavations at 25 Bridge Street in 2001/2002 were undertaken by Gifford and Partners prior to the extension of the department store Debenhams (Garner 2008: 2). The site in situated within the city walls between Bridge Street and Eastgate Street. The excavations uncovered six plots which belonged to properties facing Bridge Street; one of which belonged to a property on Newgate Street (Garner 2008: xii). Historical research revealed that the plots were owned by Chester families from middle class households who worked in various trades as mercers, ironmongers, felt and hat makers (to name a few) (Garner 2008). This was also supported by the quantity and range of finds (e.g. Chinese porcelain and imported continental wares), including the animal bones (see Chapter Three).

2.5.2 Canal side/Witter Place

Archaeological evaluations of Canal side/Witter place were conducted by Gifford and Partners in 2001.This site is located outside of the city walls, along with the site City Road. The animal bones were mainly from the post-medieval period dating between the 18th and 19th century and consisted of faunal remains that were indicative of a tannery site (e.g. where animal hides are processed to make leather) (Carrott *et al.* 2001).

2.5.3 City Road

Excavations undertaken at the archaeological sites City Road, by L-P Archaeology, uncovered a large assemblage of post-medieval animal bones from the 17th TO 19th century. The animal bones comprised of cattle horncores and horse remains, which is indicative of a tannery site. The site also had some remains which were of a domestic nature.

2.5.4 10 Commonhall Street

10 Commonhall Street was excavated by L-P Archaeology which comprised of bones dating between the 17th and 19th century. These remains were of a domestic nature and came from a number of pits (Sykes and Wan n.d.). The site is located towards the centre of the city, inside the city walls.

2.5.5 3-15 Eastgate Street

Excavations at 3-15 Eastgate Street, also located within the walls began in 1991 to recover archaeological evidence that survived underneath a portion of Eastgate Row (also known as the Dark Row) (Matthews 1995). As well as a full scale excavation, trenches were excavated inside the properties facing the street (Matthews 1995). Animal bones were uncovered from the sites dating between the 15th to 18th centuries.

2.6 Methods: zooarchaeological analysis

Recording methods

The animal bones from Chester were recorded using an 'all fragments' method - identification to element and species was attempted on all bones providing there were diagnostic features. By identifying every bone it ensured that the more fragmentary assemblages were less affected by sample size biases, which would have occurred if a selective recording strategy was adopted (see Davis 1992). Bones that could not be identified were recorded as large, medium or small mammal/bird or fish. To measure bone completeness Serjeantson's zoning system (1996) was used for mammals and Cohen and Serjeantson's zoning system (1996) was used for birds. All identifiable bones were sided either as left or right where possible.

Species identification

The separation of sheep and goat continues to be problematic in zooarchaeology resulting in a number of publications illustrating morphological criteria to distinguish the two species (Boessneck 1969; Payne 1985; Prummel and Frisch 1986). For this study, speciation was only attempted on the following bones (after Boessneck 1969): skull, axis, atlas, scapula, humerus, radius, pelvis, femur, tibia, astragalus, calcaneum, metapodials and phalanges. Separation was also attempted on the horncores using Schmid (1972). For teeth the shape of the deciduous third premolar (dP_3) and the interlobar pillar on the deciduous fourth premolar (dP_4) on goat teeth were also used to distinguish between the two species (Payne 1985). There is some debate as to whether the interlobar pillar on the dP_4 can be used as a reliable indicator for goat. Recent evidence has shown that goats do not always display this characteristic and this pillar has also been noted on a number of sheep deciduous fourth premolars (Zeder and Pilaar 2010: 233). Therefore, caution will then be exercised when using this method. Bones or teeth that could not be confidently identified to either sheep or goat were referred to as sheep/goat.

To separate species of equid the criteria of Davis (1980, 1987b) and Eisenmann (1981) were employed to distinguish between equid species based on the morphology of the enamel folds on the teeth in the mandibular row. Although it has been recognised that certain characteristics on cranial and post-cranial elements can be used to aid the speciation of equids, their criteria are largely reliant on the shape difference between horses, donkeys and mules (Johnstone 2004: 172). Therefore metrical data, rather than morphological criteria, were utilised. Only measurements on the following post-cranial bones were used: radius, tibia, metatarsal and first phalanx. Recent evidence has shown the former three elements are particularly effective for separating horse, donkey and mule (Johnstone 2004: 203). Although measurements on the first phalanx are less reliable for separating horses and mules, they still prove to be effective for identifying donkey (Davis 1982; Johnstone 2004: 202). Furthermore, as the first phalanx is a dense element comprising of cancellous bone, the probability of the entire bone surviving complete is higher compared to the long bones (Lyman 1994, table 7.6). Where identifications were not certain, elements were referred to as equids.

Distinguishing between closely related galliforms - domestic fowl (*Gallus gallus*), guinea fowl (*Numida meleagris*) and pheasant (*Phasianus colchicus*) - can be challenging. However, morphological features on a selected suite of bones can aid identification. For example, the spur on the tarsometatarsi is present in male domestic fowl and pheasant but absent from guinea fowl. The presence or absence of the 'continual posterior keel' on the tarsometarsus and the air-sac foramen located on the proximal femur are common characteristics used to distinguish domestic/guinea fowl from pheasant. Lastly, the pronounced glenoid cavity on the scapula is typical in domestic fowl, as is the prominent intermetacarpal tuberosity on the carpometacarpi in guinea fowl (MacDonald 1992: 313). Morphological characteristics on long bones featured in Tomek and Bochenski (2009) were also utilised for separating other galliforms.

The separation of thrushes (*Turdus* sp.) and starlings (*Sturnus* sp.) is particularly problematic and was only attempted on the tarsometatarsus, carpometacarpus, humerus and femur following Stewart (1992). In cases where a species could not be determined 'turdid/starling' was used. Any passerines smaller than thrushes/starlings were not identified to species. Although they can provide useful information about the environment, their identification was not relevant to the research questions. Small rodents were identified to species based on their dentition and tooth row pattern; post-cranial bones, which are particularly difficult to speciate, were recorded as 'small rodent'.

Frogs and toads were identified based on the morphology of their pelves; other elements were identified as amphibian.

Ribs can be particularly difficult to speciate thus speciation was only attempted for mammals providing the rib head was present (Wolsan 1982).

Ageing

Animals were aged primarily using three methods: epiphyseal fusion and the eruption and subsequent wear of mandibular teeth. Five categories of epiphyseal fusion were recorded: fused (when the line of fusion between the epiphysis and metaphysis is no longer visible); fusing (when the epiphysis has partially fused to the metaphysis where the fusion line remains visible); unfused epiphysis (when only the epiphysis is present); unfused metaphysis (when only the metaphysis is present without the epiphysis); and unfused metaphysis and epiphysis (when both were present belonging to the same specimen). Bird bones were recorded as juvenile if the ends of the bones appeared 'spongy' and porous. Mammal bones were assigned to four age categories: early fusing, middle fusing, late fusing and later fusing (for the vertebra centrum) as defined by Reitz and Wing (2008, table 3.5: 72). Wear stages were recorded for teeth using Grant (1982) for cattle and pig and Payne (1973) for sheep. Wear stages were only recorded on the following deciduous and permanent mandibular teeth: deciduous fourth premolar (dP_4); permanent fourth premolar (P_4); and first (M_1), second (M_2) and third (M_3) molars. Wear stages were only recorded if two or more of the above teeth were present in the mandibular row. Tooth wear was converted into age categories using Halstead for cattle (1985), Payne for sheep/goat (1973) and Hambleton for pig (1999). Loose teeth and other teeth in the mandibular and maxillary row were recorded on a presence/absence basis.

Although epiphyseal fusion and the eruption sequence and subsequent wear of mandibular teeth are commonly used in zooarchaeology, it is important to highlight the weaknesses of each method and the ways in which they can affect the interpretation of ageing data. Skeletal maturity is not fixed: genetics and sex as well as environmental and nutritional factors can influence the age at which skeletal maturity is reached. For example, studies have shown that bone fusion rates for different sheep populations can vary (O'Connor 2000b: 95). A recent study was conducted involving the analysis of sheep bones from a contemporary population of unimproved Shetland sheep raised on two different nutritional planes: a high plane pasture with well-drained grassland and a low plane pasture with poorly drained native grassland (Popkin *et al.* 2012). The findings revealed that nutrition and sex greatly influence fusion rates; fusion of sheep on the high nutritional plane was

more advanced and females displayed a more advanced fusion rate than males and castrates (Popkin *et al.* 2012: 3). Castration can also delay fusion, causing bone growth to continue for a longer period (O'Connor 2000b: 95; Reitz and Wing 2008: 201). An important limiting factor is that once an animal has reached skeletal maturity it is no longer possible to determine the chronological age. Preservation can also be problematic as the bones of younger animals are porous and less dense which renders them more susceptible to carnivore gnawing and post-depositional degradation (Davis 1987a: 39; Thomas 2005a: 8). This can skew the ratio of juvenile and adult animals that were present on site. For these reasons, caution is advisable when defining ageing categories for past animal populations.

Teeth are considered to be more reliable for ageing animals as tooth eruption is largely genetically controlled and less likely to be influenced by environmental factors (Davis 1987a: 42; Reitz and Wing 2008: 174). Even when an animal has acquired its full set of adult dentition their teeth will continue to wear allowing for a continued age estimation (Klein and Cruz-Uribe 1984: 43). Teeth are mainly composed of dentine and enamel, both of which are hard tissues in the body; this makes them less prone to post-depositional destruction (Hillson 2005: 8, 158; Lyman 1994: 79; Reitz and Wing 2008: 46). Nonetheless, the tooth eruption sequence and tooth wear is not without its biases. Although the tooth eruption sequence allows for a clear distinction between young and old animals (Klein and Cruz-Uribe 1984: 43), the age at which teeth erupts is variable and can be dictated by physiological, genotypic and environmental factors (O'Connor 2000b: 84; Reitz and Wing 2008: 174). The rate of tooth wear can also be affected by the types of food an animal eats which can differ depending on geographical location (Reitz and Wing 2008: 174).

Despite the fact that both methods have their shortcomings, their frequent use in faunal studies demonstrates their effectiveness when investigating slaughtering strategies. Together, both methods help to regulate against their own contributing biases particularly as taphonomic factors such as butchery, gnawing and preservation, can result in the misinterpretation of ageing data.

Sexing

Sex was recorded for five species: cattle, sheep, pig, horse and chicken. Cattle and sheep pelves were sexed based on two features visible on the acetabulum: the ilio-pubic ridge and medial border and by measuring the height of the medial wall of the acetabulum (Greenfield 2002: 71, 73). Pig canines are extremely sexually dimorphic and were sexed based on the morphology of the tooth and the alveolus (the socket in the jaw). Boar canines are generally larger than sows and because they

grow throughout their life the tooth is open rooted. Sow canines are smaller in comparison and are closed rooted (Hillson 2005: 128). The presence/absence of horse canines was recorded as they are reduced or missing in females (Hillson 2005: 126). Domestic fowl were sexed by recording the presence/absence of the spur or spur scar on the tarsometatarsus, which is commonly used to distinguish cocks (or capons) from hens. However, this method has to be used with caution because some breeds of chickens (i.e. bantams and leghorns) have a higher occurrence of spurs in hens (De Cupere *et al.* 2005: 1595; Serjeantson 2009: 48). Spurs can also develop in older hens as a result of their hormone levels dropping (De Cupere *et al.* 2005: 1589). Similarly, the absence of a spur or spur scar does not necessarily suggest the individual is female. An experimental study with chickens revealed that the timing at which the spur scar develops and spur core attaches to the tarsometatarsus is variable (Serjeantson 2009: 48). Medullary bone was also recorded which is a granular calcium deposit which develops in the bones of chickens just before and during egg-laying. This bone forms as a secondary store of calcium during egg development and is mainly located in the marrow cavity of long bones where there is a good blood supply (De Cupere *et al* 2005: 1589; Driver 1982: 251; Serjeantson and Smith 2009: 49).

Measurements

Measurements were taken on complete fused elements and teeth for the main domesticated mammals, on horncores of cattle and 'adult' bird bones (i.e. bones that did not have 'spongy', porous articular ends). Measurements were taken following von den Driesch (1976) with supplementary measurements for: cattle and caprine metapodials (Davis 1992); cattle pelves (Greenfield 2002); and pig humeri and tibiae (Bull and Payne 1988). Additional measurements were taken for equid cheek teeth using Davis (1987b) and Bull and Payne (1988) for pig teeth. Measurements were taken with either a calliper or osteometric board and were recorded to a tenth of a millimetre.

Pathology

For recording pathologies on post-cranial elements, two types of bone reactions were recorded: bone formation and destruction. Based on the type of bone reaction and depending on the pathological characteristic, one or more of the generic descriptions in table 2.4 were used to describe the pathological modification. The terminology below is recommended by Vann and

Thomas (2006) as general terms that should be widely understood and sufficient enough to cover a range of bone reactions displayed in a number of pathologies.

Bone formation	Bone destruction
Extension of the bone ridge Osteophyte Enthesophyte Periostosis Callus Ankolosis	Cavity Porosity Osteopenia Articular depression Articular destruction Articular groove Necrosis Cloaca Hypervascular

Table 2.4: Pathological lesions recorded for post-cranial elements

Pathological modification caused as a result of an infection was recorded as 'active' or 'inactive' at the time of death. Fractures are one of the most common forms of trauma seen in the archaeological record and are caused by a number of variables that relate to the natural distribution of the force (Vann and Thomas 2006: 4.4). To determine the magnitude and direction of the force, the fracture type (see Mann and Murphy 1990), angle and direction of the foreshortening (distortion of the bone) was recorded as well as the state of healing.

Cattle phalanges and metapodials were systematically recorded for pathological alterations using the method established by Bartosiewicz *et al.* (1997). A scoring system was used to record the extent and presence of the modifications observed on the proximal and distal articulation of lower limb bones. Most modifications were scored on a scale of one to four or one to three: one represented no deformation and three/four represented extreme deformation (e.g. extent of osteophytes or osteoarthritis). Other modifications were recorded on a presence/absence basis: one represented absence and two represented presence (e.g. fusion of the second metatarsal with the third metatarsal). Other associated pathological lesions such as eburnation, fusion and striation were also recorded. The scores were calculated for each element using a formula to establish the pathological index value (PI) to determine the extent to which "an individual bone is affected by pathologies" (Bartosiewicz *et al.* 1997: 20).

Five types of oral pathologies were recorded: cavity; calculus; abscess; alveolar recession; and linear enamel hypoplasia. Non metric variations were recorded for teeth which included the:

presence/absence of the second premolar (P_2) and third premolar (P_3), the accessory pillar on the dP_4 and upper and lower molars and the missing hypoconulid (third cusp) on the M_3.

The diagnosis of pathologies was based on the extent, the location and the description of the lesion. Where a specific diagnosis could not be achieved the lesions were classed into broader nosological classes (e.g. trauma, infection, inflammation etc.).The location was recorded using a zoning system for mammals and birds to establish the prevalence of particular pathological lesions.

Taphonomy

Gnawing, butchery and burning were recorded on all identifiable bones. Carnivore and rodent gnawing was identified using the description outlined by Binford (1981: 44-49). Butchery was recorded as either 'cut', 'chop' or 'saw' and its location was recorded using the codes devised by Lauwerier (1988) with additional codes provided by Sykes (2007). Burning was recorded using three categories following the definitions in Thomas (2005a): 'singed', 'burnt' or 'calcined'. To assess the level of fragmentation for each site two methods were used: the ratio of loose teeth to mandibles (L:M) and the average number of zones per bone. The former works on the premise that since teeth generally survive better than bone, the greater the number of loose teeth compared to teeth located in the mandible, the higher the level of fragmentation. The latter presumes the greater the number of zones per bone, the less fragmented the assemblage.

It is important to note that site recovery methods can also influence the level of fragmentation. Sites that have only been hand-collected are bias towards larger bones and species, whereas sites where sieving have taken place are more likely to be representative of smaller bones and species (see Payne 1972; 1975). However, on-site sieving strategies can also be selective and aim to target specific areas or contexts, and therefore will not always be representative of all elements and species present. The efficiency of recovery can also affect the number of zones per bone, in addition to butchery, food preparation, gnawing, trampling, deposition and carcass utilisation (Albarella *et al.* 2009: 17; Reitz and Wing 2008: 141).

There is no easy way to assess site fragmentation as factors that compound how and why bones fragment are variable and differ between sites and contexts (Reitz and Wing 2008: 141). However, as a crude measure assessing the ratio of loose teeth to mandibles and the number of zones per bone can be a useful way to help understand site fragmentation as well as site recovery. Furthermore, by

considering both methods together it can act as a control between the two approaches, which can help to derive to better interpretations regarding bone fragmentation on site.

Preservation

Bone preservation was recorded for each identifiable bone using Harland *et al.* (2003):
(1) Excellent: majority of surface fresh or even slightly glossy; very localised flaky or powdery patches;
(2) Good: lacks fresh appearance but solid; very localized flaky or powdery patches;
(3) Fair: surface solid in places, but flaky or powdery on up to 49% of specimen;
(4) Poor: surface flaky or powdery on over 50% of specimen.

Quantification

Although most animal bone specialists have used the same methods to quantify the abundance of taxa for a number of decades, opinions have been divided concerning the most appropriate measure and the way in which it is calculated. This has inevitably resulted in numerous debates on ways to quantify animal bones (Chaplin 1971; Grayson 1979; Klein and Cruz-Uribe 1984; Lyman 1994; Lyman 2008; Reitz and Wing 2008). The two most common methods used are NISP "the number of identified specimens per taxon" and MNI "the minimum number of individual animals" (Lyman 1994: 100). Both methods have their strengths as well as their weaknesses. For instance, NISP can be calculated in more than one way and does not take into account that the bones of larger animals are more likely to fragment. Therefore, it can overestimate the frequency of species. It also does not account for the fact that the number of bones in a skeleton can be variable (e.g. foot bones). The NISP value is also subject to recovery bias, taphonomic processes such as butchery, as heavily butchered animals can also be over-represented and bone preservation, which can affect the accuracy of species identification. The MNI value can also be calculated in multiple ways which has created confusion among specialists, making comparability problematic (Lyman 2008, table 2.4: 40). Given that this method focuses on the 'individual', better represented elements can overestimate the abundance of rare or poorly represented species (Lyman 2008: 46). In addition, one major problem with MNI is sample aggregation. MNI values can vary depending on the parameters specialists employ to analyse the data, such as grouping the data by phase (Lyman 2008: 58).

For this investigation, NISP and MAU "the minimum number of animal units" were calculated. NISP is a count for the number of identified individual bone fragments per taxon (i.e. one bone, mandible or tooth would equal one NISP). The NSP count "number of specimens" was also provided for unidentifiable bone fragments including those assigned to broad size categories.

MAU was originally coined by Binford as 'MNI'. Binford advocated that animals are exploited as components of animal 'parts' rather than components of a 'single' animal (1978: 67 -72; 1984: 50). He later on changed the name of this calculation to MAU: "the minimum number of animal units necessary to account for the specimens in a collection", as 'MNI' was unsuitable for what this quantitative method aimed to calculate (Binford 1984: 50-51). MAU is calculated by dividing the minimum number of elements (MNE) by the number of times the anatomical part for that element is present in a complete skeleton (Binford 1984: 50-51). The MNE is calculated by working out the minimum number of elements by anatomical part for each taxon (e.g. four cattle distal femurs, five pig proximal ulnae). For the purpose of this investigation it was first calculated for the right and left side of each element by taxa (i.e. right femur and left femur). Then the MNE for the left and the right side were added together to get the total MNE.

The highest MNE value for an element (whether it was the left or right side) was chosen as the MAU value for that element. MAU value for each taxon was the highest MAU value out of all the elements for cattle, sheep/goat, pig and chicken and represented the 'minimum number' for that species. As MAU is used to calculate the number of 'animal units', it is a more appropriate quantitative method for this study because in an urban market cuts of meat rather than individuals will be distributed and utilised (Armitage 1982: 95; O'Connor 1989a: 194; O'Connor 1993, figure 1: 64). When complete or partial skeletons were present it was noted and their significance was discussed in the relevant context. Fish bones were quantified using NISP only.

On a final note, it is important to emphasise that quantitative evidence will have other sources of error (Olsen 1982: 8). The aforementioned biases (e.g. preservation, taphonomy, recording methods) will undoubtedly affect the prevalence of bones on an archaeological site and therefore were taken into account when interpreting the quantitative data. However, employing both NISP and MAU should help control against some of these biases by providing a theoretical maximum and minimum count of animals present; the actual figure will lie somewhere in between. Furthermore, although there are various animal bone assemblages from sites with different taphonomic histories, analysed with a range of quantitative methods, it is encouraging that assemblages from the same

period broadly show the same temporal trends. For example, the rise of cattle in Roman Britain (e.g. Albarella 2007c; Dobney 2001; Grant 1989; King 1999) and high proportion of pigs at high-status sites (e.g. Grant 1988: 159; Thomas 2007).

Statistical analysis and data manipulation

Statistical analyses provide a useful way of assessing how meaningful the observations noted are, by determining whether they are valid using a framework which identifies ways in which the observed data maybe incorrect (VanPool and Leonard 2011: 2). For this investigation, statistical analyses were carried out using PAST (PAleontological STatistics) - a free statistical software package for education and data analysis used in quantitative paleontology (Hammer *et al.* 2001). Each statistical test employed for the purpose of this study is described below (where sample sizes permit).

Mean (e.g. average) - calculated by summing together all the values in the data set and dividing that sum by the number of observations in that data set.

Standard deviation - measures how much variation there is from the mean by comparing the spread of two or more distributions. A high standard deviation implies a wide spread across a range of values whereas a low standard deviation suggests a narrow spread across a range of values (i.e. the data point is far away or close to the mean).

Coefficient of variation – standardises the standard deviation as a percentage of the mean, allowing significantly different averages (due to sample size differences) to be compared with each other by normalising the spread of values. It is calculated by dividing the standard deviation by the mean. If the value is closer to zero it suggests a narrow spread and if it is closer to one it suggests a wide spread.

Mann-Whitney U– is non-parametric test which allows the comparison of two sets of continuous data that are independent from each other (e.g. measurement data) without making assumptions that the data are normally distributed. It ranks the data to test the difference between the two sets of values and represents this difference as the statistic “U”. Mann-Whitney U can be used as an alternative to the t-test.

Dealing with a small sample of measurements is a frequent problem in zooarchaeology (Albarella 2002: 52); therefore data manipulation was exercised using the 'size index scaling technique' (Meadow 1999, i.e. log scaling). This involves combining the length, width and depth measurements of bones or teeth for one taxon onto a single axis. To carry out the log scaling method, metrical data were taken from a 'standard' for each species (a specimen which all measurements are compared against) which was chosen from the University of Leicester animal bone reference collection for cattle, sheep/goat and chicken. For pig, standards were taken from the feral Australian sow described in Legge (2009). The archaeological measurements from the site were then relativised against the standard by converting them to logarithms. A log ratio of zero implies that the measurement is the same size as the standard. A positive ratio implies that the measurement is larger than the standard and a negative ratio means that the measurement is smaller. Furthermore, the measurement of bones and teeth were kept separate.

2.7 Methods: data selection

Introduction

To carry out an appraisal of the existing post-medieval zooarchaeological evidence, faunal data were collected and quantitatively analysed. Data were collated from a range of sources: published and grey literature reports; online databases (e.g. MOLA); and through social media websites such as 'zoobook' (an online network for zooarchaeologists to disseminate information), 'zooarch' (JISC online mailing list for the zooarchaeological community) and the English Heritage Ancient Monument Laboratory (AML) series. Online regional review databases containing faunal data from sites in central and southern England were also consulted (Albarella and Pirnie 2008; Holmes forthcoming).

Defining phasing and categorising faunal data

In order to identify broad-scale changes, faunal data were assigned to chronological phases to highlight temporal variations on a site and regional level. Upon inspection of the zooarchaeological literature, there are presently no widely recognised period groups that are used when investigating animal bones from the post-medieval period. This may be due to the lack of periodisation for this period. The post-medieval period has been traditionally considered a coherent period group starting at 1500 and ending at 1750 with the arrival of the Industrial Revolution (West 1999: 9). Although this

1750 cut-off is generally being rejected, a new periodisation has yet to be widely employed (West 1999: 9). Most zooarchaeological reports with post-medieval faunal data use their own periods or sub-periods. These can range from using a more refined date (i.e. 17th century) to broad categories such as post-medieval or early/late post-medieval (Albarella *et al.* 2009; Dobney *et al.* 1996; Luff 1993; Maltby 1979; Serjeantson and Smith 2009).

For this investigation the phasing was based on the dates assigned to the faunal data that was collated for the regional site comparison. This led to the adoption of the following consecutive dates: 16th-17th century; 17th-18th century; 18th-19th century; 19th-20th century; 16th century; 17th century; 18th century and 19th century. Additional phasing comprised of overlapping dates 15th - 17th century; 16th-18th century; 17th-19th century and late 17th-20th century. Faunal remains dating from the 15th to 17th century were included in this investigation to delineate the 'transitional period' from the late medieval period and early modern period. Assemblages spanning three or more centuries or those ambiguously referred to as 'post-medieval', giving no indication of the date were excluded from the analysis. Fortunately this was infrequent.

Site information

Faunal data were recorded using a Microsoft Access database adapted from the database created by Holmes (forthcoming). Basic information recorded included: the site name; county and region; the period; and bibliographic reference. Each phase from each site was given its own record (e.g. Chester's Roman Amphitheatre a - mid-late 16th/early 17th century, Chester's Roman Amphitheatre b - early/mid-17th century). Other site information included the site type which was based on the descriptions in the site reports, grey literature, etc. (e.g. domestic, high-status, ecclesiastical, mixed, hospital, industrial and not defined). There are inherent problems with assigning a site type as such definitions are highly subjective (Holmes 2012: 31-32) and because of the complexity of urban sites such clear cut definitions are not always applicable (see Chapter Five). Consequently, these categories were broadly utilised when carrying out inter-site comparisons. In addition, interpretations were made with caution and not based on these categories alone. The preservation conditions of the assemblage were recorded when noted (i.e. excellent, good, fair, poor) and whether sieving had taken place. Other forms of information such as complete/partial skeletons and pathologies were recorded on a presence/absence basis and any additional observations were noted in the comments field.

Five types of zooarchaeological data were recorded: species presence and abundance; mortality profiles; metrical data; butchery; and body part representation. The methods used to collect each type of data are described below.

Species representation

In order to quantify the presence and relative abundance of taxa, the NISP count was chosen for synthesis. NISP data were collected for all the major domesticated mammals/birds: cattle; sheep/goat; pig; chicken; goose and duck. The total NISP for each site was also recorded. The advantage of using NISP is that most faunal specialists use this calculation as a basic fragment count for the animals present. However, in addition to the weaknesses discussed in section *2.6 Methods zooarchaeological analysis*, there are other factors that can affect the total NISP which should be considered. For instance, some sites apply correction factors to compensate for different numbers of bones per species in the NISP calculation and some zooarchaeologists record using a selective approach (Albarella *et al.* 2009; Albarella and Davis 1996; Davis 1992; Thomas 2005a). The level of identification also has to be taken into account, as some zooarchaeologists will identify elements such as ribs and vertebrate while others will not. The recovery strategy of an excavation will also affect the representation of small mammals, birds and fish, particularly if no sieving was implemented. Collectively, it is easy to see how different methods can compound the data, making comparative investigations challenging. In an attempt to control against some of these biases, only hand collected material was included in the analysis; it is assumed that all sites will be subjected to the same recovery biases (i.e. the bones of large animals will be collected more frequently over the bones of small animals). The disadvantage of this is that small mammals/birds and fish were underrepresented. However, in order to account for the presence of species recovered during sieving, they too were noted on a presence/absence basis.

Mortality profiles

In order to compare mortality profiles, raw data for mandibular wear stages were used as they give a more precise age estimation and because teeth have a higher rate of survival than post-cranial bones. A number of methods are used by zooarchaeologists to convert mandibular wear stages into age categories, some of which were used for this investigation (e.g. Payne 1973 and Halstead 1985). To standardise the raw data for wear stages, they were converted into age categories using the formula presented by Hambleton (1999). Unfortunately, not all reports included the raw data;

however some did include tables with the suggested age categories and the number of specimens (e.g. cattle, sheep/goat and pig) from each category. On most occasions, the total number of the specimens from each category was simply matched to the equivalent category in Hambleton (1999). However, this was not possible in all cases, resulting in data being discounted. Fusion was recorded by the means of basic categories (e.g. mostly young, mixed, mostly adult/elderly) to see if they compared to the tooth wear data.

Metrical data

Metrical data were obtained from the zooarchaeological analyses conducted for this investigation as well as from other faunal specialists and published site and grey literature reports. The raw data were converted into tenths of a millimetre.

Butchery

Butchery evidence was synthesised by providing descriptive summaries of the butchery marks observed largely on domestic mammals and birds. The aim was to provide an overview of butchery practices in the post-medieval period and to identify broad trends and/or significant changes in how animal carcasses were processed and utilised.

Body part representation

The presentation of body part data varies, which makes comparison of these data problematic. Generally, body part data are represented as NISP, MNI or MNE and unfortunately the method used to calculate this count is not always detailed in the report. Therefore, for simplicity, body part data were also synthesised by providing a descriptive prose.

Sample size

When conducting an archaeological investigation of this nature, a key consideration is to establish parameters for the sample size. A sample acts as a subset of a population from which inferences about that population can be drawn (VanPool and Leonard 2011: 15). As a general rule, the larger the sample, the more reliable those inferences will be; however, small samples can be equally

reliable (VanPool and Leonard 2011: 313). Deciding on an appropriate threshold for this investigation was essential to ensure reliability; an issue which has been echoed in other animal bone syntheses (Albarella *et al* 2009: 33; Hambleton 1999: 39; Hambleton 2008: 5; Holmes 2011; Sykes 2007a: 9; Thomas 2005a: 21). From the examination of the literature, a common practice is to base the sample size on the number of cattle, sheep/goat and pig present in each assemblage, although there is no consensus about what that threshold should be. A recommendation of a minimum NISP of 300 bones was proposed to remove the majority of the biases associated with small sample size (see Hambleton 1999: 39). Unfortunately, due to the paucity of substantial post-medieval faunal assemblages, this lower limit would exclude the majority of assemblages. For that reason, a minimum threshold of 100 identifiable cattle, sheep/goat and pig fragments were employed for this investigation. As a precaution, to detect whether the sample size was driving the results, a regression analysis was carried out as a way of detecting possible sample size bias (see Lyman 2008: 167). The aim of the analysis is to assess the strength of the correlation between samples of different sizes and the number of taxa present in those samples to identify where the results may be misleading (Lyman 2008: 165).

2.8 Site comparisons: conclusion

It is essential to understand that investigations which involve analysing large amounts of data will inevitably have their associated problems, some of which have already been mentioned above. Therefore recognising the factors that will influence the data is crucial. In addition to methodological issues, taphonomy and cultural activities such as butchery and waste disposal can affect species abundance. Faunal remains from industrial or residential areas will produce different faunal signatures (Maltby 1979: 3) and sites may also reflect more than cultural activity which may differ spatially and temporally (Wilson 1996). The challenge for zooarchaeologists begins in attempting to recognise and interpret these different activities while compensating for the idiosyncrasies that can manipulate the data. Although, where possible, attempts have been made to standardise the data, it is important to accept that some factors are beyond the control of any faunal specialist. On the contrary, the quantity and quality of good zooarchaeological investigations of multi-period sites, successfully demonstrate the value and potential of this type of analysis (e.g. Albarella and Davis 1996; Dobney *et al.* 1996; Holmes 2011; Sykes 2007a; Maltby 1979; Thomas 2005a).

3 Chapter Three - Animals in Post-medieval Chester: an inter-site analysis

3.1 Introduction

In this chapter I will describe the results of the inter-site analysis, which will compare the results from the primary investigations conducted on Chester's Roman Amphitheatre, Nicholas Street Mews and Hamilton Place, with post-medieval faunal data from the following excavations: 25 Bridge Street, Canal Side/Witter Place, City Road, 10 Commonhall Street and 3-15 Eastgate Street (see Chapter Two for site descriptions).

Issues did occur when comparing chronological groups from different sites. For instance, Chester's Roman Amphitheatre and 25 Bridge Street had faunal material from the 16th to 20th century. Both sites had similar tight chronological phasing, which made them easier to compare. Other sites such as City Road and 10 Commonhall Street had a broad chronological phase, which overlapped with the phasing from other sites. In cases such as this, sites that could be directly compared were considered separately from sites with a broader chronological time span. Some assemblages were lacking in ageing and measurement data therefore insights into mortality profiles and livestock size and shape variation was dependant on sites which produced more data. To limit this scenario as much as possible, data from more than one phase were combined to produce a larger sample size. Attempts were also made to ensure that all the data were comparable. This was done by re-analysing (where applicable) the raw data from the published and grey literature reports using the methods outlined in Chapter 2.

As discussed previously (see Chapter Two), there are inherent problems when conducting inter-site analyses. This is largely due to the lack of comparability between recording and quantification methods and different site taphonomic histories. Although inter-site analyses can be problematic, patterns will still be evident in large datasets, which can shed-light on husbandry practices, procurement strategies, identity and urban provisioning.

3.2 Species representation

Domestic mammals

At the majority of sites, cattle was the most common domesticate (figure 3.1, Appendix Three). The proportion of cattle ranged anywhere from 29 to 99 percent, although most sites had around 51 to 69 percent. It should be noted that as a quantitative method NISP can increase cattle frequencies as oppose to sheep and pig (Albarella *et al.* 2009: 21). As discussed in Chapter Two it is also affected by taphonomic and recovery biases, which can influence species identification. Despite this, its disadvanges should be reflected at all sites where NISP is employed as the primary quantitative method for species abundance. As there is consistently a high proportion of cattle at Chester sites it is likely to be reflecting a regional trend. It was well-known that the Cheshire climate and soil favoured cattle rearing whereas animals such as sheep and pig were reared in small numbers. This phenomenon has also been witnessed at other sites from different periods in Chester and is supported by historic accounts (Hewitt 1967: 30, 37; Gordon 2013; Smith 2008; Thirsk 1967: 83; see Chapter Two).

Sheep/goat was the second most common species; however, their proportion was more variable compared to cattle. Sheep farming in Cheshire was not practiced on the same scale as cattle farming. Most farmers only reared sheep in small numbers; large flocks of sheep were confined to particular areas such as Delamere Forest and the Eastern hills of Cheshire (Beck 1969: 42; Scard 1981: 87). Apparently, prior to the Black Death, the Cheshire hinterland appeared to be empty of sheep (Trow-Smith 1957: 142). A notable difference in the proportion of sheep/goat could been seen at 3-15 Eastgate Street (late 15th - mid-17th century), which had the highest proportion of sheep/goat (65%) and the lowest proportion of cattle (29%) (figure 3.1). This is interesting as this result appears to be atypical of sites in Chester.

Twenty-three bones were positively identified as goat from the post-medieval contexts. Goat remains were only identified at four sites: Chester's Roman Amphitheatre (n=6); Nicholas Street Mews (n=1); 10 Commonhall Street (n=1); and 25 Bridge Street (n=15). The majority were horncores, although metacarpals, phalanges, mandibular fragments/teeth and an unfused distal tibia were also found. The absence of goat remains is typical of the post-medieval period as the frequency of goat decreases after the late medieval period (Albarella 2002). This trend is also seen at Chester's Roman Amphitheatre and 25 Bridge Street, which had a higher proportion of goat remains in medieval contexts (Gordon 2013; Smith 2008).

Pigs made a minor contribution to the diet, which is not surprising as they were reared in small numbers due to the fact they did not produce secondary products. In addition, as pigs are normally slaughtered at a young age, their bones are prone to depositional processes and therefore more likely to be under-represented. 3-15 Eastgate Street in late 17th - mid-18th century had the highest proportion of pig at 39%, which was a 25% increase from the late 15th - mid-17th century (figure 3.1).

This is noteworthy as there was an obvious shift from a sheep-based diet in the late 15th - mid-17th century to a pig and cattle-based diet in the late 17th - mid-18th century, which was not replicated at other sites. Nicholas Street Mews had the second highest proportion of pig in the 14th-16th and 18th-19th century phases. However, if pig remains from sieved samples were considered, the 16th century feasting pit at Chester's Roman Amphitheatre would have had the largest proportion of pig bones (n=506). Overall, there is no consistent change in the proportion of cattle, sheep/goat and pig through time.

Other domestic mammals in Chester included equid, dog and cat. Equid remains were represented by isolated elements on a number of sites. Most of these remains were horse, although donkey and hybrids should not be discounted. Equids found at Chester's Roman Amphitheatre comprised of disarticulated elements. 12 Hamilton Place, City Road and Nicholas Street Mews had partial horse skeletons. The former sites had foal skeletons and the latter had a skeletally mature female horse. The horse from Nicholas Street Mews showed no obvious signs of exploitation and may have represented a pet or working animal that died from natural causes (see Chapter Four). It was estimated that the horse was 10 to 14 years old. The City Road excavation produced a large assemblage of tannery waste, which included a collection of horse remains, showing evidence for skinning and disarticulation (Sykes *et al.* n.d: 7). Canalside/Witter Place also produced faunal remains that pointed to craft activity taking place in the area. This site also had a few horse elements, which may be suggestive of hide preparation (Carrott *et al*. 2001: 4). Interestingly, a donkey metacarpal (spot dated to 18th-19th century) was found at City Road along with the assemblage of horse remains. It is difficult to assess the abundance of donkey in Britain as their bones are morphologically similar to horse (see materials and methods). According to Edwards (2007: 200), the 17th century saw a rise in the use of donkeys. In Victorian London, c. 3,000 donkeys were exchanged by dealers at Islington Cattle Market (Gordon 1893: 166). Thus, the presence of this specimen may be tentative evidence for the trade of donkeys in the modern period.

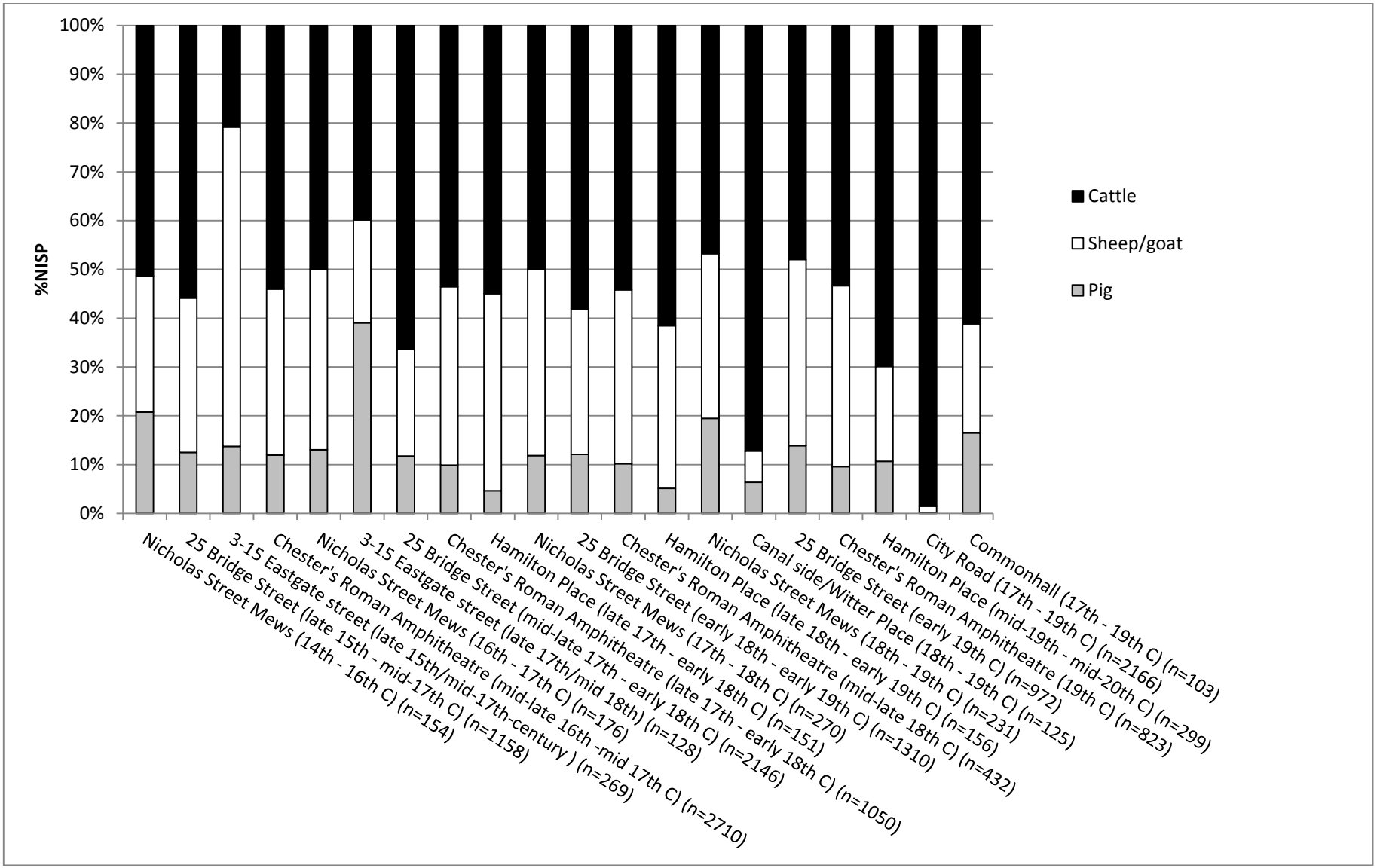

Figure 3.1: The relative proportion of hand-collected cattle, sheep/goat and pig from post-medieval sites in Chester. The sites are grouped roughly in chronology order. (n)=denotes the total number of cattle, sheep/goat and pig

Dog remains were mainly disarticulated, although partial skeletons came from 25 Bridge Street in the late 15th - mid-17th- and early 19th-century contexts (Smith 2008). The partial dog skeleton from the late 15th - mid-17th century was estimated to be six to nine months and exhibited traumatic injuries (see pathology section below). In the early 19th century context, one male dog appeared to have been carefully disposed of in its own discrete burial (Smith 2008: 367). The presence of partial burials could be indicative of companion animals.

Cat remains were also mainly disarticulated. The cat remains from 25 Bridge Street provided insight into the different disposal practices of cats on site. Cats dating from the mid-late 17th- early 18th century were recovered from cess pits and appeared to have been dumped in this feature (Smith 2008: 360). Some of these animals were very young which suggests that cats were being bred on site (Smith 2008: 361). The cats recovered from 19th century contexts from 25 Bridge Street had clearly received differential treatment as they were given discrete burials. Unusually, a double cat burial was excavated from this context. As neither of the cats exhibited any signs of butchery, it is highly likely that both cats were companion animals (Smith 2008: 367). It was speculated that they may have died after an outbreak of cat flu (Smith 2008: 367). Partial cat skeletons were also recovered from the 19th century context at Chester's Roman Amphitheatre. The partial cat skeleton from Chester's Roman Amphitheatre appeared to have been buried in a purposely-dug pit in a garden plot.

Wild mammals

Fallow deer, rabbit and hare were the most common wild species found at sites in Chester. Rabbit was the most common wild resource at Chester whereas hare was less frequent. Red and roe deer were only present in small numbers whereas fallow deer were better represented. Red, fallow and roe deer were present at 25 Bridge Street, Chester's Roman Amphitheatre, City Road, 10 Commonhall Street and Nicholas Street Mews. Unidentifiable species of deer were also found at 3-15 Eastgate Street. The sites with the most fallow deer were Chester's Roman Amphitheatre (n=67) and 25 Bridge Street (n=37); however the frequency of this species appeared to decrease over time. Six wild mammal species, only recovered from 25 Bridge Street, included: elephant (n=1); red squirrel (n=3); pine marten (n=2); stoat (n=2); polecat/ferret (n=3) and fox (n=4). The elephant ulna (cal AD 1290-1410) was undisputedly the most unusual find at 25 Bridge Street, which was recovered from the late 15th - mid-17th century context. It was excavated from a cess pit and bore a possible hack mark on the olecranon tuberosity. It was not possible to determine the origin of the

specimen; therefore, it came from either Africa or Asia. The ulna may have been brought back as a curio from Chester's port (Smith 2008: 354). The fur of red squirrels, pine martens, stoats, polecats, foxes and ferrets were highly desired by furriers; therefore, their skins may have been imported or purchased to make goods such as gloves (Smith 2008: 361).

Domestic Birds

Chicken was the most abundant domestic bird, followed by goose and duck. However, the proportion of these species differs drastically between sites (figure 3.2). It should also be noted that at some sites the number of domestic birds was low which will over represent the proportion of these species (Appendix Three). The largest assemblage of chicken remains came from the 16th century feasting pit from Chester's Roman Amphitheatre, which produced over 660 chicken bones (hand-collection and sieved samples combined). While chicken and geese were the birds of choice and they were represented at all of the sites, duck made a small contribution to the overall diet of the inhabitants at Chester. Ducks were considered to be of minor economic importance from the Middle Ages and their meat was not highly desired (Albarella 2005). This probably accounts for their low occurrence in the Chester assemblages. However, the same cannot be said for wild ducks, which were highly sought after for elite consumption (see Chapter Four).

Wild Birds

A range of wild birds were present at Chester, most of which were waders, wild galliforms and commensal birds (figure 3.3; table 3.1). The majority of these birds would have been eaten, although the presence of commensal birds (e.g. pigeons/dove, corvids, thrushes and passerines) are harder to interpret, as they are site scavengers and perching birds that can also be consumed. Although wild birds would have formed a minor component of peoples' diet, the presence and diversity of species does provide insight into social status, procurement and seasonality. Woodcock was by far the most common bird, which was recovered from the majority of sites. Woodcock is a high-status bird that is associated with feasts and banquets. In the dinner accounts for the Lords of the Privy Council in the Star Chamber, Westminster, the price of woodcock was said to have been 'comparatively low' (Simon 1959: 12). This may account for their abundance throughout sites in Chester. The sites with the highest diversity of wild birds were 25 Bridge Street and Chester's Roman Amphitheatre, which clearly demonstrates the status of the inhabitants. There was a decline in the proportion of wild

birds after the 17th-18th century (figure 3.4). This decline may signify a change in the status of the inhabitants or perhaps there was a move of wealth outside of towns as the rich sought to escape the pollution and congestion in the city (see Chapter Two). Thomas (1983: 116) states that compared to the Stuart age, the consumption of small birds decreased by the Victorian Period, since it was no longer seen as rational to shoot birds. Therefore, it is worth considering whether this decline reflects changing perceptions. The decline in wild birds has also been observed at other post-medieval sites, which could suggest that this was also national phenomenon that was witnessed around the country (see Chapter Five). High-status species were also presence at Nicholas Street Mews but not in high numbers. Their consumption on site is most likely associated with ecclesiastical and high-status community on site.

Fish remains were recovered from Chester's Roman Amphitheatre, Nicholas Street Mews, 25 Bridge Street and City Road which were exploited from estuaries, marine and freshwater environments. Hand-collected fish remains were recovered in small numbers (table 3.4). Most of the hand-collected fish remains came from 25 Bridge Street, which also had a greater diversity of species (see tables 3.5). Although the sample was too small to draw meaningful conclusions, it is worth noting that similar families such as Gadidae, Anguilldae, Pleuronectidae, Salmonidae and Rajidae were recovered from at least two sites (table 3.5). Nearly most of the fish, if not all, were recovered from samples. The largest sieved assemblages were from Chester's Roman Amphitheatre and 25 Bridge Street and a small amount of fish was retrieved from City Road. Chester's Roman Amphitheatre and 25 Bridge Street both had high proportions of eel, smelt, herring, flatfish (e.g. from the Halibut Family) and Gadidae (in particular whiting at 25 Bridge Street). In contrast, 25 Bridge Street had more flatfish, eel and herring than the Amphitheatre assemblage. The high proportion of flatfish at 25 Bridge Street could mean that the majority of fish at the site was obtained from local fisheries rather than imported fish sold at the market (Hall *et al*. 2008: 396). In terms of species diversity, 25 Bridge Street had a greater variety. However, Chester's Roman Amphitheatre did have a few species that were absent from Bridge Street such as seabass, shad, monkfish and mackerel. Fish at Nicholas Street Mews derived from marine environments. Dab and hake were only found at Nicholas Street Mews and not at other sites in Chester. Dab was also only found at two other post-medieval sites in England (e.g. Closegate I & II, Newcastle Upon Tyne a and Poole) which could suggest that it was a rare species. However, Dab is a flatfish, which can be difficult to identify.

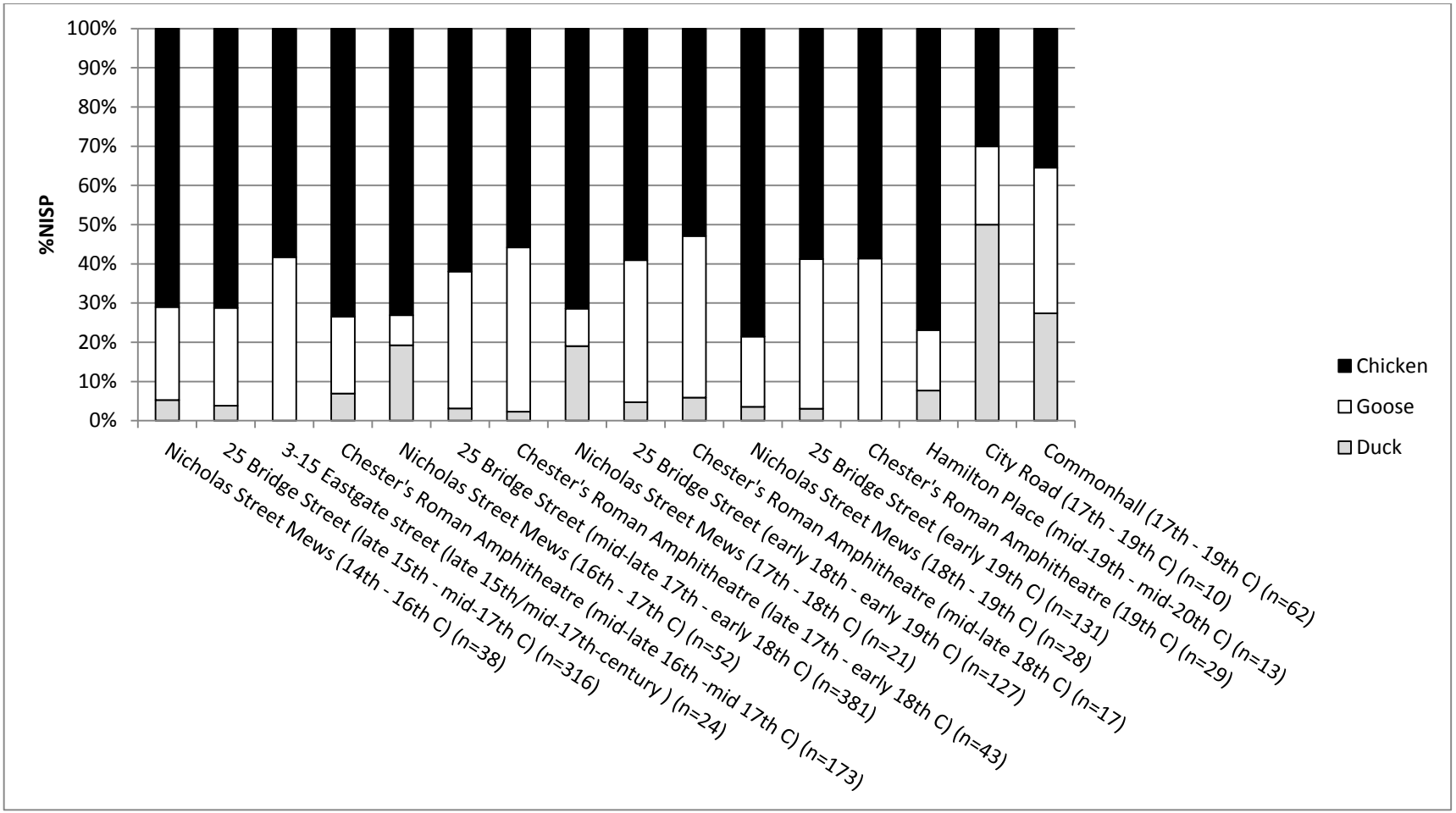

Figure 3.2: The relative proportion of hand-collected chicken, goose and duck from post-medieval sites in Chester. The sites are grouped roughly in chronology order. Only sites with 10 more chicken, goose and duck were included. (n)=denotes the total number of chicken, goose and duck

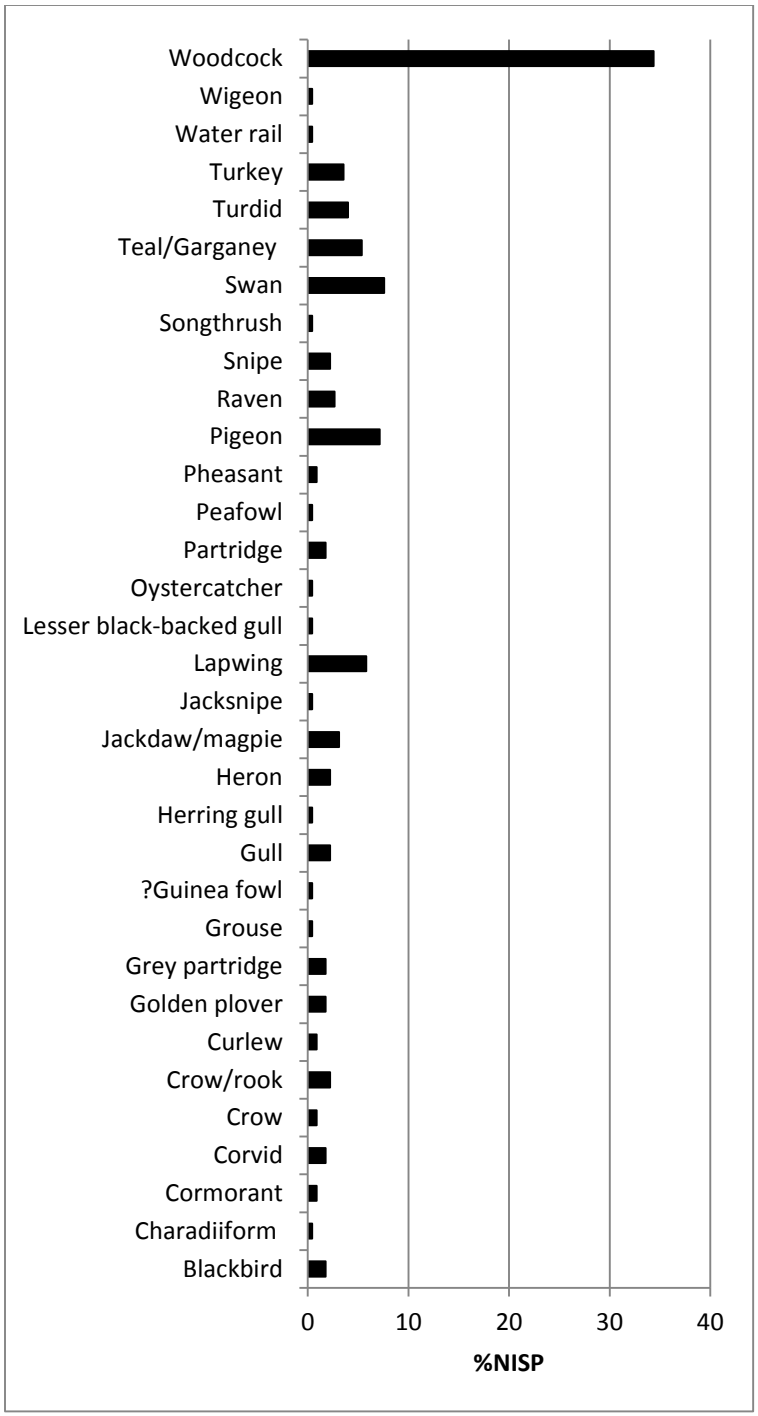

Figure 3.3: Relative proportion of identifiable hand-collected wild birds from all post-medieval Chester sites

Species	Sites					
	3-15 Eastgate street	25 Bridge Street	Chester's Roman Amphitheatre	Hamilton Place	Nicholas Street Mews	City Road
Blackbird		*				
Charadiiform					*	
Cormorant		*				
Corvid			*	*		
Crow				*		
Crow/rook		*	*			
Curlew		*	*			
Golden plover		*	*		*	
Grey partridge			*			
Grouse		*				
?Guineafowl			*			
Gull		*	*			
Herring gull					*	
Heron		*	*			
Jackdaw/magpie		*	*		*	
Jacksnipe		*				
Lapwing		*	*			
Lesser black-backed gull			*			
Oystercatcher		*				
Partridge (unident.)		*				
Peafowl			*			
Pheasant					*	
Pigeon		*	*		*	
Raven		*		*	*	*
Snipe		*				
Songthrush		*				
Swan		*	*			
Teal/Garganey		*	*		*	
Turdid			*		*	
Turkey		*	*	*		*
Water rail					*	
Wigeon		*				
Woodcock	*	*	*		*	

Table 3.1: Presence/absence of hand-collected wild birds from sites in Chester * denotes presence

Species	Sites	
	25 Bridge Street	Chester's Roman Amphitheatre
Blackbird	*	
Calidris		*
Charadiiform		*
Corvid	*	*
Curlew		*
Golden/grey plover	*	*
Grey partridge		*
Grouse		*
Gull		*
Heron		*
Jacksnipe	*	
Lapwing	*	*
Passerine	*	*
Peafowl		*
Pigeon	*	*
Redshank		*
Snipe	*	*
Teal/Garganey	*	*
Turdid	*	*
Woodcock	*	*

Table 3.2: Presence of sieved wild birds from 25 Bridge Street and Chester's Roman Amphitheatre

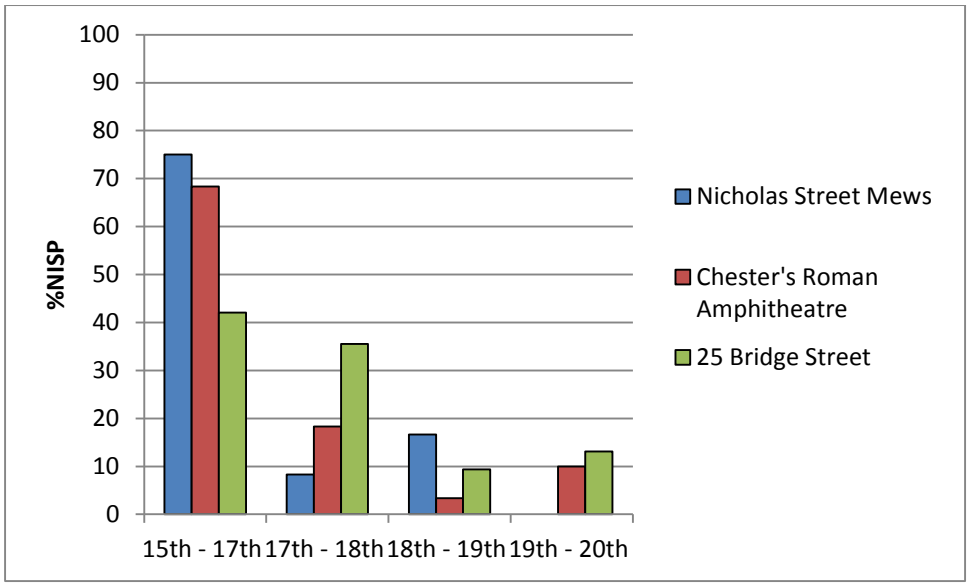

Figure 3.4: %NISP of hand-collected wild bird

Species	Sites		
	Chester's Roman Amphitheatre n=5	Nicholas Street Mews n=17	25 Bridge Street n=84
Bass			*
Cod	*	*	*
Cyprinid			*
Dab		*	
Eel	*		*
Flatfish (e.g. Halibut Family)			*
Gadid		*	*
Haddock			*
Hake		*	
Herring			*
Ling			*
Ling(?)			*
Salmon			*
Salmonid (e.g. trout and salmon family)	*		
Thornback ray		*	*
Turbot			*

Table 3.3: Presence/absence of hand-collected fish from sites in Chester

Species	late 15th-mid-17th	mid-late 17th-early 18th	early 18th-early 19th	early 19th	20th	**Total**
Bass		1				**1**
Cod	6	6	3			**15**
Cyprinid		1				**1**
Eel		1				**1**
Flatfish	12	11		7	8	**38**
Gadid	1	1	1		4	**7**
Haddock	2			1		**3**
Herring		2				**2**
Ling		2	1	1		**4**
Ling(?)		1				**1**
Salmon		2	1			**3**
Thornback ray		1				**1**
Turbot		7				**7**
Total	**21**	**36**	**6**	**9**	**12**	**84**

Table 3.4: Hand-collected identifiable fish remains from 25 Bridge Street (Hall *et al.* 2008)

Species	Sites		
	Chester's Roman Amphitheatre (n=1143)	25 Bridge Street (n=2974)	City Road (n=18)
Anchovy		*	
Anchovy/herring		*	
Atlantic horse-mackerel/scad	*		
Bass		*	
Cod	*	*	
Cod(?)		*	
Conger		*	
Cyprinid	*	*	
Eel	*	*	
Elasmobranch		*	
European seabass	*		
Flatfish (e.g. Halibut, turbot, dab)	*	*	*
Flounder		*	
Flounder(?)		*	
Gadid	*	*	*
Gadid (small)		*	
Halibut family	*		
Herring	*	*	*
Ling		*	
Mackerel family	*		
Monkfish family	*		

Table 3.5: Presence/absence of fish from sieved sample from sites in Chester * denotes presence

Species	Sites	
	Chester's Roman Amphitheatre (n=1143)	25 Bridge Street (n=2974)
Perch		*
Perch(?)		*
Perciformes order	*	
Plaice		*
Ray		*
Ray family	*	*
Salmon		*
Salmonid	*	*
Shad	*	
Smelt		*
Smelt?		*
Smelt family	*	
Smooth hound		*
Sole	*	*
Sole(?)		*
Stickleback		*
Thornback ray		*
Trout		*
Turbot		*
Turbot family	*	
Weever		*
Whiting		*
Whiting?		*

Table 3.5: (cont.) Presence/absence of fish from sieved sample from sites in Chester * denotes presence

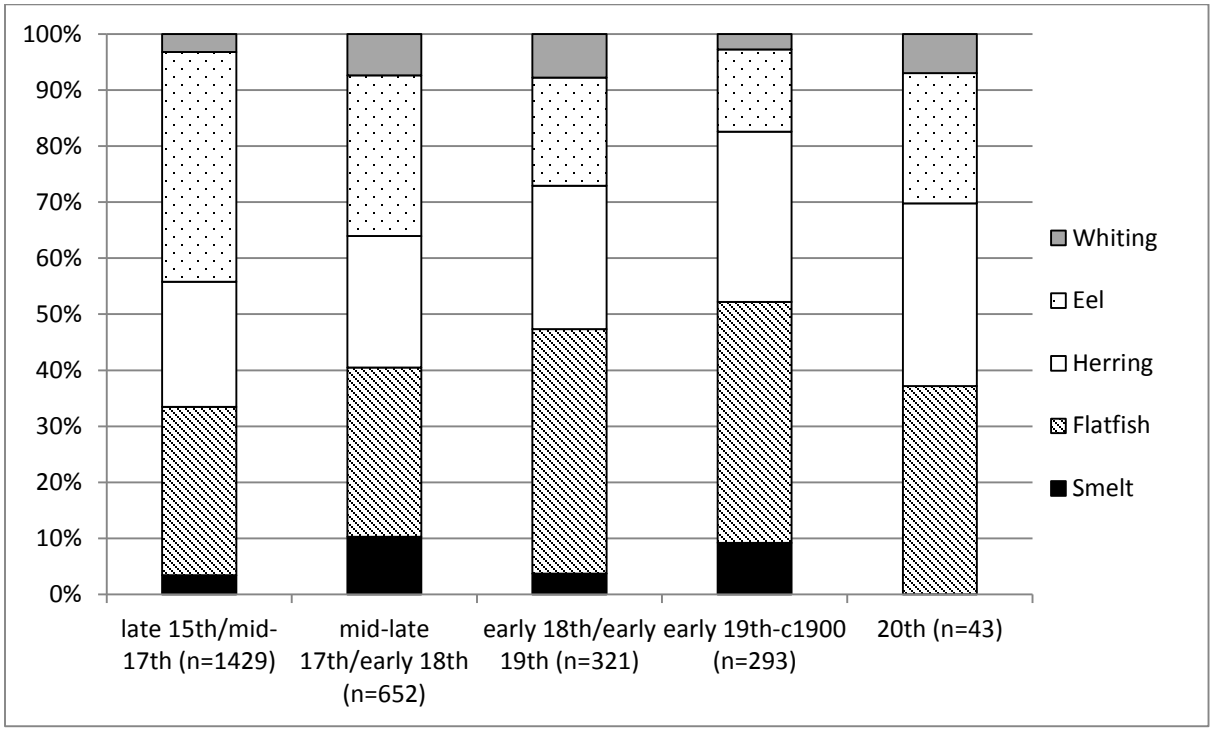

Figure 3.5: The relative proportion of the main food fishes at 25 Bridge Street by family/species based on data in Hall *et al.* (2008)

There were also higher quantities of salmon and sole at Chester's Roman Amphitheatre. It is well known that the bones of salmon do not preserve very well; therefore, the species is often under-represented (Hall *et al*. 2008: 396; Locker 2009: 145). Despite this, imported salmon was a desirable fish and cost twice the amount of herring (Kermode 1996), as cited by Hall *et al*. 2008: 396); therefore, its presence in the feasting pit is noteworthy. Sole is also considered as a 'good food fish' (Locker 2009: 145), which was also found in greater abundance in the feasting pit. City Road only produced a small assemblage of fish remains; however, these species were gadid, flatfish and herring, which is in-keeping with the most common species found at Chester.

3.3 Body parts represented

It was not possible to directly compare the body parts of domestic mammals at Chester due to the different methods adopted by specialists. Therefore, for comparative purposes the results will be presented as a descriptive account for each species.

For cattle, there were clear patterns in the body parts represented based on the function of the site and the activities that were taking place. On most sites all of the elements were represented, suggesting the whole animals were brought to site either as undressed/dressed carcasses or as pre-butchered joints from the urban market. There were some differences in the proportion of elements at some sites. For example, Chester's Roman Amphitheatre had a high proportion of calf heads, particularly in the 16th century feasting pit. Hamilton Place had a low proportion of major-meat bearing bones and few cranial elements, which could be an indicator of lower status residents. Sites such as Nicholas Street Mews, Chester's Roman Amphitheatre and 25 Bridge Street had a high proportion of heads and major meat-bearing bones (Smith 2008). At 25 Bridge Street in the mid-late 17th- early 18th century, elements largely consisted of horncores and meat-bearing bones (e.g. scapula, humerus, pelvis, femur and tibia). In this context, a horncore structure was discovered in one of the plots, which is the first of its kind to be found in Chester (Smith 2008: 355). The evidence suggests that the concentration of horncores was the result of the singular depositional event or was constructed in connection with a building (Smith 2008: 355 -358). It was also suggested that the horncores were transported to the site to line the cesspit (Smith 2008: 357). 10 Commonhall Street had all elements present but there was a higher frequency of foot bones; therefore, it is possible that cattle were slaughtered on site (Sykes and Wan n.d.: 2). The two industrial sites, Canalside/Witter Place and City Road had a high frequency of cattle horncores, which is characteristic of many tannery sites.

The skeletal representation for sheep/goat consisted of major-meat bearing bones, which probably arrived on sites as dressed carcasses or as pre-butchered cuts. Common elements were the scapula, humerus, pelvis, radius, femur and tibia. There was less evidence to suggest the use of sheep/goat bones for industrial activities. At 25 Bridge Street there was a shift in the use of sheep/goat between the late medieval and post-medieval period. The late medieval deposits had high concentrations of metapodials, which is indicative of processing sheep skins (Smith 2008: 347). This is in stark contrast to the post-medieval period, which clearly shows a higher proportion of major meat-bearing bones. Although this difference could reflect a change in disposal methods, it was concluded that the overall lack of metapodials suggest that leatherworking was less intensive by this period (Smith 2008: 352). This pattern was also observed in the medieval and post-medieval contexts at Chester's Roman Amphitheatre. The medieval animal bones from the sites produced more sheep/goat metapodials compared to the post-medieval contexts, which may also suggest that the processing of sheep skins was less intensive by the later period. It may be that those involved in the hideworking relocated to different areas within the city or chose not to dispose of industrial waste in close proximity to residential areas.

Sheep/goat horncores found at City Road, suggest that sheep skins were processed on site (Sykes *et al.* n.d.: 8).

Goat was less common and mainly represented by horncores along with a few cranial and post-cranial elements: mandibles, metacarpal, phalanges and tibia. The paucity of goat post-cranial remains has been witnessed at a number of medieval and post-medieval sites and it has been suggested that this may reflect the importation of goat skins (Albarella 2003: 80). Documentation refers to the importation of goat skins to Chester; therefore, the lack of post-cranial elements at these sites could support this explanation (Carrington 1994: 81).

For the most part, pig post-cranial elements tend to be less well represented than cattle and sheep/goat because many of the bones are from young animals, rendering them more susceptible to post-depositional destruction, and because pork was also purchased as filleted cuts of meat. At Chester there appeared to be an emphasis on certain body parts like the scapula, humerus, radius and pelvis. Pig metapodials appeared to be more common than cattle and sheep/goat metapodials at 3-15 Eastgate Street (Harrison 1995b: 51). Pig mandibles and skulls were also commonly represented at 25 Bridge Street and Chester's Roman Amphitheatre.

At City Road, an analysis of the body parts for horse showed that all elements were represented; however, there was a difference in the proportion of particular elements. In general, long bones were less common in relation to the pelvis and mandible (Sykes *et al.* n.d.: 6). It seems that the whole animal was brought to the site alive or as a complete carcass, after which the skin was removed and the carcass dismembered. The major meat -bearing bones were believed to have been exported, which could account for their paucity in the assemblage (Sykes *et al.* n.d.: 10). Although there was clearly a demand for horse remains at City Road, it is not fully understood what they were being used for (Sykes *et al.* n.d.). A partial adult horse skeleton was found at Nicholas Street Mews and partial foal skeletons were found at Hamilton Place and City Road.

Fallow deer was largely represented by hindlimb bones at Chester's Roman Amphitheatre and Nicholas Street Mews. 25 Bridge Street had complete metatarsals and fragments of an ulna, radius, metacarpal, tibia and antler (Smith 2008: 353). City Road had one fallow deer humerus. The presence of fallow deer hindlimbs is a pattern that has been recognised at very high status medieval castle sites (e.g. Albarella and Davis 1996; Davis 1987c; Thomas 2005a).

Chicken body parts from Chester's Roman Amphitheatre and Nicholas Street Mews showed that most elements were represented. Although the majority of chickens from sites in Chester were disarticulated, the remains from the 16th century feasting pit most likely came from complete carcasses. Analyses of the chicken body parts reveal that there was a preference for the meatier elements (e.g. femur and humerus). In general, there was a low proportion of wing elements, which could be due to their removal during primary butchery. At 25 Bridge Street complete chicken carcasses from young individuals were found, which may represent natural mortality of birds kept in backyards or the consumption of poults (Smith 2008: 354). Chicken bones from 10 Commonhall Street largely consisted of tibiotarsi, femora and humeri, although the sample size was small.

3.4 Mortality profiles

Epiphyseal fusion and tooth wear data were limited for many of the published and unpublished sites, which made site comparisons problematic. For the sites that did not produce enough data it was only possible to draw to conclusions based on the information provided by the analyst. Some phases produced more data than others and data also came from sites with a broad chronological time span; therefore it was not always possible to explore temporal changes in slaughter strategies. Despite these gaps in the data, interesting patterns could still be discerned. Tooth wear data were limited on most sites; therefore, husbandry strategies are largely based on epiphyseal fusion. Although fusion data can produce a less accurate picture of farming practices (see Chapter Two), it is still an invaluable method that can highlight broad trends and patterns in animal husbandry.

Chester's Roman Amphitheatre, 25 Bridge Street and City Road had enough cattle tooth wear data to permit comparison. However, the sample size was small thus the results should be considered with caution. Tooth wear data for cattle from the mid-late 17th - early 18th century revealed that none were culled between 0-1 months. However, there appeared to have been an emphasis on animals between 1-8 months which is probably connected with the dairy industry (figure 3.6). Chester's Roman Amphitheatre had a wider range of cattle from different age categories compared to 25 Bridge Street. Nonetheless, this was probably due to the small sample size from the latter site. By the early 18th - early 19th century at 25 Bridge Street (figure 3.6) there were a higher number of animals between 1-8 months, which may suggest that more calves were consumed during this time, in contrast to those at Chester's Roman Amphitheatre and City Road. At City Road, the tooth wear data showed that the

majority of cattle were adult and older than those from Chester's Roman Amphitheatre and 25 Bridge Street. The limited tooth wear data available for Hamilton Place suggested that young and adult animals were present on site.

Epiphyseal fusion data allowed for a better understanding of the mortality profile for cattle. At 25 Bridge Street, cattle were younger than those from Chester's Roman Amphitheatre, clearly showing that younger animals were consumed on site (figures 3.8-3.10). This is also loosely supported by the tooth wear data (see figure 3.6). In addition, cattle from the mid-late 17th - early 18th century at 25 Bridge Street were markedly younger. Smith (2008: 355) suggested the possibility of calf skins being brought to the site for processing in this period. It is also possible that on-site breeding was taking place. Chester's Roman Amphitheatre had an unusually high proportion of younger cattle during the early-mid 17th century which could reflect different husbandry strategies for cattle during the Civil War (see Appendix One). It is tempting to consider whether similar factors influenced the high proportion of young cattle at 25 Bridge Street in the mid-late 17th - early 18th century. Cattle from Chester's Roman Amphitheatre during the 19th century showed that there was an emphasis on juvenile animals, which probably attests to the growing dairy industry. Nicholas Street Mews (14th-17th century) appeared to have younger cattle than Chester's Roman Amphitheatre and 25 Bridge Street (figure 3.11); however, this result was most likely affected by the low number of middle fusing bones from this site. At 3-15 Eastgate Street, epiphyseal fusion data were limited; however, it was noted that there was younger cattle in the 15th-16th-century context compared to the earlier periods (Harrison 1995b: 50).

Nicholas Street Mews had a high proportion of young cattle in the 17th-19th century (figure 3.11). However, this too was most likely influenced by the low number of middle fusing bones. City Road had a higher percentage of unfused early fusing bones (figure 3.7). This tentatively contradicts the tooth wear data, which suggest that adult cattle arrived on site. However, it should be emphasised that the sample size for tooth wear data from this site was low; therefore, caution should be exercised with the results. Fifty percent of cattle from 10 Commonhall Street were culled around 3 to 4 years, which suggests that a mixture of young and adult cattle were consumed on site. Hamilton Place had a higher frequency of middle fusing bones that were fused, which suggests that most of the animals eaten were older than 2 to 3 years.

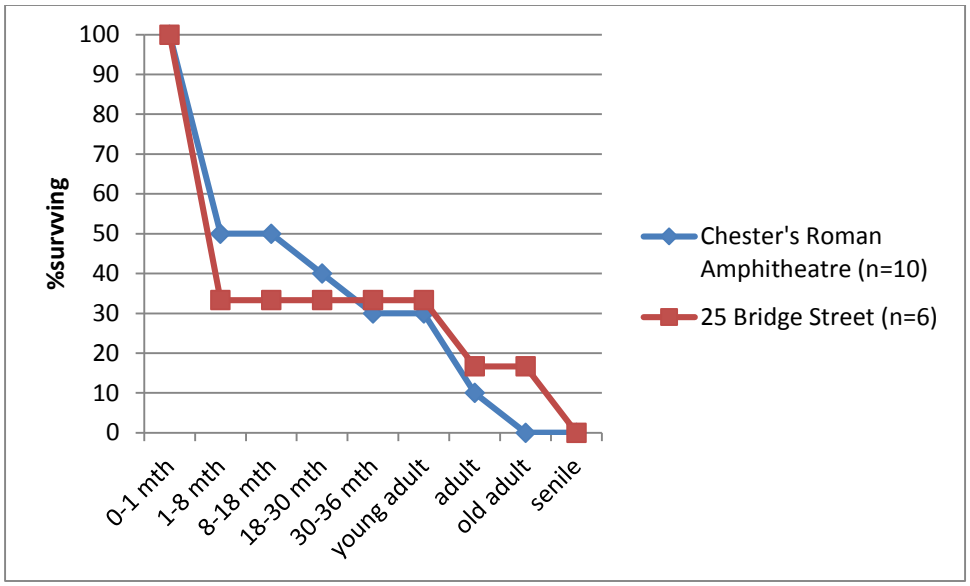

Figure 3.6: Tooth wear data for cattle mandibles from Chester's Roman Amphitheatre (late 17th - early 18th C) and 25 Bridge Street (mid-late 17th - early 18th C) showing the percentage of those surviving

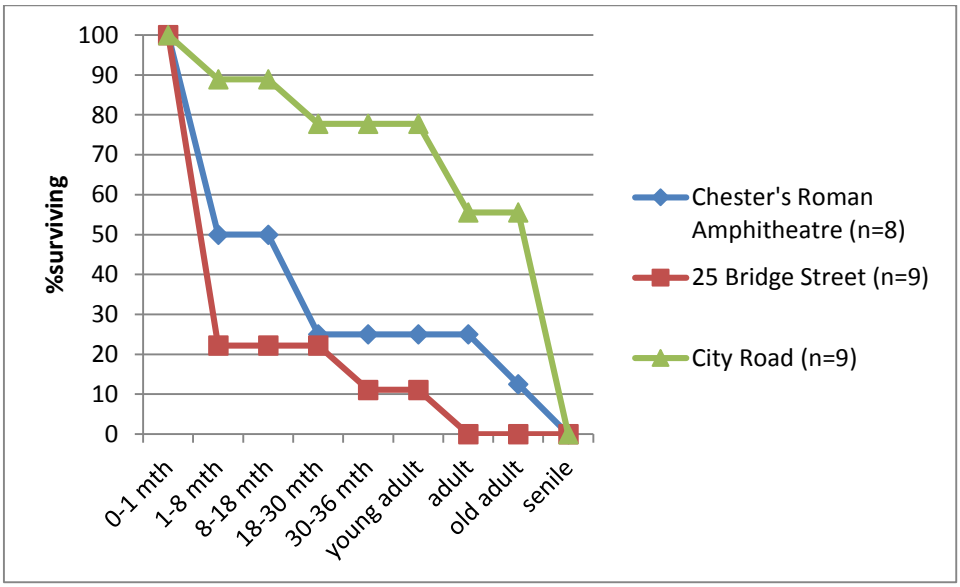

Figure 3.7: Tooth wear data for cattle mandibles from Chester's Roman Amphitheatre (mid-late 18th C), 25 Bridge Street (early 18th - early 19th C) and City Road (17th-19th C) showing the percentage of those surviving

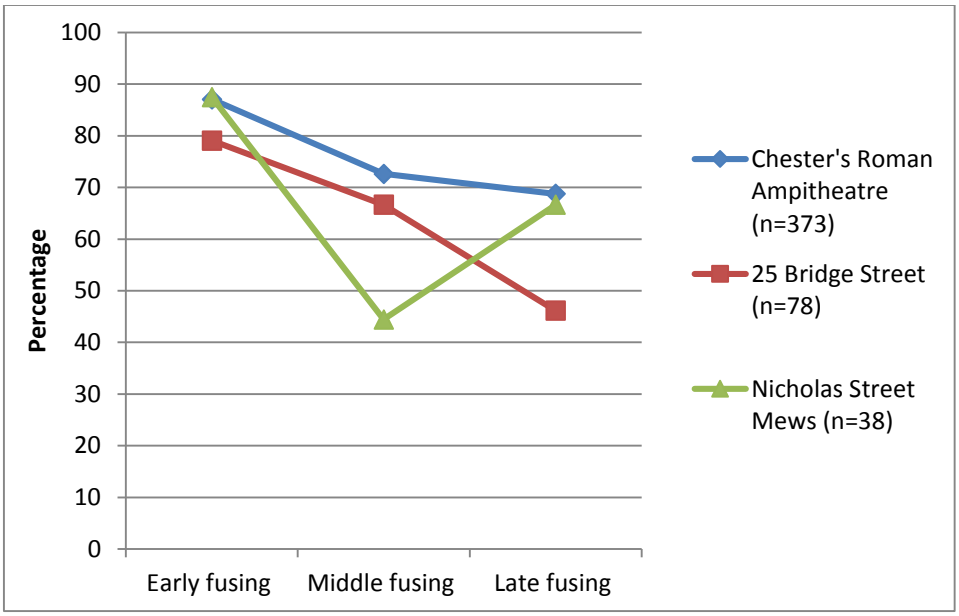

Figure 3.8: Epiphyseal fusion data for cattle from Chester's Roman Amphitheatre (mid-late 16th/early-mid-17th C) and 25 Bridge Street (late 15th - mid-17th century). Phase XIV and XV from Chester's Roman Amphitheatre were combined

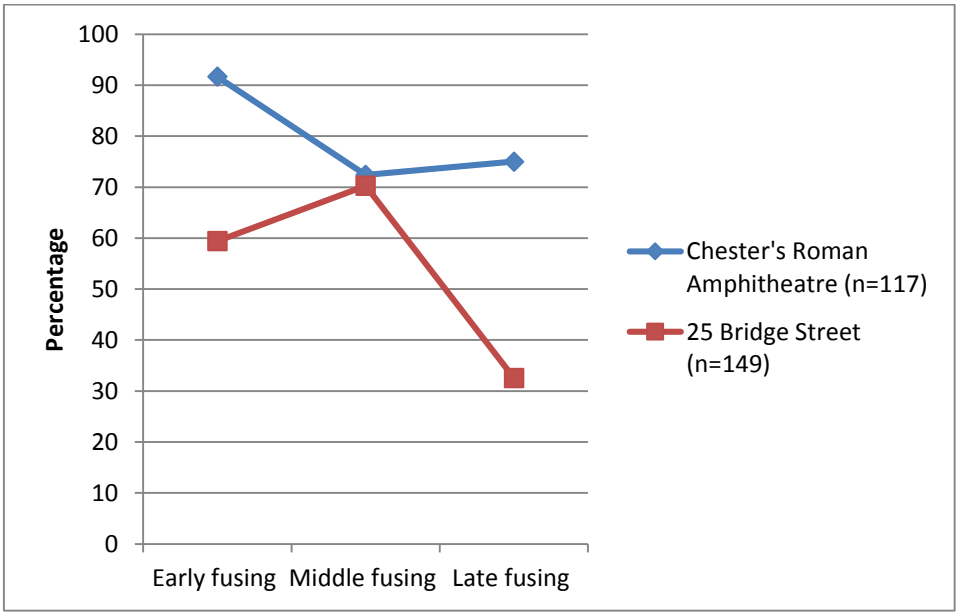

Figure 3.9: Epiphyseal fusion data for cattle from Chester's Roman Amphitheatre (late 17th - early 18th C) and 25 Bridge Street (mid-late 17th - early 18th C)

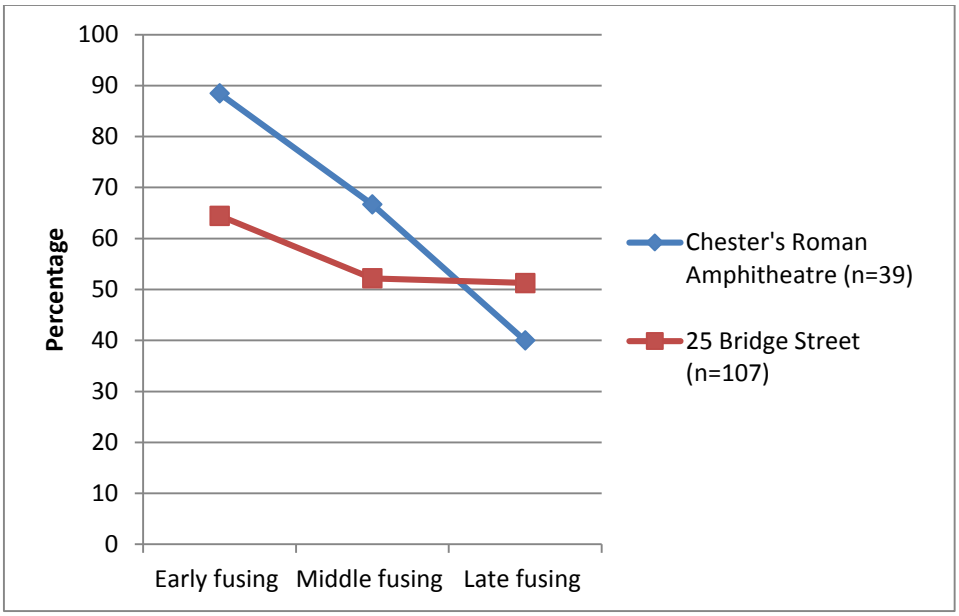

Figure 3.10: Epiphyseal fusion data for cattle from Chester's Roman Amphitheatre (mid-late 18th century) and 25 Bridge Street (early 18th - early 19th century). Phase XVII and XVIII from Chester's Roman Amphitheatre were combined.

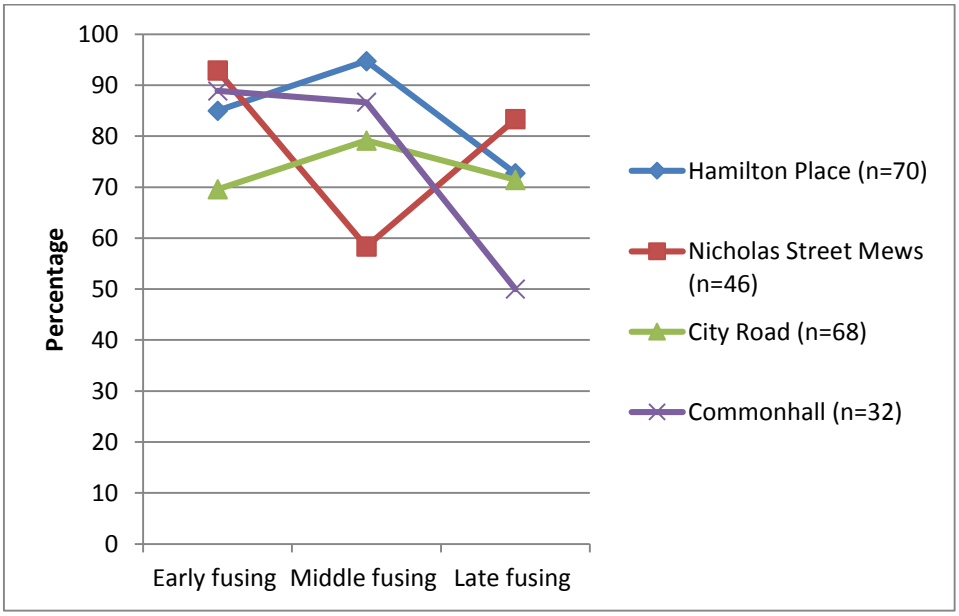

Figure 3.11: Epiphyseal fusion data for cattle from Hamilton Place, Nicholas Street Mews, City Road and 10 Commonhall Street. All sites date from the 17th-19th century except Hamilton Place which dates from the late 17th to mid-20th century. Data from City Road and 10 Commonhall Street was obtained from Sykes *et al.* n.d.; Sykes and Wan n.d.

In the late 17th-early 18th century, tooth wear data for sheep/goat at Chester's Roman Amphitheatre showed that most were culled around 4 to 6 years, which is characteristic of animals that are reared for their fleeces (figure 3.12). Tooth wear data from 25 Bridge Street reveal that there was a higher proportion of lambs and young adults on site. By the early 19th century there was a higher percentage of sheep/goat between 2 to 12 months; reflecting a meat-based economy.

Epiphyseal fusion for sheep/goat from Chester's Roman Amphitheatre and Nicholas Street Mews highlighted the presence of prime meat and older animals (figure 3.13). Most were slaughtered after 2½ years with the majority killed by the time they reached 3½ years and beyond. In the late 15th - mid-17th century, 25 Bridge Street had a strikingly higher proportion of younger animals compared to the other sites (figures 3.13). Although few animals were killed before their first year of life, there was a high number of animals that were slaughtered between 2 to 3 years. This distinctive pattern may suggest that animals from these age groups were deliberately selected (Smith 2008: 352). Given that there was a high frequency of lambs in this phase, the possibility of hide/skin working on site was suggested. It was mentioned earlier that metapodials were less common in the post-medieval phases, which would contradict this hypothesis. However, if a change in disposal strategies was implemented this would account for the lack of foot elements on site. It is also possible that skins could have arrived on site with no foot bones attached (Smith 2008: 352). Historical evidence refers to the trade of sheep skins to the city and the trade in woollen sheep felts to Bridge Street (Smith 2008: 352). Therefore, it is possible that lamb skins were processed on site.

At 25 Bridge Street in the mid-late 17th-early 18th century, there was a clear shift in the mortality profile for sheep/goat, revealing that many were culled after 3 years of age (figure 3.13-3.16). This changed again by the mid-late 18th century where was a higher proportion of animals killed between 2 to 3 years. In the 19th century, there was an even greater emphasis on juvenile animals, strongly suggesting that sheep were mainly reared for meat (figure 3.16). This pattern can also be seen in the tooth wear data. When compared with Chester's Roman Amphitheatre, it is evident that younger sheep/goat were being consumed at 25 Bridge Street. This raises the question as to whether inhabitants at Bridge Street had better access to prime meat animals. Sheep/goat mortality profiles also changed at Chester's Roman Amphitheatre; however, not as radically. The mid-late 16th-early-mid 17th century and 19th century had a higher proportion of younger animals compared to the other phases, which could suggest an emphasis on rearing sheep for meat. During the 17th-19th century, Hamilton Place and

Nicholas Street Mews had a similar age profile, indicating that most animals were of prime meat age or older at the time of death (figure 3.17). The number of sheep/goat elements with fusion data from City Road and 10 Commonhall Street was limited, although most were mainly adult (Sykes *et al.* n.d.: 8; Sykes and Wan n.d.: 2).

Tooth wear data for pig at Chester's Roman Amphitheatre in the mid-late 16th/early-mid 17th century, showed that a high number of the pigs were consumed at 0-2 months. The rest were between 7 to 27 months old at the time of death. For the other sites there was insufficient tooth wear evidence for comparison.

Pig epiphyseal fusion data were available for Chester's Roman Amphitheatre and 25 Bridge Street. The vast majority of pigs were slaughtered before they reached 2 years of age with a few surviving beyond two years (figures 3.18-3.30). Neonates represented by the suckling pigs at Chester's Roman Amphitheatre and 25 Bridge Street were indicative of backyard production. The mortality profile for pigs differed between Chester's Roman Amphitheatre and 25 Bridge Street. At Chester's Roman Amphitheatre, in the mid-late 16th/early-mid-17th century contexts, there were a high frequency of pigs that were 1 to 2½ years or younger by the time they were slaughtered. Some of these animals came from the feasting pit, which contained suckling pigs (figure 3.18).

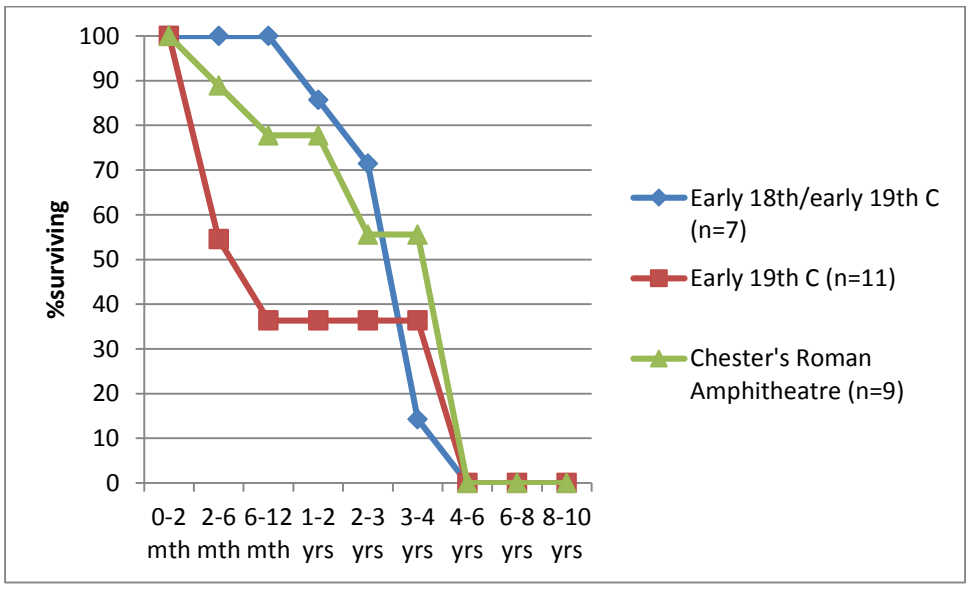

Figure 3.12: Tooth wear data for sheep/goat mandibles from 25 Bridge Street compared with Chester's Roman Amphitheatre (late 17th - early 18th century), showing the percentage of those surviving

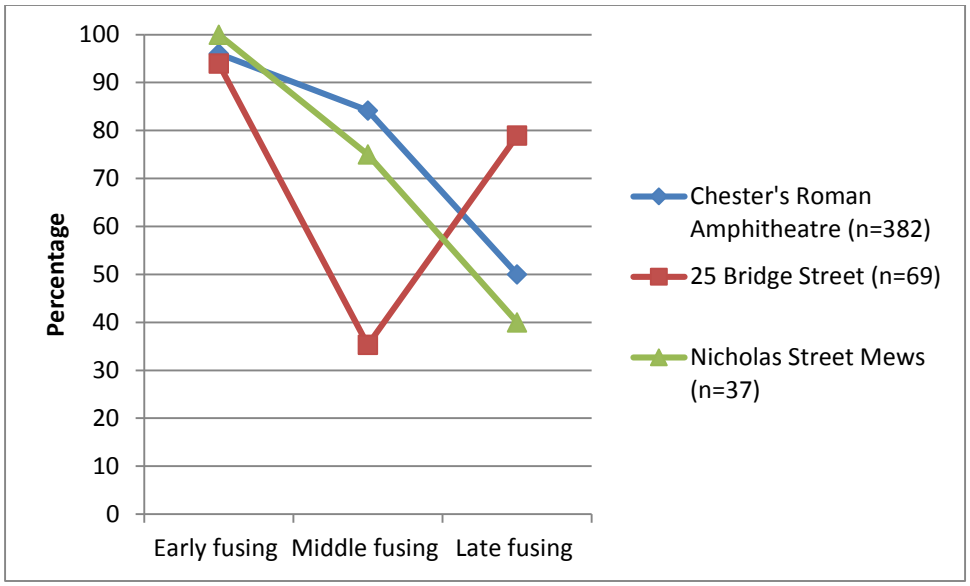

Figure 3.13: Epiphyseal fusion data for sheep/goat from Chester's Roman Amphitheatre (mid-late 16th - mid-17th C), 25 Bridge Street (late 15th - mid-17th C) and Nicholas Street Mews (14th-17th century). Phase XIV and XV from Chester's Roman Amphitheatre were combined

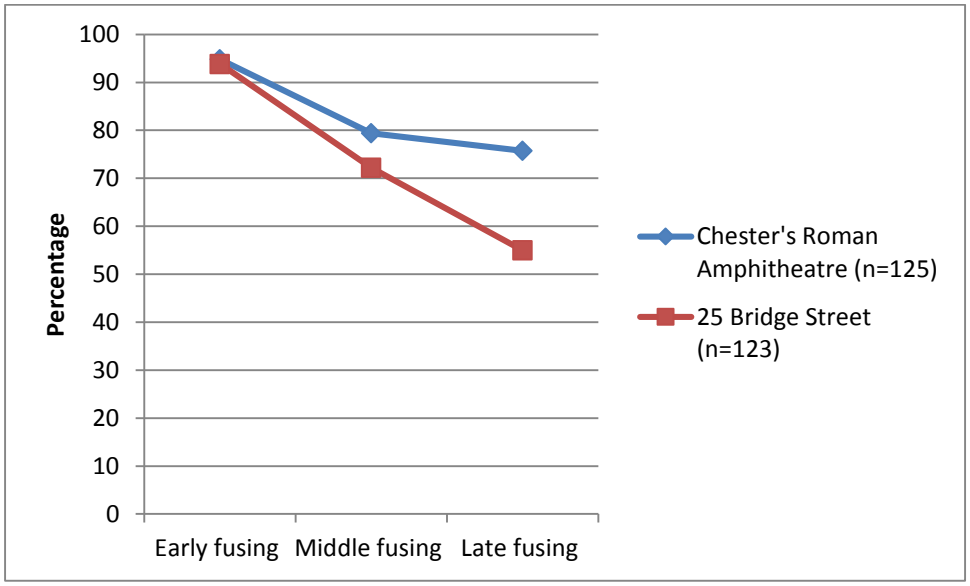

Figure 3.14: Epiphyseal fusion data for sheep/goat from Chester's Roman Amphitheatre (late 17th - early 18th C) and 25 Bridge Street (mid-late 17th - early 18 C)

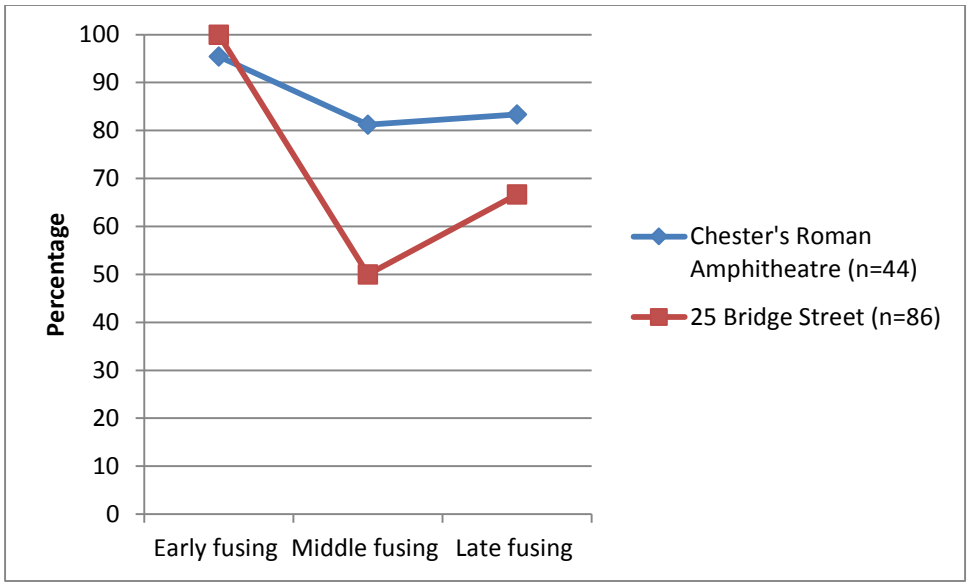

Figure 3.15: Epiphyseal fusion data for sheep/goat from Chester's Roman Amphitheatre (mid-late 18th C) and 25 Bridge Street (early 18th - early 19th C)

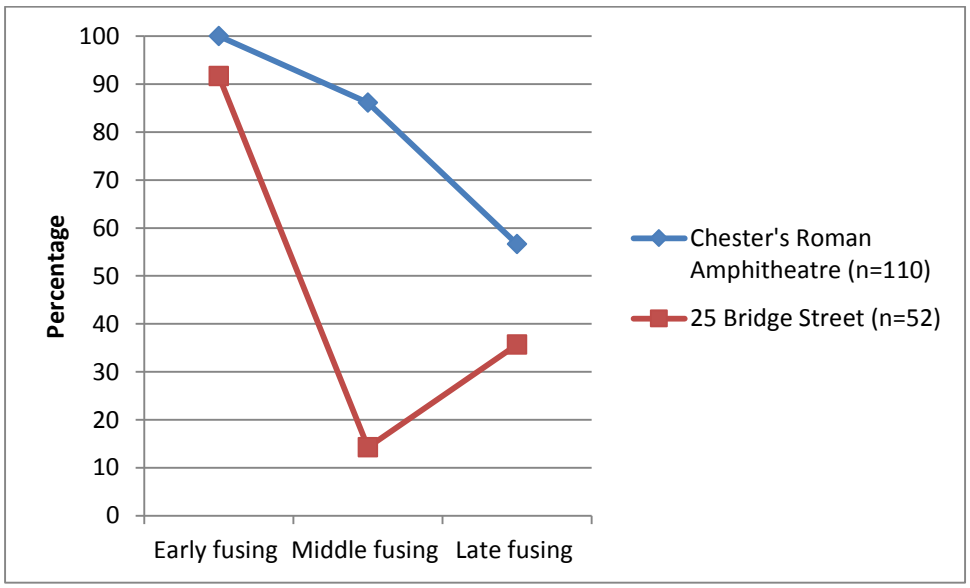

Figure 3.16: Epiphyseal fusion data for sheep/goat from Chester's Roman Amphitheatre (19th C) and 25 Bridge Street (early 19th C)

In the late 15th - mid-17th century, 25 Bridge Street had a slightly higher proportion of pigs between 2 to 2½ years of age (figure 3.18). By the mid-late 17th-early 18th century at Bridge Street, there was a shift towards younger pigs as well as an increase in pigs that survived beyond 2 to 3½ years. It could be

that inhabitants at 25 Bridge Street had a preference for pork and bacon. However, this changes again by the early 18th to early 19th century where none survived beyond 2 years of age, perhaps indicating presence of faster maturing breeds. Overall, the pigs at 25 Bridge Street were younger than pigs at Chester's Roman Amphitheatre.

At Chester's Roman Amphitheatre 10% (Area C) and 14% (Area B) of chickens were juvenile. Juvenile chickens at Nicholas Street Mews account for 23% in the late medieval/early modern period and 44% in the early modern/modern period reflecting a rise in emphasis on meat production (Albarella 1997b, see Appendix One). 3-15 Eastgate Street had an immature chicken coracoid and humerus in the 15th-16th century context and 10 Commonhall Street had a total of 7 (out of 16) chickens that were immature. At 25 Bridge Street chicks and juvenile chickens came from the late 15th to early 18th century contexts. A number of them also came from partial skeletons (Smith 2008: 354). Clearly, chickens were kept and bred in and around the Chester city.

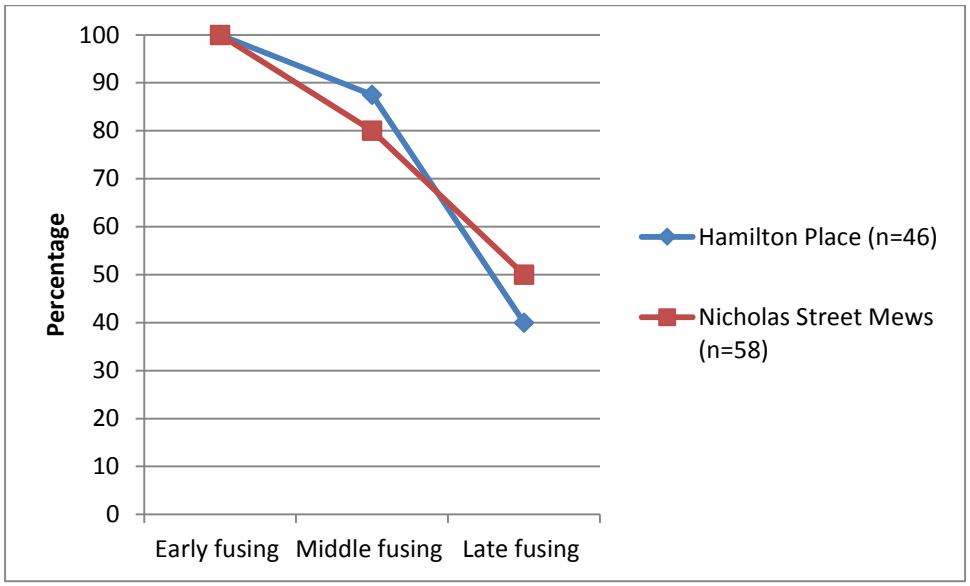

Figure 3.17: Epiphyseal fusion data for sheep/goat from Hamilton Place (late 17th - mid-20th C) and Nicholas Street Mews (17th-19th C)

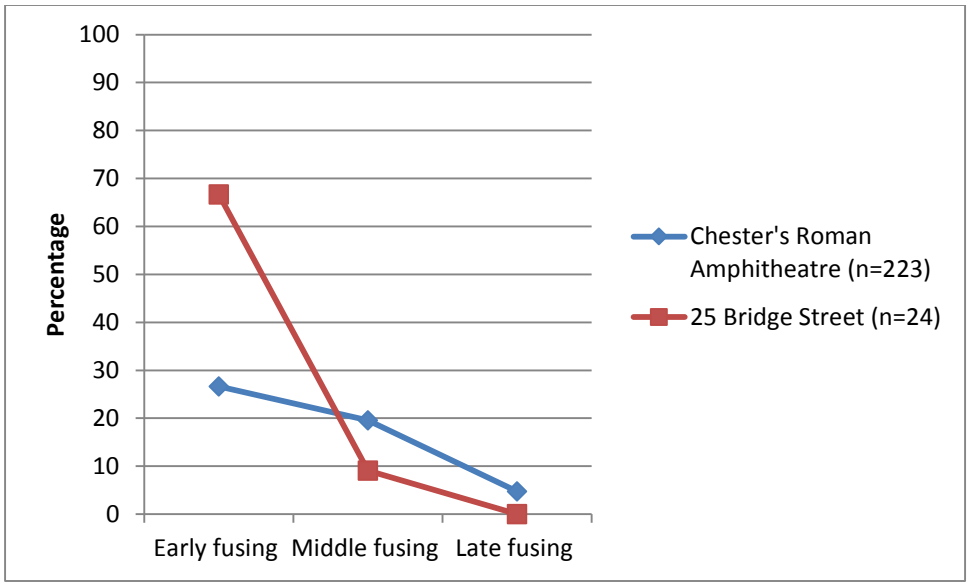

Figure 3.18: Epiphyseal fusion data for pig from Chester's Roman Amphitheatre (mid-late 16th - mid-17th C) and 25 Bridge Street (late 15th - mid-17th C). Phase XIV and XV from Chester's Roman Amphitheatre were combined

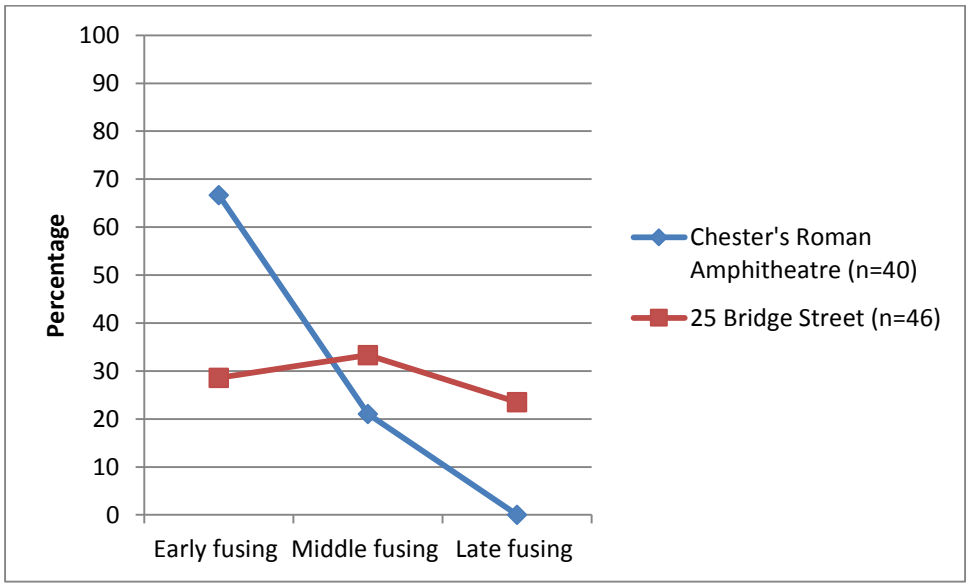

Figure 3.19: Epiphyseal fusion data for pig from Chester's Roman Amphitheatre (late 17th - early 18th C) and 25 Bridge Street (mid-late 17th - early 18th C)

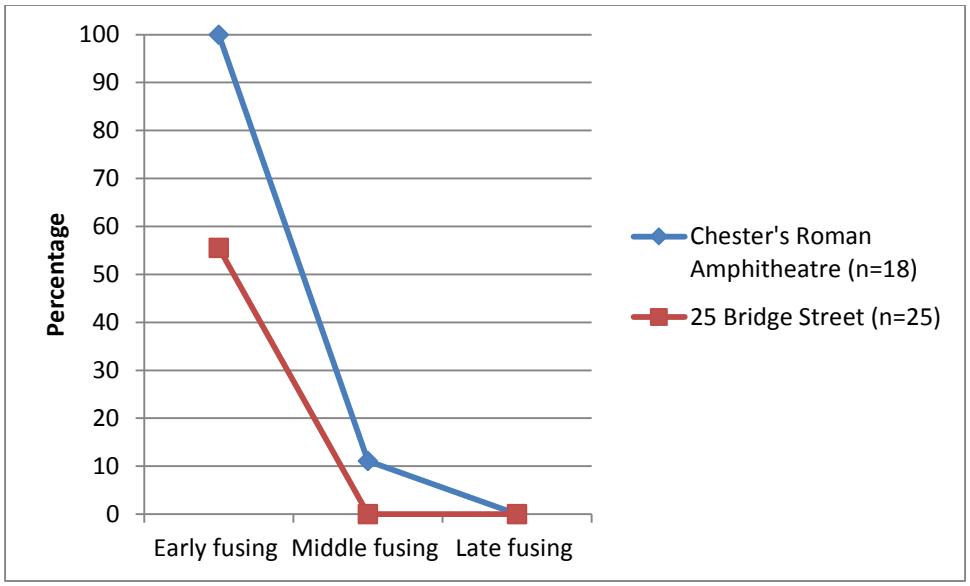

Figure 3.20: Epiphyseal fusion data for pig from Chester's Roman Amphitheatre (late 17th - early 18th C) and 25 Bridge Street (mid-late 17th - early 18th C)

3.5 Sexing data

Due to the disarticulated nature of animal bone assemblages it is difficult to determine the sex profile of animals in Chester. Ideally, large samples are required to arrive to meaningful conclusions about sex profiles; unfortunately, this is often atypical of many faunal assemblages. However, there were some observations about the ratio of males and females at Chester that are worth mentioning. Cattle metacarpals from 10 Commonhall Street were subjected to a shape index analysis, which showed that the majority of metacarpals plotted with the female group (Sykes and Wan n.d.: 3). Cattle horncore data from City Road and 25 Bridge Street (see figure 3.21) revealed that there was a predominance of females and probably some castrates (Sykes *et al.* n.d.: 4; Smith 2008: 359). At Chester's Roman Amphitheatre, five of seven pelves were identified as female. Although these results are unlikely to represent Chester as a whole, it could be suggested that mainly cows were arriving on sites. This interpretation is not wholly unfounded given Cheshire's reputation as a dairying district (see Chapter Four), since one would expect for there to be more cows then oxen and bulls.

Not much can be determined about the ratio of males and female for sheep/goat and pig at a regional level; however some sites did show a predominance of males or females. At Chester's Roman

Amphitheatre, 11 sheep/goat pelves were positively identified as female and four were male. Sheep/goat horncores from City Road were mainly from rams and one pelvis was identified as male (Sykes *et al. n.d.*: 8). Pig canines from Chester's Roman Amphitheatre revealed that eight of 13 specimens were male. However, the high frequency of male canines may be because they are larger and therefore more likely to spot during excavation.

As for other mammals, the presence/absence of loose canines from equids at City Road showed that males were more common; however, based on pelvis morphology 2 of 20 were male. The remaining pelves either came from females or castrates. Since there was a predominance of jaws with canines, it was concluded that geldings were almost certainly present (Sykes *et al.* n.d.:7). At Nicholas Street Mews, one horse canine was identified as male and the partial horse skeleton was female based on the morphology of the pelvis.

Chicken bones could be sexed based on the presence/absence of medullary bone and the spur. A number of bones from 10 Commonhall Street contained medullary bone (no males were identified) (Sykes and Wan n.d.: 3). The biometric analysis of chicken bones from Chester's Roman Amphitheatre suggested that there were a predominance of hens. The presence of hens at these two sites could provide evidence for egg production.

3.6 Biometry

A limited number of sites allowed for intra- and inter-site biometrical analysis of the post-cranial bones for domestic mammals (Chester's Roman Amphitheatre, 25 Bridge Street, City Road, Hamilton Place and Nicholas Street Mews). In order to carry out a comparative analysis, data from more than one phase was combined to produce a larger sample size. This amalgamation of data meant that broad chronological groups were created to allow for comparison (e.g. 15th-17th century, 17th- 19th century).

The intra-site biometrical analysis of cattle post-cranial bones from Chester's Roman Amphitheatre, showed that following the medieval period there was a statistically significant size increase in breadth by the mid-late 16th/early-mid 17th century and in the mid-18th to 19th century (see Appendix One). Length measurements showed an increase in mean size for sheep/goat in the late 16th - early-mid 17th century, although this was not statistically significant. In the late 17th - early 18th century, however, there was a statistically significant size increase in the length measurements. Post-cranial bones for pigs

showed an increase in the mean size by the late 17th-19th century but this was not statistically significant. The mean for chicken post-cranial bones increased after the medieval period and decreased thereafter. However, neither of these results was statistically significant. At Nicholas Street Mews, the mean breadth for sheep/goat increased by the 17th-19th century, but this was not statistically significant.

Measurement data from 25 Bridge Stre*et al*lowed for intra-site analysis of the biometric results (see figures 3.23-3.25). Biometrical analysis of breadth measurements for cattle post-cranial bones showed that there was a size increase by the mid-late 17th - early 19th century (figure 3.23). This could also be seen in an increase in the mean size, although this was not statistically significant (U=94.5; *P*=0.682). Breadth measurements for sheep/goat demonstrated that there was an increase in size by the later post-medieval period (figure 3.24), which was statistically significant (U=75.5; *P*=0.005). Chicken post-cranial length measurements also witnessed an increase in the average; however, this result was not statistically significant (U=53; *P*=0.132) (figure 3.25).

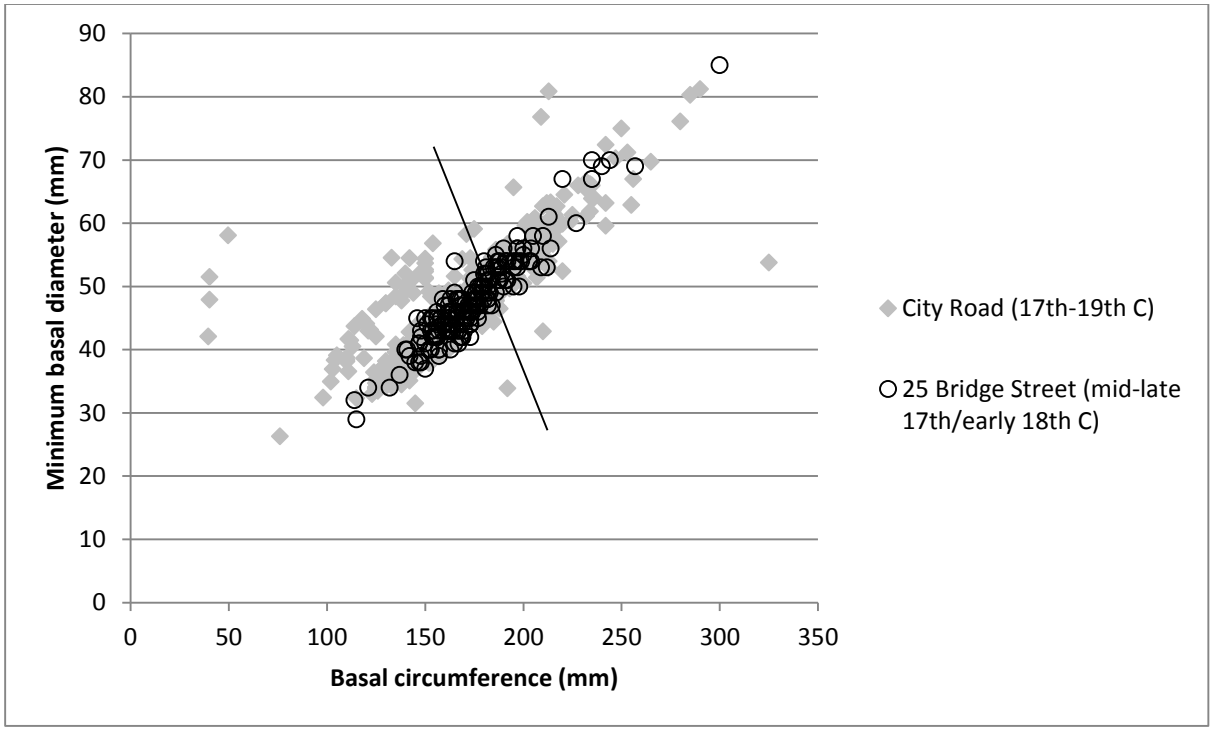

Figure 3.21: City Road and 25 Bridge Street horncore data with the dividing line following the divison of modern female and male cattle horncorns (after Sykes and Symmons 2007)

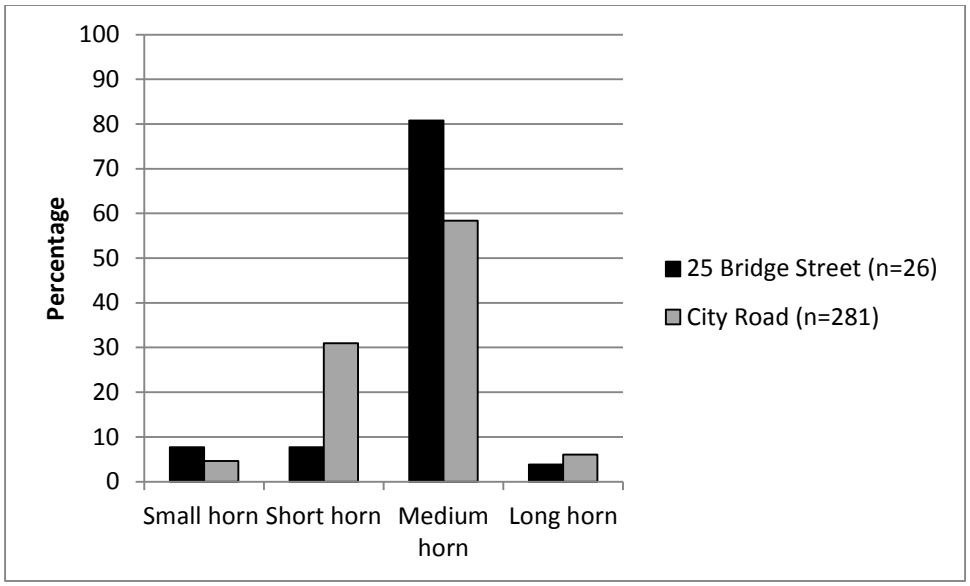

Figure 3.22: Percentage of cattle type from 25 Bridge Street and City Road (out of the total number of complete horncores) following Sykes and Symmons (2007). Only those aged as 'young adult or above were included

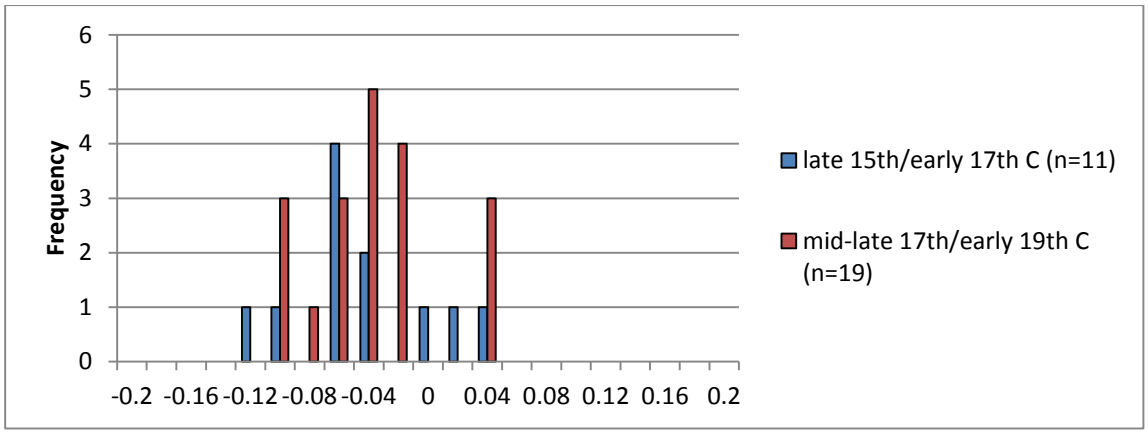

Figure 3.23: Log-scaled of cattle post-cranial bone breadth measurements from 25 Bridge Street. Phases VII to IX (mid-late 17th - early 19th century c1900) were combined

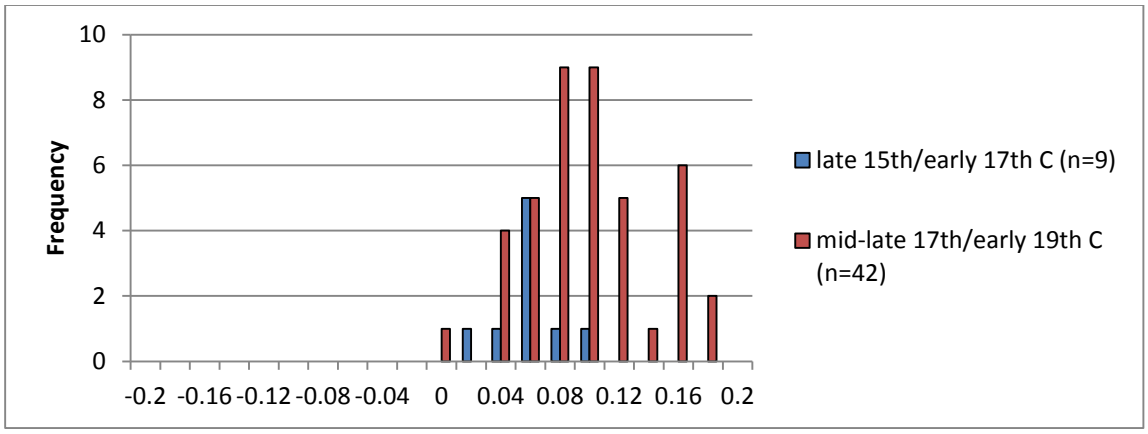

Figure 3.24: Log-scaled of sheep/goat post-cranial bone breadth measurements from 25 Bridge Street. Phases VII to IX (mid-late 17th - early 19th century c1900) were combined

The inter-site analyses revealed temporal and spatial differences in the size of domestic animals at Chester. Cattle from 3-15 Eastgate Street (late 15th - mid-17th century) were statistically smaller than cattle from Chester's Roman Amphitheatre (mid-late 16th- early-mid 17th century) (U=114; P=0.020) and 25 Bridge Street (late 15th - mid-17th century) (U=19; P=0.043). The difference in size between 3-15 Eastgate Street and Chester's Roman Amphitheatre could be chronological. Late 17th-19th century cattle from Chester's Roman Amphitheatre were statistically smaller than cattle from 25 Bridge Street (mid-late 17th- early 19th century) (U=331; *P*=0.034). Cattle from City Road (17th-19th century) were statistically larger than those from Chester's Roman Amphitheatre (late 17th - early 19th century) (U=273; *P*=0.004) and Hamilton Place (late 17th - mid-20th century) (U=54; P=0.008).

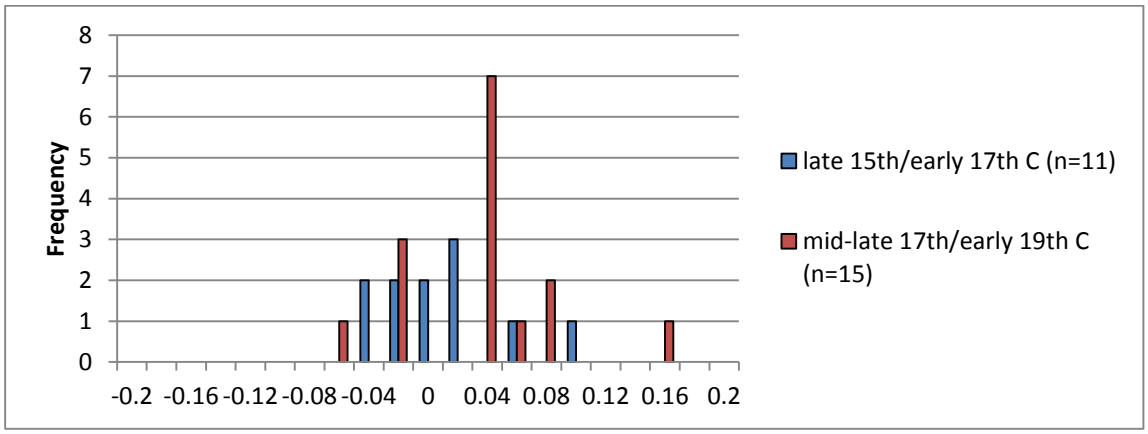

Figure 3.25: Log-scaled of chicken post-cranial bone length measurements from 25 Bridge Street. Phases VII to VIII (mid-late 17th- early 19th century) were combined

Metrical analyses of sheep/goat post-cranial elements showed little difference in the size of animals dating from the late 15th to 17th century. However, at 25 Bridge Street sheep/goat from late 17th-19th century were statistically larger than those from Chester's Roman Amphitheatre (late 17th-19th century) (U=2046; *P*=0.010), Nicholas Street Mews (17th-19th century) (U=410.5; *P*=0.020) and Hamilton Place (late 17th/mid-20th century) (U=265; *P*=0.019). Unfortunately, there were too few pig measurements to conduct an inter-site biometric analysis.

There were a few domestic fowl measurements which allowed for metrical data to be compared from different sites. This revealed that chicken length measurements from Chester's Roman Amphitheatre (late-17th-19th century) were statistically smaller than those from the mid-late 17th - early 19th century at 25 Bridge Street (U=9; *P*=0.005) and those from the 17th-19th century at Nicholas Street Mews (U=5; *P*=0.045). This could be because they were more hens in the former site, which can be seen in the scatter diagram results (see Appendix One). This is possible, especially as sites with a higher proportion of juvenile chickens (e.g. Nicholas Street Mews) tend to have more males (Albarella 1997b: 27).

There were very few mandibular measurements to allow for comparisons. Cattle third molar width measurements from Chester's Roman Amphitheatre (n=8) (mid-16th- early 18th century) and Nicholas Street Mews (n=5) (17th-19th century) were compared but the results were not statistically significant (U=9.5; *P*=0.142). As were measurements from Nicholas Street Mews (17th-19th century) and Chester's Roman Amphitheatre (n=7) (mid-late 18th - 19th century) (U=11; *P* =0.329). Similarly, third molar measurements from Chester's Roman Amphitheatre from the mid-late 16th - early 18th century and mid-late 18th - 19th century were not statistically significant (U=26; *P*=0.861). Third molar measurements for sheep/goat from Chester's Roman Amphitheatre between the mid-late 16th- early-mid 17th century (n=9) and late 17th- 19th century (n=11) were also not statistically significant (U=41; *P*=0.541).

Metrical data from Chester's Roman Amphitheatre and 25 Bridge Street were compared with contemporary sites to assess regional differences in the size of domestic animals from Cheshire. However, although both sites had large assemblages, the metrical data were still limited.

The greatest length measurements of the astragalus showed that the mid-late 16th - early-mid 17th century cattle from Chester's Roman Amphitheatre were statistically similar to cattle from contemporary sites such as Dudley Castle (1533-1647), Launceston Castle (16th century-1650) and Prudhoe Castle (mid-16th - early 17th century) (see table 3.6)

Tibia sheep/goat breadth measurements from the mid-late 16th- early - mid 17th century at Chester's Roman Amphitheatre were statistically similar to sheep/goat from contemporary sites (see table 3.7), expect for Launceston Castle (16th century-1650) which where statistically smaller. This was also true for sheep/goat from the late 17th - early 19th century at 25 Bridge Street, which also showed sheep/goat from Launceston Castle to be smaller (see table 3.8).

There was a paucity of pig elements with measurable data from Chester, therefore preventing comparisons with other contemporary sites. Chicken tibiotarsi breadth measurements from Chester's Roman Amphitheatre (mid-late 16th century) were a similar size to chickens from other post-medieval sites. However, tibiotarsi from Spitalfields Market (Lamb Street), London, were statistically larger than those from Chester's Roman Amphitheatre (table 3.9)

Sites	**n**	**Mean**	U	*P*
Dudley Castle (1533-1647)	11	598.72	47	0.253
Launceston Castle (16th-1650)	33	634.09	158	0.310
Prudhoe Castle (mid-16th -early 17th century)	26	595.19	110.5	0.157
Chester's Roman Amphitheatre (mid-late 16th- early 17th century)	12	618.58	-	-

Table 3.6: Mann-Witney U-test of cattle astragalus greatest length measurements from the mid-late 16th - early 17th century at Chester's Roman Amphitheatre and contemporary sites: Dudley Castle (Thomas 2005a); Launceston Castle (Albarella and Davis 1996) and Prudhoe Castle (Davis 1987c)

Site	**n**	**Mean**	U	*P*
Dudley Castle (1533-1647)	23	260.91	273.5	0.363
Launceston Castle (16th-1650)	50	245.04	397.5	0.001
Launceston Castle (1660-1840)	48	258.18	654	0.850
Lincoln 1600-1750	17	267.47	186	0.227
Little Lane (16th-17th)	52	262.23	592	0.171
Chester's Roman Amphitheatre (mid-late 16th- early 17th century)	28	257.92	-	-

Table 3.7: Mann-Witney U-test of sheep/goat tibia distal breadth measurements from Chester's Roman Amphitheatre (mid-late 16th - early 17th century) and contemporary sites: Dudley Castle (Thomas 2005a); Launceston Castle (Albarella and Davis 1996); Lincoln (Dobney *et al.* 1996) and Little Lane (Gidney 1991)

Site	n	Mean	U	*P*
Dudley Castle (1533-1647)	23	260.91	133.5	0.153
Launceston Castle (16th-1650)	50	245.04	149	0.000
Launceston Castle (1660-1840)	48	258.18	267	0.070
Little Lane (16th-17th)	52	267.47	153	0.085
Lincoln 1600-1750	17	267.47	121.5	0.613
25 Bridge Street mid-late 17th- 19th century	16	270.87	-	-

Table 3.8 Mann-Witney U-test of sheep/goat tibia distal breadth measurements from 25 Bridge Street (mid-late 17th - 19th century) and post-medieval sites: Dudley Castle (Thomas 2005a); Launceston Castle (Albarella and Davis 1996), Lincoln (Dobney *et al* 1996) and Little Lane (Gidney 1991)

Site	n	Mean	U	*P*
Dudley Castle (1533-1647)	11	120.45	121	0.249
Castle Mall (late 16th-18th-C)	14	119	180.5	0.568
Spitalfields Market (Lamb Street), London a (1580 - 1710)	7	131.14	35.5	0.008
Spitalfields Market (Lamb Street), London c (1800 - 1900)	11	126.27	71.5	0.007
Launceston Castle (1660 - 1840)	7	112.85	91.5	0.703
Stafford Castle (19th-C)	19	116.73	244	0.513
Chester's Roman Amphitheatre (mid-late 16th century)	29	115.75	-	-

Table 3.9: Mann-Witney U-test of chicken tibiotarsus distal breadth measurements from Chester's Roman Amphitheatre (mid-late 16th century) and post-medieval sites: Castle Mall (Albarella *et al* 1997); Dudley Castle (Thomas 2005a), Stafford Castle (Thomas 2011), Spitalfields Market (Lamb Street) (Rielly 1998) and Launceston Castle (Albarella and Davis 1996)

Measurement analysis provided some insight into different cattle morphotypes. Post-cranial bones from City Road were subjected to biometric analysis, which suggested that cattle from the site were of the same type (Sykes *et al.* n.d.: 5). However, the horncore measurement data suggested that a wide range of cattle types were present (Sykes *et al.* n.d.: 5). Cattle horncores from 25 Bridge Street suggested that medium-horned animals were more abundant. Upon comparing the outer curve of complete cattle horncores from City Road and 25 Bridge Street, both sites revealed that medium-horned cattle were the

most common type (figure 3.22). Withers heights were calculated for a number of horse bones from City Road, which illustrated a wide range of sizes; probably representing a mix of ponies and horses (Sykes *et al.* n.d.: 7). A comparison of horse metapodials showed that the City Road specimens were more gracile; however, this could be due to the presence of geldings (Sykes *et al.* n.d.: 7).

At 25 Bridge Street it was possible to recognise the presence of different dog breeds based on the withers heights. One dog deposited in a cess pit dating to the late 15th - mid-17th century had a similar height to a fox terrier (Smith 2008:353). In another cess pit dating to the mid-late 17th- early 18th century, the partial remains of a small, short-faced dog was believed to be the size of a Dandie Dinmont (Smith 2008: 360). In an early 19th century context, a partial skeleton of a male dog, buried in its own discrete burial, was estimated to be the height of a Labrador. From the same context, a number of small dogs were found including one that probably came from a Jack Russell or lapdog (Smith 2008: 367).

3.7 Butchery

Most of the cattle butchery marks were typical of disarticulation and dismemberment on the cranial and post-cranial elements. Examples of chop marks through the occipital condyles were seen at sites such as Chester's Roman Amphitheatre, Nicholas Street Mews and 25 Bridge Street (Smith 2008: 335). Singular and multiple examples of chopped marks on horncores were observed at Chester's Roman Amphitheatre, Canalside/Witter Place, 25 Bridge Street and City Road (Carrott *et al.* 2001: 4; Smith 2008: 357; Sykes *et al*. n.d. 5). These included chop marks through the base of the horncore and the tip, to remove the horncore from the skull or the sheath from the core. Cut and chop marks were also seen down the length of the horncore at City Road and 25 Bridge Street (Sykes *et al*. n.d. 5; Smith 2008, table 6.1.35: 372-375). Butchery marks were observed on skulls and mandibles at Chester's Roman Amphitheatre and Hamilton Place, which are typical for skinning and marrow extraction. 3-15 Eastgate Street had skulls and mandibles that were smashed and bore cut marks probably for the removal of the cheek meat (Harrison 1995b: 51). Examples of cut marks on the hyoid bone were occasionally seen at Chester's Roman Amphitheatre. This often results from the removal of the cheek meat and the tongue. Skinning marks were seen on cattle phalanges on specimens from Chester's Roman Amphitheatre, Hamilton Place and Nicholas Street Mews. Sagittal splitting of the vertebrae was common at Chester's Roman Amphitheatre, Hamilton Place and Nicholas Street Mews. A humerus from Nicholas Street Mews, and tibiae from 25 Bridge Street, had been chopped longitudinally for marrow extraction or to fit

into a cooking pot (Smith 2008: 364). At Hamilton Place the bones of two humeri, a femur and pelvis was hacked into small portions and three large mammal ribs, probably belonging to cattle, were sawn into a triangular shape. Adult scapulae from Chester's Roman Amphitheatre and 25 Bridge Street had traverse chop marks to divide them into portions (Smith 2008: 351). At Chester's Roman Amphitheatre the spinous process on cattle scapulae were also chopped off. At 25 Bridge Street filleting marks were seen on various calf bones such as the humerus, radius, scapula and femur (Smith 2008: 351, 360, 364). Sawn bones were more common in the 18th- and 19th century contexts, particularly at Chester's Roman Amphitheatre and 25 Bridge Street (Smith 2008: 365). The use of the saw became more widely adopted for carcass dismemberment in the modern period as butchery practices became more organised and technical (Seetah 2006: 1).

Butchery marks on sheep/goat included sagittal splitting on the vertebrae seen at Chester's Roman Amphitheatre, Nicholas Street Mews, Hamilton Place and 25 Bridge Street (Smith 2008: 352). Filleting marks on the scapula, humerus, femur, pelvis and radius were seen at Chester's Roman Amphitheatre, 25 Bridge Street and 10 Commonhall Street (Smith 2008: 364; Sykes *et al*. n.d.: 3). A sheep/goat scapula from 10 Commonhall Street had cut marks on a medial and lateral side, which resembled carving techniques for the shoulder joint, as described by Mrs Beeton (2000: 183). This example highlights the social practice of carving techniques in the later post-medieval period and its visibility in faunal assemblages (Sykes *et al*. n.d.: 3). A sheep/goat scapula from Nicholas Street Mews had a hook mark, and humeri and femora from Chester's Roman Amphitheatre and Nicholas Street Mews had circumferential cut marks around the mid-shaft. In addition, a skull from Nicholas Street Mews was chopped through to extract the brain. Cranial butchery marks were also observed on sheep/goat horncores and mandibles from Chester's Roman Amphitheatre. Sawn sheep/goat bones were seen at Hamilton Place and 25 Bridge Street (Smith 2008: 365).

Typical butchery marks on pigs included filleting marks on the femur and humerus and sagittal splitting of the vertebrae. Examples of this were noted at Chester's Roman Amphitheatre and 25 Bridge Street (Smith 2008: 360, 364). Butchery marks were observed on pig mandibles at Chester's Roman Amphitheatre and 25 Bridge Street. At the latter site, pig mandibles had been chopped to divide them in half as well as through the diastema (Smith 2008: 364). Nicholas Street Mews and 25 Bridge Street had pig ribs that bore cut/chop marks on the corpus costae and rib head (Smith 2008: 352). Suckling pigs from Chester's Roman Amphitheatre and 25 Bridge Street had cut marks on the long bones and two pig

fibulae from Chester's Roman Amphitheatre had been sawn through (Smith 2008: 352). One pig scapula from 3-15 Eastgate Street had a hole resembling a hook mark (Harrison 1995b: 51).

Other domestic mammals with butchery marks included horses, cats and dogs. City Road had the largest assemblage of butchered horse bones. Examples of butchery were cut, chop and shaving marks consistent with skinning, disarticulation and slaughtering (Sykes *et al.* n.d.: 7). Disarticulation marks were observed around the distal and proximal articulation on the long bones and the femur and pelvis exhibited most of the butchery marks. A humerus, scapula, femur and tibia had cut marks reminiscent of filleting and two horse skulls appeared to have been poleaxed (Sykes *et al.* n.d.: 7-8). Isolated examples of cut marks on horse elements were noted at Chester's Roman Amphitheatre and on two foal tibiae from Hamilton Place. Cut marks were observed on cat and dog elements from the Amphitheatre and on one dog cervical vertebra from Hamilton Place. A dog axis and femur from the early-mid 17th century context at Chester's Roman Amphitheatre had butchery marks typical of dismemberment and slaughtering. At 25 Bridge Street, similar dismemberment and filleting marks were also observed on two dog femora from the late 15th - mid-17th century context and on one dog axis and femur from the mid-late 17th - early 18th century context (Smith 2008: 352, 360).

Wild mammals with butchery marks included the occasional rabbit/hare at Chester's Roman Amphitheatre, Hamilton Place and 25 Bridge Street. Deer antlers from Chester's Roman Amphitheatre, 10 Commonhall Street, Nicholas Street Mews and 25 Bridge Street had chop and saw marks, indicating craft-working (Sykes and Wan n.d.: 4; Smith 2008: 353). A number of fallow deer elements from Chester's Roman Amphitheatre and Nicholas Street Mews had butchery marks. This included one humerus with a circumferential cut mark around the mid-shaft at Chester's Roman Amphitheatre. A mandible of a possible fox, and the skull and mandible of a polecat/ferret, had fine cut marks associated with skinning (Smith 2008: 365).

The majority of the butchery marks on domestic birds were observed on chicken remains with some examples noted on ducks and geese. Most of the cut marks on domestic birds were associated with disarticulation and carving. Two chicken skulls from Chester's Roman Amphitheatre were particularly interesting as they had been chopped sagittally down the middle. One male chicken tarsometatarsus, from the same site, had cut marks on the spur. A goose sternum from 10 Commonhall Street had fine cut marks consistent with carving techniques described in Mrs Beeton, to slice the breast meat (Sykes and Wan n.d. 2008:4). Similar cut marks have also been observed on a goose sternum from an 18th-century animal bone assemblage from Cannon Street, London (Gordon 2010: 51).

Butchery on wild bird bones was less common. At Chester's Roman Amphitheatre, cut marks were noted on a woodcock, gull, grey partridge and swan. In addition, a sternum of a small charadiiform had been cut through the middle of the keel (see Appendix One, Chester's Roman Amphitheatre). A swan pelvis from 25 Bridge Street was observed with fine cut marks (Smith 2008: 362).

3.8 Pathology

This section will be dedicated to pathologies described in the following Chester reports: 25 Bridge Street, 10 Commonhall Street and City Road. A full summary of the pathology from the primary investigations are detailed in the individual site reports (see Appendix One).

At 25 Bridge Street, four cattle skulls displayed occipital perforation (Smith 2008: table 6.1.35, p. 372-375) and the remaining pathologies were described for dogs and cats. Layer 766 contained a partial skeleton of a dog (late 15th - mid-17th century) aged between six to nine months, with a broken axis, radius and ulna. The dog appeared to have survived these injuries for a period of time, as there were signs of infection and remodelling (Smith 2008: 353). As the proximal and distal articulation of the radius and ulna remained unfused it is possible that the injuries led to this dog's demise (Smith 2008: 353). Three cats had dental problems in the form of alveolar recession and one pelvis had remodeled following luxation to form a false acetabulum (Smith 2008: 361).

10 Commonhall Street had cattle metapodia with various lesions. This included periosteal growth on three metatarsi, broadening of the condyles on two metacarpals and osteochondrosis on five of nine proximal metacarpals (Sykes and Wan n.d.: 2). An articulating dog cervical vertebrae (i.e. axis and third and fourth vertebra) had evidence of osteoarthritis, which included periosteal growth and eburnation on the articular surfaces as well as slight ankylosis (Sykes and Wan n.d.: 3).

The large cattle horncore assemblage from City Road had 16 horncores that exhibited depressions, similar to the thumb print depressions described by Albarella (1995), and 'ring depressions' running completely or partially around the base of the horncore. Horses from City Road mainly displayed joint disorders such as spavin, which were observed in the metatarsi and astragali. Exostoses and eburnation was seen on two first phalanges and one second phalanx. Osteoarthritis was noted on the proximal end of a femoral head and pelvis. Three thoracic and three lumbar vertebrae had evidence of ankylosis as

well as new bone formation on the lumber vertebrae (Sykes *et al.* n.d.:8). Bit wear was also observed on three lower premolars (Sykes *et al.* n.d.:8).

3.9 Summary

In Chester, cattle were frequently the most common domesticate followed by sheep/goat and pig. Other domestic mammals such as horse, cat and dog were present, either as isolated elements or as partial skeletons. Partial cat and dog skeletons were found in discrete burials at Chester's Roman Amphitheatre and 25 Bridge Street, which could be evidence for the presence of companion animals; a trend that becomes more common in the later post-medieval period. However, evidence of butchery on some of these animals also suggests that they were exploited as a commodity and/or a food resource. Rabbit was the most common wild animal and fallow deer was the most common species of deer; however, the proportion of fallow deer declined over time. The presence of other animals, like pine marten and stoat, showed that wild species were also sourced for their skins. Chicken was the most common domestic bird followed by goose and duck. Wild birds were present at a number of sites in Chester and their presence/absence provides insight into the status of the inhabitants in the city. The main food fishes consumed at Chester were eel, smelt, herring, flatfish and gadid, although there were differences in the proportion and diversity of species at individual sites. The industrial assemblages at City Road and Canalside/Witter Place demonstrate the importance of the leather trade industry in Cheshire. The large assemblage of horse remains at City Road provides a unique insight into the trade and procurement of horses for hide processing.

Overall, the age of cattle at sites in Chester was a mix of young and adult animals. However, at Chester's Roman Amphitheatre and 25 Bridge Street the 17th- to early 18th-century contexts had a strikingly higher proportion of young cattle, which could reflect a shift in the region's husbandry strategies during the Civil War. Domestic mammals at 25 Bridge Street were consistently younger than animals from Chester's Roman Amphitheatre and some periods showed a preference for particular age groups. Domestic animals increased in size during the post-medieval period and inter-site analysis of the biometrical results, showed spatial and temporal differences in the size of domestic animals in the city.

4 Chapter Four - Urban Provisioning, Animals and City Life in Post-medieval Chester

4.1 Introduction

In this chapter I will discuss the results of the individual faunal reports and the inter-site analysis to investigate the temporal and spatial changes in the role and use of animals in Chester during the post-medieval period. The results will be considered in light of Chester's urban and demographic history, environment and agricultural economy to explore urban provisioning and consumption behaviours in the city. The chapter will focus on four topics: species representation; Chester's agricultural economy and livestock; food and status; and industry and craft specialisation.

4.2 Species representation

Major domesticates

The domestic mammals present in Chester were in-keeping with other contemporary sites in England (see Chapters Five and Six). Cattle were the most abundant species in the city, consumed in the form of beef and veal. Cheshire's climatic and environmental conditions meant that the region was better suited for cattle rearing. The Cheshire plain consists of clay sand and gravel soils, which was ideal for a pastoral economy focused mainly on raising cattle (Thirsk 1967: 80; Davies 1960: 2). As most farmers kept and gained their wealth from cattle rearing, it is not surprising that Cheshire became a thriving dairying district (Davies 1960: 139; Foster 1998). By the 17th century the county became well-known for its production of Cheshire Cheese; and, cows were kept in large numbers (Thirsk 1967: 83; Hodson 1978: 71). The regions' dependency on cattle did receive some criticisms from agricultural commentators, particularly when farmers suffered from severe loss of livestock because of the cattle plague (Hey 1984: 154; Hodson 1978: 73). Major outbreaks occurred between 1745 and 1750 which lasted around 11 years, killing round 30,000 Cheshire cattle (Hodson 1978: 73; Scard 1981: 87). There was another outbreak in 1865-66 (Phillips 2002: 58). However, despite the severity of the outbreak the effect was short-lived and the herd numbers rapidly recovered due to restocking efforts (Phillips 2002: 58).

Sheep/goat was often the second most abundant species at Chester. This is typical of contemporary sites, particularly from regions such as London and the West Midlands (see Chapter Five). Tudor and Stuart documentary records in Chester rarely refer to sheep farming, while some inventories show that only half of Chester's farmers decided to keep sheep (Beck 1969: 42; Hey 1984: 154-5). Arable land was limited in Cheshire and the waterlogged clay soils prevented farmers from benefiting from a mixed farming economy like the East Midlands and South East (Thirsk 1967: 83; Davies 1960: 138). Therefore, there was little profit in keeping sheep, so people only kept enough sheep to provide meat for household consumption (Hodson 1978: 76). The woollen industry was restricted to areas where the land was better for raising sheep such as Macclesfield and Delamere forest (Davies 1960: 138; Hey 1984: 155; Thirsk 1967: 84; Beck 1969: 42). 3-15 Eastgate Street (late 15th - mid-17th century) had the highest proportion of sheep/goat out of all the sites in Chester. This was clearly uncharacteristic for the region. It was suggested that the increase in sheep/goat may reflect a shift in husbandry practices after the Saxon period (Harrison 1995b: 52). However, it was also noted that due to the complicated nature of the deposits it was difficult to come up with a definitive conclusion as most of the remains came from make-up layers and foundation backfills (Harrison 1995b: 50, 52). The elements were mainly major meat-bearing bones indicating food refuse. There were cooks in the Eastgate Street area; therefore, mutton joints may have been sold as street food; although this interpretation is speculative (Laughton 2008: 137-138; Thacker 2003a: 73).

Goat remains were only present in small numbers in post-medieval Chester; represented mainly by horncores. It is well-attested that after the Middle Ages there was a decline in the proportion of goats. This trend has been observed in the medieval and post-medieval assemblages at Chester's Roman Amphitheatre and 25 Bridge Street (Gordon 2013; Smith 2008). The prevalence of cranial remains suggests that goats were traded and exploited for their skins (Albarella 1999, 2003). Goats were also eaten and may represent high-status consumption. They have been identified at high-status sites probably because their meat was desirable, especially kid meat, which was believed to be as tasty as venison (Thirsk 1967: 193). The Book of Carving (*The Boke of Keruynge*), which contains accounts of dishes served at feasts; refers to serving kid as a main course (Furnivall 1868: 159, 161).

Pig was the least common of the three major domesticates. They were mostly kept for domestic purposes to provide meat and fat (Hodson 1978: 76). A low proportion of pig is typical of the post-medieval period as their number began to decline in relation to sheep because of the rise in the wool trade and a decrease in woodland and wasteland during the 13th and 14th century (Albarella 1997b: 24; Albarella 2006: 74, 76; Hamilton and Thomas 2012). Although pigs appear to have been

bred in small numbers in the towns, in the rural regions of Cheshire they seemed to be more common. Every cottager had a least one pig and dairy farmers always kept a couple as they consumed the by-products from cheese and butter making (Beck 1969: 41; Davies 1960: 137). Neonatal or suckling pigs were found with butchery marks at 25 Bridge Street and Chester's Roman Amphitheatre, which is evidence for their consumption. The presence of neonatal remains provides evidence of pig breeding in the city. Raising urban pigs was easy because they could live off table scraps and household waste; making them useful for reducing the level of rubbish on the streets and in backyards (Albarella 2006: 72). 3-15 Eastgate Street (late 17th - mid-18th century) had the highest proportion of pig out of all the sites in Chester. During the excavation at 3-15 Eastgate Street a cellar associated with Buttershops, where dairy products were sold, was discovered (Matthews 1995). Buttershops were documented to have been in Eastgate Street from the late 13th - early 14th century (Matthews 1995: 1; Thacker 2003b: 209). As pigs could eat the whey and buttermilk produced from the dairy industry, their high proportion could be attributed to the Buttershops that were in the Eastgate area. The majority of Chester's tapsters were also based in Eastgate Street from the late medieval to early modern period (Thacker 2003a: 74). Brewing was a domestic activity that was initially carried out by women and pigs also consumed the barley grains and lees produced from malting and distilling (Laughton 2008: 138; Thacker 2003a: 74; Trow-Smith 1957: 220; Velten 2013: 27). Therefore, the large number of pigs could also be attributed to the brewers in the area (Trow-Smith 1959: 41; Velten 2013: 27). It is also worth noting that there was a pig market in Eastgate Street up until the 1640 (Barrow 2005a *et al*.: 94-100). Regardless of the reason there was clearly a surplus of pigs in the area.

Minor domesticates

Horse, dog and cat were common domesticated mammals in Chester, although they made a small contribution to the assemblages. Horses played an important role in Chester's economy. From the early modern period, fairs in Chester were well-known for selling horses and dealers from around the country attended these events to purchase and sell their horses (Forster 2003: 103, 141). The city was also celebrated for horse racing at the Roodee. These races were held at Chester from as early as the 16th century and attracted spectators across England (Forster 2003: 109; Matthews 1999: 161; Ward 2009: 100). In the late 1600s, Chester horses were increasingly replacing oxen as draught animals, which was a shift that was taking place in many parts of the country. Photographic evidence also shows horses pulling trams in Bridge Street showing that they were employed as working animals (Hodson 1978: 76; Langdon 1986; Ward 2009, figure 135: 103).

Horses were represented by disarticulated remains, although articulated remains were found at Nicholas Street Mews, Hamilton Place and City Road. It is not common for horse remains to be present in large numbers in urban assemblages because they rarely died in cities and towns; they tend to be better represented in rural sites (Albarella 2007b: 139; Langdon 1986). However, archaeological evidence does point to an increase in horse remains in post-medieval urban sites (see Chapter Five). They are also animals that were not usually eaten as consuming their flesh was strictly forbidden; however, horsemeat was eaten during times of hardship (Albarella 2007b: 140; Grant 1988: 160). Another reason why horse remains were scarce was because horse carcasses were in high demand. Once the animal was dead the whole carcass was utilised, recycled and manufactured into marketable products (Yeoman 2004: 75; Yeoman 2006). Horses sent to a Knacker's Yard in Victorian London were used to make leather products and had their meat de-fleshed for cat and dog food (Gordon 1893: 185-6). Their bones were also boiled for oil and ground into powder to be sold to manure merchants (Gordon 1893: 185-6). Horse foot bones went to glue and button makers and the hair from the tail and mane was used on sofas/chairs or was used to make fishing-lines (Gordon 1893: 186-7).

The horse remains at City Road showed that the tanning industry processed horse hides on an industrial scale (see Industry and craft, in this chapter). Considering how extensively horse carcasses were utilised it is surprising that the partial horse skeleton from Nicholas Street Mews displayed no signs of butchery or human modification. It is possible that the animal represented a cherished pet or working animal, whose owner did not want to send it to the knackers' yard or tannery. The partial foal skeleton with butchery marks at Hamilton Place probably represented a natural mortality, which may have been exploited for its skin or meat after death. Horses were extremely useful animals, which were costly to buy. Therefore, it seems unlikely that a foal would have been killed purposely, since it would have been more valuable alive (Velten 2013: 44).

The donkey metacarpal found at City Road could attest to the trade of donkey or donkey body parts in Chester. In the Tudor period, donkeys in Chester were used for pulling carts and sledges (Beck 1969: 42). Two hundred thousand donkeys were reared in Ireland and were used for agricultural purposes (Gordon 1893: 169). It could be speculated that the donkey from City Road came from Ireland considering the strong trading links the country had with Chester. Although donkeys were said to have been on the rise from the 17th century (Edwards 2007: 200); their abundance in the archaeological record is difficult to determine due to the morphological similarities between donkey and horse bones.

Dogs in Chester were frequently found as disarticulated remains, although partial skeletons were found at 25 Bridge Street. Cut marks were observed on some of the disarticulated dog remains at Chester's Roman Amphitheatre and Hamilton Place, which suggests that dog skinning was taking place in these areas. A dog axis and three femori from the late 15th - mid-17th century and mid-late 17th - early 18th century at 25 Bridge Street had dismemberment and filleting marks (Smith 2008: 352, 360). In times of famine and stress some people did resort to eating dog meat (Thomas 1983, 116; Woodward 1970: 52-3). In the 16th century, there were episodes of stress in Chester where adverse weather condition affected agricultural production; therefore, people may have resulted to eating dog meat despite it being taboo (Smith 2008: 353). At Chester's Roman Amphitheatre a dog axis and femur from the early-mid 17th century had been slaughtered and dismembered. This was found in the Civil War context; therefore, it is possible that food shortages affecting the city, forced people to consume dog meat (Forster 2003: 120). It is also worth noting that in the early modern period dogs were considered as a 'dainty dish' and the meat of young spaniels was popular in England and France (Thomas 1983, 116; Smith 2008: 353). Dogs were also exploited for their fur, although were considered to be of low quality. Dog fat was also used for cosmetic and medical purposes (Gidney 1996 as cited by Albarella *et al.* 2009: 76).

Partial dog skeletons found in burials at 25 Bridge Stre*et al*so suggests that these animals were companions. The different dog breeds identified at 25 Bridge Street could provide tentative evidence for the status of the dog owners. Based on withers height calculation dogs fell into the range of a fox terrier, Dandie Dinmont, lapdog and Labrador. Lapdogs and hunting dogs were particularly popular with the aristocracy and the middle and upper classes (Kalof 2008: 88; Thomas 1983: 102; Velten 2013: 184). Documentary evidence shows that occupants at 25 Bridge Street enjoyed a fair amount of wealth and status (see Chapter Two); therefore, it is not unreasonable to suggest that they owned some of these animals as pets (Garner 2008).

Most of the cat remains were disarticulated but there were partial skeletons from 25 Bridge Street and Chester's Roman Amphitheatre. Butchery marks on cat remains from Chester's Roman Amphitheatre suggests that fur was a commodity. In the mid-late 17th- early 18th century a cess pit at 25 Bridge Street had a number of cats ranging from new born to adult (Smith 2008: 360). The occurrence of new born and very young cats could be suggestive of on-site breeding or the result of selective culling to prevent unwanted breeding (Smith 2008: 361; Thomas 2005b: 95). Cats were also known to be mass slaughtered when outbreaks of plague were anticipated, as they were seen as the reason for the spread of the disease (Kalof 2007: 88). In addition, the presence of these animals could also be indicative of the urban trade in cat skins. A similar assemblage of young cats was

discovered in a well at Bene't Court, Cambridge, which represented animals that were slaughtered for consumption (Luff and GarcÍa 1995). In the 19th century, at Chester's Roman Amphitheatre and 25 Bridge Street cat burials were discovered and a double cat burial was found at the latter site. These burials suggest that cats were also considered as companions.

Wild mammals

Wild mammals made a minor contribution to the diet of Chester's inhabitants. Deer consumption was restricted to the elite and was commonly found on high-status castle sites (e.g. Dudley Castle (Thomas 2005a), Launceston Castle (Albarella and Davis 1996), Stafford Castle (Sadler and Jones 2007) and Wigmore Castle (Thomas and Vann 2015). Deer could only be hunted, which was a privilege reserved for aristocrats and noblemen who owned land or had the rights to hunt in deer parks (Thomas 2007: 138). In the late medieval period, Delamere Forest and Shotwick (North West of Chester) had royal parks for hunting game and the king granted access to these parks to his local friends and noble men (Driver 1971: 95; Laughton 2008: 165). Compared to castle sites, deer remains were less frequent on urban sites because venison could not be bought on the urban market until the Victorian period (Mayhew 1967: 120; Grant 1988: 164; Thomas 2007: 138). Deer could be received as gifts or they were illegally poached (Grant 1988: 165; Laughton 2008: 185). However, in light of the archaeological evidence the presence of deer probably represents high-status consumption, rather than illegal poaching. In the late medieval period, Chester's shoemarkers and saddlers often hunted deer along with clerks and noble men, after which the meat was distributed in the city (Laughton 2008: 185). Fallow deer was more common than red and roe deer, a pattern consistent with contemporary urban sites (see Chapter Five). After the Saxon period there was an significant decline in the proportion of red and roe deer and a surge in the number of fallow deer (see Holmes 2011; Sykes 2007a). This was because fallow deer was introduced in England during the Norman period (Sykes 2007a). Their herding and eating habits also meant that fallow deer was better suited for hunting parks in comparison to red and roe deer, which also accounted for their increasing popularity (Thomas and Vann 2015). In addition, following the decline of woodland areas in the medieval period, red and roe deer faced severe habitat loss while fallow deer were able to graze and breed within deer parks (Thomas and Vann 2015).

Rabbit was the most common wild resource which is typical of post-medieval urban sites (see Chapter Five). Rabbits were believed to have been introduced during the Norman period (Veale 1957), although there has been recent evidence that suggests they may have been introduced to

Britain earlier (see Sykes 2010). The 13th century marked the period when rabbit keeping became more prominent in Britain (Sykes 2010: 123). Initially they were kept in warrens, which were owned by the elite and ecclesiastical members, rendering them as a high-status food. However, after the Black Death and following their escape into the wild they became more abundant, which down-graded them from a luxury meat (Sykes 2010: 123-5). Rabbits were particularly valued for their fur. In Chester, from 1420 there was an increase in the number of glovers who worked with a variety of animal skins including rabbit, and documents show that their skins were also imported (Carrington 1994: 81; Laughton 2008: 148). Rabbit was more common at 25 Bridge Street, probably because there were glovers and skinners in the area (Backhouse 2008; Laughton 2008: 148-9). Butchery marks associated with skinning was found on a rabbit mandible from Bridge Street which suggests pelt processing (Smith 2008: 353). Nevertheless, it should be noted as rabbits are burrowing animals their presence on archaeological sites can be difficult to interpret as they could represent natural mortality. However, none of the rabbit bones came from obvious partial skeletons and as some displayed butchery marks it is likely the majority were brought to site for their meat and fur. Moreover, there is generally less open land in urban areas for rabbits to burrow.

Hare was less common than rabbit probably because, like deer, they were restricted to the elite (Salisbury 1994). In the medieval period they were protected species, which meant that hunting and eating them was prohibited (Cummins 1988: 113). They were used by the elite as a way to prepare their hounds for hunting deer (Salisbury 1994: 52). Hare hunting was seen as a challenge because of their unpredictable nature, which tested the hounds' speeds and tracking ability (Griffin 2007: 82). It was also noted that in Delamere Forest, hares were hunted by the gentry in the later medieval period (Driver 1971: 95). It is also plausible that they were exploited for their fur, but on a small scale compared to rabbit.

Other wild mammals found at 25 Bridge Street included red squirrel, pine marten, stoat, polecat/ferret and fox. These animals were highly sought after for their fur and may have been obtained by furriers in Bridge Street (Smith 2008: 361). Skinners were known for their trade of squirrel, fox, badger, otter, rabbit and marten furs, which were traded in Chester from the 10th century (Laughton 2008: 149; Thacker 2003a: 76). Fox hunting in Cheshire was documented as early as the 1200s; therefore, they could have been captured in forests during the hunt (Cheshire Mammal Group 2008: 91; Driver 1971: 95). An elephant tibia (cal AD 1290-1410) from Africa or Asia was found in a cess pit dating to the late 15th - mid-17th century at 25 Bridge Street (Smith 2008: 354). It was most likely brought back as a curio from Chester's port after the animal's death or was

curated in the city before it was thrown in the cess pit (Smith 2008: 354). Exotic animals were not uncommon in places with an active maritime trade (see Albarella 2007a).

Domestic birds

Chicken was obviously the popular bird of choice as it was present at all sites in Chester. The largest assemblage of chickens was at Chester's Roman Amphitheatre from the 16th century feasting pit. The high quantity of chickens and range of body parts suggest that they arrived on site alive or as complete carcasses. There was also evidence for breeding chickens at Chester's Roman Amphitheatre; therefore, it is also possible that they were raised on site and slaughtered for the feast. However, poults were also consumed by the elite as immature chickens were considered to be sweeter than adult chickens (Serjeantson 1998: 29; Thomas and Vann, 2015). Juvenile chickens were also common throughout the city at sites such as 25 Bridge Street, 10 Commonhall Street and Nicholas Street Mews. People would have kept chickens as a cheap source of protein and for their eggs (Grant 1988: 164; Velten 2013: 28). Geese were also a popular bird that would have been exploited for their eggs, meat and feathers. Goose husbandry became more widespread in the later medieval period (Albarella 2005). Ducks were less common, which is not surprising as they were viewed as a low status bird in the medieval period (Albarella 2005). In the early modern period, the skin of 'cloven-footed' birds was deemed to be unwholesome, which may have accounted for their continued low occurrence into the post-medieval period (see Furnivall 1868: 165). Ducks were probably primarily exploited their eggs followed by their meat.

Wild birds

There was a wide variety of wild birds consumed in the city, most of which came from Chester's Roman Amphitheatre and 25 Bridge Street. In the medieval and post-medieval period there was an increase in the number of wild birds on archaeological sites (Albarella and Thomas 2002). This was due to an increase in disposable wealth after the Black Death, allowing more people to consume more meat; a luxury that was only privy to the elite beforehand (Thomas 2007). Therefore, the rich sought to maintain the divide between them and the poor by consuming wild birds, which were more difficult to obtain unless you had the money and access (Thomas 2007). The wild birds at Chester generally fell into three categories: waders, wild galliforms and commensal. The most common bird was woodcock, which was a popular high-status bird that has been found at a number

of post-medieval sites (see Chester Five). In the early modern period, woodcock was considered as a good table bird that was reasonably affordable (Simon 1959: 12). In the dinner accounts at the Star Chamber woodcock ranged in price from less than 1s to 2s per bird (Simon 1959: 12). This would have been the equivalent of £7.55 to £17.39 (based on the National Archive's currency converter). Woodcock continued to be served at dinners until the Victorian Period; however, they were less frequently consumed (Beeton 2000: 237). Swan, teal/garganey, lapwing and pigeon were also common birds in Chester. Swans were associated with the aristocracy and were served at dinners and feasts in the early modern period (Furnivall 1868). They were eaten at the Star Chamber and were expensive with one bird costing 2s 4d, which would have been the equivalent of £35.88. Teal was also a popular bird, which was considered to be a '…pleasantnesse and wholesomenesse of meat, excelleth all other water-fowl' (Venner as cited in Simon 1959: 10). Lapwing was another table bird that was costly and ranged in price. Six to eight birds cost around 8s 4d to 16s (Simon 1959: 13). Of the commensal species, pigeon was the most common. It is difficult to determine whether they were eaten without signs of butchery. The presence of guinea fowl(?) and turkey is interesting as both species were introduced in Britain. The guinea fowl is an African bird and the turkey is a North American bird, both of which arrived in Britain around the 16th century (Poole 2010: 164; Fothergill 2012: 43). It has been difficult to assess their abundance in archaeological and documentary records because of identification problems and confusion over nomenclature as turkey and guinea fowl were often confused (Fothergill 2012). Nonetheless, upon their arrival both were restricted to the elite and guinea fowls may have been displayed on table at dinners and feasts (Fothergill 2012: 43; Poole 2010: 164). Turkeys were kept by farmers in Cheshire in the 1600s. William Heyward of Audley who had a dairying parish in the south of Cheshire had hens, geese and turkeys (Thirsk 1967: 84). Like rabbit, the turkey became more widespread and by the 19th century it was a common species that was raised on an industrial scale (Fothergill *et al.* 2013: 244).

Fish

In Chester, fish consisted mainly of marine and migratory species: eel, smelt, herring, flatfish and gadidae (e.g. cod and whiting). Fish was a vital dietary component as the Church declared it was to replace meat for more than a third of the year (Laughton 2008: 136). Cheshire was well-situated to supply the city with fish as there was easy access to the River Dee and the Irish Sea (Laughton 2008: 136). In 1588, the city's fish market (also known as the Fishboards) was located to the south of Watergate Street, which faced the butchers' shambles (Barrow *et al.* 2005b: 94; Laughton 2008: 136). Records of fish sold in the city included: salmon, mackerel, haddock, ling, eel, herring and

stockfish (dried cod), which have been found in the faunal assemblages. Herring and eel were readily available to purchase from the market as fresh, salted or smoked fish (Barrow *et al*. 2005b: 94; Laughton 2008: 136; Locker 2009: 145). Herring was also a popular fish during Lent, which would account for its abundance in the faunal record (Laughton 2008: 136). It was also a cheap oily fish (Locker 2009: 145). Smelt was common and was considered a delicacy (Locker 2009: 145).

Another marine fish worth mentioning is anchovy which were imported in great quantities during the Tudor period (Tames 2003: 18). Anchovies were found only at 25 Bridge Street, mainly in the mid-late 17th - early 18th century context. In Chester, they were shipped from the Mediterranean and would have been used to add flavour to food (Tames 2003: 21; Forster 2003: 138). Two weever fish bones were found at 25 Bridge Street, which have poisonous spines. Normally, the envenomed spines would have been removed become consumption (Wheeler and Jones 1989: 65).

Freshwater fish were less common, which is not surprising as their access was strictly controlled in the medieval period (Jaques 2008: 397; Serjeantson and Woolgar 2006: 125). They would have come from fishponds or other local freshwater sources, which were commonly accessed by the elite (Serjeantson and Woolgar 2006: 124). In Chester, freshwater fish included cyprinid, perch, stickleback and trout. However, cyprinids did become more common by the post-medieval period, which has been noted at other sites in England (Harland 2010; Serjeantson and Woolgar 2006: 130; see Chapter Six).

In the late medieval period, inshore fishing was undertaken by those who ran their own stalls along the banks of the River Dee or by those who rented fishgarths and traps on the estuary shore (Thacker 2003a: 73). The King's Pool was the most important fishery in Chester where salmon, lamprey, eels, bass and sprats could be caught (Thacker 2003a: 73). Ownership of the fishery changed hands throughout Chester's history. It was first owned by the earl of Chester in the 1200s, after which it was leased out to various people including the Crown, farmers and prominent civic members until the 1900s (Thacker 2003a: 44; Barrow *et al.* 2005b). In the 14th century, approximately a dozen fishmongers traded in the city; however, this number declined by the late 15th century (Thacker 2003a: 73). A great deal of Chester's fish came from Ireland, which included imported cod, ling, whiting, eel, herring and salmon (Jaques 2008: 396). Salmon was a vital import and catch in the 15th- and 16th-centuries. By the 16th century, a salmon cage was constructed and the fish in question was the most profitable of the fish species (Barrow *et al.* 2005b). Salmon was more common in the 16th century feasting pit, which is not surprising as it was an expensive high-status fish. One fresh salmon served at the Star Chamber cost between 9s (£56.38) and 44s (£275.64) (Simon 1959: 19). Cod and ling would have come from deep sea fisheries, which would

have been bought dried, salted, pickled or smoked (Jaques *et al.* 2008: 396). Flatfish, smelt and whiting were probably caught by inshore fishing and supplied by local fisheries (Jaques *et al.* 2008: 396). The city also exported to herring to Wales in the 16th and 17th century (Jaques 2008: 396). In the late post-medieval period, fish from Wales was also imported to Chester (Jaques 2008: 397).

4.3 Cheshire's agricultural economy and livestock

In the medieval period, Chester's countryside was described as a land that was 'rich in beasts and fish' (Laughton 2008: 164). Despite this, the heavy clay soils meant that the land could only produce enough food to feed families and allow farmers to keep a small amount of livestock (Carrington 1994: 64; Thirsk 1967: 80). To improve land productivity a number of strategies were adopted, which included marling the embankment against the sea and enclosure (which began in the 14th century) (Thirsk 1967: 81). In Macclesfield Forest, rye and oats were sown into the soil to improve the quality of the land.

Cheshire's agricultural economy can be roughly divided into four districts: the north, where cattle were fattened and the woollen industry was concentrated; the south and the west where dairying took place (where the soil was the heaviest); and the forests Macclesfield and Delemere where cattle, sheep, pigs and horses were reared (Hey 1984: 155; Thirsk 1967: 83-84). In the 16th century, Cheshire adopted a pastoral economy, most likely taking advantage of the fact the land was more conducive to cattle rearing (Hey 1984: 129). As a result, many farmers focused their efforts on cattle farming and the region became famous for its dairy products. The topographer William Smith wrote, '[Cheshire's] pasture ground is reserved, especially for their kine…The cause for keeping so many kine is, as well for breeding Cattel as for their milk wherewith…they make great store both of Butter and Cheese' (quoted in Trow-Smith 1957: 210).

Cheshire's dairy industry did not expand until the 1650s; before which, dairy products were produced on a small scale (Hey 1984: 153). After 1650 Cheshire's dairy industry grew rapidly largely due to the demand of butter and cheese in London. In the 1640s, Suffolk supplied London with most of its butter and cheese; however, the region suffered from severe cattle loss due to disease and floods causing their dairy products to double in price (Foster 1998: 6). As a result, London merchants began to buy cheese from Cheshire as well as the North and West of England. Although Cheshire cheese was more expensive, because of its high quality people were happy to pay the premium price (Foster 1998: 6-7). John Speed claimed that Cheshire cheese was the best cheese in all of Europe

(Thirsk 1967: 83). This growing market for dairy products would have called for more cows and resulted in a surplus of calves, which can be seen in the zooarchaeological data.

Cheese was shipped from Chester's port and with the development of the canal systems in the 18th century the industry continued to expand as cheese was transported to other regions in the country (Foster 1998: 7, 9). The quantity of cheese sent to London from North West England was estimated to be 2,000 tons in the 1680s and between the early modern and modern period Cheshire sent 14,000 tons of milk to London and Bristol alone (Foster 1998: 7; Trow-Smith 1959: 19). In the 19th century, liquid milk market was important in Cheshire especially after the development of the railway system and because of the growing urban population (Scard 1981: 68; Phillips 2002: 58).

Reports referring to Cheshire cattle mention that farmers kept a range of different breeds and that no particular breed dominated as 'every farmer [had] his own fancy' (Davies 1960: 132; Holland 1808: 250). Cheshire cattle breeds included: long-horned Lancashire, Yorkshire short-horned, Holderness, Derbyshire, Shropshire, Staffordshire, Welsh, Irish, Scotch and New Leicestershire cattle (Hey 1984: 152; Holland 1808: 250). Each of these breeds arrived at different times and was reared throughout Cheshire; therefore, dairy cows consisted of a mix of these types (Holland 1808: 250). Cheshire dairy cattle were typically longhorns as they had good milking properties (Holderness 1989: 159; (Trow-Smith 1959: 85, 177). Horncore measurements from City Road and 25 Bridge Street showed that the majority of cattle fell into the medium horn category; very few represented long horned animals (see Chapter Three). This may be because longhorns were not frequently slaughtered for their meat and hides compared to other cattle breeds, which could account for their virtual absence from the City Road and 25 Bridge Street assemblage. Raw and tanned cattle skins were also imported from Ireland, so it is possible that those skins came from medium horned animals (Forster 2003: 139; Trow-Smith 1957: 229 139).

Cheshire cattle were described as 'very large and big of bone…' (Trow-Smith 1957: 210). Although some farmers attempted to improve milk yields by cross-breeding cattle with Dutch breeds, many were sceptical of the selective breeding efforts that were sweeping the nation (Davies 1960: 132; Trow-Smith 1957: 210). Despite this, the milk yields of Cheshire cattle were high in comparison to other regions (Davies 1960: 132). In 1845, farmers were still purchasing cattle 'by the eye', so breeds were commonly mixed with some 'improved' short horn bulls (Davies 1960: 133). The biometrical analysis shows that there was a size increase in cattle from Chester's Roman Amphitheatre between the medieval to the mid-late 16th- early-mid 17th century and another size increase in the mid-18th-19th century. The increase in the 16th-17th century attests to the introduction of larger Dutch breeds to the region (Trow-Smith 1957: 210). This size increase was also observed in cattle from 25

Bridge Street, although a bit later in the mid-late 17th- early 19th century. The size increase in cattle from the mid-late 17th century to the 19th century could reflect improvements made to the dairy industry during the 18th and 19th century, which involved the introduction of new breeds to improve productivity and the removal of poor quality cows from dairy stocks (Holderness 1989: 159). There was, however, a decrease in the average size of cattle from Chester's Roman Amphitheatre between the mid-late 17th century and late 17th early 18th century (see Appendix One). This decrease in the mean may be attributed to cattle producing offspring at a younger age. In the mid-late 17th-century context, there was a notable high proportion of young cattle, which could be associated with different husbandry strategies during the Civil War (see Provisioning during the Civil War, in this chapter). During this time there was a high demand for dairy products to provide food provisions for soldiers. There were also terrible food shortages and poor weather condition resulting in bad harvests. In such unpredictable times the pressure to provide dairy products and food may have resulted in farmers using young cattle to produce offspring to keep up with the demand. As a consequence this may have caused offspring to be morphologically smaller resulting in a decrease in the average size and therefore would have resulted in a 'negative breeding strategy' by producing smaller animals (Thomas *et al.* 2013: 3319). A recent study of Soay sheep has shown that females which bred at a younger age produced smaller offspring (Ozgul *et al.* 2009). This was due to the 'physiological or morphological constraints caused by not having reached full adult size' (Ozgul *et al.* 2009: 467). The study also showed that poor weather conditions caused the Soay lambs to grow at a slower rate, years after a bad winter (Ozgul *et al.* 2009: 467).This may have also caused a decrease in the mean of Chester cattle. The difference in the size of cattle from sites in Chester could reflect the presence of several morphotypes in the region. Breeds may have been smaller or larger than others, which could account for the temporal difference in cattle size. Holland states that 'it is impossible to say which of the intermixed breeds are most approved [as farmers had different preferences, therefore] to describe the variety of opinions…would be almost an endless task' (1808: 250).

Accounts referring to Cheshire sheep were much more limited probably because farmers believed 'their Ground serveth better to other purpose' (Trow-Smith 1957: 211; Holland 1808: 287; Beck 1969: 42). The profits gained from beef and dairy production out weighted the money earned from wool production, particularly as the region was not suited for sheep farming (Trow-Smith 1957: 211; Holland 1808: 288). Horned and polled sheep breeds were present in Chester and by the 18th century there was a mixture of sheep breeds. In the late 18th century, 'improved' breeds were introduced into the breeding stock (Trow-Smith 1957: 211; Davies 1960: 139). The biometrical analysis showed that there was very little change in the size of sheep/goat between the 15th- to

17th century probably because farmers dedicated their attention towards dairy farming. An increase in the size of sheep/goat appeared to have occurred later, from the late 17th century onwards. This could be reflecting the introduction of 'improved' breeds, such as Merino rams, which were used to improve the quality of sheep's wool in the early modern period (Davis 1960: 139). Sheep/goat measurements from Chester's Roman Amphitheatre showed that there was a greater range of breeds by the mid-18th- 19th century, which provides further proof for the introduction of different breeds in the 18th century (Davis 1960: 139). Depending on the location, sheep from Cheshire also varied in size; for example, those from the east were larger than sheep from Delemere Forest (Davis 1960: 139).

Like sheep/goat, there is very little information about pig husbandry in Cheshire (Davies 1960: 137). Pigs were reared in large numbers on dairy farms and in the 18th and 19th century milk-fed pigs became an important by-product of the dairy industry (Holderness 1989: 154; Hodson 1978: 76; Trow-Smith 1959: 41; Hey 1984: 154; Davies 1960: 137). In the 1840s, the 'improvement' of Cheshire pigs started to gain momentum and those in the region were a mix of long eared and short eared breeds (Davis 1960: 137). Investigating the size and shape change in pigs was challenging due to the limited number of fused post-cranial elements as the majority of pigs were slaughtered by the time they reached two years of age. There were also too few pig teeth to permit biometric analysis. However, post-cranial pig measurements from Chester's Roman Amphitheatre did show a possible size increase by the late 17th-19th century.

Poultry were kept in large numbers on nearly every farm in Cheshire (Holland 1808: 293). Geese were raised by cottagers, who sold them to farmers for fattening and a small number of turkeys were raised in farm houses (Holland 1808: 293-4). The inventory of Edward Glegg of Gayton (1623), a wealthy Cheshire farmer, said he had peacocks, peahens, geese and turkeys as well as other types of poultry (Beck 1969: 47). Farmers believed that there was more gain from keeping chickens for their eggs rather than meat (Holland 1808: 293). However, the presence of juvenile chickens in Chester showed that inhabitants also raised chickens for meat and eggs. At Nicholas Street Mews, in the early modern/modern period, 44% of chickens were juvenile compared to 23% in the earlier phase, suggesting an increasing emphasis on meat production. This has also been observed at Castle Mall which had a higher percentage of juvenile chickens in the post-medieval period (Albarella *et al.* 2009: 85). Biometrical analysis of chickens from Chester's Roman Amphitheatre showed that there was a size increase after the medieval period. Other contemporary sites have also demonstrated an increase in the size of chickens between the late medieval and early modern period (see Gordon *et al.* 2014, table 1). However, by the mid-late 17th century there was a decrease in the size of chickens

which may account for the presence of different breeds (e.g. bantam forms). Observations of breadth measurement for chickens exhibit a greater size range which is also indicative of different breeds (see Chapter Five). Biometrical analysis of chickens from London also demonstrated a decrease in the mean (Thomas *et al.* 2013). The articulating chicken tibiotarsus and tarsometatarsus displaying lesions associated with chondrodystrophy and the 'creeper' mutation indicates that Cheshire farmers were implementing selective breeding strategies for poultry in the early modern period (Gordon *et al.* 2015).

4.4 Urban provisioning in Chester

Provisioning a city or town with food would have involved a complex web of trading systems, controlled by producers, consumers, traders, yeomen, labourers, merchants, middlemen, craftsmen and butchers. The urban market would have been in constant flux, influenced by the ebb and flow of supply and demand as well as tied into social, political and economic affairs (Costin 1991: 2). The faunal remains from Chester provide insight into the provisioning strategies of the city based on what species were present, their body part representation and livestock demographics.

Livestock arrived in the city through Eastgate Street and Bridgegate. The livestock market was located in Bridge Street and Lower Bridge Street. Although after 1530, the market remained in Lower Bridge Street in an attempt to limit the disturbance and mess made by the animals (Barrow *et al*. 2005a: 94-100) (see figure 2.3). Other live animal markets included the horse market in Gorse Stacks and the pig market in Eastgate Street. In the 1700s, the cattle market was held in Upper Northgate Street before it was re-located outside the city walls in 1850 due to animals obstructing the roads (Barrow *et al*. 2005a: 94-100) (figure 4.1). Chester's butchers would have purchased live animals, and then would have slaughtered and butchered them on their premises before selling them at the meat market or in their shops. The majority of the animal remains found at sites in Chester would have represented butchered caracasses. From the 1500s, the Butchers' shambles was located in Northgate Street, along with the fish market but by the early 1800s the shambles was removed due to rising concerns about sanitation and demands for space for urban development (Barrow *et al*. 2005a: 94-100).

Most of the cattle remains would have arrived around the city as dressed/undressed carcasses or bought as pre-butchered joints. Many of the assemblages were dominated by 'meatier' cattle elements (e.g. femur, radius, tibia and humerus), which is typical of an urban economy. Cattle remains from urban Roman deposits also had high proportions of major meat-bearing bones, which

were attributed to the large-scale processing of beef for the market economy (O'Connor 1989b: 13). Urban sites are also more likely to have a higher occurrence of specialised bone deposits (i.e. head and feet) because of the presence of skilled professionals involved in crafts and trades (Albarella 2007b: 137-138). The evidence for industrial activity at Chester is a prime example. This demonstrates that tradesmen, craftsmen and merchants also had control over what animals and animal body parts were provisioned to the city. Mortality profiles showed that a mix of beef and veal was eaten, which is typical of a dairy economy (O'Connor 2000a: 51). At some sites there were significant differences in the proportion of beef and veal. This may reflect consumer preferences as slaughter profiles can reveal the age of animals eaten on-site rather than the 'slaughtering policy' of animals in the hinterland (Albarella 2007b: 134; see Food and status in this chapter).

Similar to cattle, sheep body parts would have been represented by undressed/dressed carcasses or as pre-butchered joints. There were a high proportion of major meat-bearing bones indicating a heavy reliance on portions and cuts of meat. The slaughter profile for animals revealed that lamb and mutton were consumed, which is characteristic of a mixed husbandry strategy focused on raising sheep for wool and meat. However, by the 19th century there was a high frequency of young sheep/goat which suggests a greater emphasis was placed on rearing sheep for meat or the presence of faster maturing breeds. Sheep/goat from 25 Bridge Street showed that the age of animals consumed on site were selected by the inhabitants, more so than other sites as the age profile of sheep/goat differs over time, which points industrial activity and domestic consumption. In the late 15th - mid-17th century, there was a high frequency of lamb, suggesting that these animals were brought on site for the purpose of hide/skin working (Smith 2008: 352). In the later phases, there was a shift in the age profile of animals showing that large amounts of mutton and/or juvenile animals were consumed. These changes in the age profile reflect the mix of activities taking place on site and the difference uses of sheep/goat at 25 Bridge Street.

Pig remains would have arrived as undressed/dressed carcasses and as filleted cuts or joints of meat. However, the presence of neonatal pig bones at Chester's Roma Amphitheatre and 25 Bridge Stree*t a*lso suggests they were bred in town as backyard animals for domestic consumption and/or to be sold at the market. The majority of pigs in Chester were slaughtered once they had achieved the optimum balance between weight and age (e.g. c. 2 years). At Chester's Roman Amphitheatre, in the Tudor feasting pit there was a preference for suckling pigs and at 25 Bridge Street pork and bacon were consumed. However, by the later post-medieval period the majority of pigs did not survive past two years of age, which could indicate the presence of faster maturing pig breeds in the 18th-19th century (Albarella 1997b).

Pigs and poultry were raised locally; however, it is possible that a small amount of cattle and sheep were kept in the city too. Livestock animals were occasionally reared in fields on the outskirts of towns and cities (Albarella 2007b: 143; Barrow *et al.* 2005a). However, local production in Chester would have stagnated over time due to population pressure, which increased the demand for land to develop on, and as concerns about diseases in urban areas became more widespread (see Chapter One).

Food procured from hunting would have formed a minor dietary contribution; however, the presence of hunted species does shed light on urban supply and demand, because they would only be available if people were willing to pay for them (O'Connor 1989b: 19). As these animals were obtained from different environmental niches, requiring a certain level of skill to capture them, they were often more expensive. Therefore, their presence in an archaeological assemblage can be used to determine the social status of site occupants (O'Connor 1989b: 19) (also see Food and status in this chapter).

Hunted animals included rabbits and hares, although they would have arrived in the city through different trajectories. By the post-medieval period, rabbits were increasingly common after their escape into the wild; making them more accessible on the urban market. The commercial breeding of rabbits for food did take place on a small-scale but this died out by the 19th century (Holderness 1989: 148). Hares were less common probably because they were associated with high-status consumption. Unlike rabbits, they were hunted by the wealthy and could be given as gifts or brought back from the hunt to eat (Griffin 2007: 72). Deer would have been unavailable to purchase on the urban market until the modern period; beforehand deer could only be eaten by the rich, received as gifts or illegally poached (Griffin 2007: 72). Poaching was also a popular way of feeding the urban population, which would have provided an additional method of procurement (Holderness 1989: 148).

There were a number of wild birds found in Chester, which would have been captured via wildfowling. These birds would have been caught along the floodplain of the River Dee, from salt marshes in the west and in royal hunting parks (Smith 2008: 354). Wildfowlers used an assortment of methods and techniques to catch birds including: nets, snares, traps, decoys, guns, hawking and birdlime (a sticky substance that is spread across branches and twig) (MacPherson 1897; Serjeantson 2009: 238-249). Nets and snares were used to catch waders, game birds and small flocking birds (Serjeantson 2001: 271; Serjeantson 2009: 244, 249; MacPherson 1897). These were sometimes used in conjunction with 'Duck decoys' (live or model birds placed in the water to tempt other birds to land) (Serjeantson 2009: 249). The use of guns for wildfowling became more common in the 16th

century, particularly after the technology was simplified, enabling more people to use them (Serjeantson 2009: 248). The use of hawks to catch wild birds was less common mainly because of the time invested in training the hawk. Therefore, it was rarely used as a method for commercial wildfowling (Serjeantson 2009: 239).

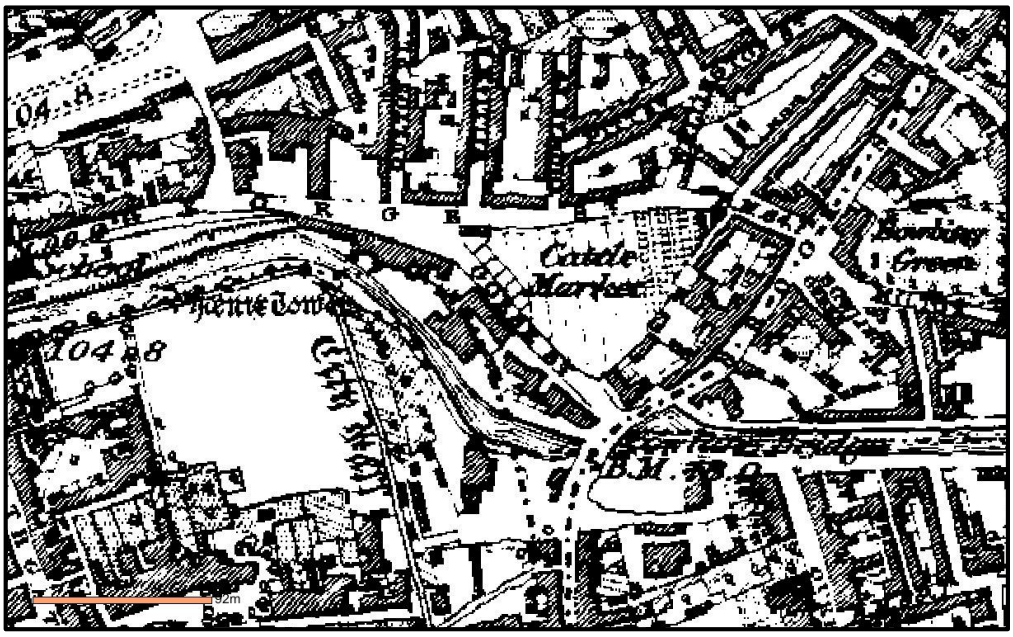

Figure 4.1: 1875 OS map of Chester showing the location of the Cattle Market. Scale bar indicates 92m

http://maps.cheshire.gov.uk/tithemaps/TwinMaps.aspx?srch=&singleplot=&hlt=&hlp=&e=340737.825&n=366716.945&scale=0.635&tabL=L2&tabR=R1

Wildfowling was a seasonal occupation; therefore, the presence of wild birds on archaeological sites has been used to determine the time of year an assemblage was created as various species would have only been available to purchase during selected seasons (Serjeantson 2009: 230). In the northern hemisphere, wildfowling usually takes place in autumn and winter because most of the birds are plump after a month of summer reserves (Serjeantson 1998: 25-26). This was the case in Edinburgh city during the 18th century, where wild birds were mainly bought from the market between October and February (McCormick 1998: 60). In Mrs. Beeton's *Book of Household Management* (1861), wildfowl were also noted to be in season between October and March (Beeton 2000). A number of wild birds in Chester would have been caught or slaughtered in autumn and winter, such as the woodcock, turkey, grouse, grey partridge, lapwing, plover, snipe and jacksnipe (Serjeantson 1998: 25; Serjeantson 2001, table 6: 272; Smith 2008: 354).

As previously discussed fish, would have been caught in the River Dee and imported from Ireland, Wales, the Mediterranean and North Sea fisheries. There was a heavy reliance on marine and migratory species and a small amount of freshwater fish. Freshwater fish may have also been a specialist import (Serjeantson and Woolgar 2006: 124).

There was little temporal difference in Chester's provisioning strategy; however, the evidence does suggest further emphasis towards meat production in the late post-medieval period and a decline in the consumption of wild mammals and birds (excluding rabbit). However, the decline in wild species has been observed on other post-medieval sites suggesting that this trend is a national phenomenon (see Chapter Six). On the whole, the animals that were provisioned to Chester reflect what was being supplied by the countryside. However, variations in assemblages show that some occupants had a more varied diet (e.g. a greater diversity of wild species, fish and younger animals), which demonstrates that consumer preference and social status were also driving factors of urban provisioning.

Provisioning during the Civil War

As Chester played a crucial role during the Civil War (1642-1646) it is worth discussing the provisioning strategy during that period. The Civil War had a devastating effect on Britain's food supply, particularly in areas where soldiers were engaged in battle (Thirsk 2007: 97). After the Civil War had ended another war broke out from 1649 to 1652, resulting in soldiers being sent to Ireland and Scotland (Thirsk 2007: 97). To sustain the war effort vast quantities of food was required to feed the soldiers. As a result there was a huge demand for butter and cheese, which was seen as immediate food for soldiers, particularly while on the march (Thirsk 2007: 97). Large quantities of butter and cheese were sent from Cheshire and East Anglia to Ireland and Scotland (Thirsk 2007: 97). Consequently, cheese became more widely available and veal was sold more readily (Thirsk 2007: 122).

When on the march a soldier's basic diet would consist of bread or biscuit, cheese and beer (Edwards 1998). Parker states that the daily ration of food for armies was 1½lb of bread and 1lb of meat, fish or cheese, 6 pints of beer or 3 pints of wine (1996: 75). During Cromwell's campaign in Scotland (1650-1651) a soldier's daily ration was similar; 1-1½lb of bread and 8-12oz. of cheese (Edward 1998). In a three month campaign in the Scottish Highlands, one of the soldiers involved stated that the late wars of Scotland and Ireland, '…were conquered by timely provisions of Cheshire cheese and biscuit (Parker 1996: 75).

In the early-mid 17th-century context at Chester's Roman Amphitheatre there were a markedly higher proportion of young cattle compared to the other centuries. The results revealed that almost half of the cattle from this phase were less than four years of age, at the time of death. Cattle from 25 Bridge Street in the mid-late 17th - early 18th century also had a notable number of young animals. Although the date for 25 Bridge Street was later than Chester's Roman Amphitheatre, it is still worth considering whether the high proportion of calves was influenced by the same events.

The high proportion of juvenile and young animals is most likely attributed to two factors: (1) The rise in Cheshire's dairy industry during the mid-1600s and (2) the demand for Cheshire cheese and butter during the Civil War. Since a large number of farmers worked in the dairy industry many would have directed their energies towards dairy production, especially because the city acted as a base from which soldiers and supplies were sent to and from Ireland (Sylvester 1980: 67; Ward 2009: 64).

Investigation of 17th-century faunal remains from Pontefract Castle also showed that procurement strategies were unpredictable during the war (Richardson 2002: 366). The Civil War contexts had an unusually high proportion of neonatal and calf bones (Richardson 2002: 374). This was interpreted as: either juveniles being culled when fodder was in short supply; evidence of milk production during the Civil War; and/or the utilisation of young animals when the meat supply was low (Richardson 2002: 374). Young cattle, sheep/goat and pig, were also observed in the Civil War context at Sandal Castle. The possibly that they represented livestock that were killed as a result of food shortages during the sieges was considered (Richardson 2002: 374). In light of this evidence, it is also worth considering whether cattle in Chester were killed at a younger age because of a lack of fodder and food shortages. This seems probable as there was a series of bad weather events, which continued between 1646 and 1651; ruining harvests and killing livestock (Thirsk 2007: 98). As discussed earlier the food shortages, demand in dairy products and poor weather conditions, may have resulted in farmers using young cattle to produce offspring before they had reached full adult size. This could have caused the decline in cattle size at Chester's Roman Amphitheatre between the early-mid 17th century and late 17th - early 18th century.

The wars and bad harvests meant that food supply was a major concern in the country and some regions were on the brink of starvation, particularly in areas where soldiers were stationed, as armies often commandeered food (Thirsk 2007: 97-98). To feed a garrison of 3,000 or a field army of 30,000 would require more food than a town or large city (Parker 1996: 75). It has been estimated that over 10,000 pounds of flour and 30,000 pounds of meat would have been required to feed soldiers daily (Parker 1996: 75). Evidently, soldiers caused an immediate strain on local resources as

they began to eat their way through household supplies (Parker 1996: 75; Purkiss 2007: 340, 346). This was not helped by the fast growing food prices and decline in wages, which resulted in food riots (Walter 1991: 104; Thirsk 2007: 98). Chester's residences also faced severe hardships in light of the war. Soldiers, refugees and royalist supporters caused the city to be overcrowded and put a strain on local supplies. The city had to deal with serious food shortages as well as Irish soldiers who created havoc by stealing and carrying out act of general lawlessness (Forster 2003: 117, 120). During times of famine and starvation it was not uncommon for people to eat the meat of animals that were considered taboo (e.g. dogs and horses). Butchered dog remains from the early-mid 17th century at Chester's Roman Amphitheatre may provide indirect evidence for the consumption of 'non-food' animals. At Banbury and Carlisle, sieges during this Civil War also resulted in people eating cats, dogs and rodents (Wilson and Edwards: 1993:51). In Colchester, the high percentage of cats at the site Kent Blaxill and the High St was interpreted as animals eaten during the starvation period at the 1648 Civil War siege (Luff and García 1995: 107-108). However, not all of Chester's residences were at the mercy of food shortages as the wealthy still managed to uphold their diet as long as they could afford it (Garner 2008: 415). In the early-mid 17th century context at Chester's Roman Amphitheatre wild birds associated with high status consumption were found, which suggests that those living on-site managed to maintain their diet throughout the sieges. Evidence from 25 Bridge Stre*et al*so suggests that wealthy residences managed to uphold their status during the war (Garner 2008: 415).

Soldiers' misdeeds were rife during the Civil War, especially as they too had to deal with low food supplies. In areas were soldiers camped or were known to pass by, animals were killed or disappeared (Thirsk 2007: 97-98). Poaching deer and wild birds became 'fair game' during the war. Landowners had to deal with the fact that their animals were going to be pilfered off by soldiers and the local population (Griffin 2007: 102). These actions were best described by the parliamentary soldier, Nehemiah Wharton, who explains in his letters, his regiment's involvement in the ransacking of a deer park (Griffin 2007: 102). According to Wharton, poaching in deer parks became such a common practice that venison was eaten as frequently as beef; although there is no archaeological evidence to support this (Griffin 2007: 102). Poaching during the war would have resulted in a decline in the number of wild species in urban assemblages. This may have attributed to the decline in fallow deer and wild birds after the 17th century.

4.5 Food and status

Post-medieval towns and cities were inhabited by people across the social spectrum and Chester was no exception. The city was home to the gentry, merchants, tradesmen, craftsmen, ecclesiastical members and the poor (Laughton 2008; Ward 2009; Matthews 1999). Different classes were concentrated in various parts of the city (Thacker 2003b). Merchant and gentry houses were generally located on the main streets such as: Bridge Street, Eastgate Street, Commonhall Street, Watergate Street, Castle Street and Northgate Street (Thacker 2003b: 210, 221, 224). However, by the early modern period gentry houses began to appear in the suburbs (Thacker 2003b: 220; 224; 228). In the early 18th century, slum 'courts' were established to house the poor, which were often cramped behind shop frontages in back yards and gardens (Thacker 2003b: 229). Lodging-houses also provided temporary accommodation for the poor, which were set up around the city (Glazier 1996: 54; Hulme 1997-8: 83). At the bottom of the scale, the poorest members of Chester's society lived in cellar-dwellings and the more affluent town worker lived in 'through-terraced housing' (Hulme 1997: 83).

The faunal remains from the 16th-century feasting pit at Chester's Roman Amphitheatre demonstrated how Chester's rich displayed their social position using food. In the Tudor period, social exclusion was defined by diet and was used as the simplest form of class separation (Spencer 2004: 101). Feasts were a social and political statement about wealth and power of the individual(s) hosting the event (DeFrance 2009; Dietler and Hayden 2001). It was a visual display/performance of their money, their home and the skills of their staff (Sim 2006; Brear 1985: 19; Spencer 2004: 121).

Identifying feasting activity archaeologically is not straight-forward; however, it can be achieved successfully by pulling together multiple strands of evidence (see Dietler and Hayden 2001). An example of this can be seen in the investigation of 17th-century animal bones from Worcester Cathedral, which represented the remains of a high-status feasting deposit (Thomas 1999). The evidence used to draw to this conclusion was: the diversity of species; the presence of high status animals; the presence of luxury artefacts; historical documentation referring to audit feasts held at the cathedral; as well as the homogenous appearance of the material (Thomas 1999). The 16th-century faunal remains from Chester's Roman Amphitheatre largely came from one pit, which was most likely backfilled as a singular event or over a short period of time after the pit had gone out of use. It is highly possible that the pit was dug as a rubbish pit. A number of species identified have been associated with high-status consumption (see below). The faunal material also appeared to be homogenous, showing very little difference in colour and texture, which further suggests that the contents represented a one off event. Although there was very little pottery in the pit, high quality

artefacts such as the tin-glazed owl cup and the gold sergeant-at-law ring were found (Edwards 2006a, 2006b). There is also historical evidence referring to gentry housing in the vicinity of the site (Wilmott *et al.* 2006: 17).Taking all of this into account it is highly probable that the remains represented a high-status feast.

In the Tudor period, the same importance that the medieval elite placed on dinners, banquets and feasts continued into the 16th century as well as the majority of the dishes that were enjoyed at that time (Brear 1985: 6, 18-19). Many of the species found in the pit were high-status food commonly eaten by the elite such as: woodcock, golden plover, lapwing, snipe, swan, teal/garganey, grey partridge, peacock, grouse, gull, heron, sandpiper (family), fallow deer and hare. Similar species have also been identified at other contemporary high-status sites (Launceston Castle, Albarella and Davis 1996; Dudley Castle, Thomas 2005a; Worcester Cathedral, Thomas 1999; Wigmore Castle, Thomas and Vann, 2015). Joints of beef and mutton were also served; however, the shoulder joint of mutton was more popular. The tooth wear data for cattle suggests that calves' heads were served. This was a popular dish in Britain which was served up until the Victorian Period (Beeton 2000: 205-206). Suckling pigs were served and probably pigs' head and feet. The flesh of suckling and immature pigs was popular among elite and was a favourite at medieval feasts (Hammond 2005: 60, 64; Holderness 1989: 154). Brawn and pigs feet were a popular dish in Tudor England and have been referenced in a number of literary sources (Simon: 1959: 5; Spencer 2004: 117; Furnivall 1868: 156; Sim 1997: 114). The abundance of chickens suggests that a minimum of 25 birds were eaten at the feast. Two chicken skulls had been sagittally split down the middle; a practice that has been observed on late medieval-early modern chicken, geese and swan skulls (García 2009: 125; Gidney 1993: 7). Reasons for this practice have been proposed by Gidney (1993) which includes: to attach an ornament to the head for display purposes; to expose the brain inside; or a special way of carving the bird. In the Tudor period, crowned and gilded swans were used as a way to impress guests attending a formal dinner (Spencer 2004: 117). Fish identified in the feasting pit were typical species found in the region (e.g. herring, cod, smelt and eel). However, there were expensive and popular fishes such as salmon/trout, turbot and sole (Simon 1959: 16, 19-20).

In the early modern period, there was a preference for eating the wings of wildfowl (Thirsk 2007: 260). A good example of this can be seen in John Russell's *Boke of Nurture* (Book of Nature), which explains how to carve roast birds. He instructs the reader to remove the wings of a capon or hen with a knife; 'mince' them in a sauce and give the wings to the lord (Furnivall 1868: 26). He also explains how to take the wings off a pheasant, partridge, plover or lapwing to serve them on a dish (Furnivall 1868: 27). The *Boke of Keruynge* also instructs how to remove the wings and/or legs of

wild and domestic birds to serve them on a platter after dipping them in a syrup, wine or ale (Furnivall 1868: 158). Based on general observations of body part representation for woodcock, snipe and sandpiper (family) it is worth considering whether this preference for wings is reflected in the assemblage. A dominance of wings was also noted for wild birds at Stafford Castle (Sadler 2007).

Feasts were held for a number of reasons, including weddings, funerals, Shrovetide, Michaelmas and Christmas (Brear 1985: 18; Sim 1997: 113). It was possible to roughly narrow down the time the feast took place based on the presence of wild and domestic birds (Serjeantson 1998; Serjeantson 2001). A number of the birds found in the pit would have been captured during autumn and winter: woodcock, grey partridge, lapwing, golden plover, snipe, curlew, swan, grouse and turkey (Serjeantson 1998: 25; Serjeantson 2001, table 6: 272). Geese were also usually killed at the end of autumn (Serjeantson 1998: 26). Taking this into consideration it is likely that the feast took place sometime between September and March. In the Tudor period the biggest feast during that time of year was Christmas (Sim 1997: 114). The foods typically served at Christmas was also found in the pit such as brawn, veal, turkey, goose, capon, mallard, mutton, beef, swan, rabbit and woodcock (Sim 1997: 114; Furnivall 1868: 164-166). A medieval Christmas dinner enjoyed by the Bishop of Hereford and guests, also included consuming large quantities of roast hens or capons (Hammond 2005: 60). Although there is no definitive way to identify that reason for the event, the scale and magnitude of the feast suggests that it was an important occasion.

At Chester's Roman Amphitheatre there were also temporal differences in the presence of species and the age of animals consumed on site, which may point to a change in status. In the 16th- and 17th century there were a high proportion of wild birds and mammals consumed on site. Thereafter, there was a decline in the number of wild species, particularly in the 18th- and 19th century, which had edible wild birds and mammals. Determining the reason for this shift is complicated as it may be tied into other factors as well as a change in status. In the 17th century, many royalist hunting parks and estates were sequestered and sold during the Civil War and landowners sought to gain more profit from their hunting parks by converting the land to farmland (Griffin 2007: 103, 106; Thirsk 1985: 367). This may have also contributed to the decline in wild species on site. In addition, the age of animals consumed changed over time. In the 16th and 17th century, more veal and suckling pig were eaten compared to the 18th and 19th century. In the 19th century, the Georgian houses in the area were demolished. Dee House, the 18th-century Georgian mansion located near to the excavation, was turned into a convent and boarding school for girls (Wilmott *et al.* 2006: 22). The difference in the number of wild species and the age profile of animals could be attributed to this change of site ownership (see Chapter Two, Site History for more detail). However, despite the

decline in social status, species such as woodcock and the presence of major meat-bearing bones for cattle, sheep/goat and pig suggest that wealthy individuals were still in the area. This is likely as suburban houses owned by the gentry were still situated nearby, particularly in Foregate Street (Thacker 2003b: 224; 228).

Based on the faunal remains from 25 Bridge Street it is evident that the occupants on site were wealthy. This was noted by the diversity of species (including wild mammals, birds and fish) and the high proportion of major meat-bearing bones for cattle, sheep/goat and pig. In addition, more veal, lamb and young pigs were consumed compared to other Chester sites. The consumption of young animals and wild birds was consistent over time, indicating that the site continued to be occupied by the wealthy, in contrast to Chester's Roman Amphitheatre. Documentary evidence refers to properties and shops in the area that were owned by ironmongers, hat makers, skinners, aldermen, drapers and merchants, who would have had a reasonable amount of income (see Backhouse 2008). The 16th century witnessed a rise in social mobility, which was associated with the emergence of the middle class (e.g. merchants, traders and yeomen) (Spencer 2004: 101). In the late 16th and 17th century, Chester also saw the rise of this new emerging power as merchants began to build houses and shops around the city (Garner 2008: 413; Laughton 2008: 159). The middle class demonstrated their wealth and refined tastes by emulating the foods traditionally eaten by the elite and sought to enjoy the food and privileges (e.g. hunting deer) that were ordinarily exclusive to the elite, as a way of displaying their new found wealth and power (Thirsk 1985: 371; Spencer 2004: 101, 127).

The Nicholas Street Mews assemblage also showed evidence for high-status consumption as wild species such as fallow deer, pheasant, golden plover, woodcock and teal/garganey were present in small number. The body part representation suggested that major meat-bearing bones for cattle and sheep/goat were consumed. The site was originally owned by the Black Friars, after which it became land and garden space for nearby houses and town mansions from the late medieval period, which attests to the high-status origins of the site.

Animal bones from the slum-courtyard at Hamilton Place provided evidence for moderate to low status consumption. The main characteristics of the assemblage included: a high proportion of minor meat-bearing bones for cattle, small portions of butchered bones (probably for soup-making) and the virtual absence of edible wild mammals and birds. The residence had a basic diet, which consisted of beef and mutton with a small amount of veal and pork. Although they had some access to wild resources (e.g. rabbit and hare), it only constituted a small amount to the overall diet. The presence of three turkey bones is interesting considering that it was a high-status animal in the early modern period. However, by the 19th century turkey was more widely accessible; therefore, it lost

its original status as a luxury food item (Fothergill 2012: 45). Excavation of urban slum at Hungate, York and St Giles Court, London, had a similar range of species (Hunter-Mann 2008; Pipe 2009). Although at the former site a fallow deer radius and woodcock was found (Hunter-Mann 2008).

The faunal remains from 10 Commonhall Street, City Road and 3-15 Eastgate Street showed less evidence for high-status consumption. At 10 Commonhall Street the age of domestic animals reflected wider husbandry strategies and the only high-status animal was hare, which was represented by one bone. There was evidence of domestic refuse at City Road, which included one turkey and fallow deer bone. However, given the nature of the assemblage and the small amount of domestic refuse present, it is not possible to confidently comment on the status of the site. The only evidence for wealth at 3-15 Eastgate Street was the presence of woodcock and the emphasis on major meat-bearing elements.

The animal bones from Chester suggest the presence of a mix of social classes in the city as well as differences between high-status sites. For instance, the faunal remains from Chester's Roman Amphitheatre, Nicholas Street Mews and 25 Bridge Street, showed that Bridge Street had better access to young animals and luxury foods. The faunal evidence from 3-15 Eastgate Street suggests inhabitants may have been some wealth in the area whereas 10 Commonhall Street, City Road and Hamilton Place exhibited little evidence for wealth. Chester's Roman Amphitheatre, 25 Bridge Street and Nicholas Street Mews all witness a decrease in the number of wild birds. Overall, most of the sites displayed some form of dietary diversity and the species found in Chester were in-keeping with other contemporary post-medieval urban sites.

4.6 Industry and craft-specialisation in Chester

Chester's occupants were involved in a number of industries, crafts and trades. The city was home to butchers, merchants, cooks, fishmongers, brewers, cloth workers, mercers, bakers, carpenters, blacksmiths and goldsmiths, to name a few (see Laughton 2008: 133-161). However, by the late 16th century more than a fifth of craftsmen had professions in the skin trade, which continued to be the city's most lucrative industry until the 19th century (Carrington 1994: 81-82; Beck 1969: 53; Hodson 1978: 71, 117; Ward 2009: 49, 95). This is not surprising given the region was dominated by cattle farming, which would have ensured a steady supply of hides.

Those involved in the skin trade included: tanners, tawyers, glovers, corvisers, curriers, saddlers, parchment/vellum makers as well as butchers and barkers. Leather was used to make clothes, saddles, military equipment, shoes, bottles, bags and belts (Laughton 2008: 145-147; Carrington

1994: 80). In the medieval period, skinners, glovers, tawyers and shoesmakers were prominent figures of city life; (Laughton 2008: 148-149; Thatcher 2003a: 51). By the 16th- and 17th century shoemakers, glovers and tanners made up a large proportion of those involved in the leather trade (Forster 2003: 102). The latter two usually sold their products wholesale, whereas saddlers and shoemakers sold to retail shops (Forster 2003: 102). Of all those involved in the leather trade, tanners were considered to be at the bottom of the scale because of the smells produced by the tanning process (Ward 2009: 49). In the medieval period, there was also a reduction in the export of leather goods which could have been attributed to their lowered status (Yeomans 2007: 100). However, some tanners did enjoy a reasonable amount of success, particularly in regions where leather production was common (Yeomans 2007: 100).

Leather production was separated into two trades: the heavy and light leather industry (Yeomans 2006: 31). Cattle and horse were classed as heavy hide production whereas sheep, goat, deer and game were classed as light hide production (Carrington 1994: 81). Tanning was a process carried out by tanners, tawyers and curriers to treat cattle hides and occasionally sheepskin with vegetable tannins (which came from the bark of oak trees) (Yeomans 2006: 31). It was a timely process, which took up to two years to complete (Laughton 2008: 146). The process involved: (1) removing the hides from the carcasses; (2) getting rid of the hair and excess flesh by soaking the hides in lime; (3) systematically re-soaking the hides in a number of pits with tannin solution of varying strengths; (4) stacking the hides on top of one another with layers of oak bark in-between while submerging it in a stronger tannis liquor; and (5) removing the hides from the solution so they could be dried and then passed on to the currier, who usually softens the hides by soaking it in water or urine (Yeomans 2006: 31-32). Chester's leather industry benefited from the supply of oak bark from Delamere Forest, Shotwick and Nantwich (east Cheshire) (Laughton 2008: 164-167). Records show that the bark of oak trees was sold to Chester's tanners and corvisers (Laughton 2008: 164).

Tawying was a process that was usually carried out to treat the skins of sheep, goat, deer (and sometimes horses and dogs). Although the process was similar to tanning, the skins were treated with oil and alum rather than tannis (Yeomans 2006: 32). After coating or soaking the skins in an alum and oil mixture, which was sometimes added with salt, flour, oatmeal and egg yolk, the skins were hung for about a month and then reshaped and smoothed using egg yolk (Yeoman 2006: 32-33). Sheep were processed differently, in that prior to soaking the skin in alum and oil, it was smoked in order to putrefy the roots of the wool, which were plucked and bought by felt-makers (Yeoman 2006: 32). After the hides and skins were processed, the finished product would have been

passed on to various craftsmen (e.g. shoemarkers, saddlers, glovers) who manufactured them into products (Carrington 1994: 81).

The tanned/raw hides, skins and pelts which supplied the leather industry came from the hinterland and were imported from Ireland and the Isle of Man (Carrington 1994: 81; Laughton 2008: 149; Hodson 1978: 117; Thacker 2003a: 46). These included cattle hides, sheep, goat, lamb, rabbit, marten, badger and otter skins/pelts. Butchers, traders and local graziers also supplied hides and skins and some tanners had their own farms (Carrington 1994:81; Laughton 2008: 146; Forster 2003: 102). From the 17th century, Chester's most common export was leather (Carrington 1994:81; Beck 1969: 55; Knowles 2001: 14). Leather was exported to Ireland and tanned calf skins were shipped to France and Spain (Beck 1969: 55; Carrington 1994: 82; Knowles 2001: 14). The city also became one of London's main suppliers of leather goods (Carrington 1994: 82).

Evidence for hide and skin processing was observed at a number of sites in Chester. City Road and Canalside/Witter Place produced industrial assemblages associated with tannery waste. Both sites produced a high frequency of cattle horncores, which is typical of hide processing as the horncores and/or feet are commonly left attached to the hides (Serjeantson 1989: 136). In the late medieval period, local and national urban legislations attempted to remove/exclude animal industries from cities and towns to the suburbs because of the noxious smells they created (Yeomans 2004: 70). Based on documentary evidence, most of Chester's heavy leather trade took place outside of the city walls (Carrington 1994: 82; Ward 2009: 49). Therefore, it is highly likely that tanneries were operating in the City Road and Canalside/Witter Place area. Archaeological evidence of tannery waste has been discovered at a number of sites outside of the city wall. At 5-7 Foregate Street, a medieval ditch was excavated which had large quantities of oak bark and cattle horncores and excavations at Love Stre*et* also revealed tanning pits (Laughton 2008: 146; Carrington 1994: 82). At Gorse Stack, cattle horncores and horse carcasses were found which was characteristic of tanning waste (Holmes 2012: 208). Excavation of the 19th century tannery complex at Witter Place, revealed a large assemblage of cattle horncores and metapodials, similar to the assemblage at City Road (Sykes 2002). Records also refer to two tanners who were renting land in The Bars for their businesses (Laughton 2008: 146; Carrington 1994: 82).

There has been some debate why certain elements were left attached to the skins and not others (see Albarella 2003; Serjeantson 1989; Sykes *et al.* n.d.; O'Connor 1984). Cattle horncores were the most abundant elements at City Road and Canalside/Witter Place. Since the head is the heaviest part of the animal, high frequency of horncores on industrial sites have baffled scholars, because logically it would be practical to transport skins without their heads. Sykes *et al.* (n.d: 10) suggests that the

presence of horncores is most likely to do with how and where the tanner obtained their skins. Skins bought from a local source may have the horncores and metapodials attached whereas imported skins may have had the horncores or/and feet removed to get rid of the excess weight. Another important factor to consider is the value that was attributed to certain animal parts. The sheath of horncores was a valuable commodity, which would have been ideal for fashioning objects such as window and lantern panels, drinking horns, cutlery handles and combs (Albarella 2003: 74; Serjeantson 1989: 139; Yeomans 2006: 39). Therefore, tanners may have kept the horncores to sell the sheath to hornworkers (Serjeantson 1989: 139; Yeomans 2007: 73). Ten horncores from City Road had their tips sawn off, which was a common method for removing the sheath from the core (Sykes *et al.* n.d.: 5; Yeomans 2006: 41). This was also observed on medieval and post-medieval cattle horncores from Chester's Roman Amphitheatre (Gordon 2013; see Appendix One). One of the most common modifications on the horncores from City Road was the presence of nails or nail holes on the aboral surface (Sykes *et al.* n.d.: 6). This has been noted on cattle horncores from a tannery site in Willemstraat, Bruges (Ervynck *et al.* 2003a) and similar examples were seen at a tannery site in London (Yeomans 2006: 176). The reason behind this modification is unclear, although it is associated with hide preparation (Yeomans 2006: 176).

The lack of cattle foot bones at City Road and Canalside/Witter Place could imply that they were sold to bone workers and craftsmen as metapodials were a valuable raw material (Yeomans 2004: 73). Neatsfoot oil could also be made from cattle foot bones by boiling them in water, which was used as a leather softener by curriers and other craftworkers of leather products (Serjeantson *et al.* 1986: 231). Butchers in North England were also known to sell neatsfoot oil, so it is likely that the metapodials were sold or kept by butchers before they sold the hides (Serjeantson *et al.* 1986: 231). The marrow from metapodials was also used to make glue and/or tallow to make soap and candles (Thomas and Vann, in 2015).

The assemblage of horse remains from City Road showed that tanners were also involved in processing horse carcasses. All the skeletal elements were present, which suggests that leather production was taking place on-site (Yeomans 2004: 75; Albarella 2003: 76). Processing horse hides on industrial sites was more common at tanneries (Yeomans 2006: 38). The horses were brought to City Road alive or as complete carcasses and were skinned, butchered and de-fleshed. The majority of the horses were adult; many of which were over 7-10 years of age with some as old as 20 years and above (Sykes *et al.* n.d.: 6). A number of the horse remains had pathologies related to old age, which could suggest that the remains came from old working animals. This was also noted at The Green, Northampton; a tannery site where many of the horse remains were from sick, aged

individuals (Shaw 2011: 125). There was not much documentary evidence regarding the production of horse leather in Chester, maybe because it only made up a small proportion of the leather trade (Sykes *et al.* n.d.: 10). Although horse leather was considered inferior to cattle leather, it was still used to make a range of products (Yeomans 2004: 75). The horses at City Road probably came from all over the region from farmers, horse traders and owners. Sending horses to tanneries was typical among horse owners. A quote in Clarkson (1960: 180), as cited by Yeomans (2006: 216-217) explains that 'When the husbandman hath a horse killed by mischaunce or otherwise he tanneth his hyde it easeth his losse …'.

The meat from the carcasses were de-fleshed and filleted off the bone, suggesting that the flesh was also utilised. Horse meat was commonly used to provide food for dogs and cats. In Victorian London, the Knackers' Yard, Harrison Barber Ltd, slaughtered 26,000 horses a year and processed 70 tons of horsemeat per week, which were bought by retailers' who sold the meat as food for cats and dogs (Gordon 1893: 188-189). Evidence for processing horsemeat as food for cats and dogs has also been observed at other archaeological sites. Excavated partial horse skeletons (c. 1710) from Dudley Castle had butchery marks, which suggested that horsemeat was removed to feed hunting dogs (Thomas and Locock 2000). Similarly, butchered horse skeletons at Witney Palace were processed for their flesh to feed the hounds (Wilson and Edwards 1993).

The low proportion of major meat-bearing elements at City Road suggests they were in high demand and were exported from the site (Sykes *et al.* n.d.: 11). Horse bones had a range of uses; they could be boiled to make oil, used as fertiliser, made into objects and used as building material. Two right horse mandibles (late 16th- to 18th century) found in a ditch at Castle Mall, Norwich, were polished at the bottom due to constant wear (Albarella *et al.* 2009: 77). Based on pictorial evidence it was proposed that the mandibles were used as a sledge; as bones were commonly used to make sledges and skates (Albarella *et al.* 2009: 77). Horse remains excavated from a site in London were used to support the floor of a leatherdressers' workshop, along with sheep metapodials (Yeomans 2006: 156).

Documentary records frequently mention the separation of the heavy (hides) and light (skins) leather trade. The heavy leather trade was strictly regulated and those involved in the trade were discouraged to practice both (Albarella 2003: 72). However, archaeological evidence has shown that both trades sometimes operated in the same area, which contradicts the historical evidence (Albarella 2003: 76). The species present at City Road and Witter Place suggest that tanneries in Chester operated differently. This probably depended on who owned the tannery. For instance, the City Road assemblage represented the heavy leather trade whereas Witter Place showed that both

heavy and light leather trades were practiced on site (Sykes 2002). Chester's wealthy leather manufacturer, Robert Brerewood, worked as a tanner, glover and also dealt with sheepskin (Forster 2003: 102). This demonstrates that it was possible to work in more than one trade. If one did, it surely would have put them at an economic advantage.

In Chester, those involved in the light leather trades and the production of leather products were normally located inside the city because the smells emitted from those industries were not as offensive. Tawyers, glovers, saddlers, cobblers, shoemakers, glovers and skinners were concentrated in different parts of the city. Many belonging to these professions were based in Bridge Street and around the castle, which became known as Gloverstone (Garner 2008; Laughton 2008: 145,148; Ward 2009: 57; Thacker 2003a: 76). A lane that ran along the river bank below the castle was occupied by a number of skinners which was called Skinner's Lane (Ward 2009: 57; Laughton 2008: 149).

In the post-medieval period, there was less evidence for tawying probably because Cheshire's hinterland had a limited number of sheep. However, sheepskins were commonly imported from Ireland in great quantities (Thacker 2003a: 46, 69). In 1525-6 in Chester, over 13,000 lambskins, 10,200 sheepskins and 90 goatskins came from Ireland (Thacker 2003a: 69). At 25 Bridge Street and Chester's Roman Amphitheatre, there was more evidence for tawying in the medieval period compared to the post-medieval period. This may be because by the 17th century sheep and goatskins were not as frequently imported to Chester (Sykes *et al.* n.d.: 10). At 25 Bridge Street in the late 15th - mid-17th century there were a high proportion of lambs, which may have represented imported lambskins (Smith 2008: 352). However, by the mid-late 17th - early 18th century most of the sheep/goat at 25 Bridge Street were three years of age and older. This change in the slaughter profile could be reflecting a decline in the importation of sheep skins after the 17th century. The faunal and historical evidence indicates that goat skins were processed and sold in Chester, although the lack of goat remains suggests that the trade in goat skins was small in comparison to sheep, cattle and calves. Records state that goat skins were traded in Chester and kid skins were supplied from Ireland (Carrington 1994: 81; Yeomans 2006: 28). In 1666, a tawyer called William Jackson travelled from Southwark, London, to Chester to buy £100 worth of goat skins (Yeoman 2006: 198).

The faunal remains at 25 Bridge Stre*et* also provide evidence for the trade in wild mammal skins and pelts. Fox, pine marten, red squirrel and polecat/ferret were skins that were highly sought after by skinners and furriers, which were sold for a hefty price (Smith 2008: 361; Thacker 2003a: 69). In Chester, between 1525 and 1526, 2,300 badger pelts and 640 marten and otter skins were imported

from Ireland (Thacker 2003a: 69). Records also show that hundreds of fox skins arrived from Ireland in the 16th century (Smith 2008: 361). By 1550 the price of skins had raised so rapidly that marten and otter skins tripled and quadrupled in price (Thacker 2003a: 69). Skinners, furriers and glovers also dealt with deer and rabbit skins (Laughton 2008: 148-149). At 25 Bridge Street there was also evidence for processing rabbit skins on site.

At 25 Bridge Street, juvenile and adult cats dumped in a cess pit suggested that they were being bred on site and processed for their skins (Smith 2008: 360). High quantities of young cat remains have been associated with pelt production, which has been observed at sites in Cambridge, Ireland and West Cotton (Luff and Moreno García 1995; McCormick 1988; Albarella and Davis 1994). Although the cats at 25 Bridge Street showed no signs of butchery, it is still likely that these animals were skinned for their fur, as very experienced skinners does not always leave butchery marks (Luff and Moreno García 1995: 361). Cat skins were noted in the inventory of the skinner Robert Fletcher, who was a resident at Bridge Street. Cat bones from Chester's Roman Amphitheatre also had cut marks typical of skinning. Cat fur was less desirable then marten, fox and rabbit as it was considered low quality (Jones 2002: 105; Serjeantson 2009: 178). Cat skinning became more common in the 10th- and 11th century and peaked around the 12th to 16th century, with the majority coming from urban sites (Fairnell 2003: 62). Cat fur was traded in Britain up until the 19th century but probably declined thereafter due to concerns about animal cruelty (Velten 2013: 190; Kalof 2007:124). At Chester's Roman Amphitheatre and Hamilton Place dogs were found with skinning marks and at Witter Place dog fur was processed on an industrial scale (Sykes 2002). Archaeological sites with evidence for dog skinning was more frequent on urban and high status sites (Fairnell 2003: 63). Their fur was used to make muffs and buskins, and like cats, it was not highly valued (Fairnell 2003: 63-64). Skinners and curriers dealt with dog skins; however, the presence of dog remains at Witter Place showed that tanners were involved in the trade.

Deer antlers were found at Chester's Roman Amphitheatre, 10 Commonhall Street, Nicholas Street Mews, Hamilton Place and 3-15 Eastgate Street, which indicates that some form of craft-working was taking place at these sites. Antlers were used to make a range of objects including combs, handles for cutlery and playing pieces (MacGregor 1989: 107, 110). At Hamilton Place the residents worked as blacksmiths and were involved in metal-working and button-making (Matthews 1999: 165, 168; Edwards 2003). Bone plates were found on site, which were made by slicing the bone lengthways (Edwards 2003). Most of these plates had circular cut-outs similar to bone buttons, which had been found on site. Documentary evidence refers to a button maker and a bone cutter in the 18th century, who owned a bone cutting business in the Handbridge area (Edwards 2003). Some

of the inhabitants at Hamilton Place probably took up button making as a way of providing extra income and/or for personal use (Edward 2003).

4.7 Chester's urban identity: Summary

Domestic livestock made up the majority of the animals consumed at Chester. Although wild species made a minor contribution to the diet, the range of species suggests that Chester's inhabitants enjoyed a reasonable varied diet. Cattle were the most common animal as the region was geared towards a pastoral and dairy economy. Sheep were the second most common animal as the environment was less well suited for sheep farming and pig was the least abundant of the three major domesticated species. Beef, veal, mutton, lamb and pork were the staple meat products of the city. Chicken and geese were popular domestic birds, which provided meat and eggs. The few goats present in the city were likely to have been imported as skins or bought for consumption. Although horses were a prominent feature of the city, the majority were probably sent to tanneries, knackers' yards or the countryside once they had out lived their use as working animals.

Cats and dogs were probably represented by stray and feral animals; however, dog breeds such as lapdogs and hunting dogs were most likely kept as pets by the rich. Burials of cats and dogs in the later post-medieval period suggest that animal companions were becoming more popular. Wild resources such as rabbit, hare and deer would have provided an additional source of protein. Fallow deer was the most common species of deer; however, their numbers declined after the 17th century, as a result of habitat loss and a decrease in hunting. There were a range of wild birds consumed in the city; many were waders and wild galliforms. They not only added variety to the diet but were also used to display wealth. Wild bird species also decline over time; a phenomenon that has been observed on other post-medieval sites. Reasons for this could be due to habitat loss, laws established for the protection of wild birds and objections against shooting small birds (see Chapter Six). Chester was ideally located close to the River Dee and the Irish Sea to exploit a range of marine and migratory species. Herring, eel, flatfish, gadidae and smelt were the most popular food fishes, which would have been eaten fresh, smoked, salted, pickled or dried. The most important fishery in Chester was the Kings Pool, which made most of its profit from salmon. Inshore fishing was carried out by fishmongers who own stalls on the Dee and by people who rented fish traps and garths. The city's fish was also imported from Ireland, Wales, the Mediterranean and North Sea Fisheries.

Most of the city's food was supplied by the hinterland, Ireland and Wales. Animals arrived as dressed/undressed carcasses and as pre-butchered joints. Juvenile chickens and neonatal pigs

suggest that people were breeding these animals in backyards, gardens or in open areas. Pigs may have been kept by those involved in brewing and owners of butter shops. Wild animals were obtained from different environmental niches such as the River Dee, the salt marshes, hunting parks and near the coast. The Civil War in Chester had an impact on husbandry strategies, resulting in farmers producing more cheese and butter for soldiers. The food shortages could have caused the residents to eat dogs, as the city faced starvation. The rich, however, managed to maintain their high-status diet because they had the money to do so.

Chester was a hierarchical city and this was represented by the food that was consumed on site. Chester's middle class merchants and tradesmen ate similar foods to the aristocrats as a way of displaying their wealth. Occupants at 25 Bridge Street and Chester's Roman Amphitheatre displayed the most wealth as they ate a greater range of wild birds, fish, deer and young animals. At Hamilton Place the food eaten was in-keeping with the social status of the inhabitants, as there were few edible wild mammals and birds as well as a lack of major meat-bearing elements.

Evidence for industrial activity demonstrated the importance of the leather industry and where different trades took place within the city. Cattle and horse hides were processed as well as the skins/pelts of sheep/goat, dog, cat and other wild mammals (e.g. fox, polecat/ferret, red squirrel and pine marten). Status of individuals involved in certain trades provided insight into industries and businesses carried out by different social groups. Based on the historical and faunal evidence, Chester's middle class made a living by working in the leather trades and as merchants and craftsmen. The evidence from Hamilton Place suggests that the working class were involved in the blacksmithing and made money from home businesses such as button-making.

5 Chapter Five - Regional Site Comparisons: A Zooarchaeological Analysis

5.1 Introduction

In this chapter I will describe the results of the zooarchaeological regional site comparison undertaken on 148 post-medieval urban sites in England. The chapter will provide some background information about the sites and the data used for this review, after which the results will be presented under the following themes: species representation, butchery and body parts distribution, slaughter profiles, livestock size and shape and pathologies.

5.2 The sites and the data[1]

The post-medieval sites were located in the East Midlands, East of England, London, North East, North West, South East, South West, West Midlands and Yorkshire/Humber (figure 5.1; see Appendix Four, figure 4.1). Southern England (South East, South West and London) produced the most sites (96), followed by Central England (East Midlands, East of England and West Midlands) (33); Northern England (North East, North West and Yorkshire/Humber) had the fewest (19). This investigation was affected by the accessibility to faunal reports and data. The representation of sites will also influenced by external factors such as the number of excavations undertaken in the region as well as the climate and geology of an area, which affects bone preservation. For example, the dearth of northern sites was observed in other period regional reviews, illustrating the paucity of sites in the area (see Holmes 2011 and Sykes 2007a). This is possibly because the number of cities and towns in Northern England are fewer in comparison to the South as well as the acidic nature of the soil in the region, which effects bone preservation (Huntley and Stallibrass 1995: 15). The state of post-medieval investigations in some parts of northern England may also be a contributing factor. In the 2007 Yorkshire archaeological research agenda, it was acknowledged that the early modern period was not fully appreciated for its archaeological and research potential (Roskams and Whyman 2007: 6, 37). The South, particularly London, produced the most sites. This is unsurprising considering the high amount of urban development and developer-funded archaeology that was

[1] Regions and counties were grouped following the Office for National Statistics 2011 map of *Regions, Counties and Unitary Authorities* at http://www.ons.gov.uk/ons/guide-method/geography/beginner-s-guide/maps/index.html.

taking place in the city. The curation and research of archaeological evidence from the city was carried out regularly, which has resulted in the archiving of archaeological data. The South West had the fewest sites in Southern England, which may be due to the acidic nature of the soil in the region (Soil Map of England and Wales, Sheet 5: 1983).

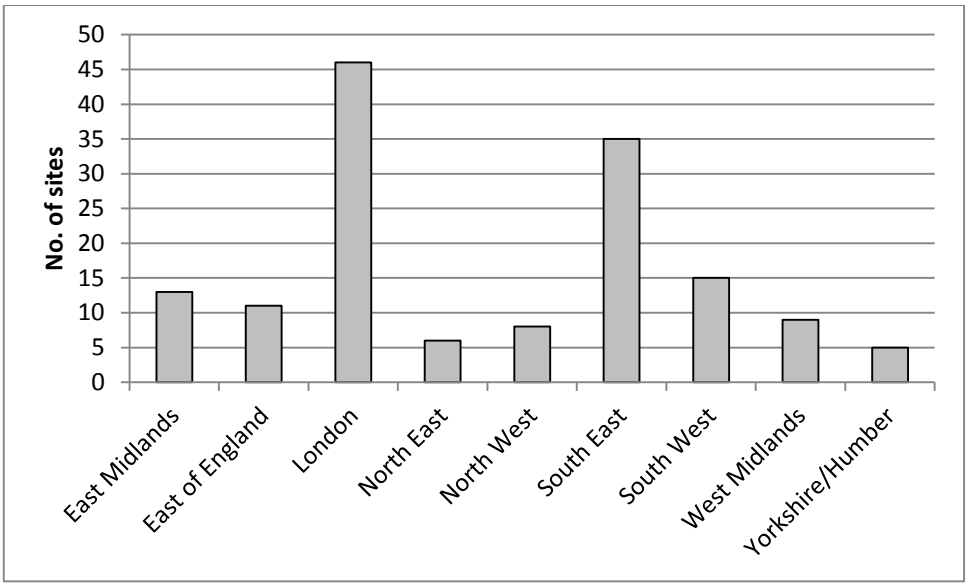

Figure 5.1: The number of post-medieval urban sites yielding analysed faunal assemblages by region

The data also varied chronologically. A large number of the samples originated from multi-period sites; with sites producing up to five difference chronological phases in the post-medieval period. It is apparent that after the 17th century the number of post-medieval sites with faunal data diminishes, with the 19th to 20th century producing the fewest sites (figure 5.2). Some chronological phases were more common including the 16th and 17th century and the 16th-18th century (the latter largely represented by London sites). The high representation of 16th and 17th century sites and low representation of 18th to 20th century sites probably reflects the 1750s cut-off point for the investigation of archaeological material as this period marks the transition into 'modernity' (Thomas 2009). The lack of post-medieval faunal assemblages in the 19th-20th century could also reflect improvement in waste management strategies resulting in the removal of rubbish from residential areas (see Chapter One).

The majority of the faunal data were represented by urban 'domestic' assemblages, followed by 'mixed' assemblages (with both 'domestic and industrial activity) (figure 5.3). These categories have to be considered cautiously as urban faunal assemblages are complex and can differ greatly from

one another (Maltby 1979: 3). For instance, most domestic assemblages showed some degree of industrial activity and the extent of that evidence varied and changed over time (e.g. see 25 Bridge Street, Chester). It is likely that many of the domestic assemblages encapsulated a broad spectrum of activities, social classes and human behavioural practices (e.g. butchery, cooking, burning, waste disposal). High-status sites referred to castle, palace and manor sites; however, there were a number of domestic sites, which showed signs of high-status consumption (See Chapter Seven). However, for the sake of simplicity these sites were referred to as 'domestic' because it was not possible to consult all the original reports to gather information regarding site status. Ten sites were not assigned to a site classification; however, it is most likely these sites represented mixed or domestic activity. It should be noted that site types were only adopted as a crude classification for urban assemblages. As urban spaces were continuously changing and developing to accommodate the growing population, it can be anticipated that this constant transition will also be evident in the faunal assemblages. However, they were a useful way to help identify certain characteristics or patterns within the data.

Sample Size and Recovery Biases

Zooarchaeologists have long been aware of the correlation between the size of an assemblage and the number of species identified at archaeological sites (Bartosiewicz and Gál 2007; Byrd 1997; Grayson 1984; Hambleton 1999; Holmes 2011; Lyman 2008). This can create problems when comparing assemblages because the presence/absence of species may be affected by the assemblage size rather than the species that were exploited. This is important to consider when interpreting faunal remains in order to gain a better understanding of past husbandry practices. For example, a study of the comparison between prehistoric faunal assemblages and sample size revealed differences between the number of mammal and bird taxa identified. The investigation also demonstrated that the identification of birds was influenced more by the assemblage size than mammals because they were subjected to different taphonomic, anatomical and taxonomic factors (Bartosiewicz and Gál 2007).

Regression analyses were carried out on the post-medieval data to understand the extent to which sample size affected the diversity of identified taxa. The strength of this correlation is determined by the magnitude and statistical significance of the two variables (Lyman 2008: 165). Based on the results it was evident that there was a strong positive correlation between sample size and the number of identified species in assemblages with more than 100 NISP (P=0.00) and 300 NISP (P=0.00) (see figures 5.4 and 5.5).

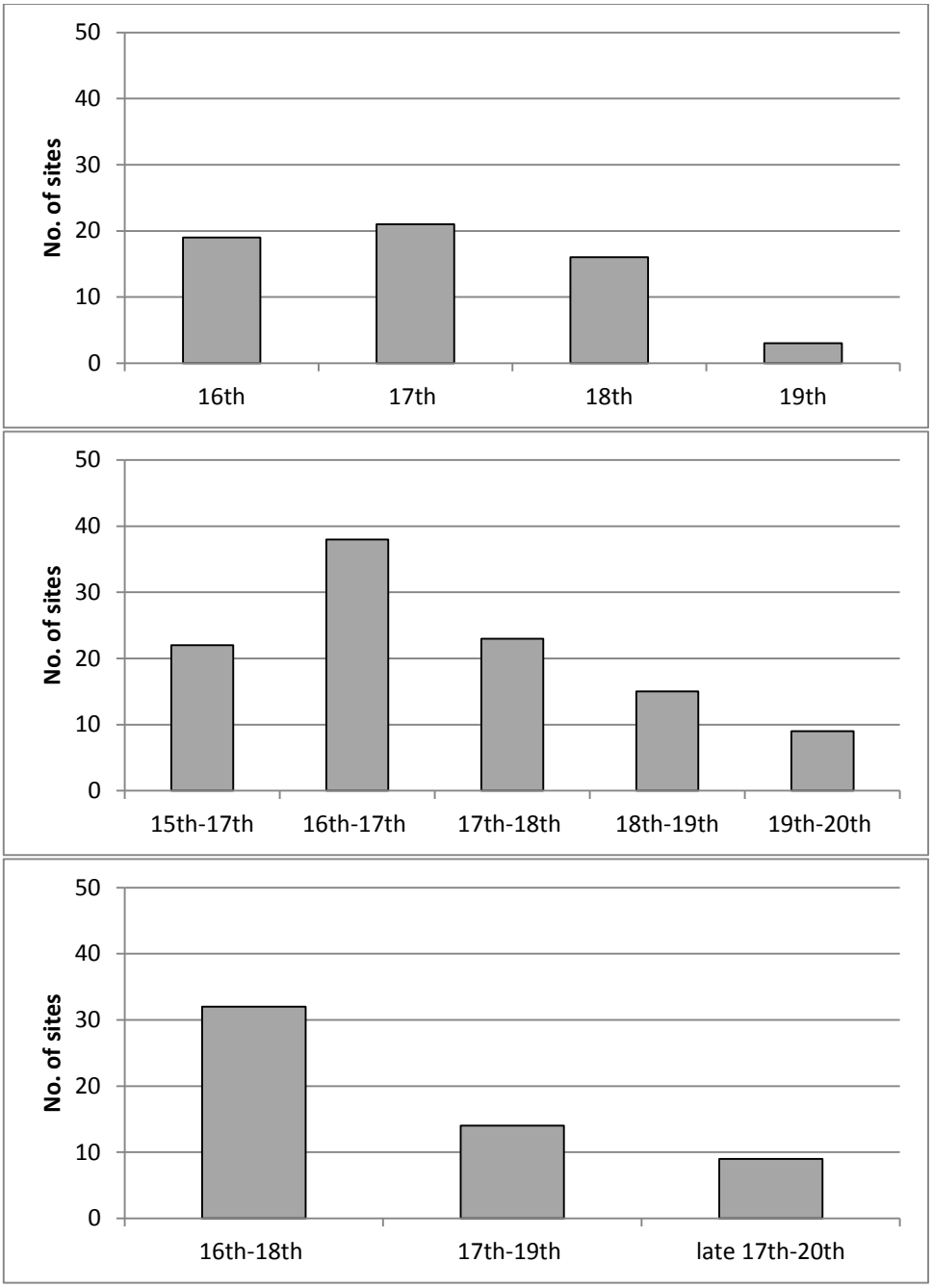

Figure 5.2: The number of sites by chronological group

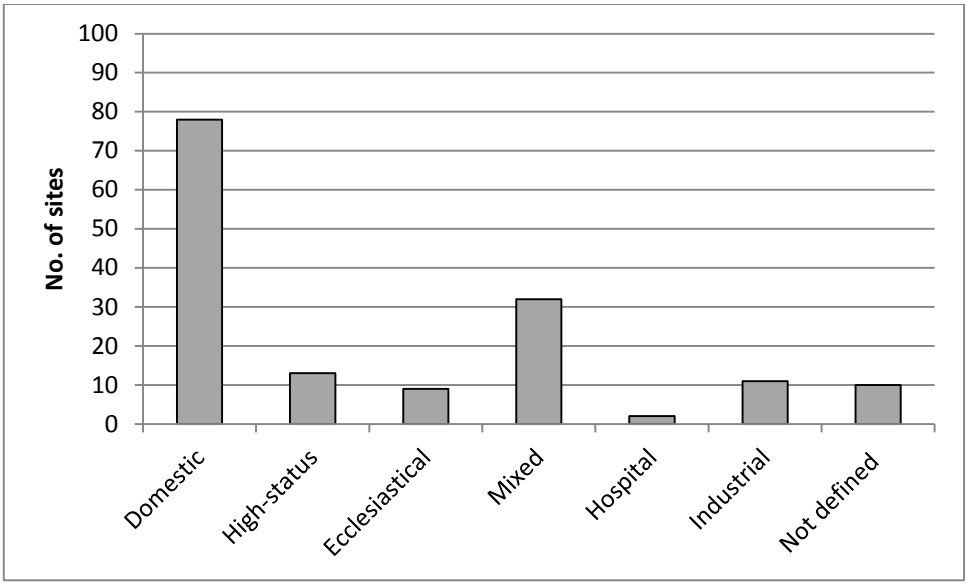

Figure 5.3: The number of multi-period sites by site type

However, assemblages with <100 NISP were affected more by sample size than those with >300 NISP; the latter had an average of 14 species whereas the former had an average of eight species. This suggests that assemblages with >300 NISP were a better indicator of species diversity. However, sample size biases will not be as problematic for larger animals; therefore, species comparison between cattle, sheep/goat and pigs with >100 NISP will be more reliable (Holmes 2007: 70). It is also important to note, that although attempts were made to ensure only hand-collected data were included in the results, it was not always possible to separate out sieved data. As a result, this too will have had an effect on the number of species present of different sites. This is less problematic for cattle, sheep/goat and pig, as they will not be affected by recovery biases to the same degree as smaller species. However, this will mean that comparisons between birds can potentially be challenging. Such problems are unavoidable in large scale analyses as it is not possible to consider all the biases associated with each site. Nonetheless, because this investigation is comparing chronological and regional groups rather individual assemblages, this should help remove some of the associated issues with sample size. In addition, adopting a broad scale comparison can still successfully highlight similarities and differences within the datasets by detecting general patterns and trends (Albarella *et al.* 2009: 34).

Bone preservation was recorded where possible, which showed that the faunal remains from 51 sites were deemed to be in good condition. Only two sites were recorded as 'excellent', eight were considered as 'fair', one was 'poor' and the remainder were 'not defined '.

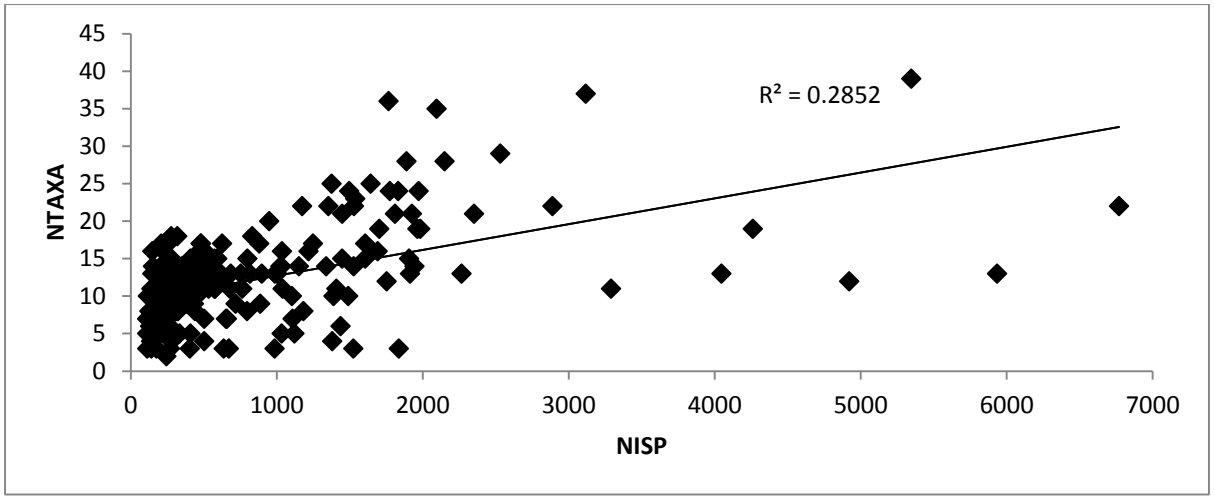

Figure 5.4: Relationship between taxonomic richness (NTAXA) and sample size (NISP) for post-medieval mammals and birds (>100 NISP) (after Lyman 2008). Only sites with up to 7000 NISP were included

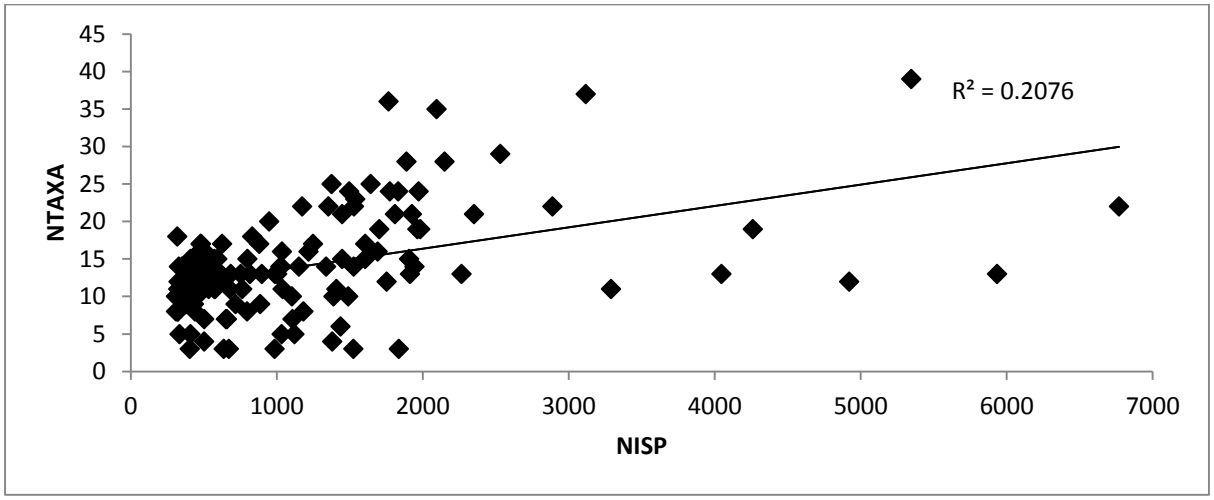

Figure 5.5: Relationship between taxonomic richness (NTAXA) and sample size (NISP) for post-medieval mammals and birds (>300 NISP) (after Lyman 2008). Only sites with up to 7000 NISP were included

5.3 Species representation

Major domesticates

Cattle, sheep/goat and pig were the most common major domesticates throughout the post-medieval period; however, their frequency varied over time in different regions of England (see Appendix Four). Post-medieval sites dating between the 15th-17th century largely had a high proportion of cattle or a relatively equal proportion of cattle and sheep/goat (figures 5.6-5.7). Pig was the least common domestic animal, which ranged between 4 to 18 percent. Sites in London and

the East of England had the highest proportion of pig. By the 16th-17th century, sites demonstrate an increase in cattle and a decline in sheep/goat and pig (figures 5.8-5.9). There was an overall 11% increase in the proportion of cattle and a 7% decrease in sheep/goat and a 5% decline in the proportion of pig. This shift in the proportion of the three domesticates between the 15th-17th century and the 16th-17th century, most likely reflects a change in husbandry strategies. In the early modern period the consumption of beef became more popular and was seen as a national symbol of Britain's identity (Rogers 2004). Dairy products also became more prevalent after 1500, and by 1750 dairy foods were considered high fashion (Thirsk 2007: 271). In the 16th-17th century, London had the highest proportion of cattle and the West Midlands had the highest proportion of pigs (figure 5.9). In the West Midland, counties such as Shropshire and Derbyshire had vast areas of woodland, which allowed for large numbers of pigs to be kept as they fed on beech mast, rhizomes and acorns (Thirsk 1967: 104; Albarella 2006: 77). However, more recent evidence has begun to reject the view that pigs were largely loosely managed and raised in woodland as investigations conducted by Hamilton and Thomas (2012) has shown they were also raised on pasture and marshes. In the 16th and 17th century, some regional differences can be observed. For instance, South East was more sheep/goat dominated whereas London was more cattle dominated (figures 5.10-5.13). The only difference worth noting is the shift in the South West assemblages, which had a greater abundance of sheep/goat by the 17th century as opposed to cattle (figures 5.11 and 5.13).

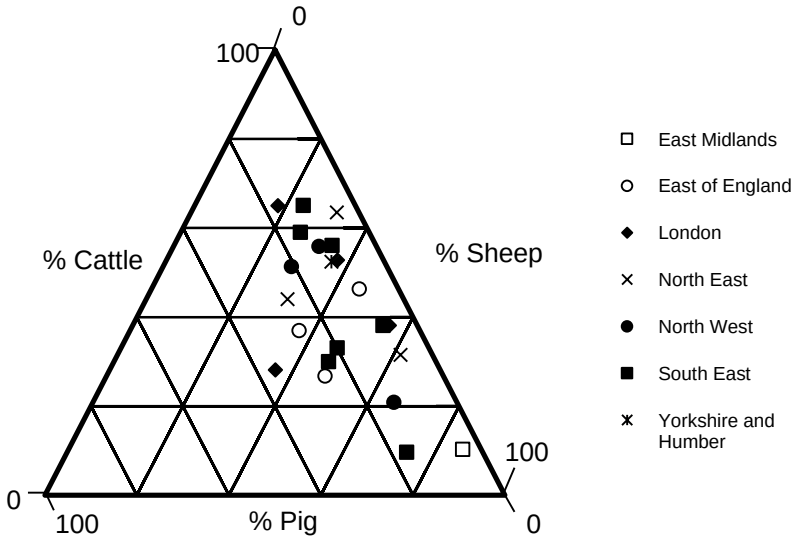

Figure 5.6: Ternary plot showing the relative percentage of cattle, sheep/goat and pig from 22 urban sites in England dating from the 15th to 17th century

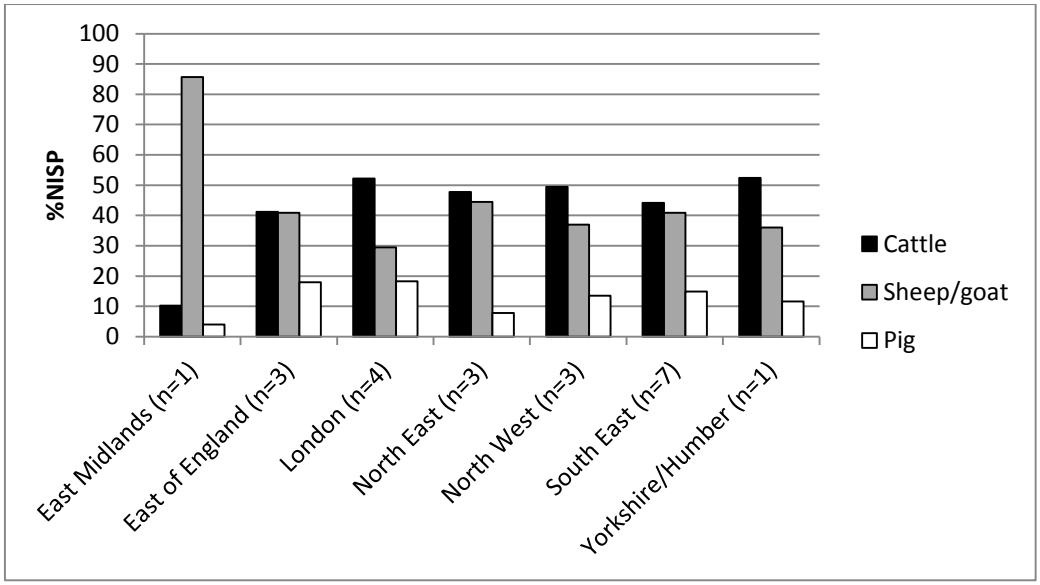

Figure 5.7: Relative proportion of cattle, sheep/goat and pig by geographical region dating from the 15th-17th century with a combined NISP of >100. (n)=number of sites. All sites date between the 15th-17th century except one that dated to the 14th-16th century

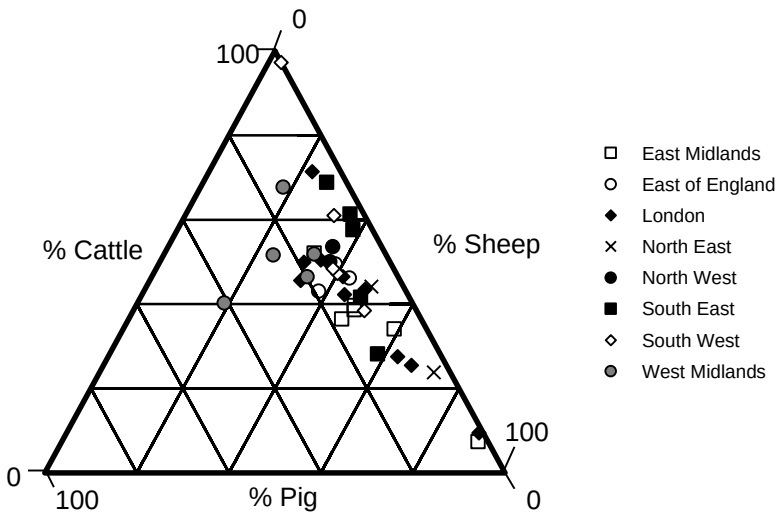

Figure 5.8: Ternary plot showing the relative percentage of cattle, sheep/goat and pig from 38 urban sites in England dating from the 16th-17th century with a combined NISP of >100.

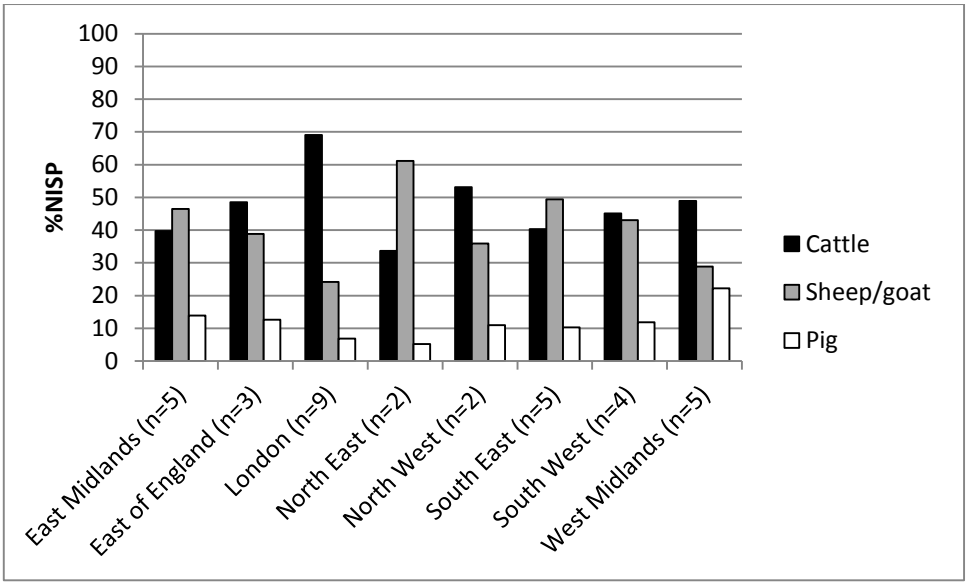

Figure 5.9: Relative proportion of cattle, sheep/goat and pig by geographical region from the 16th-17th century with a combined NISP of >100. (n)=number of sites. Assemblages dominated by a single species were excluded

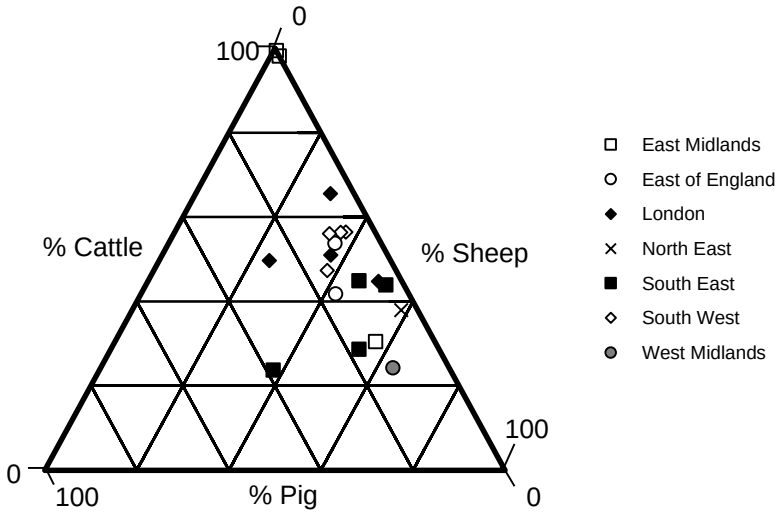

Figure 5.10: Ternary plot showing the relative percentage of cattle, sheep/goat and pig from 19 urban sites in England dating from the 16th century

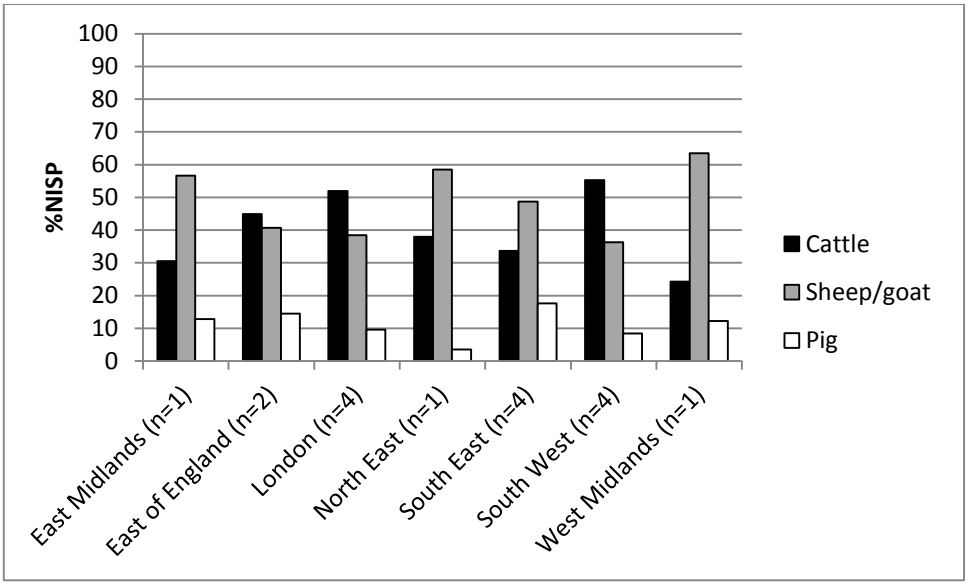

Figure 5.11: Relative proportion of cattle, sheep/goat and pig from geographical regions in the 16th century. (n=) number of sites. Assemblages dominated by a single species were excluded

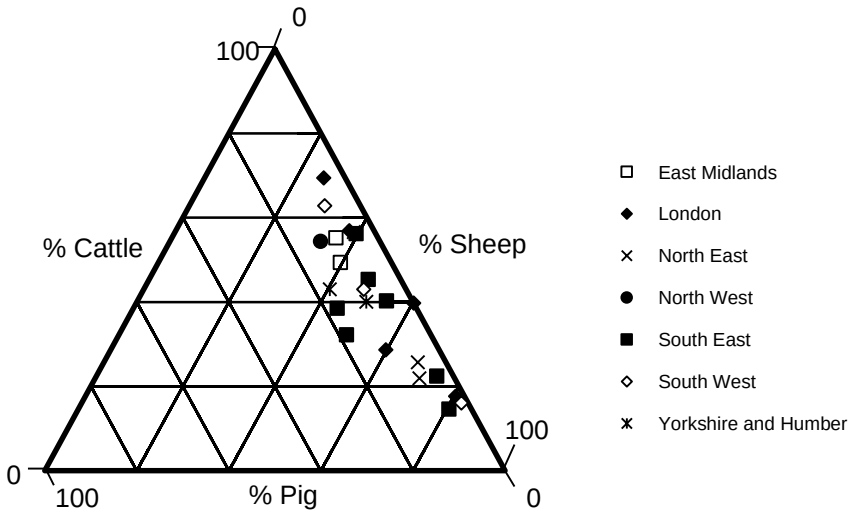

Figure 5.12: Ternary plot showing the relative percentage of cattle, sheep/goat and pig from 21 urban sites in England dating from the 17th century and including two sites with two phases dating from this period

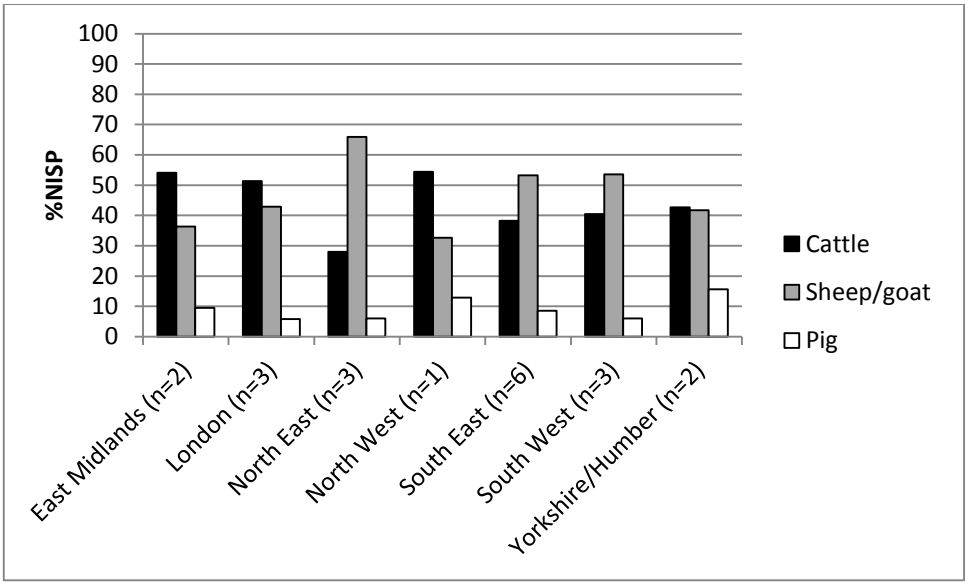

Figure 5.13: Relative proportion of cattle, sheep/goat and pig from geographical regions dating from the 17th century. (n=) number of sites. Two sites had two phases dated to the 17th century, therefore each site was counted a one. Assemblages dominated by a single species were excluded

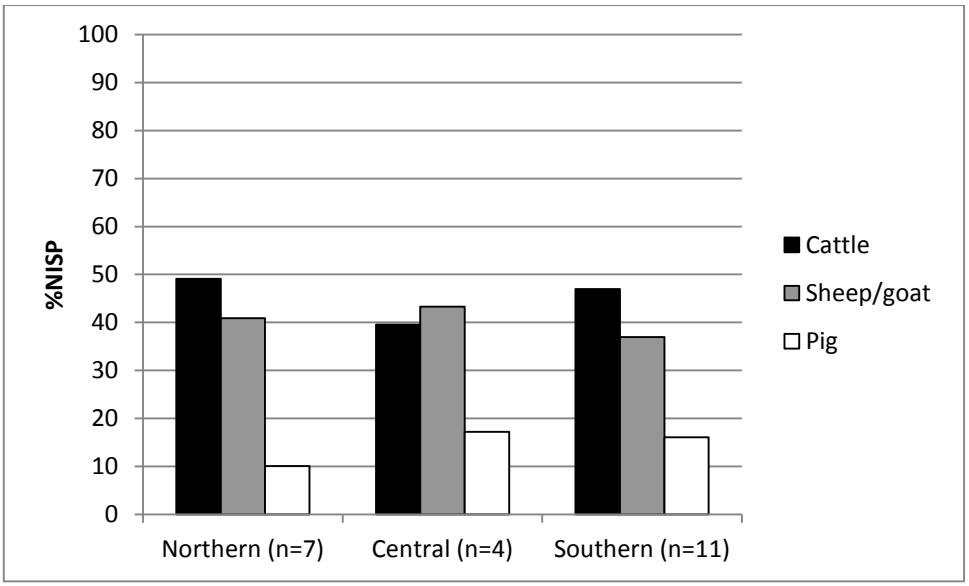

Figure 5.14: Relative proportion of cattle, sheep/goat and pig from northern, central and southern England dating from the 15th-17th century. All the sites date between the 15th-17th century except one that dated to the 14th-16th century

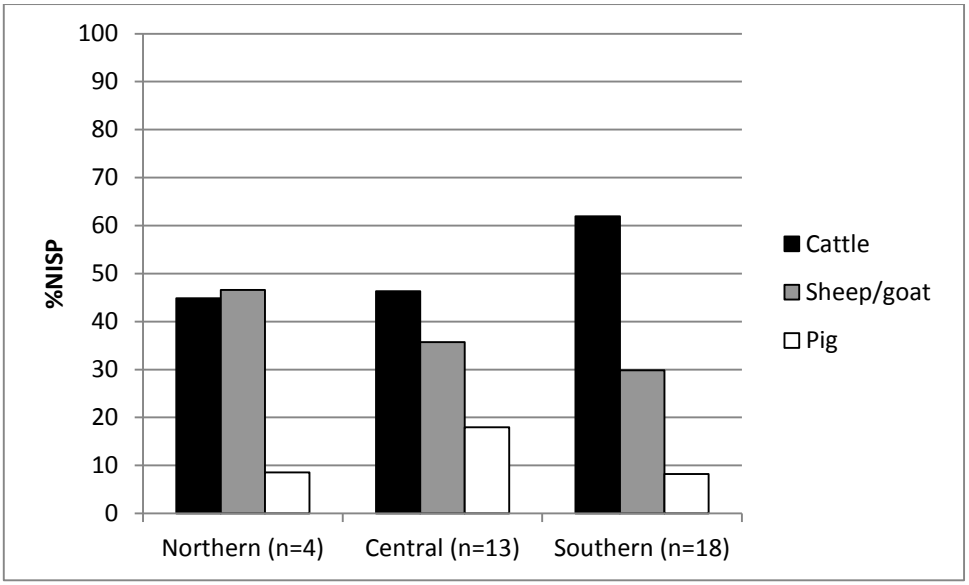

Figure 5.15: Relative proportion of cattle, sheep/goat and pig from northern, central and southern England dating from the 16th-17th century. (n)= number of sites. Assemblages dominated by a single species were excluded

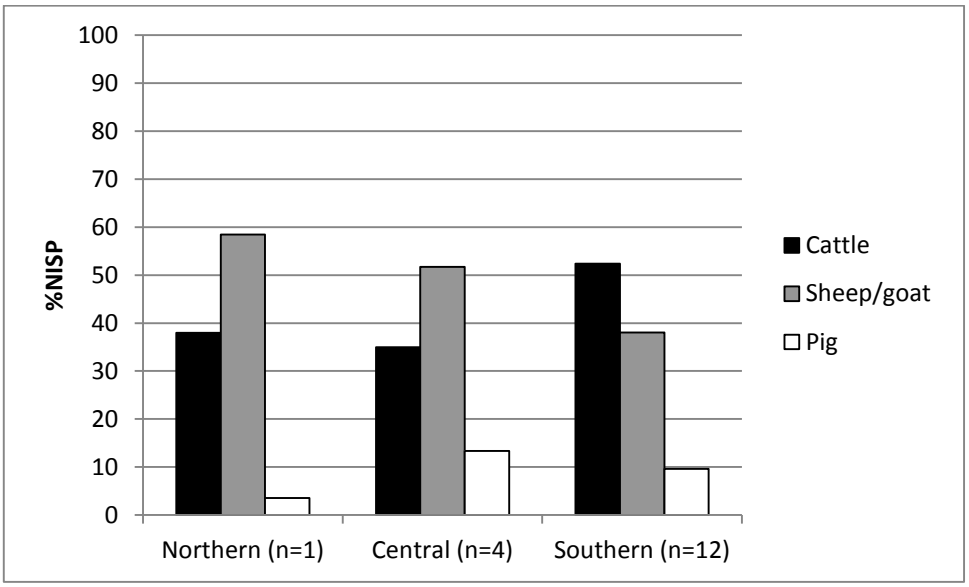

Figure 5.16: Relative proportion of cattle, sheep/goat and pig from northern, central and southern England dating from the 16th century. (n=) number of sites. Assemblages dominated by a single species were excluded

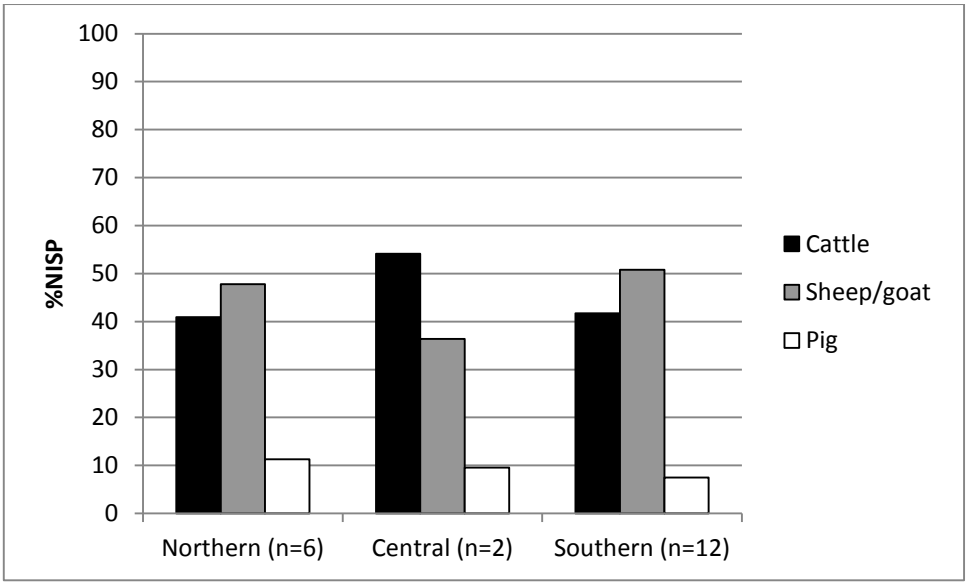

Figure 5.17: Relative proportion of cattle, sheep/goat and pig from northern, central and southern England dating from the 17th century. (n=) number of sites. Assemblages dominated by a single species were excluded

From the 17th to 18th century, cattle and sheep/goat continue to be the most frequent species (figures 5.18-5.21). Sites from this period revealed a decrease in the proportion of cattle and an increase in sheep/goat. The proportion of pigs stayed roughly the same as the previous period. Compared to the 16th-17th century there was a 7% decrease in the frequency of cattle and an 8% increase in sheep/goat. This showed that the proportion of cattle and sheep/goat moved either up or down relative to each other. However, determining a possible cause for this rise and fall is not straight forward as regional variation may be masking temporal variation. Regional patterns that continued into this period included the high proportion of cattle in the North West, East of England and London. In London there was a decrease in the proportion of cattle and an increase in sheep/goat. By the 18th-19th century and 19th-20th century, the proportion of cattle and sheep/goat remained relatively similar; however, there was an increase in the proportion of pig by the 18th-20th century, which rose by 11-12%. Agricultural historians have stated that pigs were the last species to receive attention in terms of 'improvement' and it was only until the late post-medieval period when farmers decided to profit from pigs (Trow-Smith 1959: 216; Holderness 1989: 154). These new innovations in pig husbandry could explain the increased consumption of pigs. However, it should be noted that biometric evidence from Dudley Castle has revealed that pigs in the region increased in size c. mid-14th century (Thomas 2005b: 79). Southern assemblages from the 18th-19th century revealed a shift from cattle dominated assemblages to sheep/goat dominated assemblages (figure 5.28). Unfortunately, due to the paucity of 19th-20th century sites, it was not

possible to detect regional differences. Sites from the 16th- 18th-, 17th- 19th- and late 17th-20th century showed similar results to the later period such as a decrease in the proportion of cattle, an increase in the proportion of pig as well as more sheep/goat, compared to cattle, in London assemblages (figures 5.29-5.35). Figure 5.36 shows that high-status and ecclesiastical sites had more sheep (and pig) where as domestic sites had more cattle.

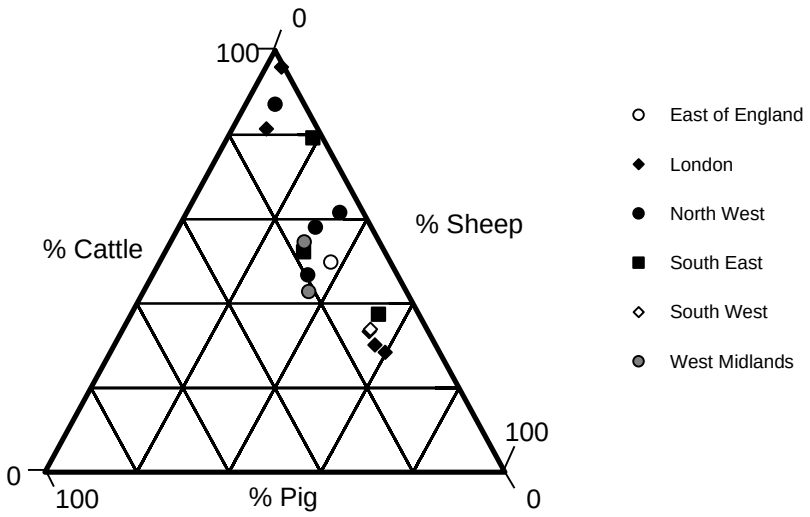

Figure 5.18: Ternary plot showing the relative percentage of cattle, sheep/goat and pig from 25 urban sites in England dating from the 17th-18th century

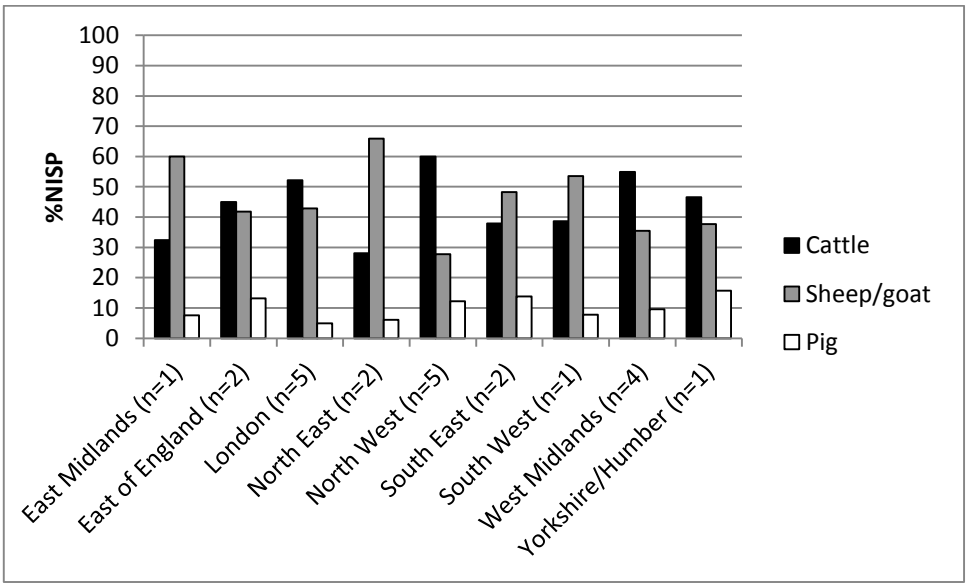

Figure 5.19: Relative proportion of cattle, sheep/goat and pig from geographical regions dating from the 17th-18th century with a combined NISP of >100. (n)=number of sites

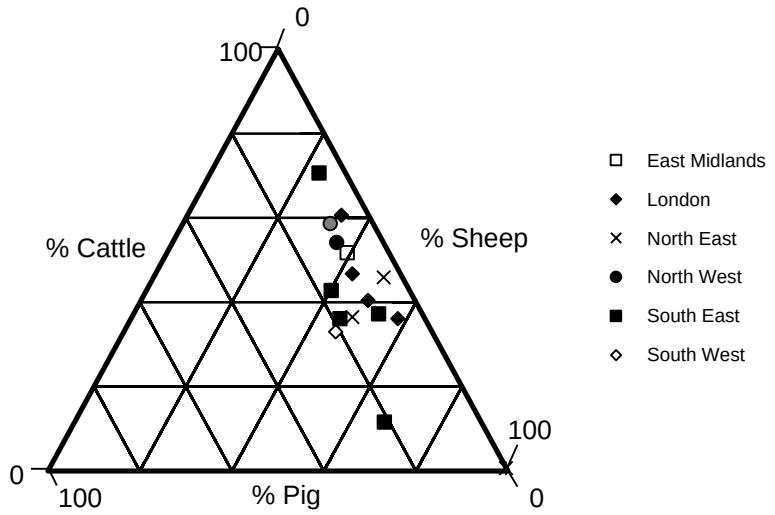

Figure 5.20: Ternary plot showing the relative percentage of cattle, sheep/goat and pig from 17 urban sites in England dating from the 18th century

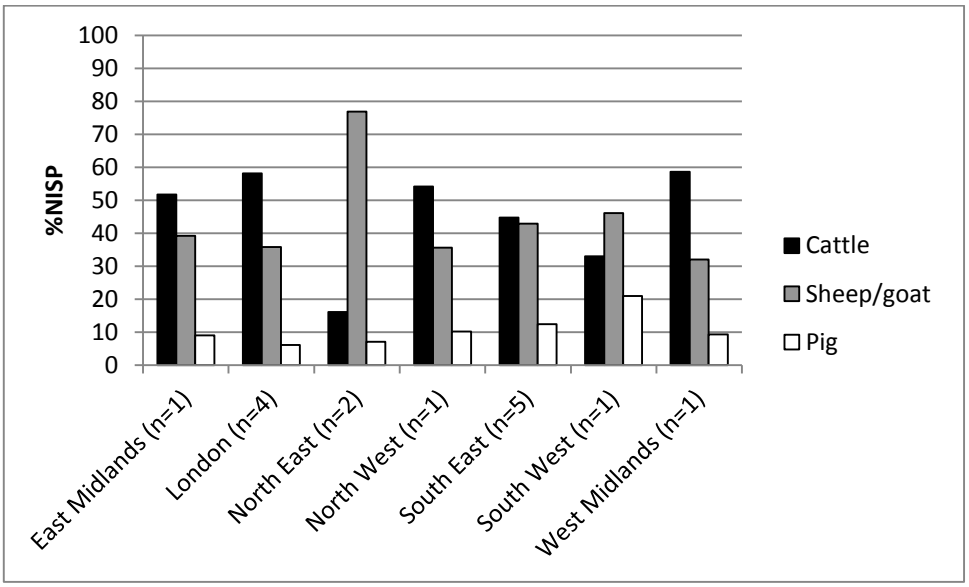

Figure 5.21: Relative proportion of cattle, sheep/goat and pig from geographical regions dating from the 18th century with a combined NISP of >100. (n)=number of sites. Assemblages dominated by a single species were not included (one York industrial site was excluded)

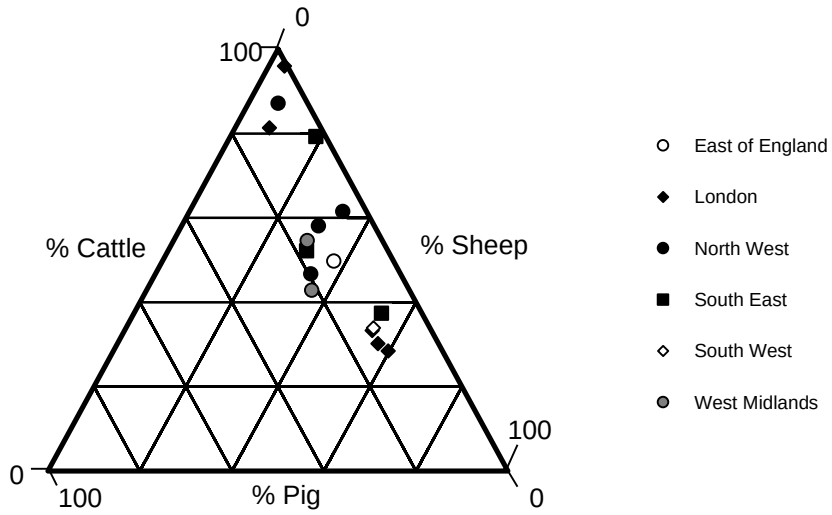

Figure 5.22: Ternary plot showing the relative percentage of cattle, sheep/goat and pig from 16 urban sites in England dating from the 18th-19th century

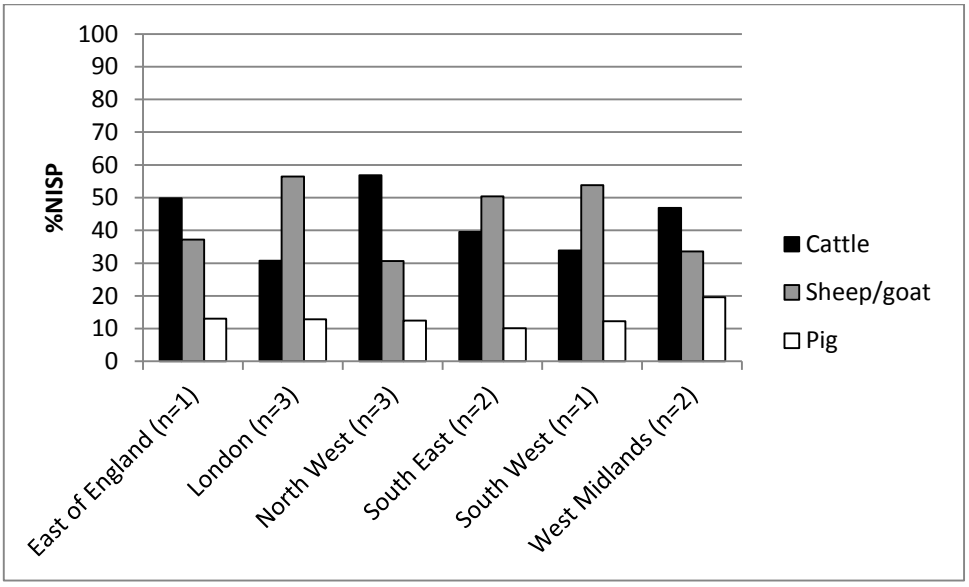

Figure 5.23: Relative proportion of cattle, sheep/goat and pig from geographical regions in the 18th-19th century with a combined NISP of >100. (n)=number of sites. Assemblages dominated by a single species were excluded

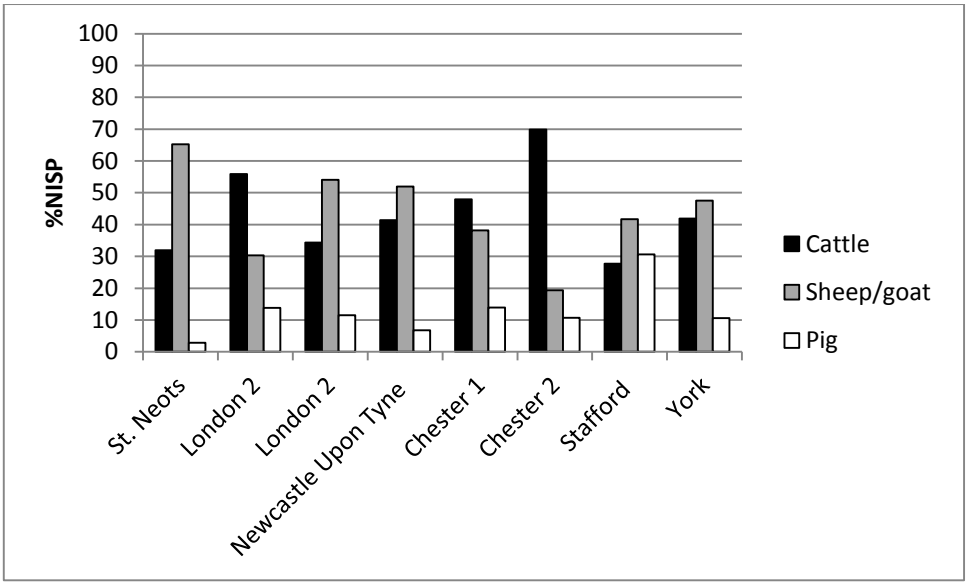

Figure 5.24: Relative proportion of cattle, sheep/goat and pig from 19th-20th century sites in England with a combined NISP of >100. (n)=number of sites. Assemblages dominated by a single species were excluded. Site details: St. Neots = Huntingdon Street; London 1 = Keeley House; London 2 = Spitalfields Market (Lamb Street) c; Newcastle Upon Tyne = Westgate Road c; Chester 1 = 25 Bridge Street d; Chester 2 = Hamilton Place c; Stafford = Stafford Castle c; York= Hungate b

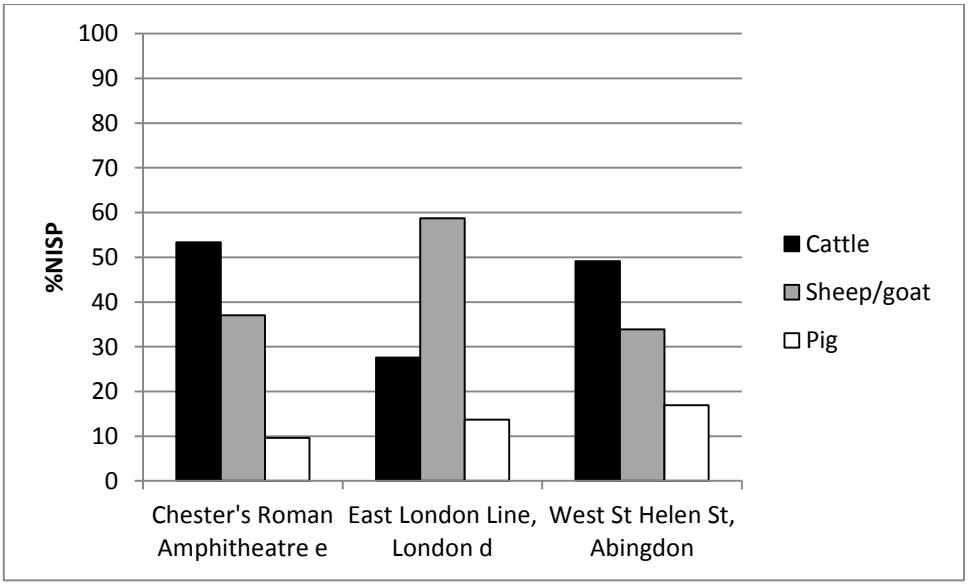

Figure 5.25: Relative proportion of cattle, sheep/goat and pig from sites dating from the 19th century in England with a combined NISP of >100

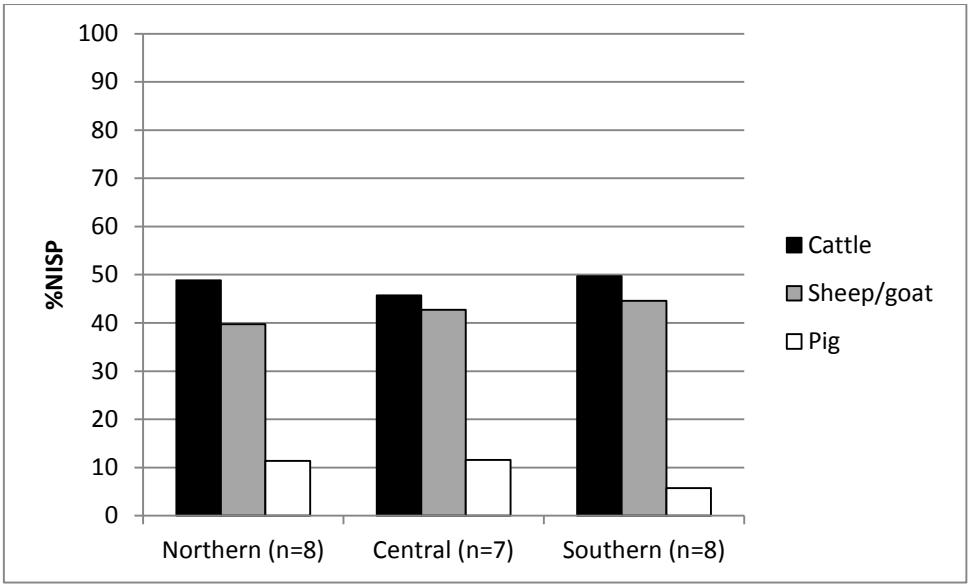

Figure 5.26: Relative proportion of cattle, sheep/goat and pig from northern, central and southern England dating from the 17th-18th century with a combined NISP of >100. (n)=number of sites

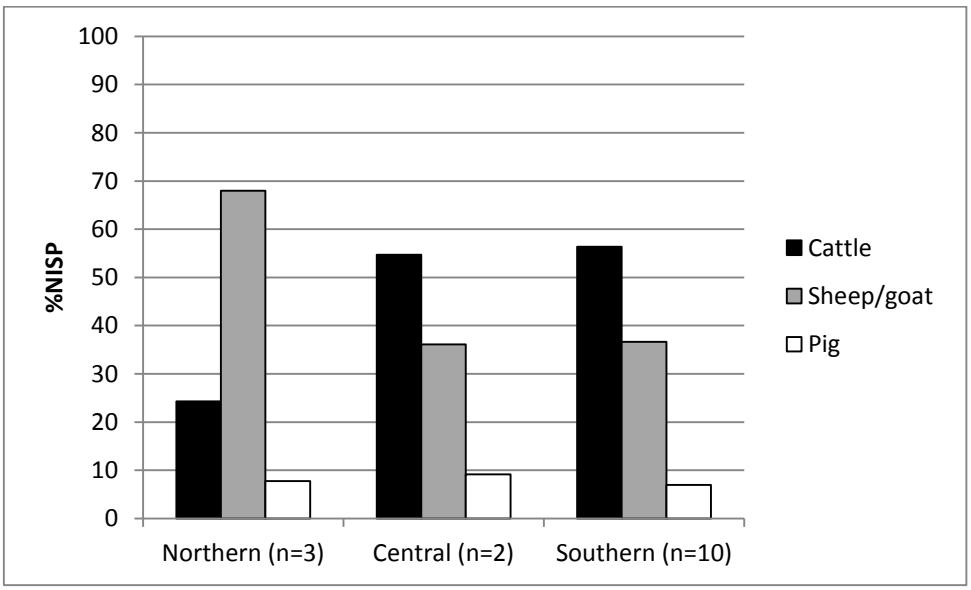

Figure 5.27: Relative proportion of cattle, sheep/goat and pig from northern, central and southern England dating from the 18th century with a combined NISP of >100. (n)=number of sites. Assemblages dominated by a single species were not included (one York industrial site was excluded)

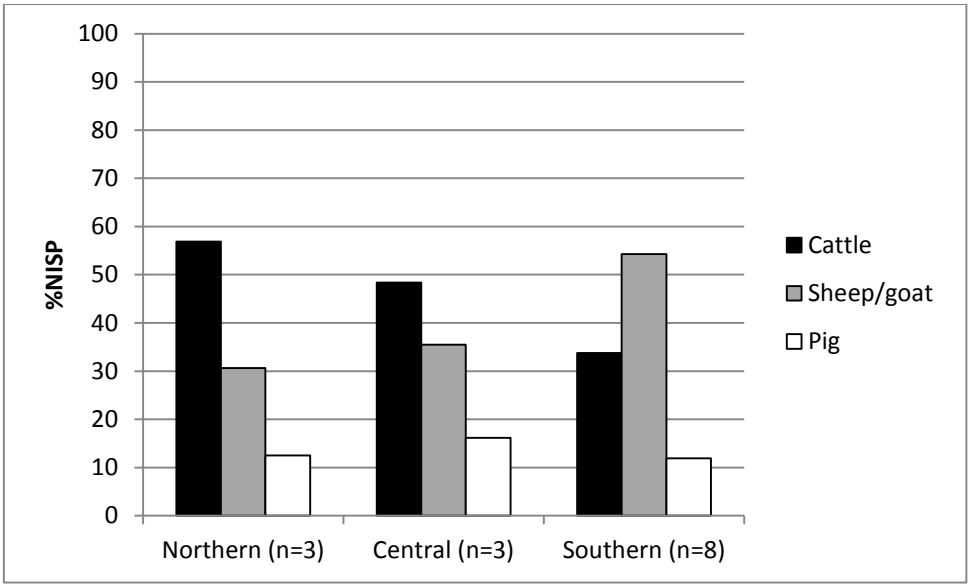

Figure 5.28: Relative proportion of cattle, sheep/goat and pig from northern, central and southern England in the 18th-19th century with a combined NISP of >100. (n)=number of sites. Assemblages dominated by a single species were not included (four industrial sites were excluded)

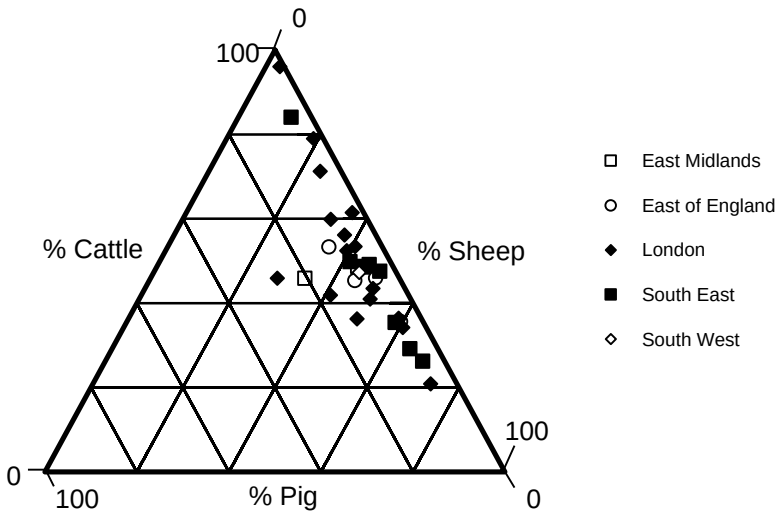

Figure 5.29: Ternary plot showing the relative percentage of cattle, sheep/goat and pig from 31 urban sites in England dating from the 16th-18th century

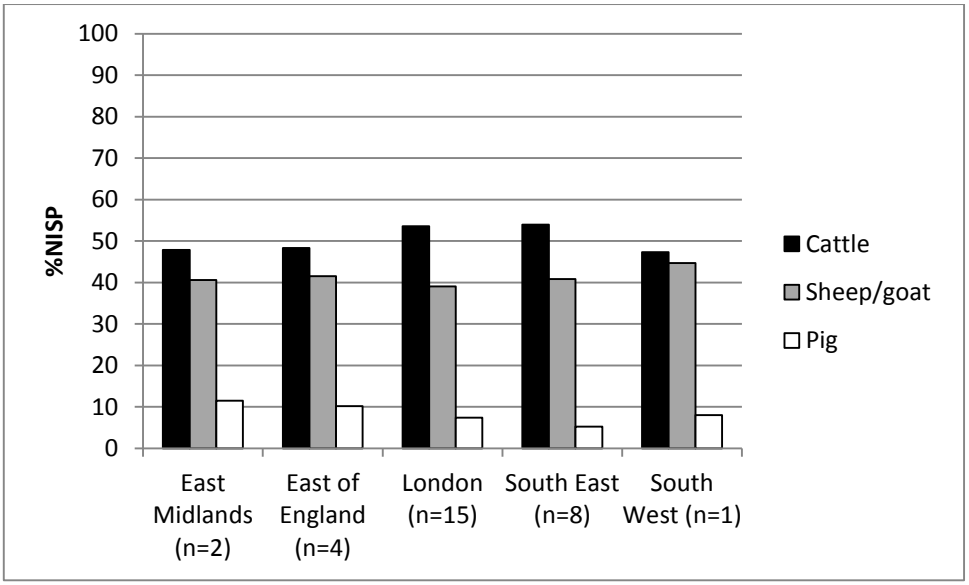

Figure 5.30: Relative proportion of cattle, sheep/goat and pig from geographical regions dating from the 16th-18th century with a combined NISP of >100. Assemblages dominated by a single species were excluded

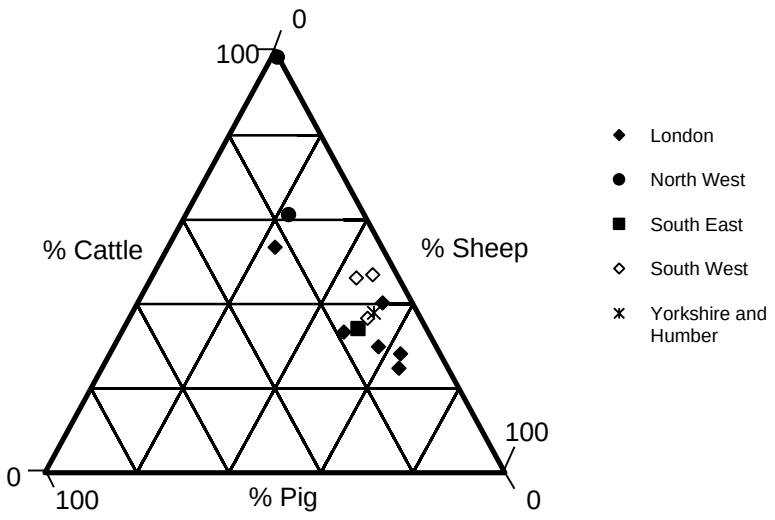

Figure 5.31: Ternary plot showing the relative percentage of cattle, sheep/goat and pig from 13 urban sites in England dating from the 17th-19th century

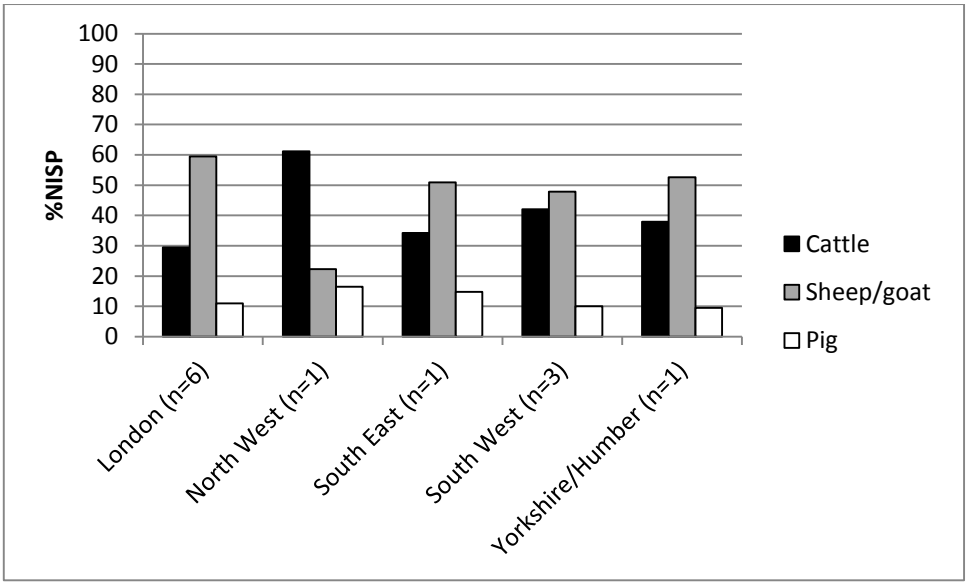

Figure 5.32: Relative proportion of cattle, sheep/goat and pig from geographical regions dating from the 17th-19th century with a combined NISP of >100. (n)=number of sites. Assemblages dominated by a single species were excluded

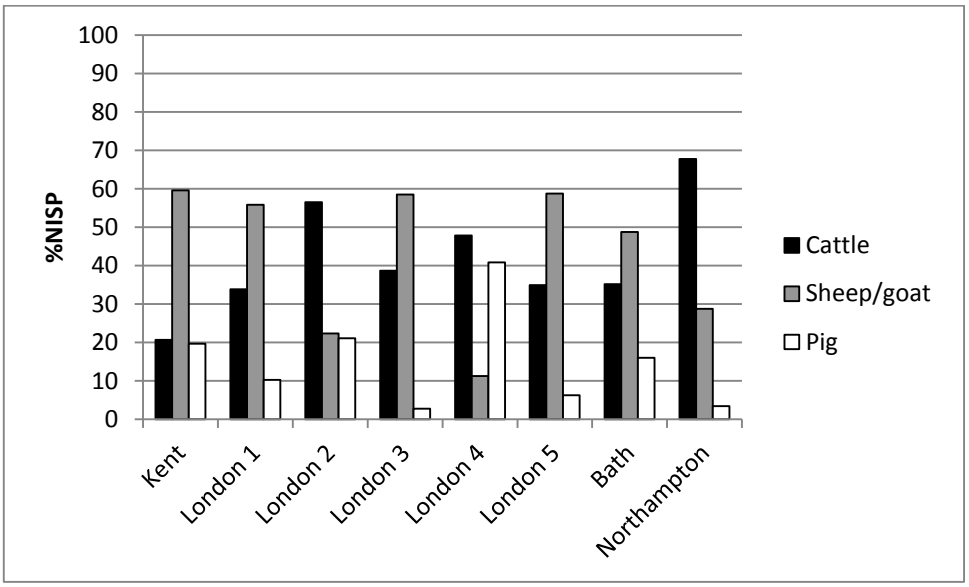

Figure 5.33: Relative proportion of cattle, sheep/goat and pig from sites dating from the late 17th to 20th century with a combined NISP of >100. Site details: Kent = Canterbury Defences; London 1 = East London Line: Holywell Priory b; London 2 = Merton Priory; London 3 = Royal London Hospital; London 4 = Saxon Lundenwic; London 5 = Southbridge House (Rose Theatre) c; Bath = Southgate Redevelopment b; Northampton = The Green b

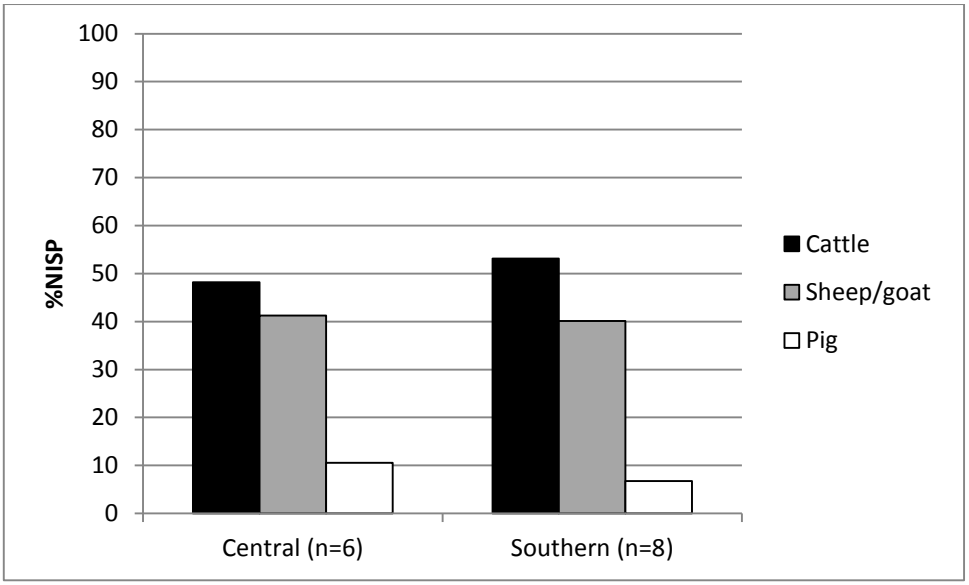

Figure 5.34: Relative proportion of cattle, sheep/goat and pig from central and southern England dating from the 16th-18th century with a combined NISP of >100. Assemblages dominated by a single species were excluded

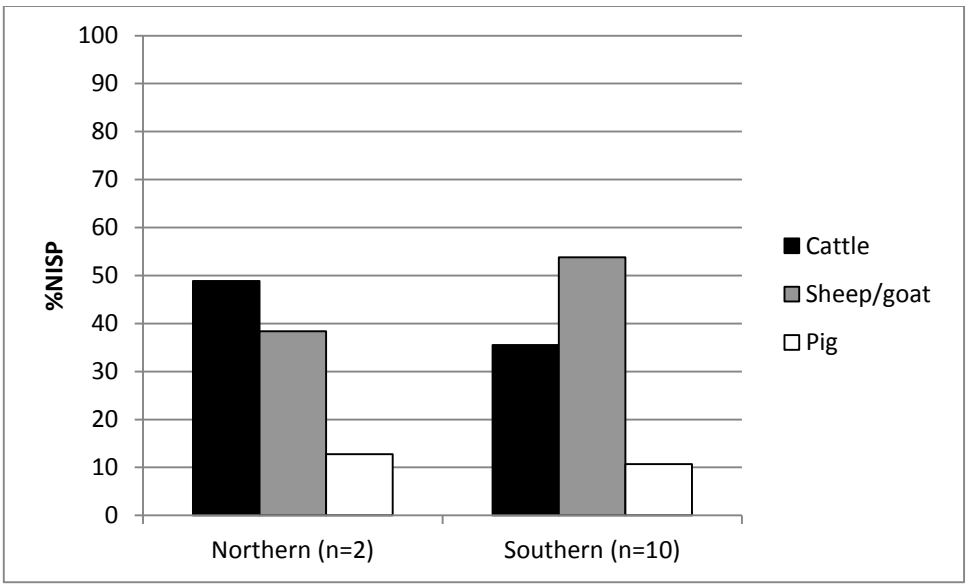

Figure 5.35: Relative proportion of cattle, sheep/goat and pig from northern and southern England dating from the 17th-19th century with a combined NISP of >100. (n)=number of sites. Assemblages dominated by a single species were excluded

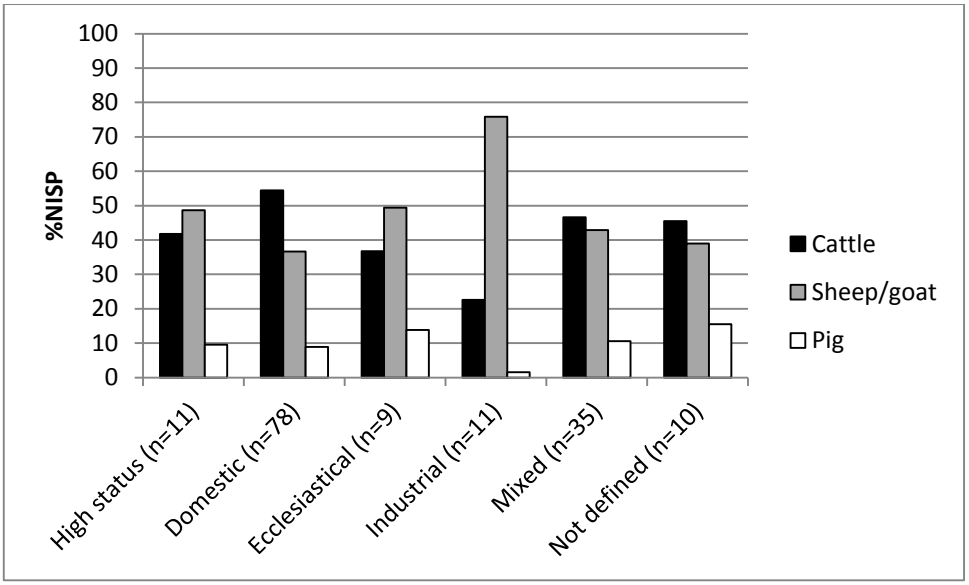

Figure 5.36: Relative proportion of cattle, sheep/goat and pig by site type. (High status includes castle, manor and palace sites)

Chicken, goose and duck were the most common domestic bird and similar to the major domestic mammals their proportion varied regionally. Chicken and goose were consistently better represented; with chicken being the most popular (figure 5.37). Only a small amount of duck was present throughout the post-medieval period. On the whole, there was a steady increase in the proportion of chicken from the 15th-17th century to the 20th century, whereas geese appear to decline. The biggest drop in the proportion of geese can be seen after the 15th-17th century. The proportion of goose increases again around the 18th-19thcentury at the expense of chicken. Geese were also better represented in central and northern England (figures 5.39 and 5.40). Expressed as a proportion of cow, sheep, pig, there is a gradual decline in the proportion of chickens, after which a potential increase in the 19th century (figure 5.38). Although it could be noted that high proportion of chickens from Stafford Castle (1800 – 1900) could be influencing this result. Observations of the proportion of chicken, goose and duck from different site types revealed that there was a higher proportion of goose on mixed sites (figure 5.41). However, once the large assemblage of goose wings from Castle Mall Barbican Well, Norwich (see Butchery and body part distribution in this chapter) was removed, geese were more common on domestic and ecclesiastical sites.

Minor domesticates

Goat remains were present on a number of post-medieval urban sites; although at the majority of sites they were found in small numbers. Unfortunately, it was not possible to determine the

proportion of remains represented by horncores and post-cranial elements. However, given the historical and archaeological evidence for the trade of goatskins, it is possible that the majority of the remains consisted of horncores and autopodia (Albarella 2003). Southern England produced the most goats, which mainly came from London from the Rose Theatre and St Mary Spital excavations (see figure 5.42, 5.43) (Reilly 2005; Pipe and Locker 1997). There is a corpus of zooarchaeological and historical evidence demonstrating the city's involvement in the tawying industry and London's leatherdressers were known to work with goat skins (Yeomans 2006). This may have accounted for the higher number of goats in the city. Most of the goats from central England came from the West Midlands, where goats were more commonly kept (Albarella 2003).

The frequency of horse remains appears to increase after the 15th-17th century, with the highest frequencies occurring in the 17th-18th, 17th-19th and 19th-20th centuries (figure 5.45). The increase in their remains may reflect the number of knackers' yards operating in towns and cities and the utilisation of horse for transportation. Horse was more common in the North West and West Midlands (figure 5.44); although the large assemblage of partial horse remains was from City Road, Chester, contributed to this result. Partial horse skeletons were also found at Dudley Castle, West Midlands (Thomas 2005a). Two donkey remains were found at two sites; Town Wall, Coventry (16th-17th century) and City Road (17th-19th century).

Dog and cat were present at most post-medieval sites. Dogs were recorded at a total of 102 sites, some of which represented ABGs (Associated Bone Groups). The largest assemblage of dogs came from Castle Mall Barbican Well, Norwich (mid-late 15th-16th century), which had 15 partial dog skeletons. Cats were recorded at a total of 101 sites; some of which also derived from partial skeletons. Again, Castle Mall Barbican Well, Norwich (mid-late 15th-16th century) as well as Exeter (1500 – 1600) had the largest assemblage of cats, although these were represented by disarticulated bones (García 2009: 119; Maltby 1979: 64). Based on figure 5.46, it could be argued that there was an increase in the frequency of dogs and cats in the archaeological record. This may be reflecting the occurrence of partial burials, which appears to become more common in the later post-medieval period.

Wild mammals

Typical wild mammals in the post-medieval period included deer, rabbit and hare. Fallow, red and roe deer were present at a total of 76 post-medieval sites. Fallow deer was the most common species of deer with red and roe deer present in small numbers (figure 5.47). After the 17th century,

the proportion of fallow deer drops; a pattern which can also be seen in red and roe deer. There is an increase in fallow deer in the 19th-20th century but this result is driven by the number of fallow deer found at the high-status site, Stafford Castle (1800 – 1900) (Thomas 2011). This is unsurprising given that venison was an elite food that is common on high status castle sites (figure 5.49). The presence of deer in urban assemblages is probably an indicator of status or that venison was sold and bought illegally on the urban market.

The abundance of rabbit in archaeological assemblages suggests that the animal was popular in post-medieval England for meat and fur. The results show that rabbit was more common than deer and hare, probably because the use of warrens came back in favour in the early modern period (Thirsk 1997: 53). Similar to deer, there was a decline in the proportion of rabbit (figure 5.48). This may reflect the decline in commercial rabbit breeding by the end of the 19th century (see Chapters Four and Six). Both rabbit and hare were more common on domestic sites, followed by castle sites. There were a high proportion of rabbits from the West Midlands but is most likely reflective of the large assemblage of these animals from Stafford Castle (1800 – 1900) (figure 5.50).

Appendix Four shows the presence/absence of uncommon wild mammals recovered from post-medieval urban sites. Out of these mammals, hedgehog, fox and badger were more frequent; however, most of the hedgehog remains came from Evesham Abbey 87-8 (NISP 17) (18th-19th century). Four bear specimens were found, all of which came from the Rose Theatre excavation in London. Although bears became extinct in Britain during the early medieval period, the importation of bear and their parts (i.e. paws) is documented throughout the medieval and post-medieval period (Hammon 2010). The presence of New World species such as the guinea pig and monkey is particularly noteworthy as they provide proof of their direct importation. Other imported species included elephant and tortoise; however, tortoises were first documented in Britain as early as the 17th century (Thomas 2014).

The occurrence of ferret/polecat, pine marten, red squirrel, stoat and badger in urban assemblages suggests that they were deliberately caught and brought back to site. Cetaceans were visibly uncommon in this period; however, this is not surprising as their flesh became unpopular from the early modern period (Drummond and Wilbraham 1939: 66). Wild boar was only noted at two sites: SOU 29, Southampton (15th-16th century) and Stafford Castle (16th-17th century). Wild boar was extinct from the 13th century, although they were supposedly re-introduced in the 16th and 17th century (Albarella 2010).

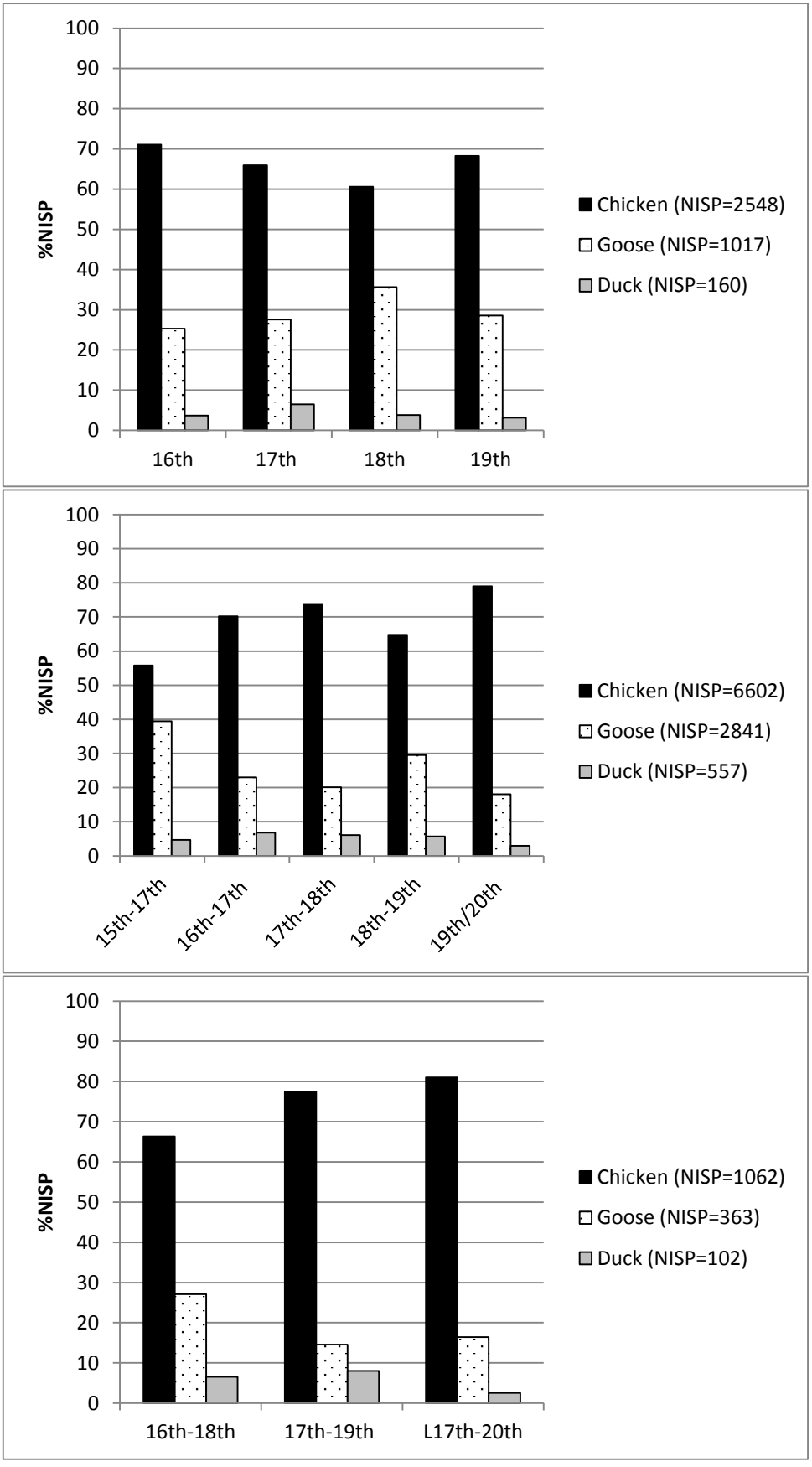

Figure 5.37: Relative proportion of chicken, goose and duck at post-medieval urban sites in England in chronological order

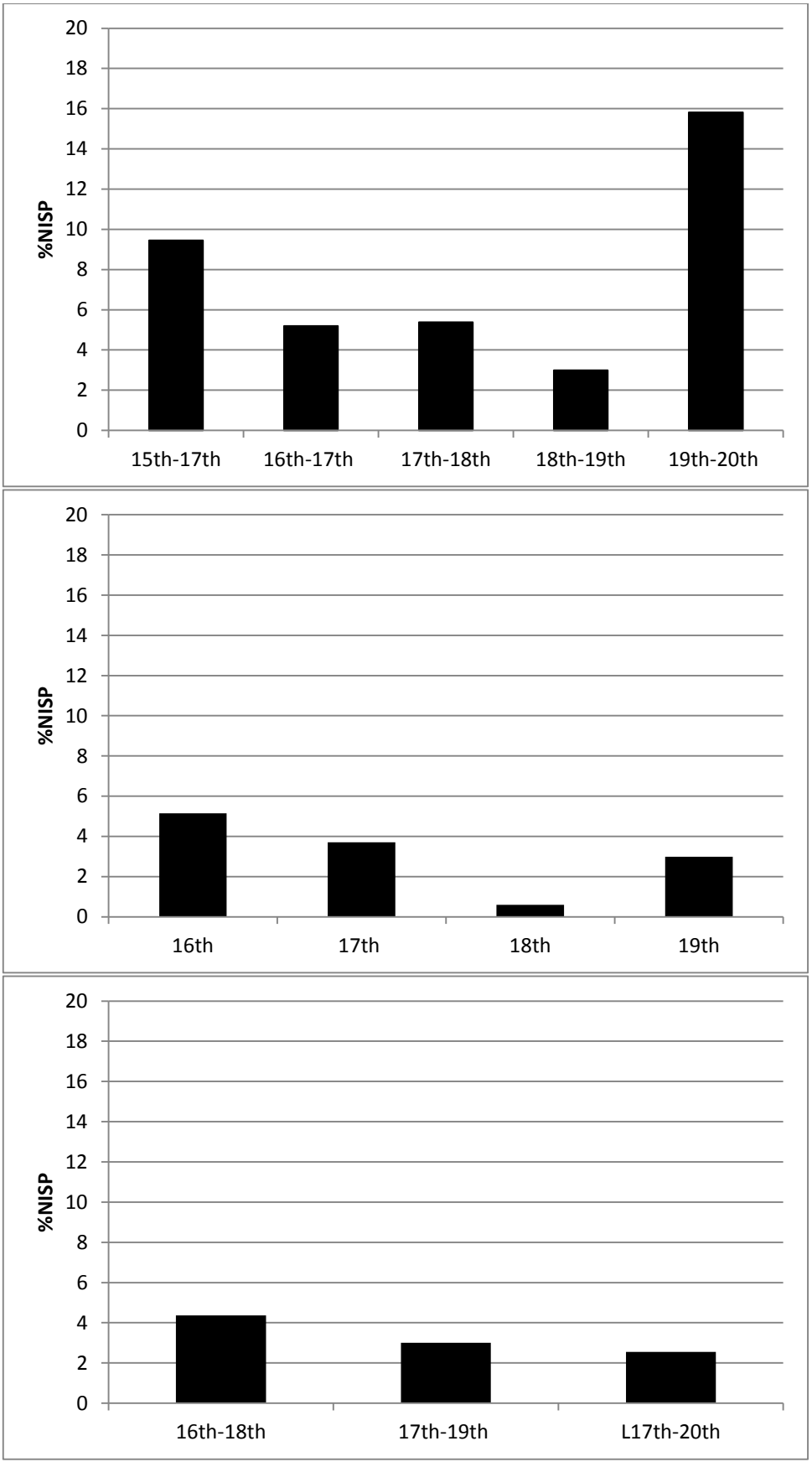

Figure 5.38: Relative proportion of chicken at post-medieval urban sites in England out of the total number of cattle, sheep/goat, pig and chicken in chronological order

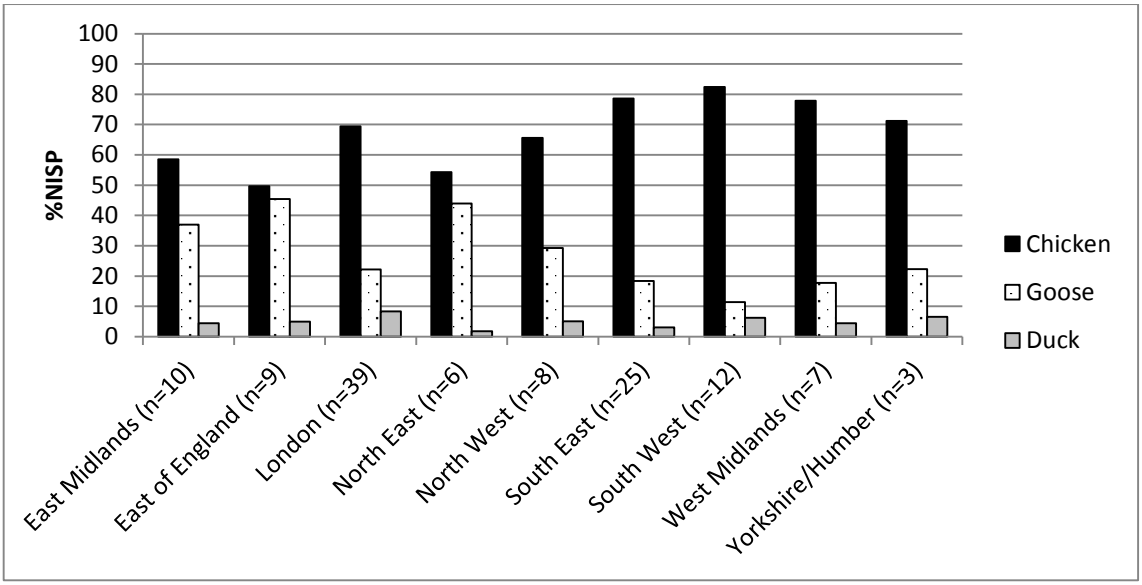

Figure 5.39: Relative proportion of chicken, goose and duck at post-medieval urban sites by region

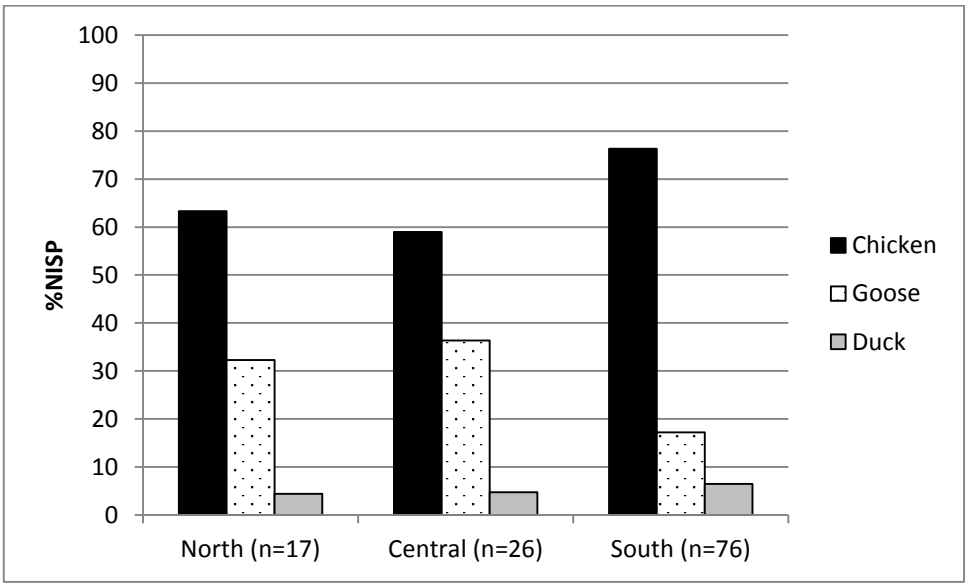

Figure 5.40: Relative proportion of chicken, goose and duck from post-medieval urban sites from northern, central and southern England

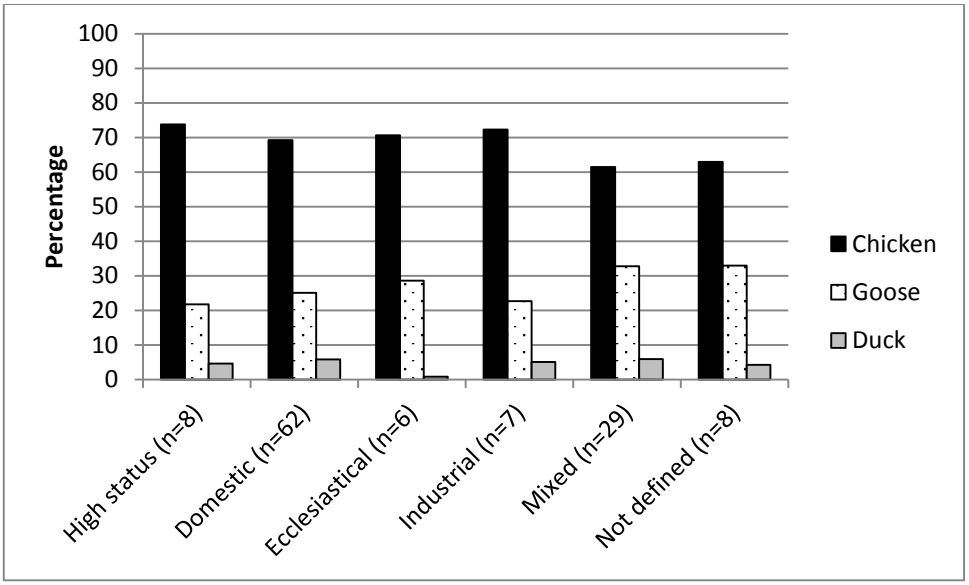

Figure 5.41: Relative proportion of chicken, goose and duck by site type (high status includes castle, manor and palace sites). (n)=number of sites

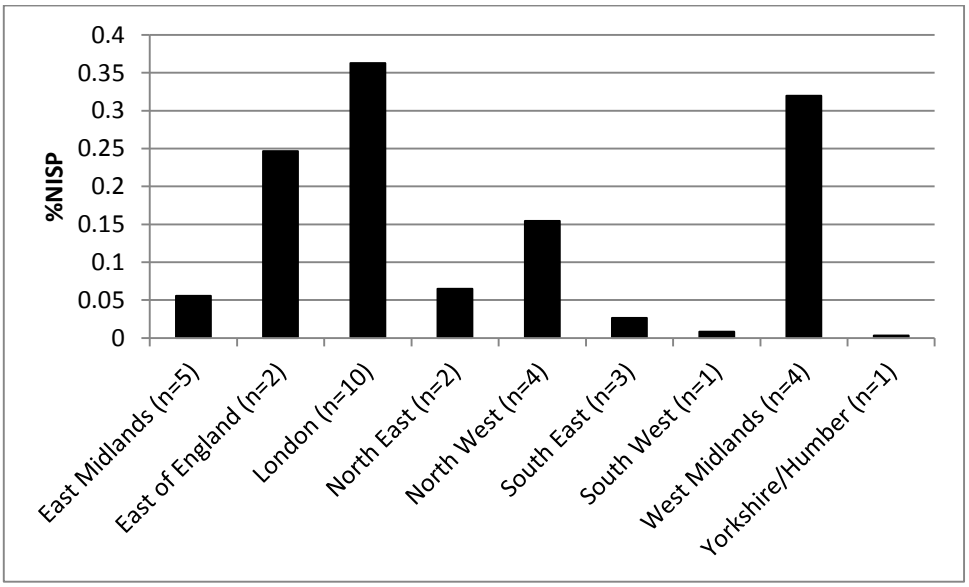

Figure 5.42: Relative proportion of goat from post-medieval urban sites in England (expressed as a % of the total amount of sheep and goat by region) (n)=number of sites with goats

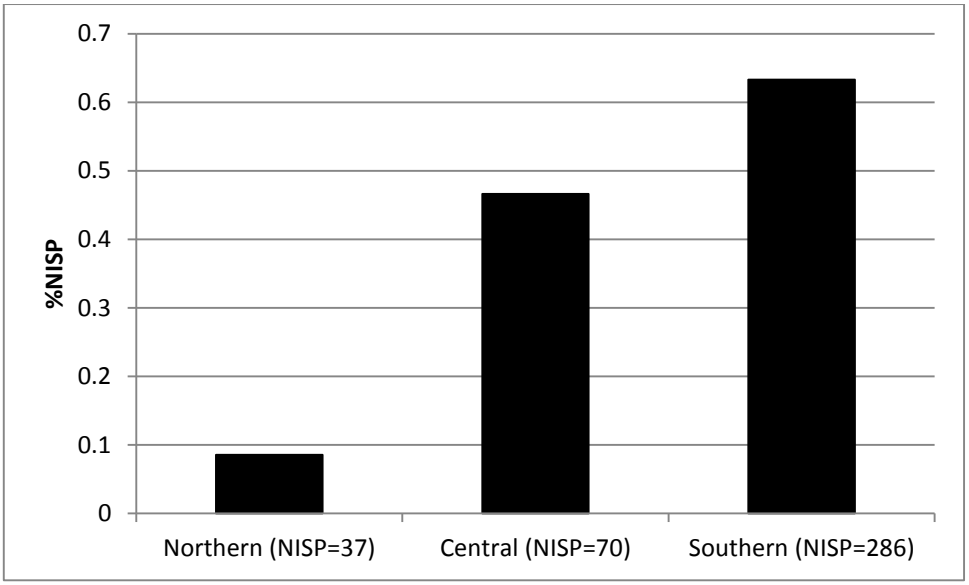

Figure 5.43: Relative proportion of goat from post-medieval urban sites in England (expressed as a % of the total amount of sheep and goat by region)

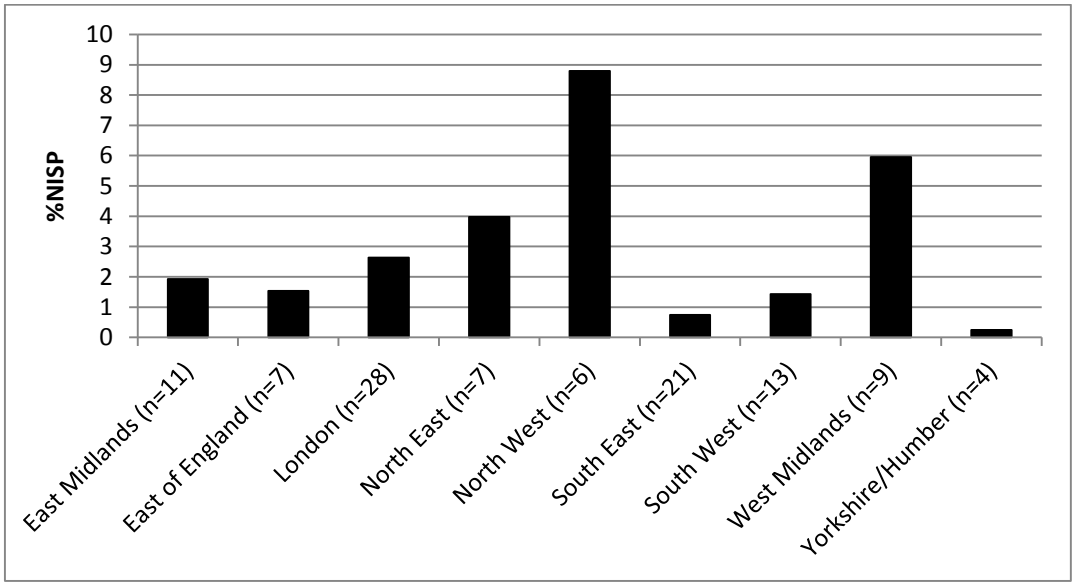

Figure 5.44: Relative proportion of horse from post-medieval urban sites in England by region (expressed as a % of cattle, sheep/goat, pig and horse) (n)= number of sites

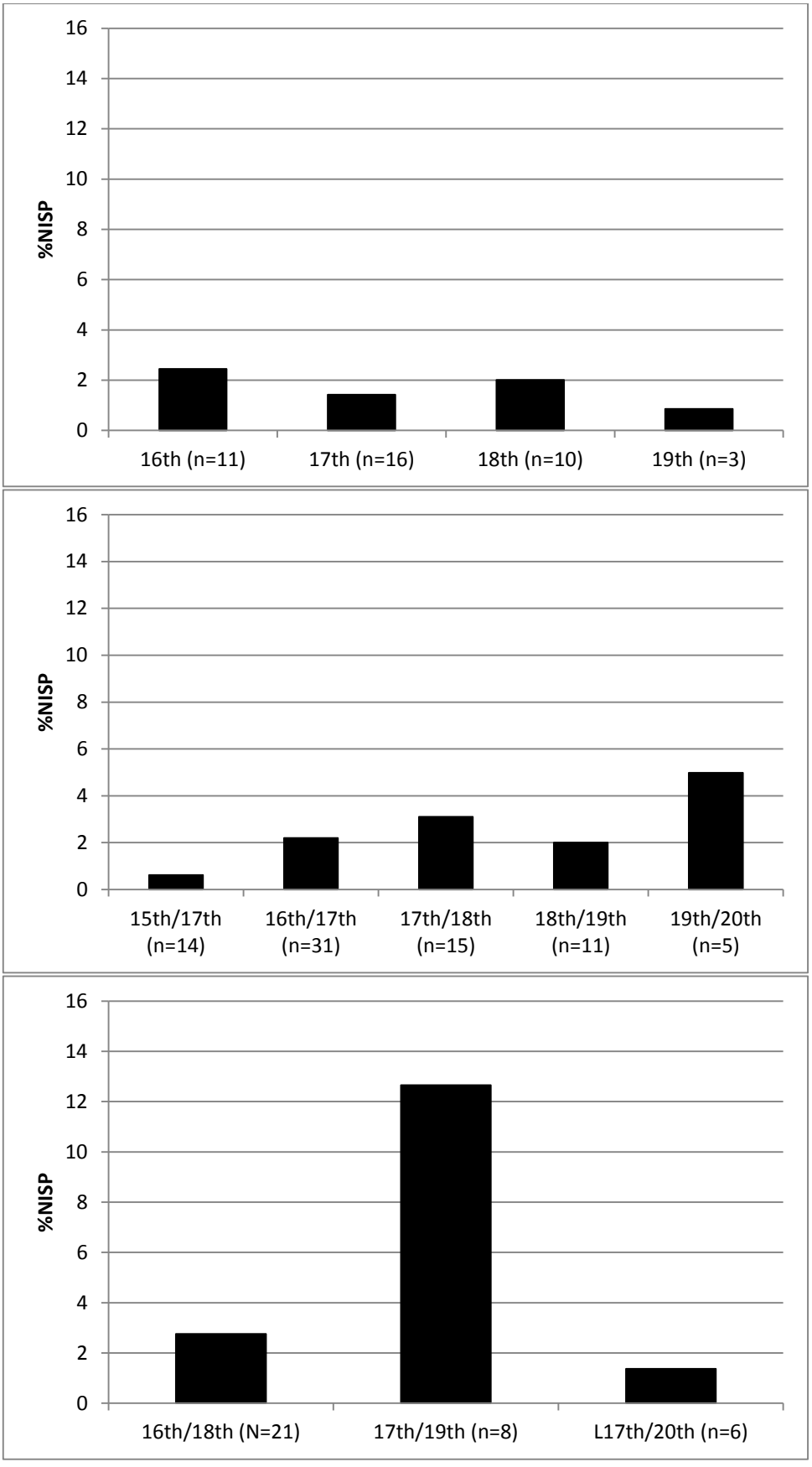

Figure 5.45: Relative proportion of horse from post-medieval urban sites in England in chronological order (expressed as a % of cattle, sheep/goat, pig and horse by phase) (n)= number of sites with horse

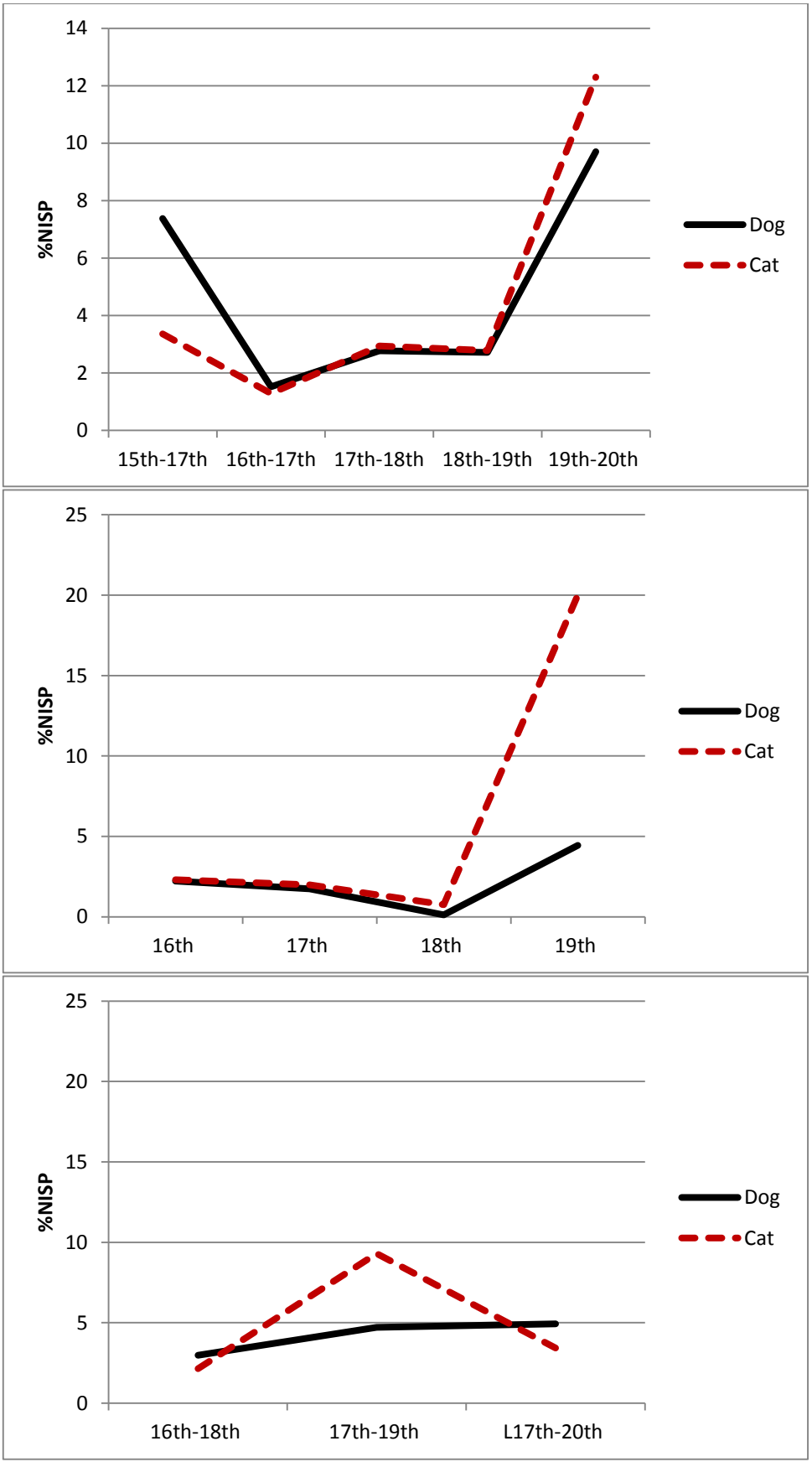

Figure 5.46: Relative frequency of dog and cat at post-medieval sites urban sites in England in chronological order (expressed as a % of cattle, sheep/goat, pig, cat and dog by phase)

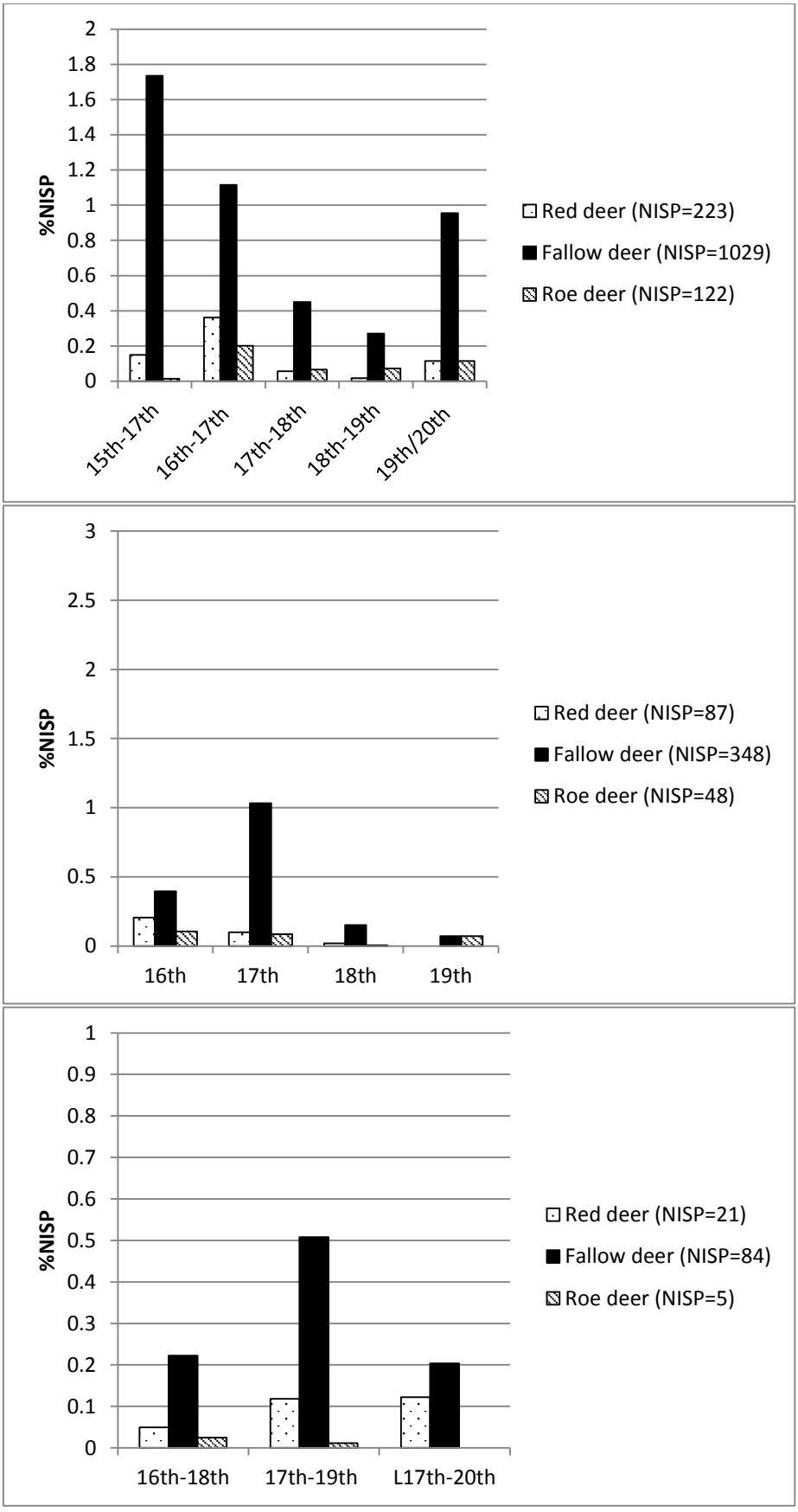

Figure 5.47: Relative proportion of identifiable deer at post-medieval urban sites in England in chronological order (expressed as a % of cattle, sheep/goat, pig and deer by phase)

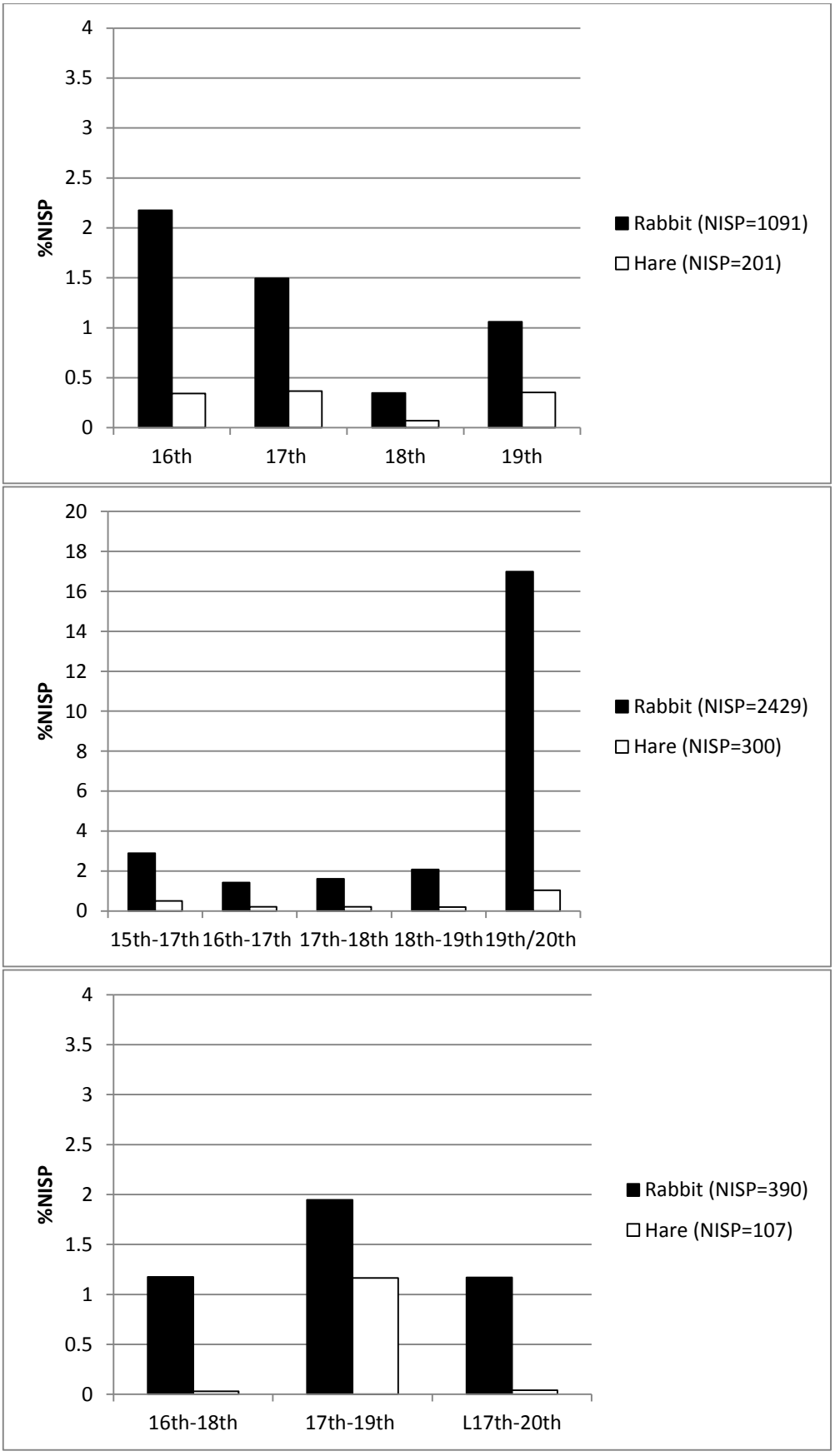

Figure 5.48: Relative proportion of identified rabbit and hare at post-medieval urban sites in England in chronological order (expressed as a % of cattle, sheep/goat, pig, rabbit and hare by phase)

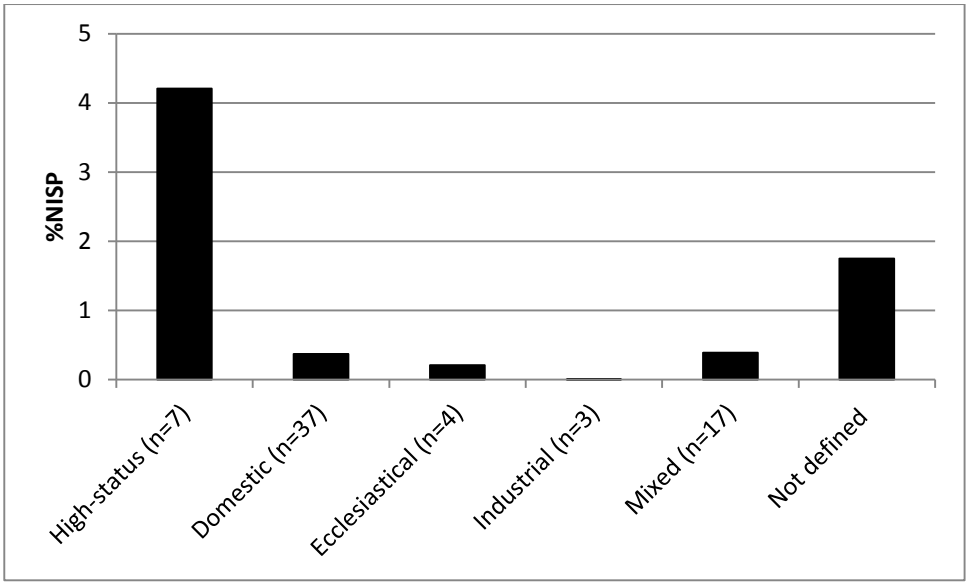

Figure 5.49: Relative proportion of deer at post-medieval urban sites in England by site type (out of the total number of hand-collected cattle, sheep/goat, pig and deer) (high-status includes castle and palace sites). (n)=number of sites with deer

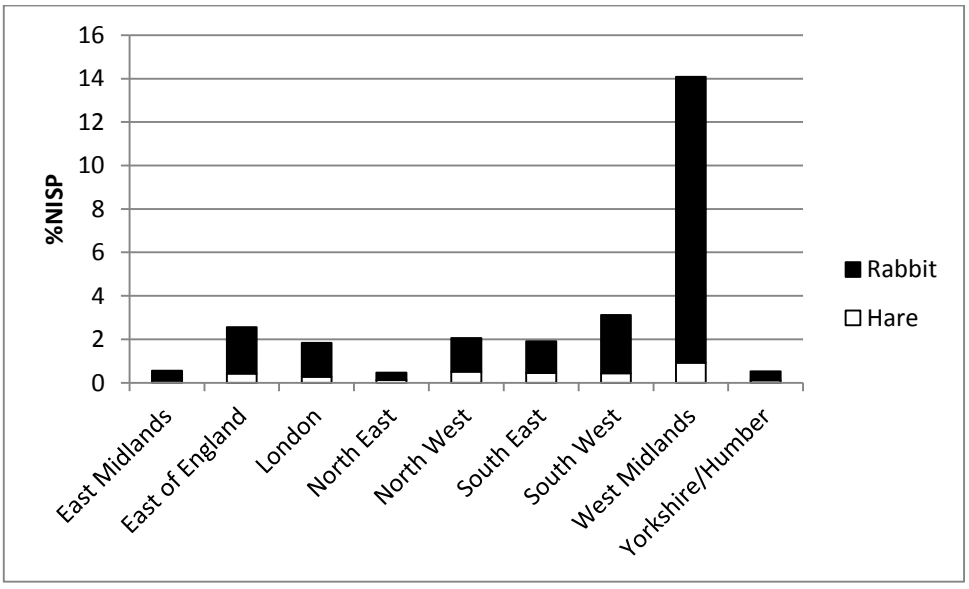

Figure 5.50: Relative proportion of identifiable rabbit and hare by region (expressed as a % of cattle, sheep/goat, pig, rabbit and hare by region)

Wild birds

In post-medieval England there was a wide variety of birds on urban sites (see Appendix Four). Figures 5.51 and 5.52 shows there were an increase in the number of wild birds in the early modern period in comparison to the medieval period; this has also been observed by other scholars (see Albarella and Thomas 2002). After the 17th century, there appears to have been a gradual decline in the proportion of wild birds. In the 19th-20th century the frequency of wild birds increased; however, this probably due to the number of pigeon/dove at Stafford Castle. The majority of wild birds fell into four categories: waders, water birds, wild galliforms and commensal (waders were separated from water birds as they formed a major group) (figure 5.55). Of the waders, woodcock was by far the most common, as discussed in Chapter Four; it was a popular food bird among the wealthy. Other waders were only found in small quantities, although plover, heron, lapwing and snipe were more common; infrequent species included curlew, bar-tailed godwit, green sandpiper and oystercatcher. Other water birds mainly comprised of teal/garganey and swan, less common species included as coot, goosander, pochard and tufted duck. Wild galliforms were primarily represented by grey partridge and turkey. Turkey was introduced in Britain in the 16th century, which is evident due to its presence in 16th-17th century contexts. Pheasant was only recorded at a select number of sites; however, this may be due to the difficulty of separating the bird from other species of galliforms. Grouse (i.e. red and black grouse) were rare species, in addition to peafowl. This was probably because of their elite associations. One possible guineafowl was found at Chester's Roman Amphitheatre. Quail was only found at Spitalfields Market (Lamb Street), London (AD 1800 – 1900). Commensal birds were the largest bird group; most of these were pigeon/stove dove and corvids. This is unsurprising as these species tend to occupy spaces where people reside; in addition pigeons were also known as a food source and a provider of fertiliser. Bird groups that were less common included birds of prey: peregrine falcon; sparrowhawk; golden eagle; osprey; buzzard; red kite; kestrel; and goshawk. The paucity of these species in the post-medieval period could reflect decreasing popularity of falconry, particularly as hunting with guns took over (Griffin 2007: 118-119; Serjeantson 2009:239). Other species worth mentioning are parrot and ostrich, which were the only two exotic bird species. Two parrot bones (one coracoid and carpometacarpus) were found at Castle Mall, Norwich (late 16th- to 18th century) and an ostrich metatarsal was found at London Bridge City, London (AD 1580 – 1700) (Albarella *et al*. 2009; Rielly 2000a). Sea birds such as the cormorant, kittiwake, auk, guillemot and scoter were also rare. Wild birds were more common on high-status sites followed by domestic sites in the post-medieval period. The high proportion of wild birds at domestic sites could be reflecting a shift in wealth towards towns and cities as common high-status edible birds were just as frequent on domestic sites (see figure 5.53-5.54).

Fish

Marine fish were more abundant in the post-medieval period, followed by migratory and freshwater species. Temporal comparisons are hampered by the fact that fish bones are often poorly preserved and the number of bones in species can differ (5.59). In addition, it was not always possible to separate out hand-collected and sieved fish remains, which further affects the reliability of the data. Nevertheless, it was still possible to detect broad patterns such as a decline in marine fish and an increase in migratory fish. Cod, whiting, other gadids, clupeiformes, herring and flatfishes (i.e. plaice/flounder) were the most popular marine species (figure 5.56-5.57). The results showed that there was a wide variety of marine fish that were consumed including rare and important food fishes like turbot, sole and halibut (Locker 2009). Common gadids were cod and whiting whereas saithe and pollack were poorly represented. Migratory taxa were dominated by eel and smelt. However, it should be noted that eel has double the number of vertebrae compared to other fish species; therefore, their abundance can be over represented (Locker 2009: 132). Less common species included grey mullet, sturgeon and salmon. Cyprinid (i.e. carp family) was the most abundant freshwater fish; as already mentioned in Chapter Four they do appear to become more common in the post-medieval period. Pike and chub were also typical food fishes in this period. Based on the presence/absence of freshwater species in the post-medieval period, the diversity of freshwater fish appears to decrease into the modern period (see Appendix Four). As many of these fishes were farmed in ponds on country and manor estates, the disuse of these ponds could be the reason for this lack of diversity. However, this interpretation should be view cautiously because of recovery biases and preservation of fish. However, this interpretation should be view cautiously because of recovery biases and preservation of fish.

Figure 5.58 shows the difference in the relative proportion of freshwater, migratory and marine fishes from regions in England. Sites in northern England appear to have a higher frequency of marine fish compared to central and southern England. There was a slightly higher proportion of freshwater species in central England and a greater number of migratory species in the south of England. It is worth noting that the representation of post-medieval fish remains is bias towards Southern England, in particular London. This is probably because the Museum of London Archaeology (MOLA) adopted a rigorous sampling strategy for the recovery of environmental remains, which were frequently analysed by in-house specialists (Rebecca Nicholson pers. comm.).

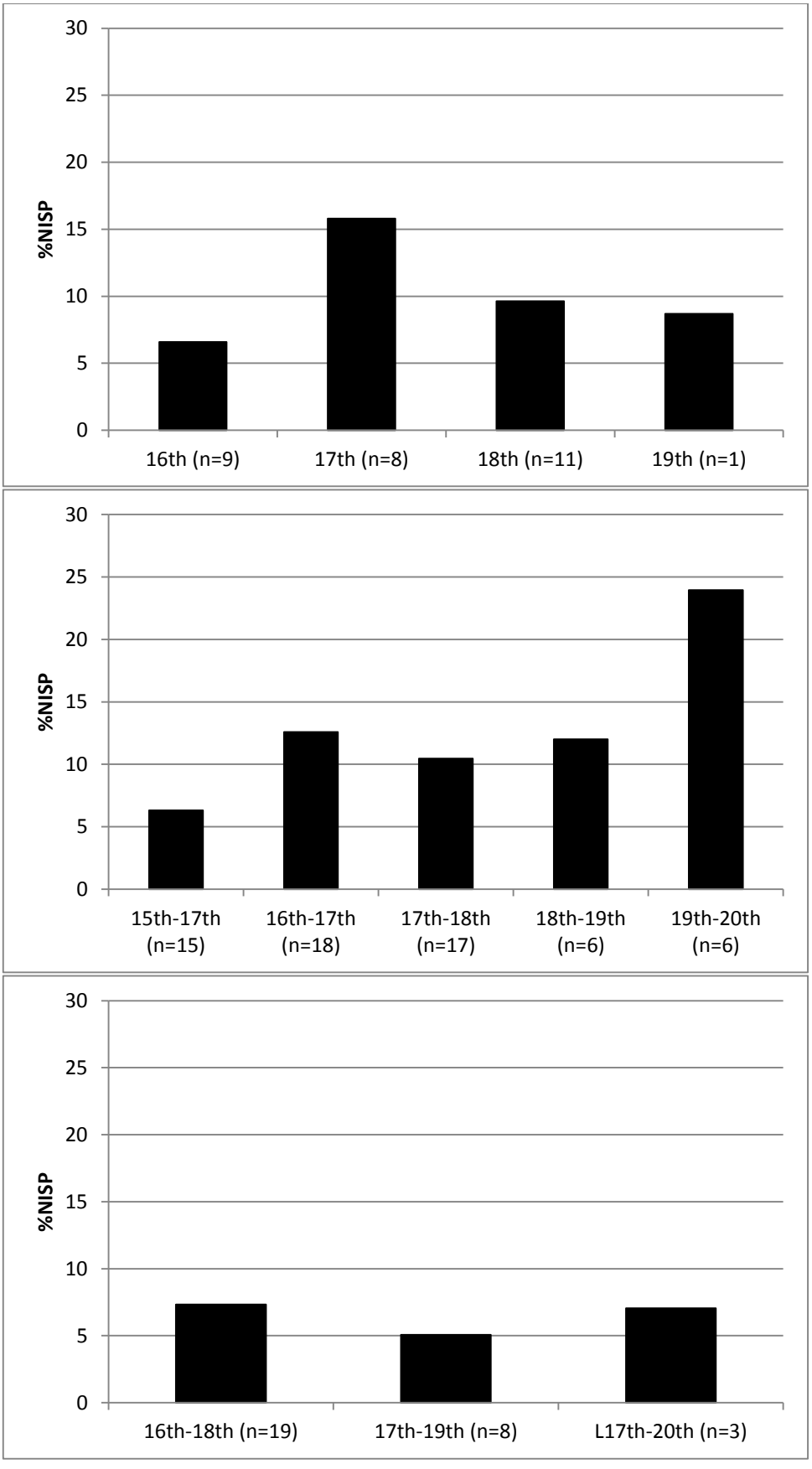

Figure 5.51: Relative proportion of wild birds from post-medieval urban sites (expressed as a % of the total number wild and domestic birds. (n)=number of sites

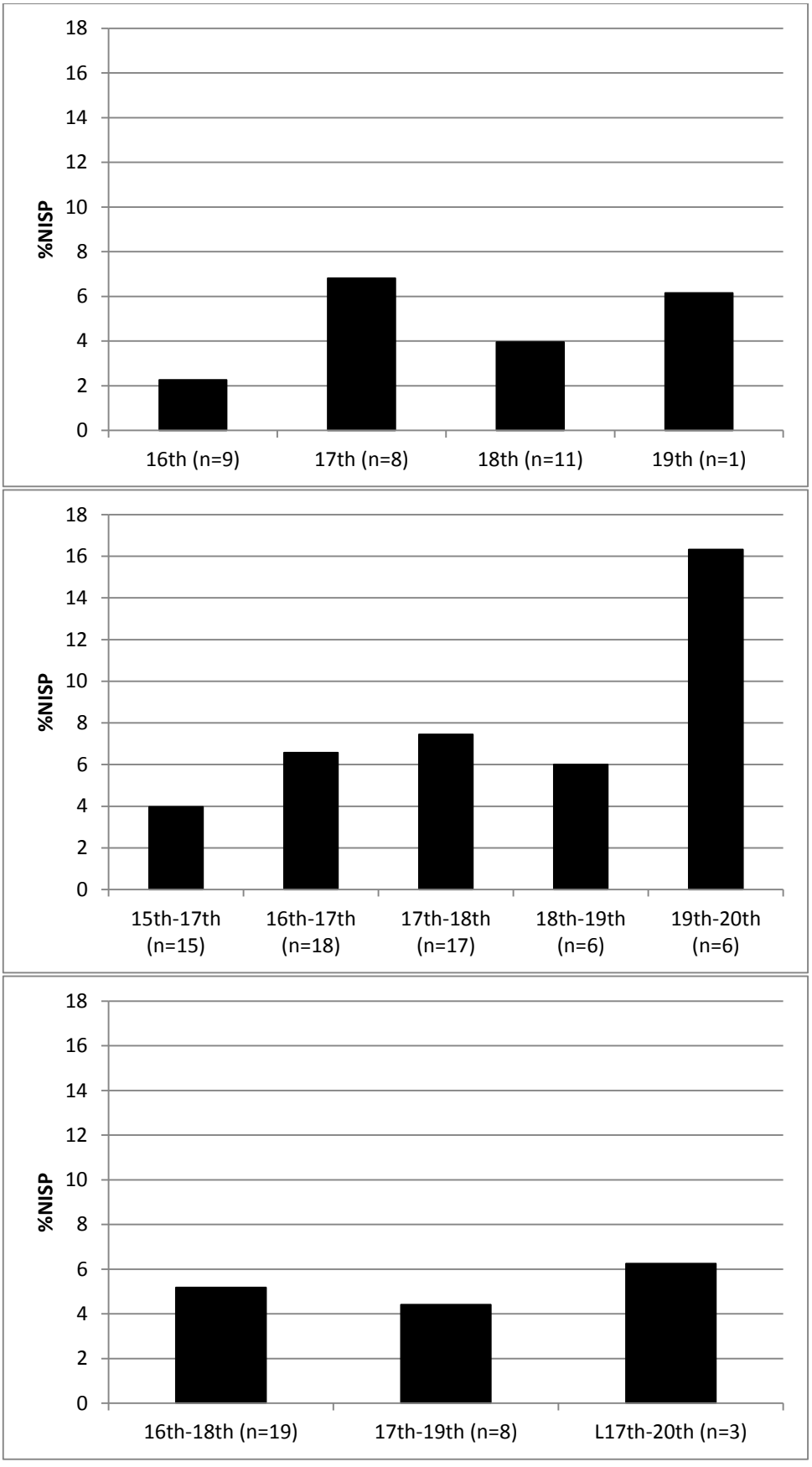

Figure 5.52: Relative proportion of edible wild birds from post-medieval urban sites (expressed as a % of the total number wild and domestic birds). (n)=number of sites

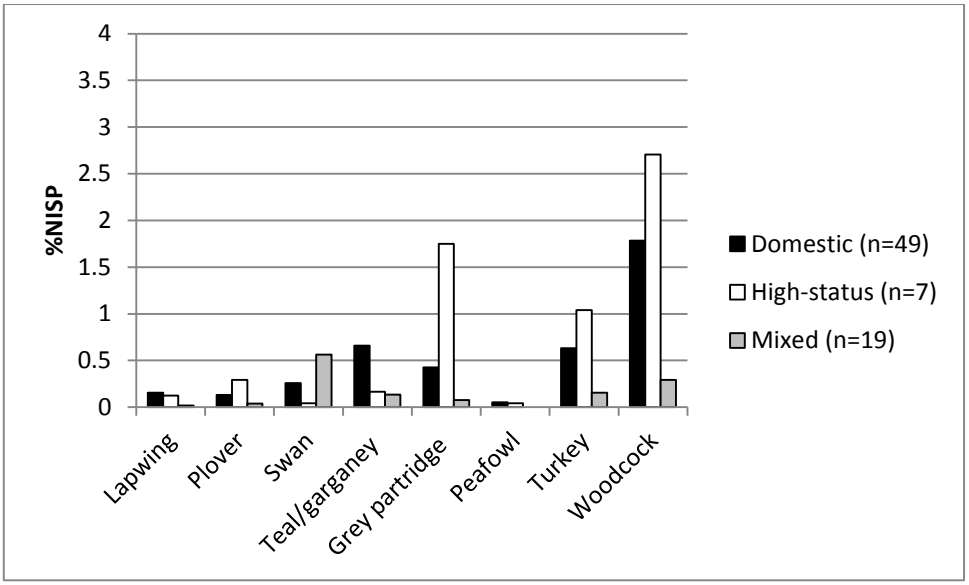

Figure 5.53: Relative proportion of common high-status birds at post-medieval urban domestic, high-status and mixed sites (expressed as a % the total number wild and domestic birds) (n)=number of sites with wild birds

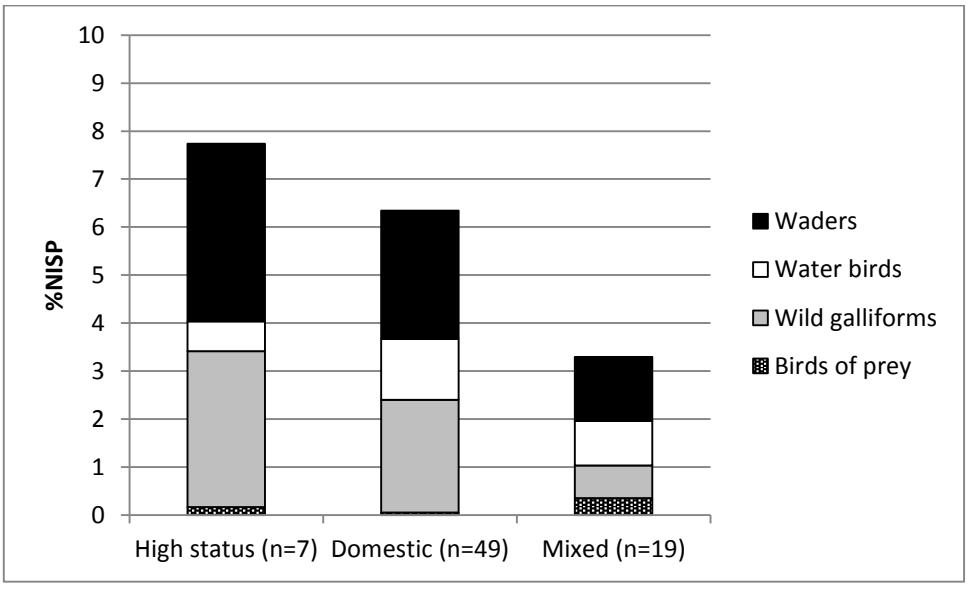

Figure 5.54: Relative proportion of wild birds at post-medieval urban domestic, high-status and mixed sites (expressed as a % the total number wild and domestic birds). (n)=number of sites with wild birds

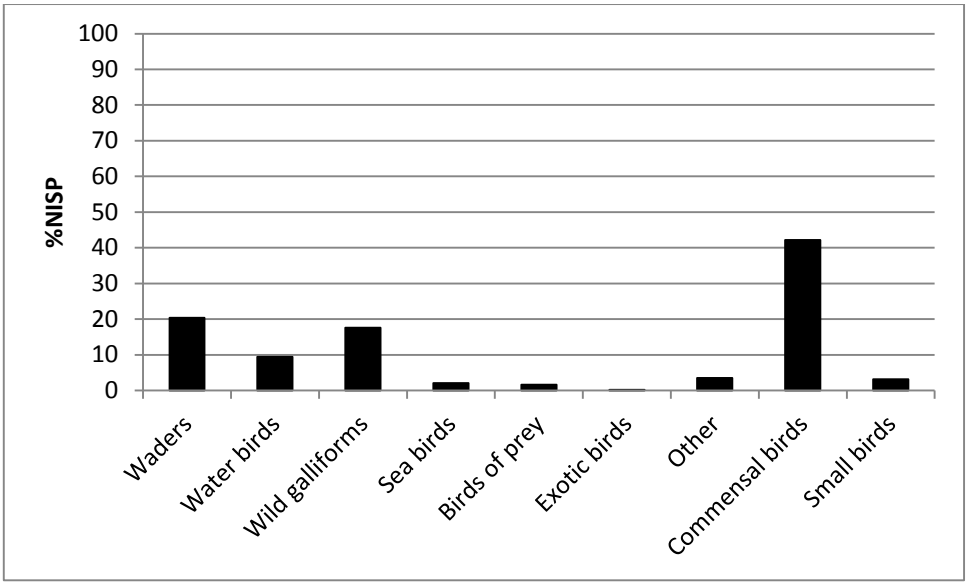

Figure 5.55: Relative proportion of wild birds by major groups from post-medieval urban sites (out of the total number of wild birds)

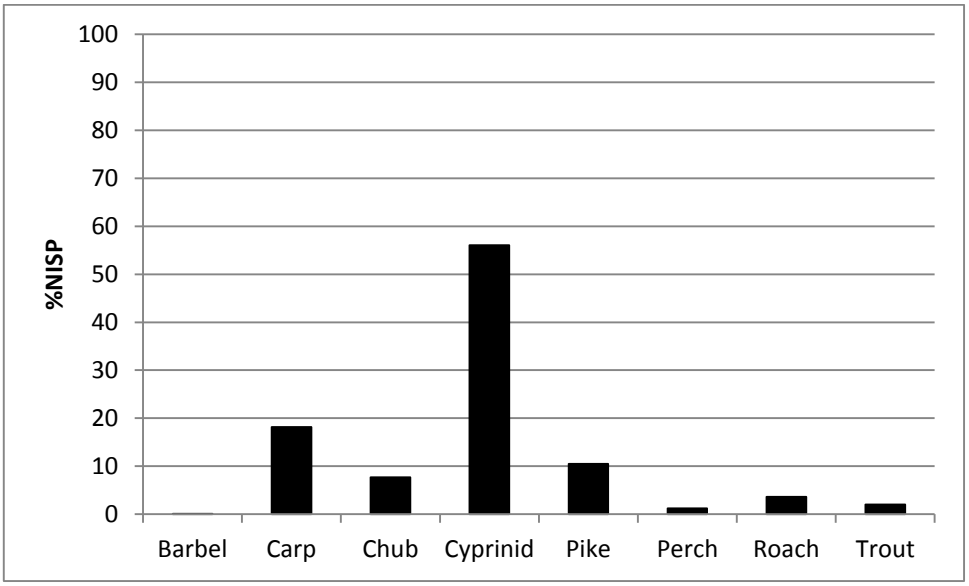

Figure 5.56: The main freshwater fishes from post-medieval urban sites (out of the total number of fresh fish)

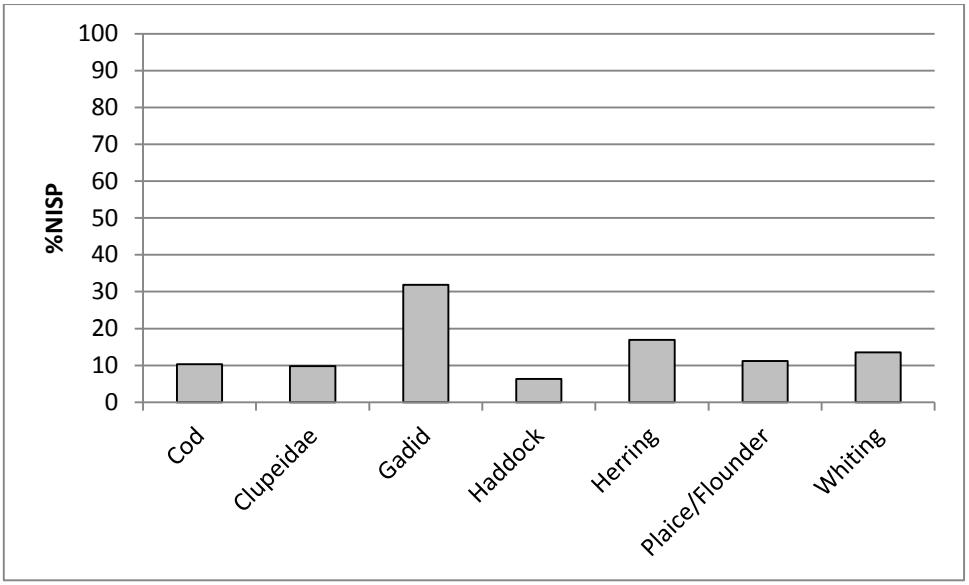

Figure 5.57: The main marine fishes from post-medieval urban sites (out of the total number of marine fish)

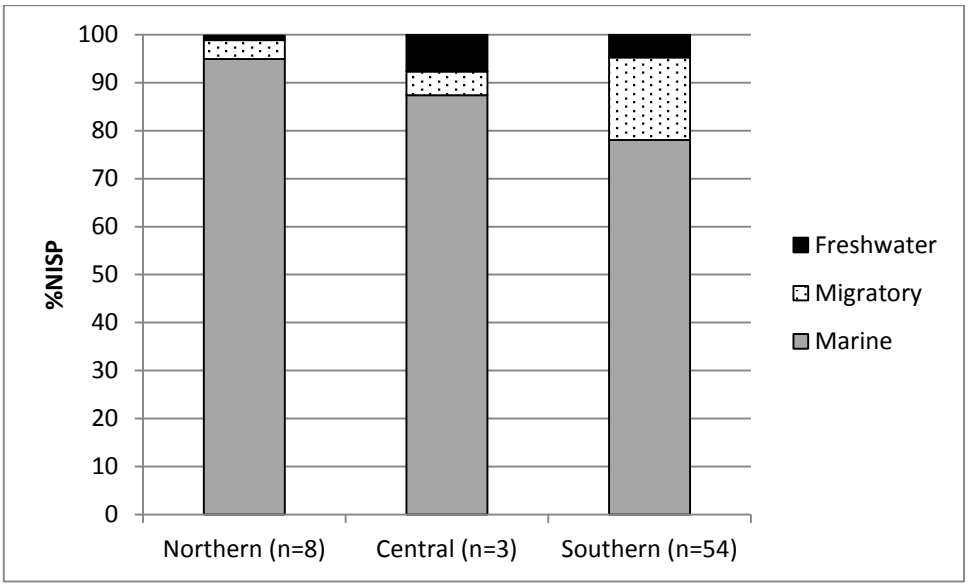

Figure 5.58: Relative proportions of freshwater, migratory and marine fish at post-medieval urban sites in northern, central and southern England. (n= the number of sites)

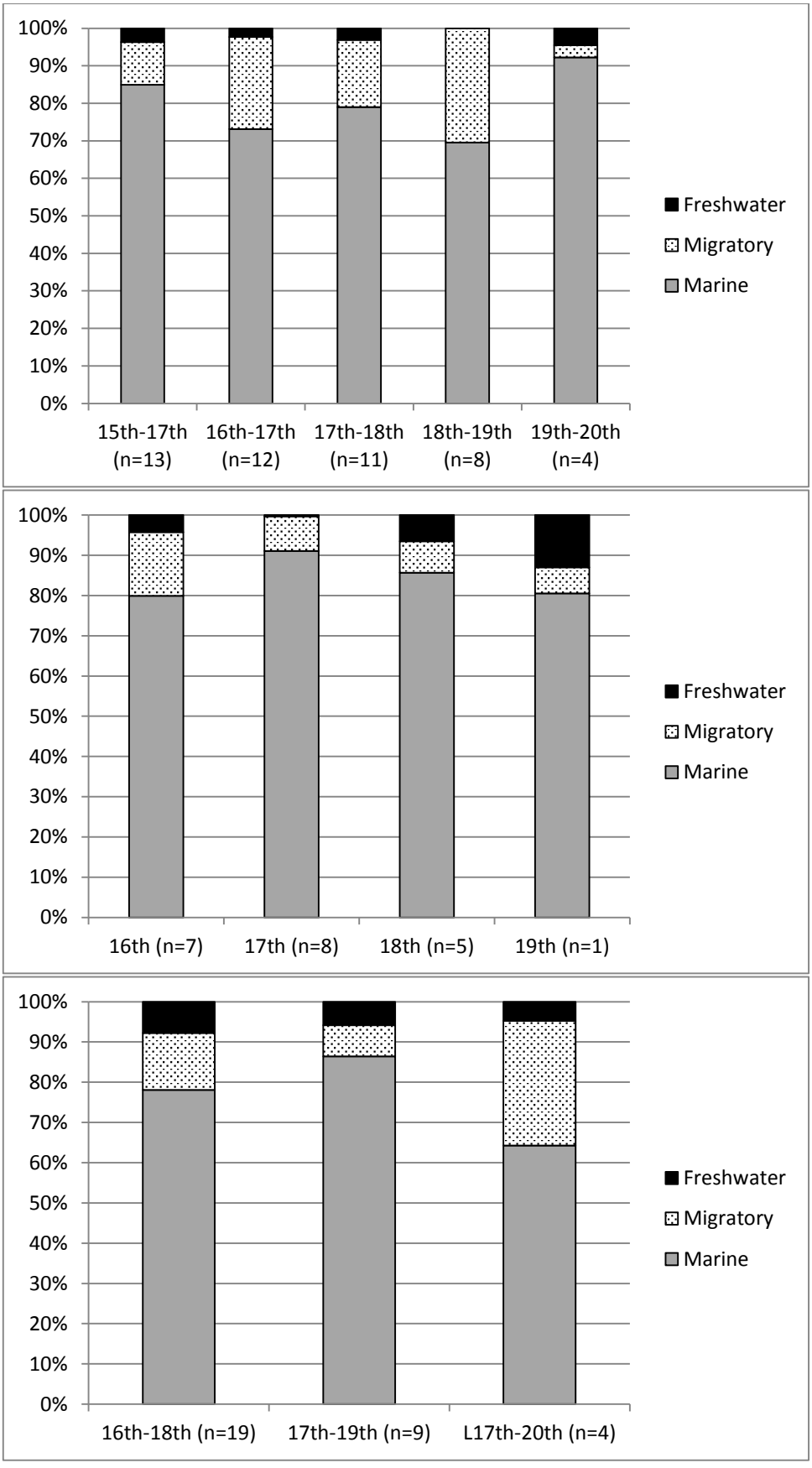

Figure 5.59: Relative proportions of freshwater, migratory and marine fish at post-medieval urban sites. (n=number of sites)

5.4 Butchery and body part distribution

Butchery and body part data were synthesised using descriptive summaries in order to provide an overview of butchery practices as well as insights into carcass processing and distribution. Butchery marks recorded on animals were mostly visible as cut, chop and saw marks, produced by a knife, chopper/cleaver and saw respectively. Based on general observations, the frequency of saw marks on bones appears to become more common in the later post-medieval period (e.g. 18th to 20th century and 19th to 20th century).

Cranial butchery was noted on cattle remains which included skinning marks on the mandible and chopped marks on the diastema (to remove the bone marrow). Two cattle skulls from Battle Bridge Lane, Southwark (late 16th to early 17th century) had been poleaxed and some skulls had been split longitudinally down the middle with a cleaver to extract the brain. A number of cattle had their horncores removed from the base and tips to remove the sheath from the core. Post-cranial butchery largely reflected disarticulation and dismemberment of the carcass. Chopped marks through the pelvis and femur were a common example of this. Many sites noted vertebrae having sagital or transverse chop marks; although the former was more common. Transverse chop marks were observed on long bones as well as filleting marks. Bones from Battle Bridge Lane, Southwark (late 16th to early 17th century) showed evidence for the breaking of bones to use for stews. Heavily butchered bones were observed at Hamilton Place, which may have been used for soup making. Skinning marks were seen on metapodials and Launceston Castle had the sawn proximal metacarpals (1660 – 1840), which may represent bone working (Yeomans 2007).

Butchery evidence on sheep/goat was largely similar to cattle. Horncores were sawn and chopped at the base, vertebrae had been sagitally split and long bones showed evidence for disarticulation and dismemberment. Skinning marks were also noted on the metapodials and long bones were chopped through the mid-shaft. However, some butchery practices appeared to be more common on sheep/goat in comparison to cattle. For instance, there were more examples of sites that had skulls which had been longitudinally split, as well as hook marks on the scapula and filleting marks. Circumferential cut marks were mostly noted on the long bones of sheep/goat.

Butchery on pig remains were less frequently reported compared to cattle and sheep/goat. In addition, younger animals tend to have low instances of butchery because they require less dismemberment. Typical butchery marks on pigs included: filleting and cut marks on the long bones; skinning marks on the metapodials and phalanges; sagital splitting of vertebrae; and splitting of the limb bones. Pig skulls were also split longitudinally for the extraction of the brain and one scapula from 3-15 Eastgate street (late 15th to mid-17th century) had a hook mark.

Other animals with butchery marks were horse, dog, cat and deer. Cut and chop marks found on horse bones were associated with skinning and dismemberment. Typically, cuts were noted on the metapodials and phalanges and chop marks were reported on the long bones. As for dogs and cats, cut marks were common on isolated elements. Butchery marks were also observed on fallow deer but less frequently reported on red deer.

There were low instances of bird butchery probably because they were most likely prepared whole. The few examples of butchery evidence on birds were mainly described on chicken and goose. Cut marks were seen on the spur of chickens, which may have been carried out to remove the spur. Cut and chop marks were also seen on the proximal and distal articulation of long bones. Two chicken skulls were sagittally split at Chester's Roman Amphitheatre (mid-16th century). A similar example was seen on a goose skull from Castle Mall Barbican Well, Norwich (mid/late 15th to early 16th century) and on chicken, goose and swan skulls at Little Lane, Leicester (1400-1550). There were also two examples of goose sterna fine cut marks from Eagle House (Cannon Street), London and 10 Commonhall Street, Chester. This was indicative of carving the breast meat.

Variation in body part distribution can differ greatly between sites and can also vary by context within individual sites. For that reason, when investigating body part distribution it is better to compare by context (Albarella *et al.* 2009: 34). Given the nature of this investigation this approach was not plausible. However, it was still possible to identify general patterns concerning the treatment, distribution and disposal of animal carcasses on urban sites.

On the whole, cattle appeared to have arrived in the city or town as undressed or dressed carcasses. Although most elements were present, many sites showed a predominance of major meat-bearing bones such as the femur, pelvis, tibia, scapula and humerus. This selectivity probably reflects the purchase and consumption of major meat joints. However, what varied considerably was the proportion of skulls, mandibles, metapodials and phalanges on individual sites. A high number of skulls and foot bones were frequently noted, which would suggest primary butchery, industrial activity and/or craft-working. Industrial sites typically had a predominance of horncores whereas mixed assemblages (i.e. domestic/industrial) mostly had skulls, mandibles, with a mixture of major-bearing bones. Many domestic assemblages had a high number of skulls and metapodials, which probably reflected the different activities taking place on site. These differences in elemental representation clearly highlight the complex nature of urban assemblages.

The range of sheep/goat elements was similar to cattle, which demonstrates they too arrived as undressed or dressed carcasses. Major meat-bearing bones predominated on many sites, as well as

skulls and metapodials which were observed in domestic, industrial and mixed assemblages. There did appear to be a greater emphasis on particular major meat-bearing bones which were consistent on a number of sites. For instance, the humerus, scapula and tibia were noted for being more common and some sites mention a dominance of forelimbs. This could reflect selectivity in what joints people were eating, in this instance the consumption of shoulder joints bought from the urban market.

The body part distribution for pigs showed that some sites had a range of elements whereas others had a more selective representation. This suggests that joints either arrived as undressed or dressed carcasses. Sites were typically noted for their higher occurrence of mandibles and skulls as opposed to post-cranial elements. The higher frequency of cranial elements could be due to preservation factors as they have a higher survival rate compared to post-cranial elements. However, as discussed in Chapter Four pig head was also a delicacy so this may testify to the importation of this particular body part. Certain major meat-bearing bones also predominated, particularly the humerus, scapula, radius and tibia. Although the humerus, radius and tibia are the most structurally dense elements, which could also account for their high occurrence (see Lyman 1994, table 7.6). However, this could also to the consumption of particular meat joints, although filleted cuts or bacon would have been eaten as well. Skulls and/or foot bones were frequent on a number of sites but this was less obvious compared to cattle and sheep/goat. Despite this, their presence could suggest the processing of pig skins, although not on an industrial scale.

Horse body part data from four sites - Dudley Castle, West Midlands; SOU 29, Southampton; City Road, Chester; London Bridge City, London; and The Green, Northampton - provided insight into the distribution and disposal of horse remains. A low proportion of major meat-bearing bones was noted at all sites (except The Green, Northampton), which suggested the removal of these elements for other purposes. At Dudley Castle and The Green, the scapula was the most common element.

Fallow deer remains were represented by hindlimbs and forelimbs. Although it appears that hindlimbs were more common on castle sites whereas both forelimbs and hindlimbs were present at domestic and ecclesiastical sites. Similar results were identified by Sykes (2007b, figure 11.6), which showed a high occurrence of deer forelimbs at medieval urban sites.

Body part data for chicken was noted from some archaeological sites. In general, all body parts were present; however, there was a predominance of major meat-bearing elements such as the femur and humerus. At some sites the leg, wing and foot elements were common, which could suggest primary butchery.

ABGs (Associated Bone Groups) and special deposits

Partial skeletons were common throughout the post-medieval period, which mainly derived from horse, cat and dog; although pig skeletons were occasionally mentioned. Bird partial skeletons were uncommon; however, bird ABGs that were found included chicken, buzzard, sparrowhawk, raven and woodcock. Special deposits were normally those associated with crafts and industries. This consisted of tanning, tawying and horn working waste. Pinner waste was identified at Creedy's Yard, Greenwich and Battle Bridge Lane, Southwark. In addition, a knucklebone floor was found at 67-69 St Thomas' St, Oxford. It should be noted that all these sites represented mixed assemblages. Horncore deposits from St Marys Guildhall 82-3, Lincoln and 25 Bridge Street suggests they were used for structural purposes. A large proportion of goose carpometacarpi was recovered from Castle Mall Barbican Well, Norwich, some of which had cut marks on the proximal articulation (García 2009: 128). A similar assemblage of goose carpometacarpi was found at Victoria Road, Winchester (13th-14th century) and in medieval deposits at St Peter's Lane, Leicester and Eastgate, Beverley (Serjeantson and Smith 2009; Gidney 1993). Concentration of goose wings has been associated with specialist activity because their feathers were used as mattress and pillow stuffers and for arrows and quills (García 2009: 128; Serjeantson and Smith 2009: 140).

5.5 Slaughter profiles

Tooth wear data were primarily used to understand the slaughtering strategy for animals as it provides a more precise method of determining the age of an animal at the time of death. Detailed epiphyseal fusion data were not employed because they cannot establish the aged of an animal beyond skeletal maturity. In addition, specialists present fusion data in a variety of formats and do not always include the raw data, which renders challenging comparative analyses. However, because epiphyseal fusion and tooth wear data can highlight different practices, fusion data were recorded using basic categories (e.g. mostly young, mixed, mostly adult/elderly) to provide supplementary information.

On the whole, tooth wear data for the three domesticates were limited for the post-medieval period. This is most likely because of the different pathways body parts are distributed and deposited within urban centres (see O'Connor 1993). Once an animal was slaughtered for consumption their body parts would have been transported to different locales within the town or city. For instance, horns and skins (which are attached to the skull) can end up with the tanner, tawyer and horn worker. As a result the number of mandibles is less likely to turn up on domestic

urban assemblages. Sheep/goat mandibles were better represented compared to cattle. This could reflect the fact that sheep bones are less commonly recycled than cattle.

The tooth wear data were analysed by chronological phase to detect trends in husbandry practices over time; however, due to the limited data some chronological groups were represented by one or two sites. Sites that produced the largest amount of data were also considered separately, to establish their influence on temporal data.

The tooth wear data for cattle were particularly limited with the largest dataset dating from the 16th-17th and 17th-18th centuries (figure 5.60). The analysis revealed that cattle on sites dating from the 16th-17th century included young and old animals, however, with a greater emphasis on young animals. Thirty-six percent of cattle were slaughtered before they reached 12 months of age and 28% were killed by the time they were young adults therefore, indicating an emphasis on meat production. This is a much younger mortality profile compared to cattle at medieval sites (see Sykes 2006). By the 17th-18th century, there appeared to be a higher proportion of young animals, which could be indicative of the rise of the dairy industry. This trend may also be observed in the 18th-19th century, however, the evidence is based on one site. The epiphyseal fusion data showed that the majority of cattle from post-medieval sites were classified as 'mixed'. This is in contrast to the tooth wear data; however, this may be because fusion data can under represents the presence of younger animals as their bones are more susceptible to post-depositional destruction. From the 16th-17th to 18th-19th century, it could be argued there is a decline in the slaughter age over time which could point to the presence of faster maturing breeds.

For sheep/goat the tooth wear data suggests that they were largely exploited for secondary products before arriving to the meat market (figure 5.61). Although some lambs were present the majority of sheep/goat appeared to be consumed at prime meat age and in the form of mutton (e.g. 3 to 8 years). This is different to cattle, which shows an increase in the proportion of young animals over time whereas for sheep/goat there is very little temporal difference. This is also confirmed by the epiphyseal fusion data. There was a slight increase in the number of juveniles from the 15th-17th century to the 16th-17th century and by the 19th-20th century it seemed that they was a higher proportion of young sheep/goat that may be tentative evidence for faster maturing breeds. Most of the young animals from the latter period derived from 25 Bridge Street.

Pig tooth wear data revealed that most were culled by the time they reached three years of age (figure 5.62). This is unsurprising as pigs were predominately exploited for meat. This is also supported by the fusion data, which describe pigs as 'mostly young'. In the 15th-17th and 16th-17th

century a number of pigs were culled around 0 to 2 months; indicating the consumption of suckling pigs. It is worth mentioning that the majority of these animals came from two sites; St John's Street, Winchester and Chester's Roman Amphitheatre, Chester. In the 16th-17th century there was a higher proportion of pigs that survived beyond 7 to 14 months, compared to the other phases. There were also a higher proportion of pigs classified as adults, showing that pork was consumed.

It was possible to gather limited amounts of information regarding the age of chickens at a select number of sites. Most of the chickens were adult; however, some sites had a mix of juveniles and adults. Nicholas Street Mews, Chester, West Midlands, had a high proportion of juveniles, suggesting an emphasis on meat production.

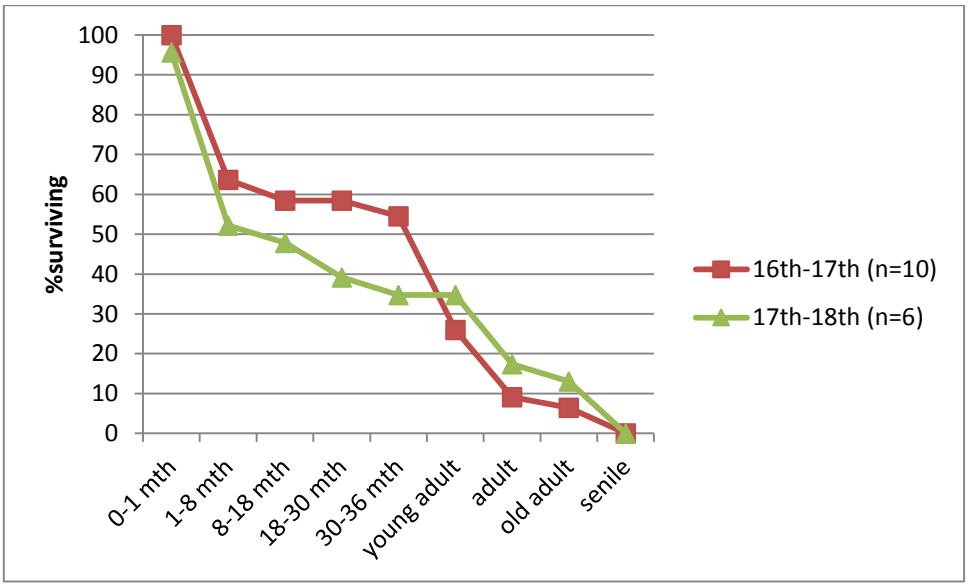

Figure 5.60: Tooth wear data for cattle mandibles from post-medieval sites. This graph was produced using the methods of Hambleton (1999). (n)=the number of sites. Phases with less than 10 mandibles were obmitted. The graph shows the cumulative percentage of the percentage total of animals from each age category

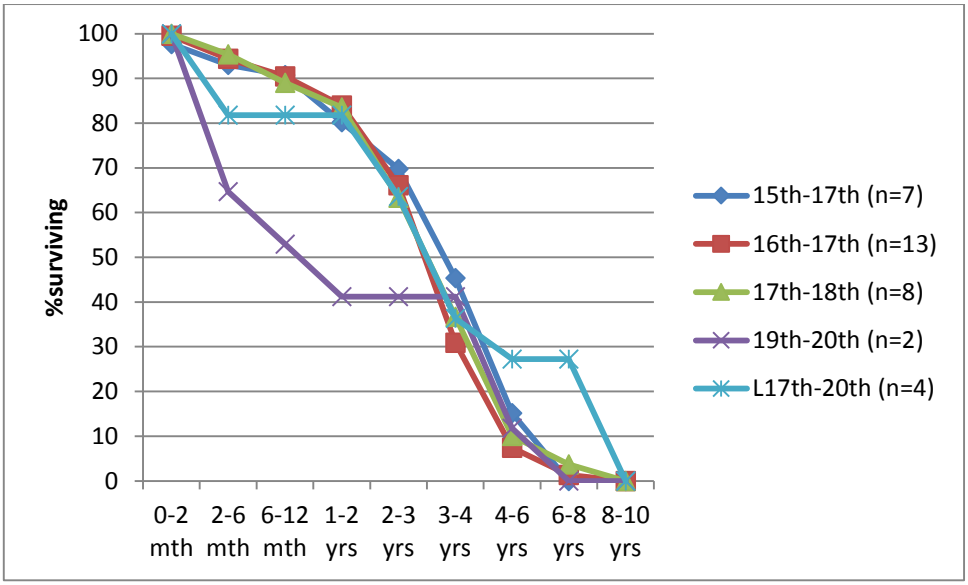

Figure 5.61: Tooth wear data for sheep/goat mandibles from post-medieval sites. This graph was produced using the methods of Hambleton (1999). (n)=the number of sites). Phases with less than 10 mandibles were obmitted. The graph shows the cumulative percentage of the percentage total of animals from each age category

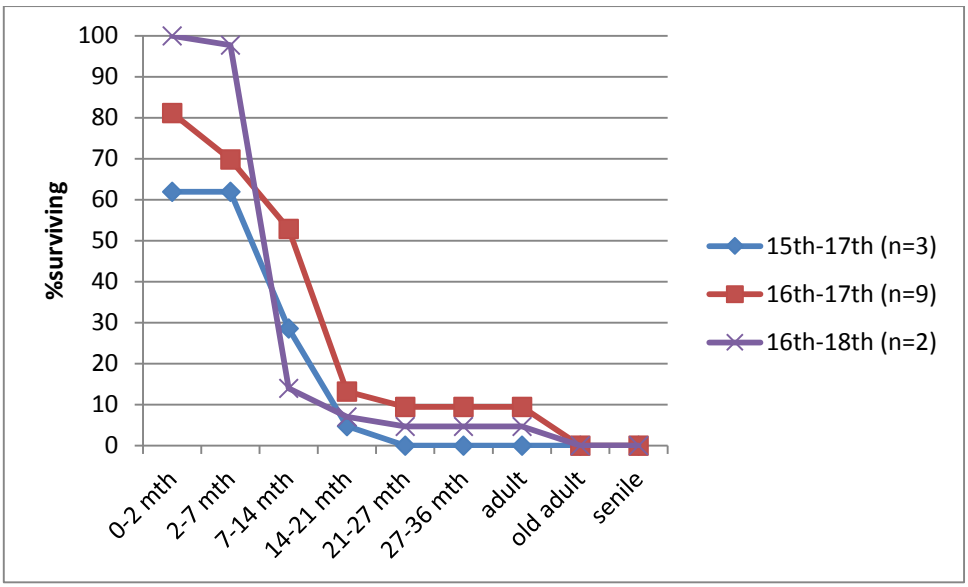

Figure 5.62: Tooth wear data for pig mandibles from post-medieval sites. This graph was produced using the methods of Hambleton (1999). (n=the number of sites). Phases with less than 10 mandibles were obmitted. The graph shows the cumulative percentage of the percentage total of animals from each age category

5.6 Livestock size and shape

To explore diachronic changes in the size of livestock the log scaling technique was adopted for cattle, sheep/goat, pig and chicken measurements. However, due to the limited dataset only length and breadth data could be employed as depth measurements were too sparse to warrant investigation. In addition, because of the limited number of tooth measurements for all three domesticates, it was only possible to carry out the log scaling technique on post-cranial bones. The size of cattle, sheep/goat and chicken were compared by region; this was not carried out for pig because of the paucity of data.

The analysis of length measurements for cattle revealed a gradual increase in the size of cattle bones (figures 5.63). This was also seen in the mean values, although the result was not statistically significant (Appendix Four, table 4.17). Breadth measurements also demonstrated a similar increase over time (figures 5.64); however, this too showed no statistical significance. There was a decrease in the mean value in breadth measurements between the 16th-18th century to the 17th/20th century (appendix four, table 4.18), which was statistically significant (U=19280; *P*=0.000). However, as these chronological groups overlap in date, the presence of 17th- and/or 18th-century bones, in either of the phases, could have caused the decline.

Cattle length measurements from northern England showed that animals from the 16th-18th century were statistically smaller than those from southern and central England (Table 5.1; figure 5.65). In the later period, length measurements for cattle in the 17th-20th century showed that animals from central England were statistically smaller than animals from southern and northern England (Table 5.2; figure 5.65). Breadth measurements were similar, showing that northern cattle in the 16th-18th century were statistically smaller than those from central and southern England (Table 5.3; figure 5.65). The breadth measurements of cattle from the 17th-20th century also revealed that northern cattle were statistically smaller than southern and central cattle (Table 5.4). Breadth log scales from the 18th-20th century showed a wide distribution in the range of cattle measurements. Such a diverse range may indicate the presence of different cattle types in the later post-medieval period (figure 5.64).

The metrical data for sheep/goat revealed a gradual increase in length and breadth from the 16th-17th century to the 19th-20th century (figures 5.66-5.67). This is also reflected in the mean log value (Appendix Four, table 4.21-4.22). The size increase in length between the 16th-17th and 17th-18th century was statistically significant (U=9574; *P*=0.000), as well as the size increase in breadth measurements from the same consecutive phases (U=85540; *P*=0.000). There is a size decrease in length measurements between the 15th-17th century and the 16th-17th century, which was also

statistically significant (U=14400; *P*=0.000). This was the same for breadth measurements (U=75620; *P*=0.000). Again, it is difficult to interpret the cause of this decline as these two phases overlap in date.

Length measurements of sheep/goat from the 16th-18th century showed that animals from northern England were statistically larger than those from central and southern England (Table 5.5; figure 5.68). In contrast, breadth measurements of sheep/goat from the 16th-18th and 17th-20th century showed that northern sheep/goat were smaller (Table 5.6 and 5.7). The size difference in length and breadth measurements of northern sheep/goat could be attributed to a number of factors as measurement data can be affected by a number of variables including age, environment and sex (Albarella 2002: 54). However, this could reflect the presence of different morphotypes of sheep in the North. As discussed in Chapter Four, by the 18th century there was a greater variety of sheep as 'improved' breeds which were introduced in Cheshire and all over the country. Further evidence for different sheep morphotypes can also be seen in measurements of sheep/goat metacarpals (see figure 5.83). Lastly, breadth measurements demonstrated that sheep/goat from southern England were larger than animals from central England in the 16th-18th century (U= 143800; *P*=0.000) and the 17th-20th century (U=16330; *P*=0.024).

Post-cranial measurement data for pig were scarce; therefore, the results were not as comprehensive (see figure 5.69, 5.70). Nevertheless, the results did reveal a size increase in length measurements from the 16th-17th century to the 17th-20th century, which was statistically significant (figure 5.69) (U= 80.5; P=0.047). Zooarchaeological studies and documentary accounts refer to the 'improvement' of pig breeds in the later post-medieval period (Albarella 2002: 53; Trow-Smith 1959: 216).

Overall chicken post-cranial length and breadth measurements showed a size increase overtime, which was also observed in the increasing mean values; although statistical analysis revealed this to be insignificant (figures 5.71-5.72; Appendix Four, table 4.27-4.28). However, regional comparisons revealed statistically significant size differences in chickens (figure 5.73; appendix four, table 4.30). For instance, length measurements for chickens from the 16th-18th century showed that those from northern England were smaller than domestic fowl from southern (U= 9548; P=0.013) and central (U=13200; P=0.034) England. This was also the case for northern chickens from the 17th-20th century, although the result was not statistically significant. Breadth measurements of chickens from the 16th-18th century revealed that northern chickens were again smaller than those from southern and central England (figure 5.73). Statistical testing did show that this difference was only significant when chickens from northern and southern England were compared (U=11730; P=0.009). In the

17th-20th century, the mean value of northern chickens showed that they were larger than central and southern chickens but this was not statistically significant. The log scales also showed that chickens ranged in size throughout the post-medieval period; this is particularly notable in the breadth measurements (figure 5.72). It is possible that this reflects the presence of different morphotypes of chickens (i.e. bantams). Based on the data, the evidence suggests that the presence of different morphotypes and breeds becomes more prominent after the 16th-17th century.

Region	n	Mean	U	*P*
Central	133	0.00133	3277	0.000
Southern	112	0.00564	2537	0.000
Northern	69	-0.01694	-	-

Table 5.1: Mann-Witney U-test of cattle length measurements from northern sites compared with central and southern sites dating from the 16th to 18th century

Region	n	Mean	U	*P*
Northern	57	-0.00132	547	0.033
Southern	69	0.007858	600	0.006
Central	27	-0.02717	-	-

Table 5.2: Mann-Witney U-test of cattle length measurements from central sites compared with northern and southern sites dating from the 17th to 20th century

Region	n	Mean	U	*P*
Central	348	-0.04059	18400	0.000
Southern	414	-0.00997	13280	0.000
Northern	131	-0.05684	-	-

Table 5.3: Mann-Witney U-test of cattle breadth measurements from northern sites compared with central and southern sites dating from the 16th to 18th century

Region	n	Mean	U	*P*
Central	58	-0.03987	2923	0.00
Southern	150	-0.02315	6512	0.00
Northern	147	-0.05918	-	-

Table 5.4: Mann-Witney U-test of cattle breadth measurements from northern sites compared with central and southern sites dating from the 17th to 20th century

Region	n	Mean	U	*P*
Central	369	0.040032	8134	0.000
Southern	97	0.040348	2495	0.016
Northern	66	0.055793	-	-

Table 5.5: Mann-Witney U-test of sheep/goat length measurements from northern sites compared with central and southern sites dating from the 16th to 18th century

Region	n	Mean	U	*P*
Central	747	0.073781	54580	0.000
Southern	466	0.084645	28420	0.000
Northern	190	0.061632		

Table 5.6: Mann-Witney U-test of sheep/goat breadth measurements from northern sites compared with central and southern sites dating from the 16th to 18th century

Region	n	Mean	U	*P*
Central	85	0.084567	8605	0.013
Southern	454	0.094637	38800	0.000
Northern	247	0.07528		

Table 5.7: Mann-Witney U-test of sheep/goat breadth measurements from northern sites compared with central and southern sites dating from the 17th to 20th century

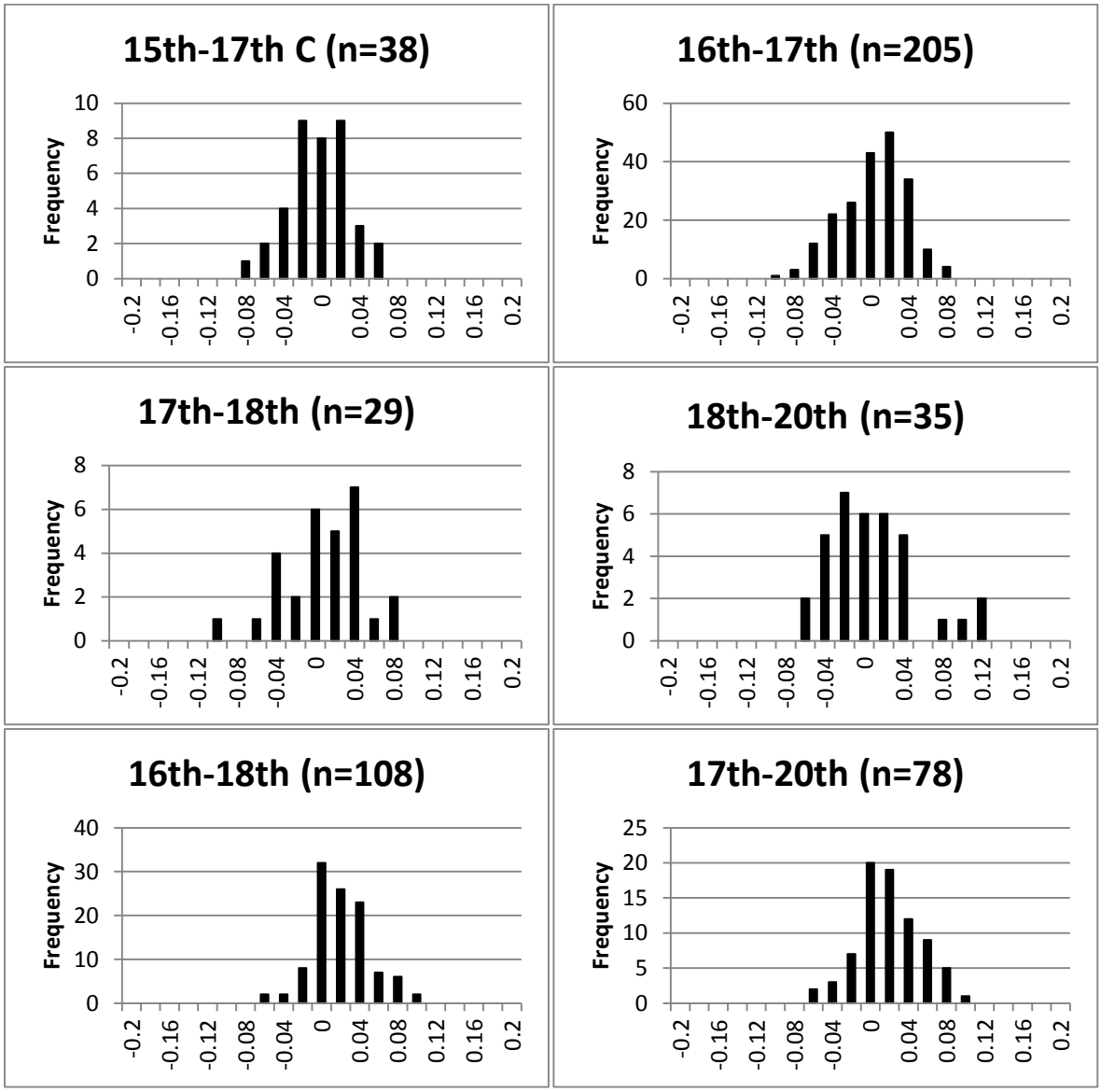

Figure 5.63: Cattle log-scaled of post-cranial length measurements from post-medieval sites in England

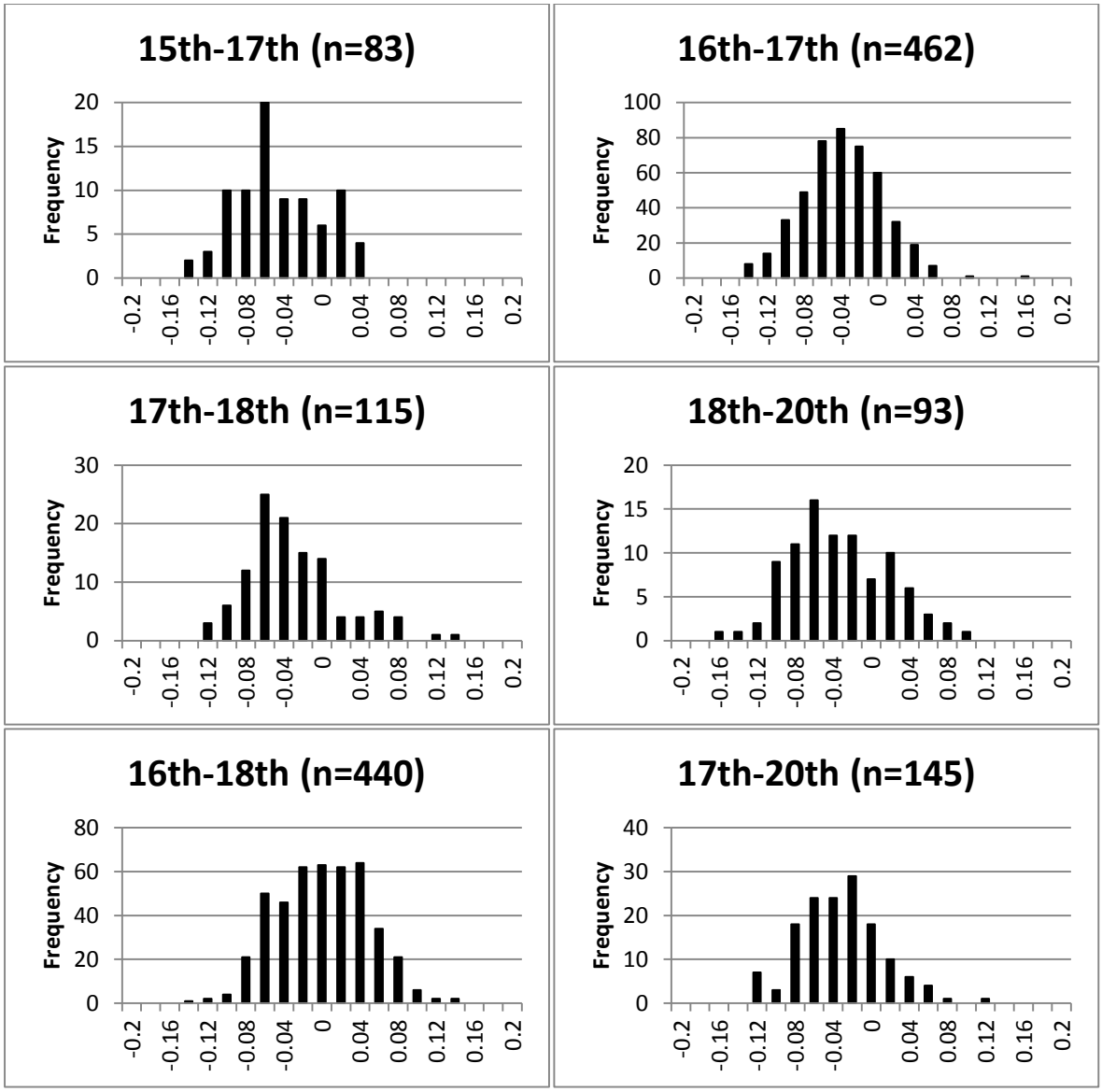

Figure 5.64: Cattle log-scale of post-cranial breadth measurements from post-medieval sites in England

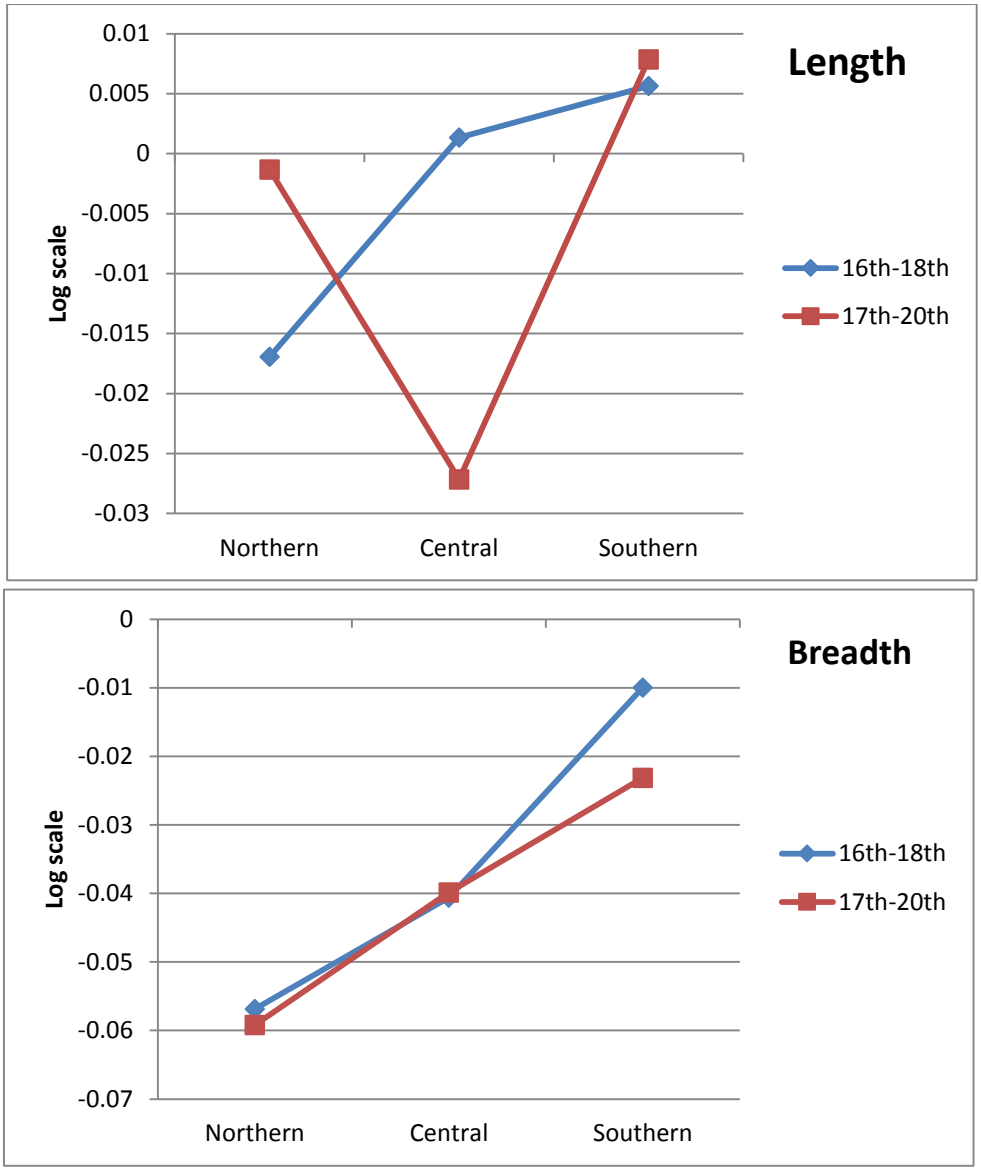

Figure 5.65: Mean log-scaled values for cattle length and breadth from northern, central and southern England

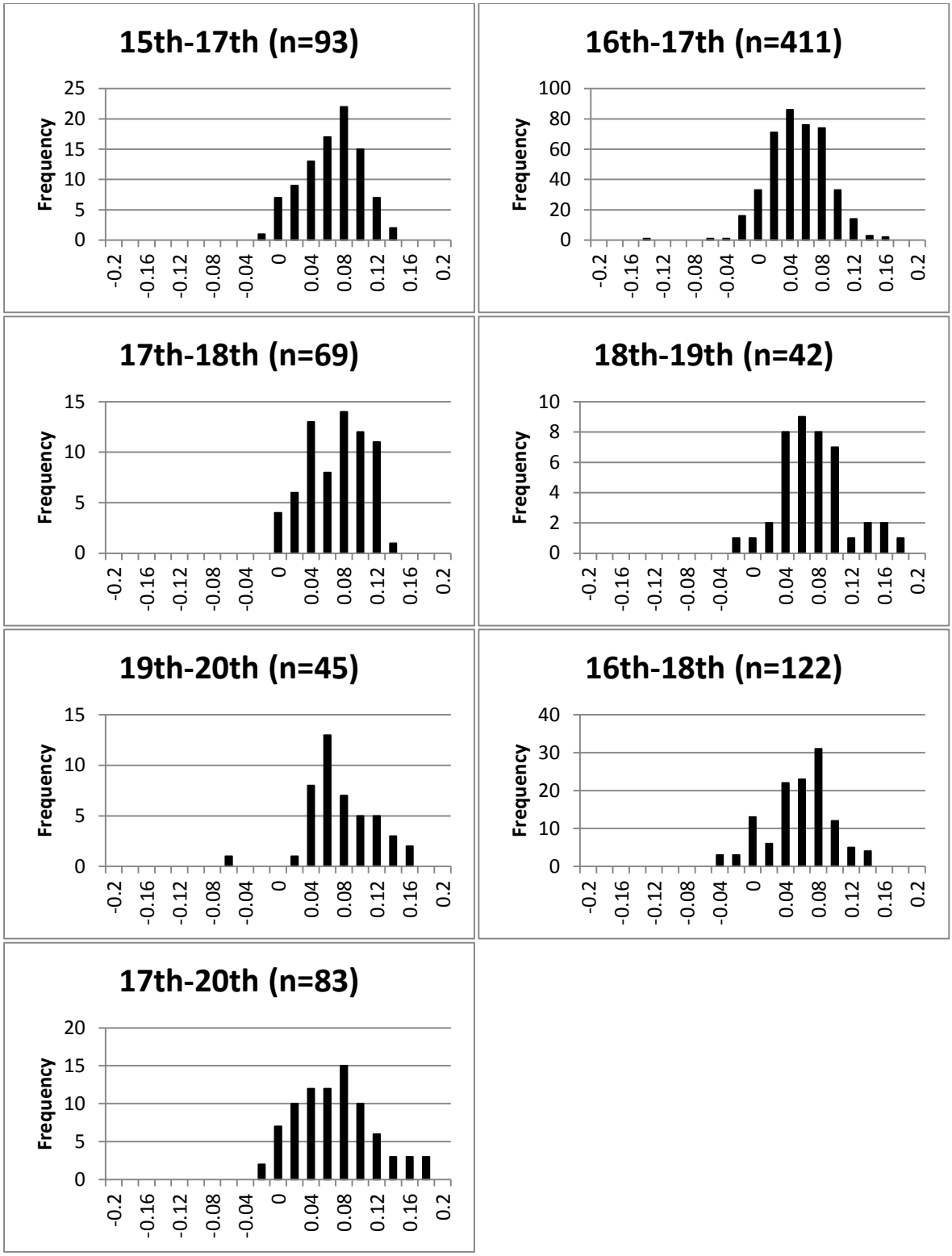

Figure 5.66: Sheep/goat log-scale of post-cranial length measurements from post-medieval sites in England

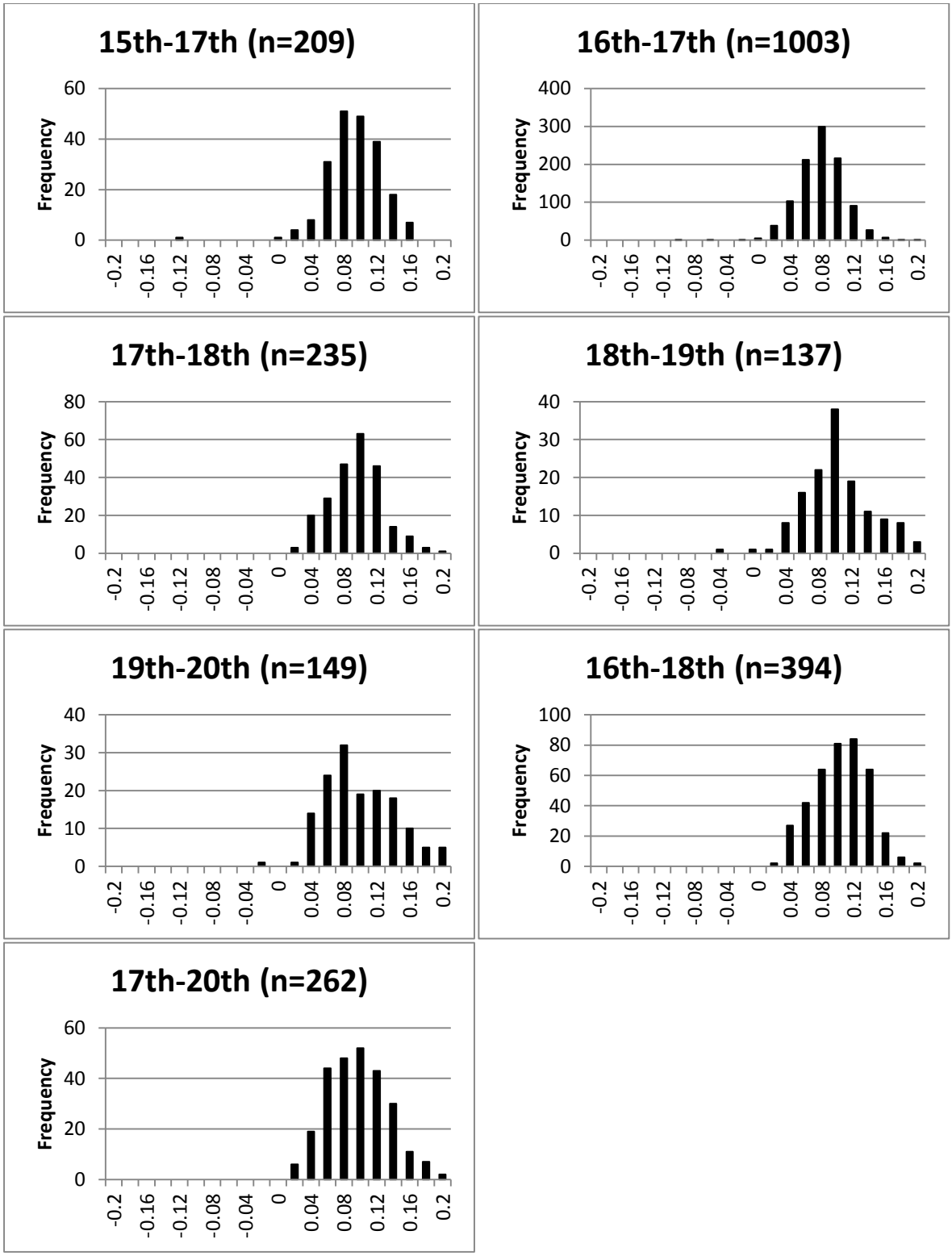

Figure 5.67: Sheep/goat log-scale of post-cranial breadth measurements from post-medieval sites in England

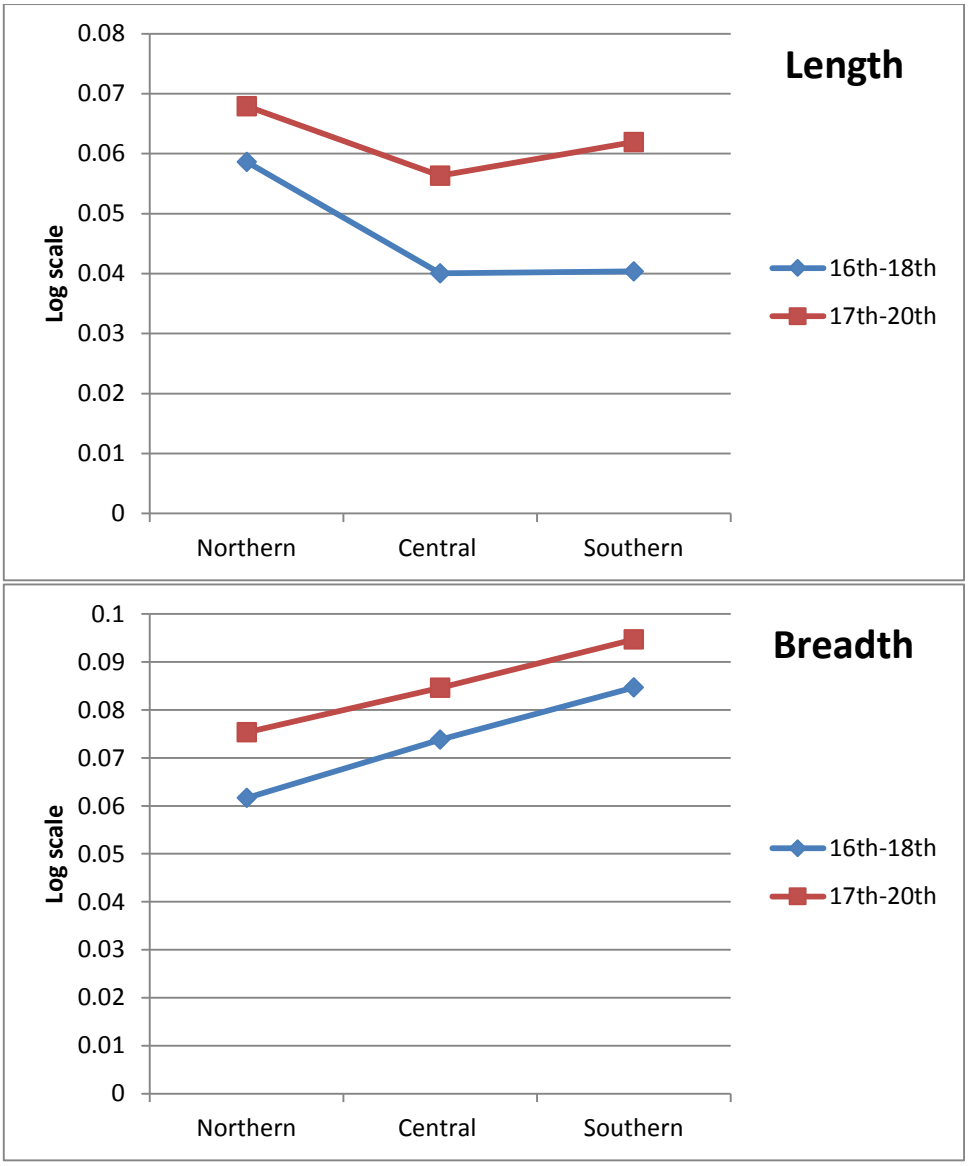

Figure 5.68: Mean log-scaled values for sheep/goat length and breadth from northern, central and southern England

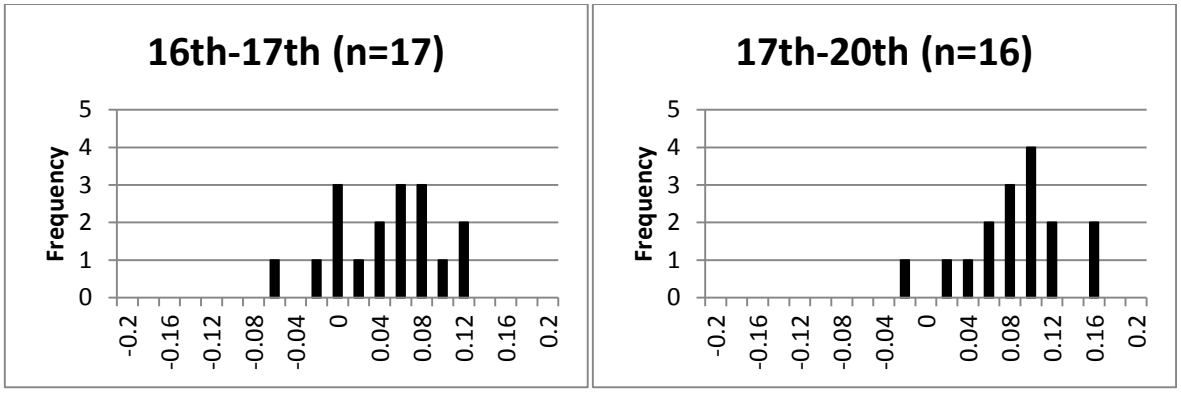

Figure 5.69: Pig log-scale of post-cranial length measurements from post-medieval sites in England.

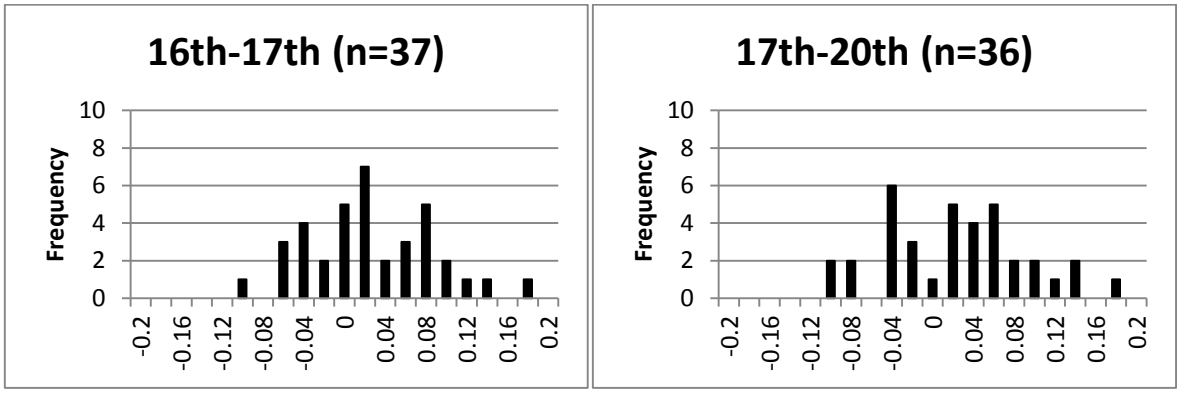

Figure 5.70: Pig log-scale of post-cranial breadth measurements from post-medieval sites in England

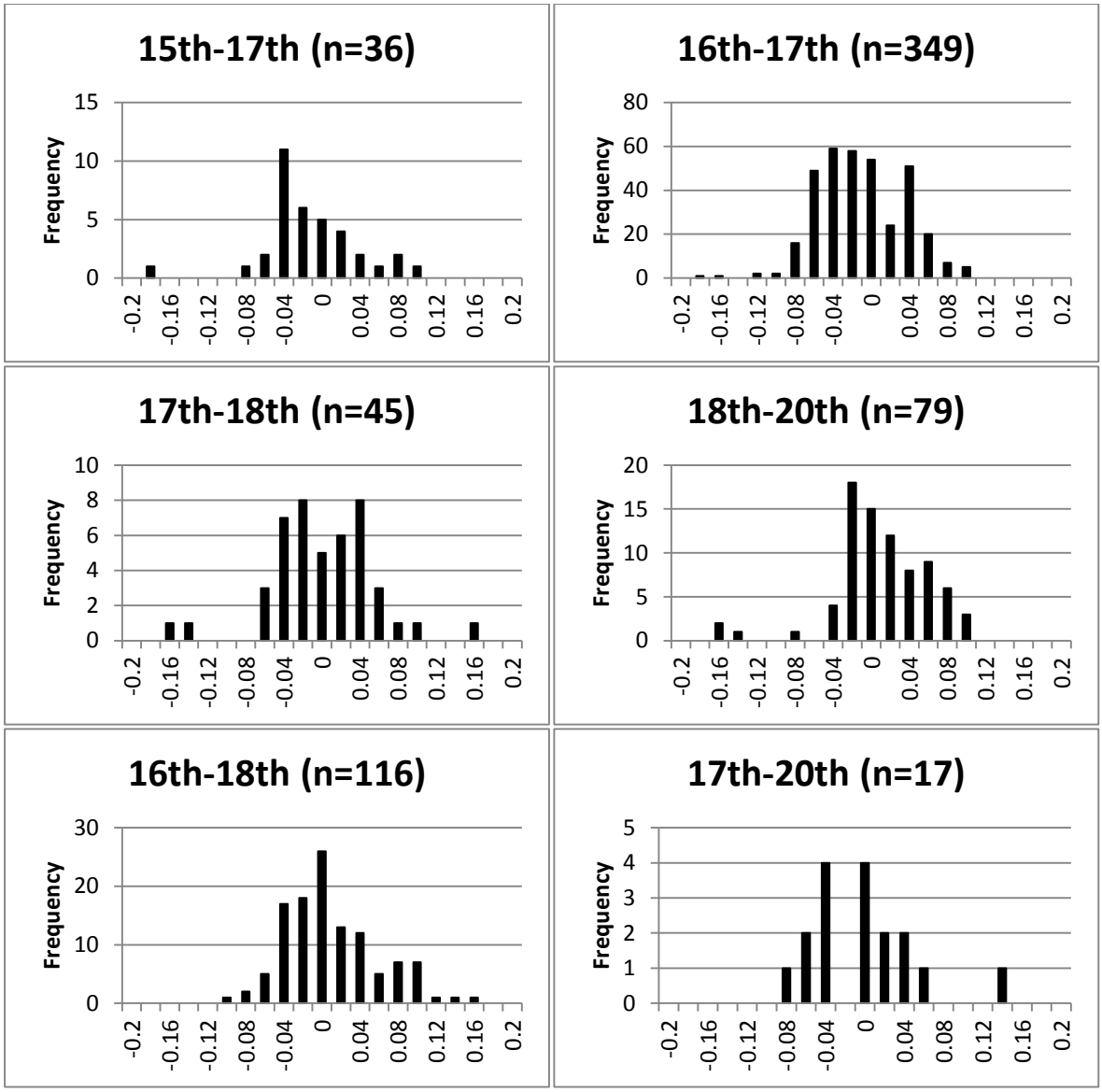

Figure 5.71: Chicken log-scale of post-cranial length measurements from post-medieval sites in England

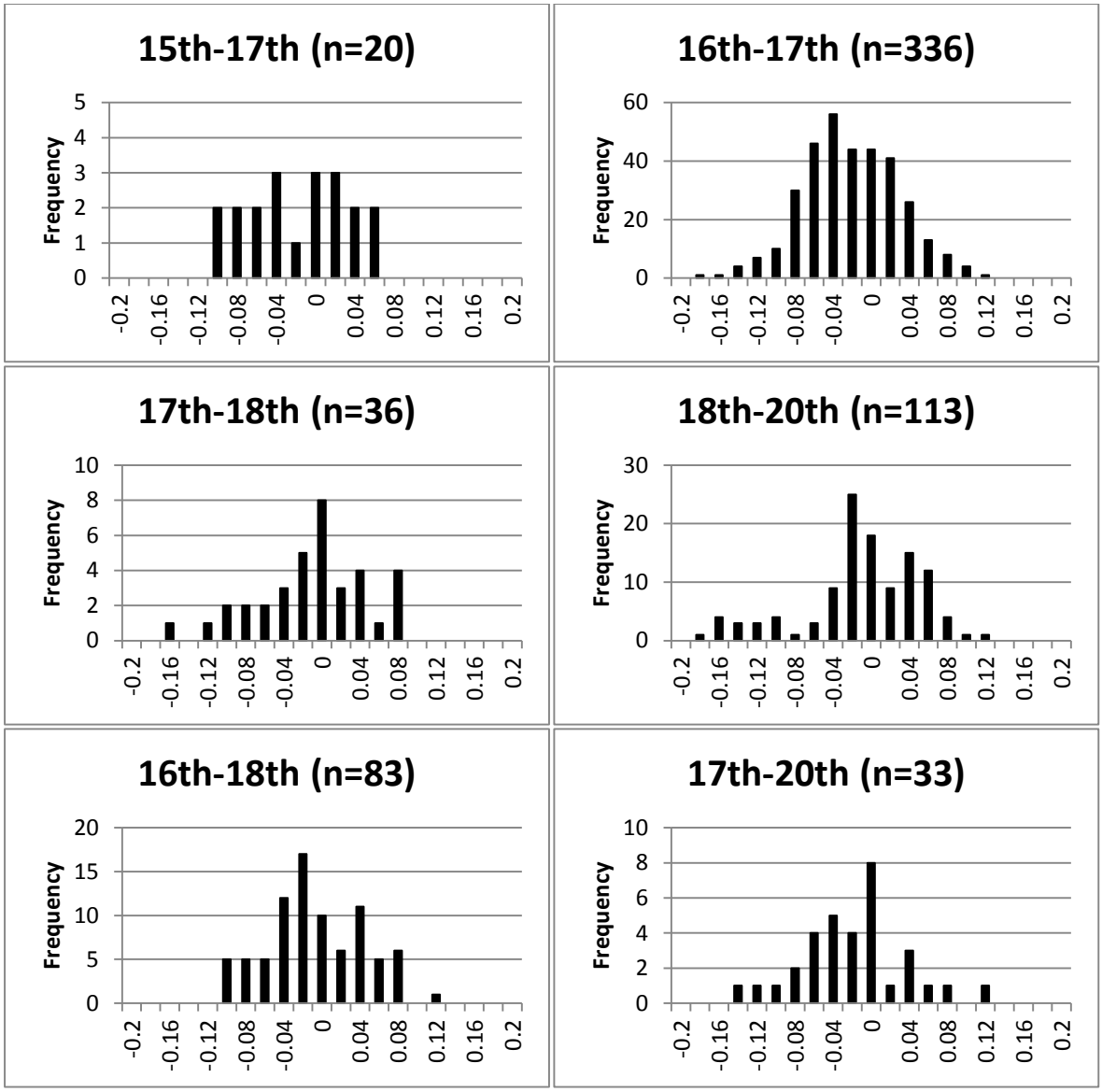

Figure 5.72: Chicken log-scale of post-cranial breadth measurements from post-medieval sites in England

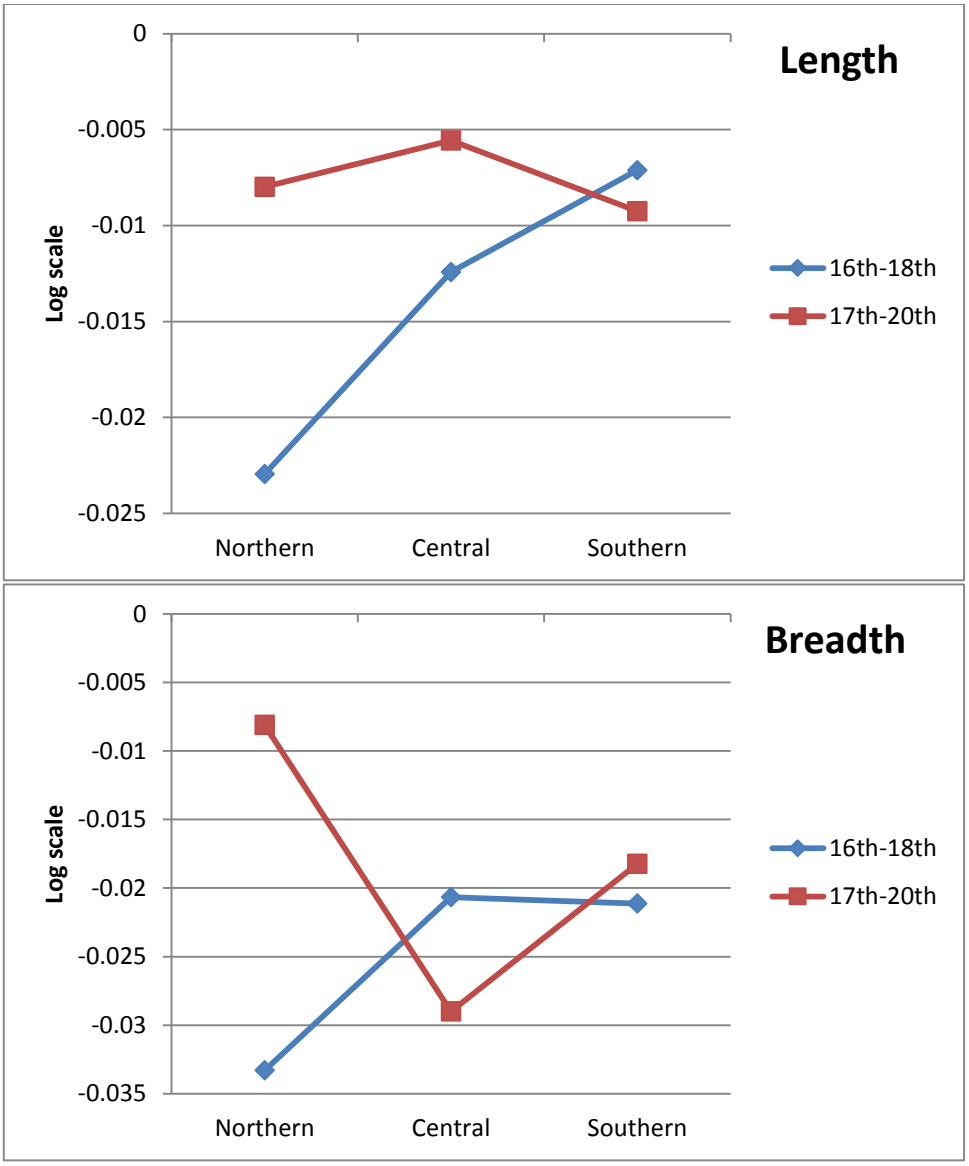

Figure 5.73: Mean log-scaled values for chicken length and breadth from northern, central and southern England

To explore sexual dimorphism and shape variation, measurement data from cattle and sheep/goat metapodials and horncores were utilised as they are sex-dependent (Albarella *et al.* 2009: 41). The cattle and sheep/goat metapodia results were presented in two formats: chronologically and by site. This was done to identify differences in the sexual composition and shape variation of these species particularly from sites that produced large samples. Unfortunately, as data for complete metapodials were limited only selected sites could be included; this was also the case for the horncore data.

Metapodials of bulls tend to be short and stocky whereas for cows they are short and gracile and in oxen they are long and gracile (Albarella (1997a: 38). The size-independent analysis of cattle metacarpals may suggest a dominance of cows and oxen with a small number of bulls (figure 5.74).

However, it would appear that bulls were slightly more common in the 16th-17th century compared to the later phases. A paucity of bulls is not uncommon for the post-medieval period as females and male castrates were more typical (Albarella 1997a: 46). This probably reflects the growing trend towards rearing cattle for dairy and meat. Figures 5.76 and 5.77 showed no major differences in the ratio of males to females. However, it should be noted that different cattle populations within an assemblage can mask differences in sex ratios as well as other variables such as age and pathology (Albarella 1997a: 46). It was possible to distinguish differences in the shape of cattle metapodia at some sites, which is suggestive of different animal populations (Albarella 1997a). For instance, the shafts of cattle metacarpals from Castle Mall were more robust than those from Lincoln which were more slender; although the distal breadths from each site were similar in size (figure 5.76). Castle Mall demonstrated a greater variation in metapodial sizes which points to different cattle types arriving on site (figure 5.76). This can also be seen more clearly in metatarsal measurements from Lincoln (figure 5.77). Overall, the analysis of the size and shape variation in cattle metapodials would suggest that the size difference in the post-cranial measurements was due to a genuine size increase, rather than a change in the sexual composition of the livestock, as cows and oxen were mainly present throughout.

Cattle horncore data revealed a mix of male, female and male castrates in the post-medieval period (figure 5.78). There appears to be some differences between the livestock demographics at Castle Mall, Norwich and Edgbaston Street, Birmingham, suggesting that fewer males were present in the latter site. Since horncore measurements can identify phenotypic variation, the size variation could indicate different cattle types (Armitage and Clutton-Brock 1976; Sykes and Symmons 2007) (figure 5.78). This is unsurprising as a size increase often coincides with the introduction of new breed and animal 'types' (Thomas *et al.* 2013).

Analysis of sheep/goat metapodials suggest that ewes and wethers were more common (figures 5.79-5.81). Davis (2000) notes that rams tend to have short and robust bones whereas wethers and ewes have short and slender bones. As there are higher incidences of short and slender bones this suggests that females and wethers dominated the sample (figure 5.81). In addition, the size variation of sheep/goat metacarpals, as shown in figure 5.82, showed that fewer rams were present.

It is also possible to detect the presence of sheep morphotypes in the data. For example, metacarpals from the 16th-18th century and 17th-20th century had more robust shafts and smaller distal breadths (figure 5.79). In the 16th-17th century there was a higher degree of shape variation with more examples of metapodials showing a higher level of robusticity. The shape variation of metapodials from individual sites, particularly from the 16th-17th century, clearly indicates the

presence of sheep morphotypes. The importation and introduction of different sheep types is well attested in the early modern and modern period (Trow-Smith 1959). The relationship between metapodial robustness and 'improvement' has also been observed in a study of modern sheep (O'Connor 1982 as cited by Thomas *et al.* 2013: 3316). For that reason, it is plausible that the size increase witnessed in sheep/goat post-cranial bones is also related to the 'improvement' of sheep in this era.

Size and shape variations could also be identified between different sites; implicating the presence of regional types. Cattle metacarpals from Little Lane were particularly slender and may represent one main regional 'type' arriving on site (figure 5.83). Metacarpals from Castle Mall, Launceston Castle b, DMU and Lincoln were more similar in shape as their shafts were more robust (figure 5.83). Shape variation between sites was less easy to distinguish in the cattle metatarsal measurements (figure 5.84). It is also worth pointing out the presence of the very robust metacarpal and metatarsal specimens from DMU, Launceston Castle b and Little Lane b (figure 5.84).

Horncore data for sheep/goat was limited and only DMU and Lincoln produced an adequate sample size to warrant comparison. This showed a clear separation between the two sites which could point to different breeds and/or livestock demographics (figure 5.85).

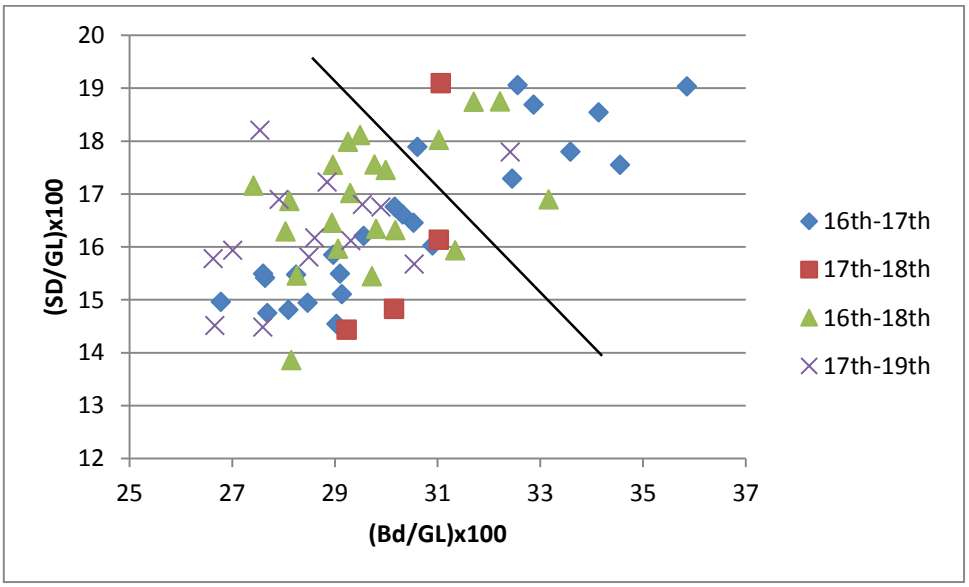

Figure 5.74: Size-independent scatterplot of cattle metacarpals from post-medieval sites

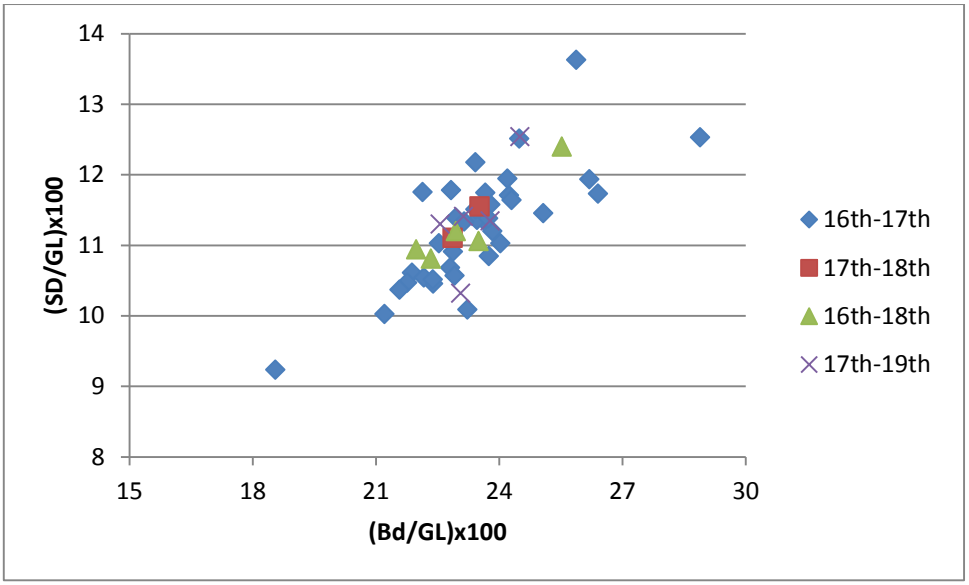

Figure 5.75: Size-independent scatterplot of cattle metatarsals from post-medieval sites

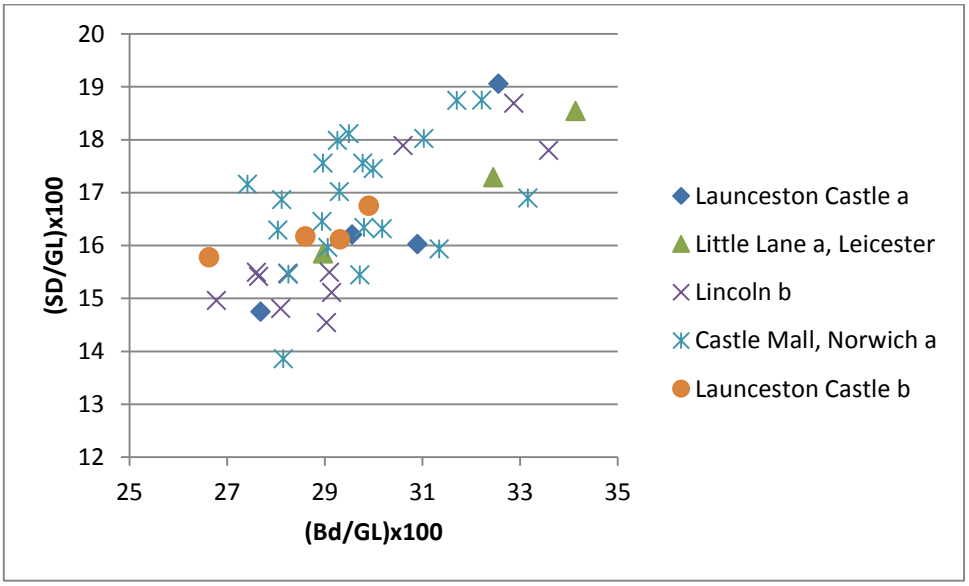

Figure 5.76: Size-independent scatterplot of cattle metacarpals from selected post-medieval sites: Launceston Castle b (1660 - 1840), Lincoln b (17th Civil War period), Little Lane a (16th century), Castle Mall, Norwich a (late 16th - 18th) and Launceston Castle a (16th century - 1650)

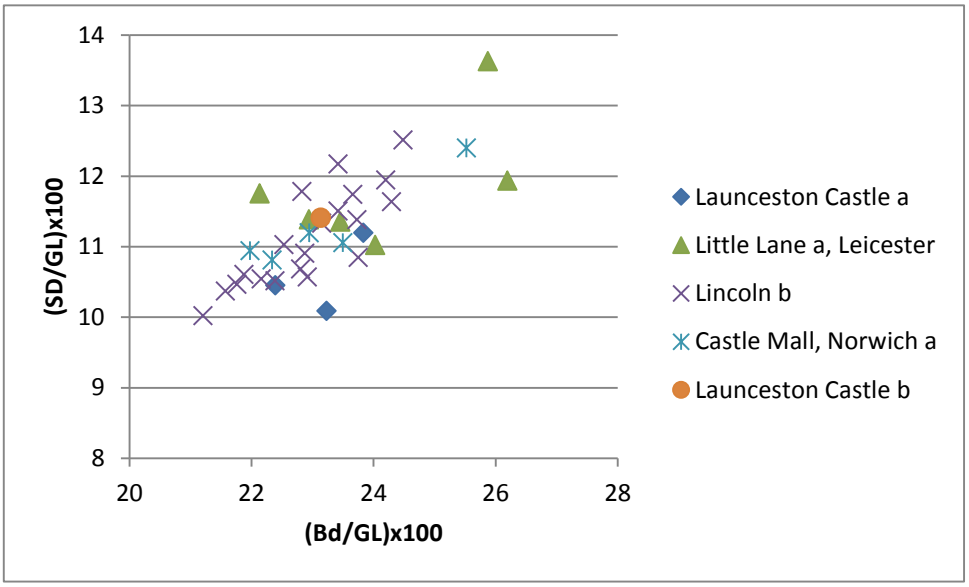

Figure 5.77: Size-independent scatterplot of cattle metatarsals from selected post-medieval sites: Launceston Castle b (1660 - 1840), Lincoln b (17th Civil War period), Little Lane a (16th century) Castle Mall, Norwich a (late 16th - 18th) and Launceston Castle a (16th century - 1650)

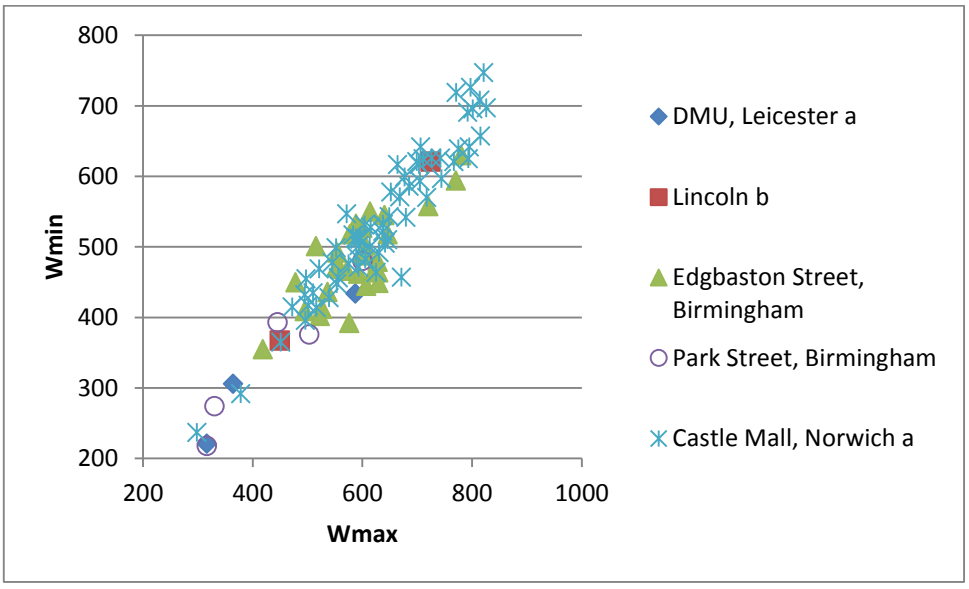

Figure 5.78: Size and shape of cattle horncores from selected post-medieval sites: DMU, Leicester a (1500 – 1650), Lincoln b (17th Civil War period), Edgbaston Street, Birmingham (17th-18th century), Park Street, Birmingham (17th-18th century) and Castle Mall, Norwich a (late 16th-18th century)

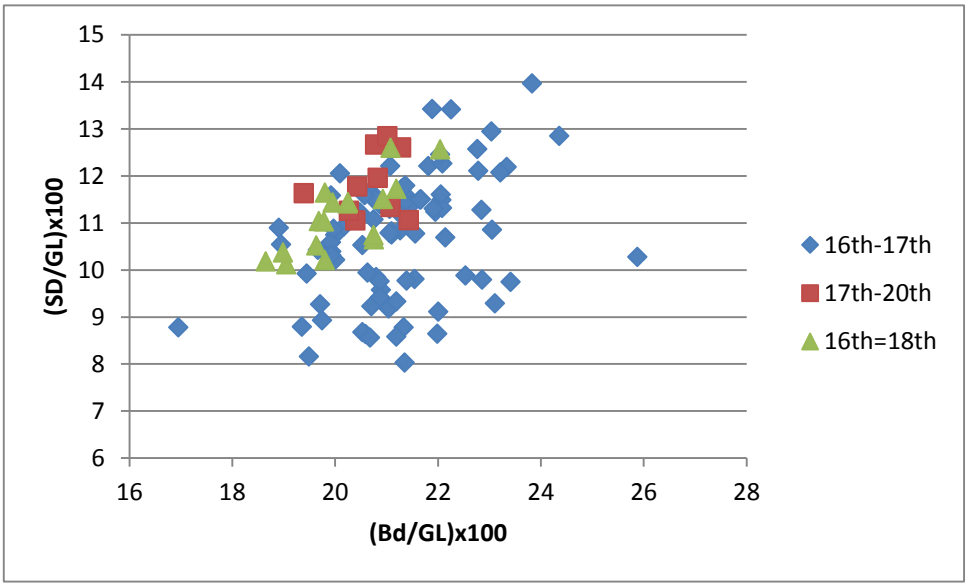

Figure 5.79: Size-independent scatterplot of sheep/goat metacarpals from post-medieval sites.

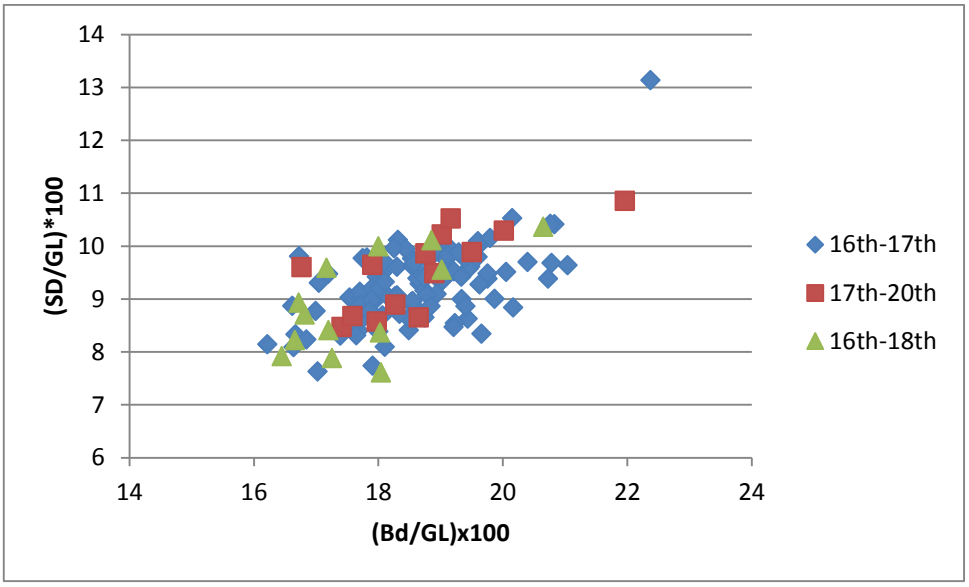

Figure 5.80: Size-independent scatterplot of sheep/goat metatarsals from post-medieval sites

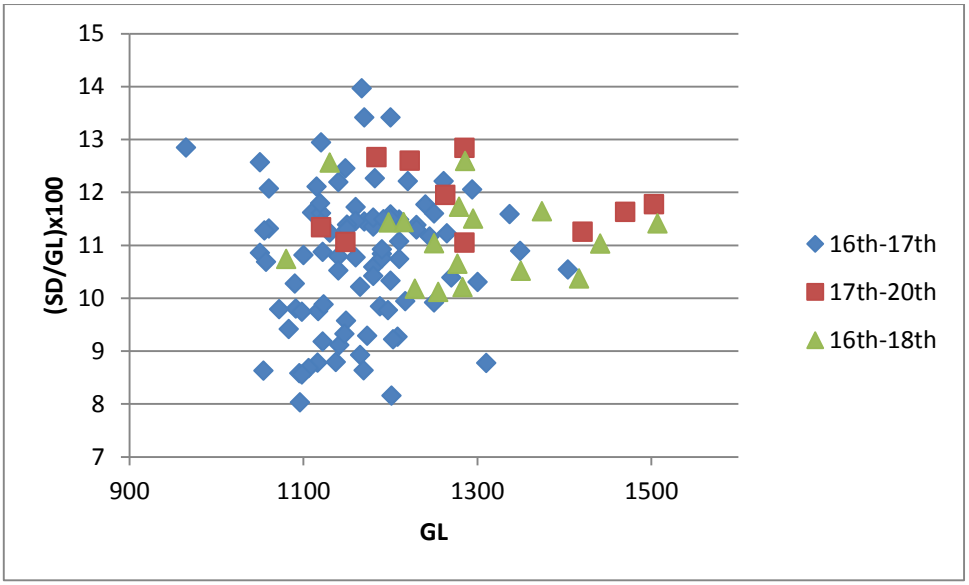

Figure 5.81: Slenderness index of sheep/goat metacarpals (after Davis 2000)

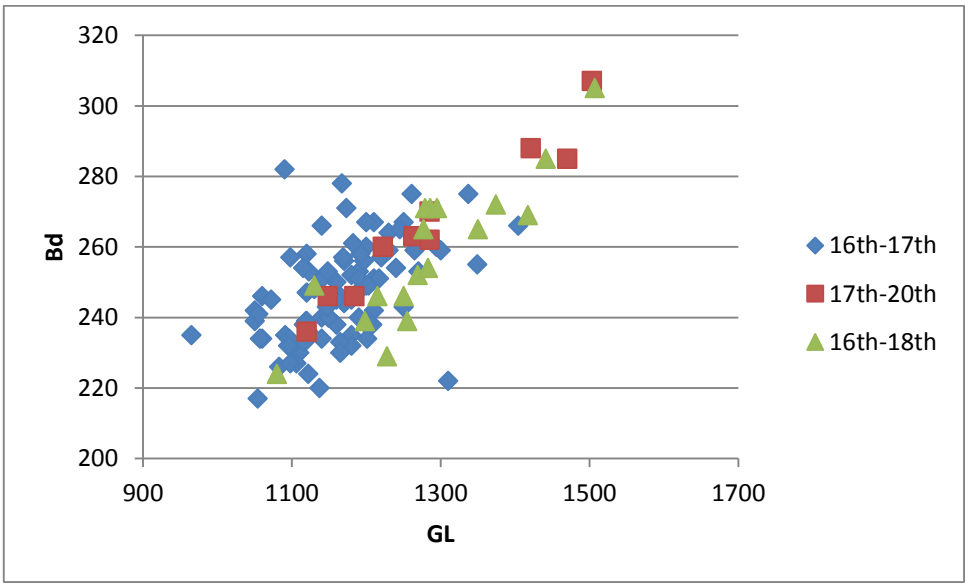

Figure 5.82: Size variation of sheep/goat metacarpals from post-medieval sites.

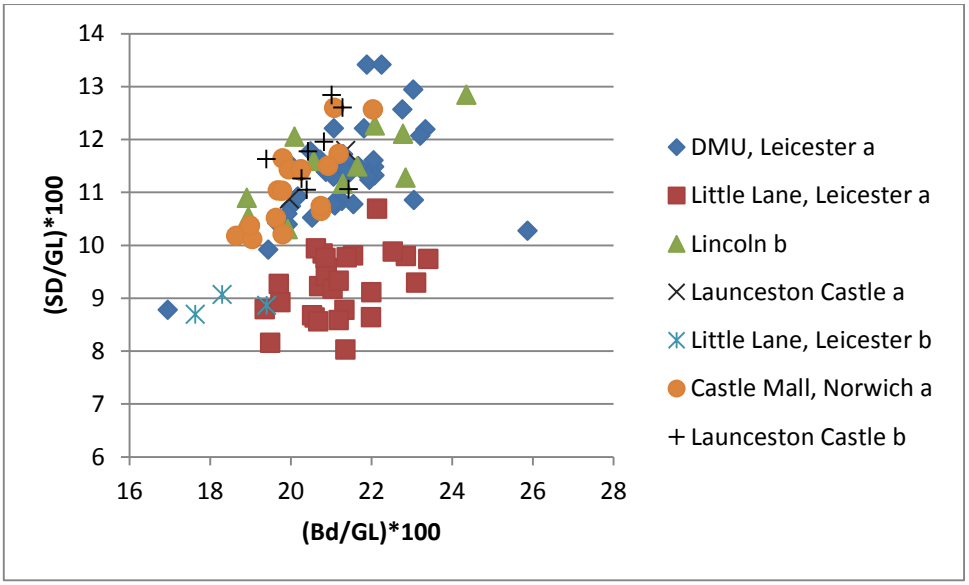

Figure 5.83: Size and shape variation of cattle metacarpal measurements from selected post-medieval sites: DMU, Leicester a (1500 - 1650), Little Lane a (16th century), Lincoln b (17th; Civil War period), Launceston Castle a (16th century - 1650), Little Lane, Leicester b (17th century), Castle Mall, Norwich a (late 16th - 18th) and Launceston Castle b (1660 - 1840).

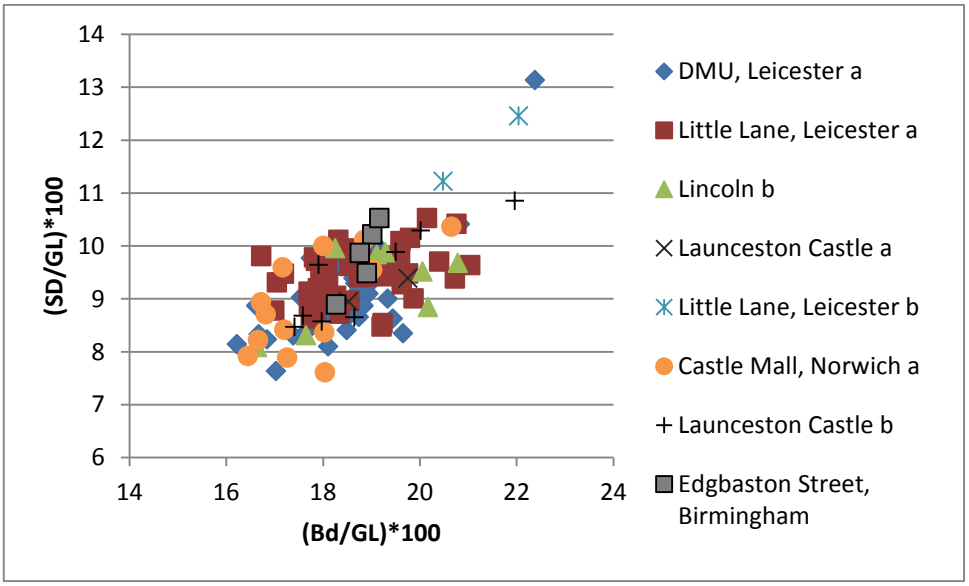

Figure 5.84: Size and shape variation of cattle metatarsal measurements from selected post-medieval sites: DMU, Leicester a (1500 - 1650), Little Lane a (16th century), Lincoln b (17th; Civil War period), Launceston Castle a (16th century - 1650), Little Lane, Leicester b (17th century), Castle Mall, Norwich a (late 16th - 18th), Launceston Castle b (1660 - 1840) and Edgbaston Street, Birmingham (17th - 18th)

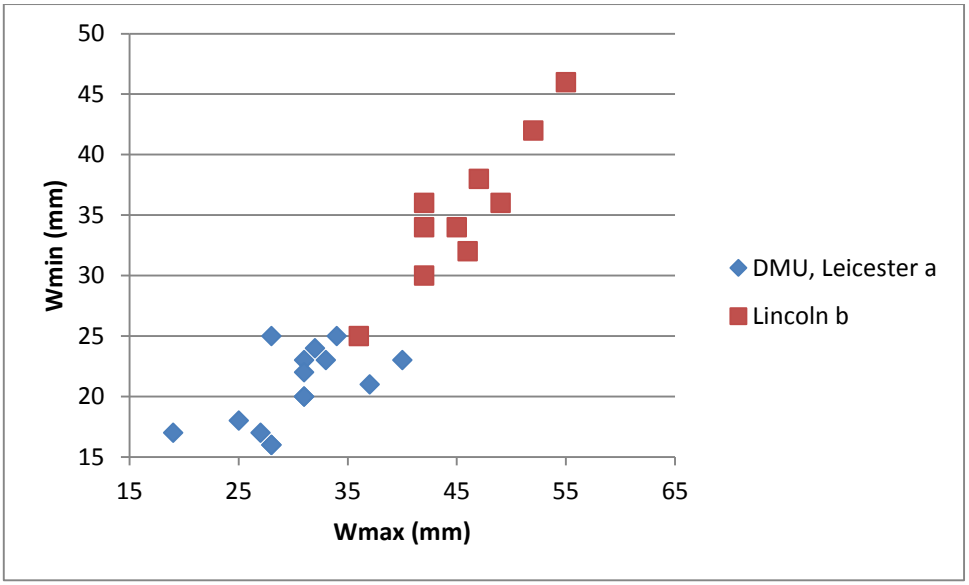

Figure 5.85: Size and shape of sheep/goat horncores from DMU, Leicester a (1500 – 1650) and Lincoln b (17th Civil War period)

5.7 Pathology and non-metric traits

It was possible to compile an inventory of the pathologies and non-metric traits from a total of 32 post-medieval sites, which is presented in a descriptive format (see Appendix Four, tables 4.31-4.34). The pathologies and non-metric traits discussed in this chapter accounted for 25% of the total number of post-medieval sites recorded in the regional review. The majority of the pathologies identified could be grouped into four categories: trauma; joint disease; infection and inflammation; and metabolic disturbances. These are typically the most frequent type of pathologies found on archaeological sites (Thomas and Worley 2014: 34). There were also cases of neoplasms, although these were less frequent.

Cattle pathologies largely consisted of lesions associated with joint disease. Evidence of osteoarthritis was mainly observed on pelves and femora. There was an example of severe osteoarthritis on the centrum of a caudal vertebra at Lion Walk, Colchester (15th-18th century). Lesions on cattle autopodia were particularly common. This included exostosis, lipping and broadening of the distal condyles as well as on the articular surfaces of the phalanges. Spavin, an ankylosing joint disease of the tarsals, was identified at 46-54 Fishergate, York (1650 – 1700). The disease has been associated with cattle used for draught purposes (Baker and Brothwell 1980: 117). Osteochondrosis was seen on proximal metacarpals from 10 Commonhall Street, Chester and cattle horncores from City Road, Chester (17th-19th century) had depressions which were characteristic of 'thumbprints'. These were observed more frequently on a number of sheep horncores at post-

medieval sites (see below). Non-metric traits included occipital perforations, which are congenital or developmental defects (Fabiš and Thomas 2011). There was also a congenitally absence second premolar and third molars had a reduced or missing hypoconulids. Congenital traits such as these are indicative of breeding within a small gene pool (Davis 1997: 425; Thomas 2005b: 74).

The most frequently mentioned pathology in sheep/goat was 'penning elbow'. This is characterised by the presence of exostoses on and round the distal humerus and proximal radius, which causes the ossification of the ligaments around the joints (Clark 2009: 158; Baker and Brothwell 1980: 127). This pathology has been attributed to trauma inflicted on sheep when they are put through pens (Clark 2009: 158). However, recent evidence observed on North Ronaldsay sheep suggest that this pathology may also be related to environmental conditions, as these animals exhibited the same lesions. It has been suggested that the repetitive shock received to the joints by walking on the rocky terrain, where these breeds reside, could have created similar lesions (Clark 2009: 158). 'Thumbprint' depressions on sheep/goat horncores was another common pathology. This condition is believed to be linked to stresses such as malnutrition, lactation, extensive milking and breeding of elderly animals, which resort to calcium resorption causing the depressions (Albarella 1995). Joint diseases on the autopodia were not as frequently mentioned as they were for cattle probably because sheep were not traditionally used for traction. However, lesions on sheep/goat metapodials included lipping, exotosis, broadening of the articular surfaces and evidence of osteoarthritis. Curiously, spavin was observed on a sheep metatarsal at Little Lane, Leicester b (Gidney 1991). This was also found on a sheep metatarsus from Castle Mall, Norwich (late 9th to 11th century) (Albarella *et al.* 2009: 63-64). As this condition can develop in animals used extensively for traction, its occurrence in a non-draught animal suggests its development can be caused by other factors (Albarella *et al.* 2009: 64). Lesions on long bones included ossified haematoma and buttressing. Two sheep femurs from Castle Mall Barbican Well, Norwich (mid-late 15th to early 16th century) showed signs of osteoporosis. This can be caused by dietary deficiencies as well as poor pastures and husbandry management (Baker and Brothwell 1980: 53). A sheep/goat tibia from Lion Walk, Colchester a (15th-17th century) had suffered from extreme bone destruction and showed signs of eburnation, which could have been caused by a bacterial infection (Luff 1993: 109). At 16 - 18 Harrison Street, Hereford a (16th-17th century) an achondroplastic femur was found. Achondroplasia is a form of dwarfism cause by a genetic disorder, which causes the limbs to be considerably shortened (see Baker and Brothwell 1980: 32). The possible presence of Ancon sheep was also noted at Little Lane, Leicester a (16th century), which are a breed known for their long bodies and short legs. The presence of these specimens tentatively supports the evidence for different sheep breeds in the post-medieval period. Non-metric traits included the congenital

absence of the second premolar; however, the most common was polled sheep (sheep without horns). Polled sheep either reflect a new type of sheep or breed as a result of selective breeding (Thomas 2005b: 47).

There were only a few examples of pig pathologies, which mostly referred to lesions associated with joint diseases, such as exostoses. There was one metatarsal from Aldersgate, London a (16th century) which exhibited characteristics of osteomyelitis or septic arthritis (Armitage 2001). Periosteal new bone formation was also noted. The lack of pig pathologies is not surprising as they often do not live long enough in order for pathologies to develop on the skeleton.

Other mammals with pathologies included horse, dog, cat and rabbit. The few cases of horse pathologies were those related to joint conditions such as spavin, osteoarthritis and ankylosis of the vertebrae. Two ribs from the partial horse skeleton from Nicholas Street Mews, Chester had a pseudarthrosis. Horse skeletons recovered from the tannery site, The Green, Northampton a (1500-1700) had ring bone, a form of exostosis that develops in the interphalangeal joint of the feet, which can arise in horses that are extensively used for draught purposes (Baker and Brothwell 1980: 120). Bit wear was also observed on premolars from Castle Mall, Norwich (late 16th-18th century) and City Road (17th-19th century). Dog pathologies consisted of osteoarthritis and fractures, in addition to lipping, exotoses and osteophytes around the articular surfaces. One mandible from Chester's Roman Amphitheatre (late 16th- early 17th century) showed signs of periodontal disease. Cat limb bones exhibited fractures and mandibles showed signs of alveolar recession. A fallow deer metatarsal from Dudley Castle (1533-1750) had an ossified haematoma on the shaft and a rabbit from Eagle House (Cannon Street), London (18th century) had osteoarthritis in the distal femur.

Chickens displayed traumatic lesions such as fractures and ossified haematomas. Eburnation and enthesophytes were also observed. A partial chicken skeleton from Stafford Castle c (1800-1900) had osteophytosis (i.e. bony spurs) (Thomas 2011: 26) and rickets were exhibited in specimens from Lion Walk, Colchester (17th century?) and Castle Mall Barbican Well, Norwich (mid-late 15th to early 16th century) (Luff 1993; García 2009). This condition is caused by a mineral deficiency/imbalance in vitamin D3, calcium, and phosphorus (Gordon *et al.* 2015: 3). Avian osteopetrosis was noted at Dudley Castle a (1533 – 1647), Castle Mall Barbican Well, Norwich (mid/late 15th- to early 16th century) and Nicholas Street Mews, Chester (17th-18th century). This virus is known for rapidly infecting the entire chicken flock should one individual shows signs of the disease (Brothwell 2002). Two sacra from Castle Mall Barbican Well, Norwich (mid-late 15th to early 16th century) and Chester's Roman Amphitheatre (16th century) had bony growths that exhibit characteristics of a neoplasm. A chicken skull from Eagle House (Cannon Street), London (18th century) had a cerebral

hernia and an articulating chicken tibiotarsus and tarsometatarsus from Chester's Roman Amphitheatre (16th century) had characteristics of chondrodystrophy. The occurrence of these specimens provides evidence for selective breeding and the presence of different chicken breeds. Examples of goose pathologies included signs of swelling, inflammation and bony outgrowths on long bone shafts as well as rickets and a displaced fracture.

5.8 Summary

Cattle, sheep/goat and pig were the most common domestic species. In the 15th-17th century there was a high or an equal proportion of cattle and/or sheep/goat. However, the 16th-17th century was noted for an increase in cattle remains as well as a decline in the proportion of pig. This was followed by an increase in sheep/goat in the 17th-18th century along with an increase in pigs by the 18th-20th century. In the early modern period, regional differences included a higher proportion of sheep/goat in the South East and North East of England, in addition to a higher proportion of pigs in the West Midlands. In the 17th-18th century, London and North West and East of England continued to be dominated by cattle. By the 18th-19th century there appeared to be a shift from cattle dominated assemblages to sheep/goat in Southern England. Chicken was the most frequent domestic bird, followed by goose and duck was a low occurring species throughout the post-medieval era. Chicken increased overtime relative to a decline in the proportion of geese. There was a higher proportion of goose in central and northern England.

Other domestic mammals were less frequently represented such as goat, horse, dog and cat. Goats were better represented in London and the West Midlands and horse remains appeared to have increased throughout the post-medieval period. Dog and cat were represented by disarticulated and articulated remains; whose frequency increased towards the end of the post-medieval period.

Popular wild mammals included fallow deer, rabbit and hare; although there was a notable decline in the proportion of fallow deer and rabbit by the 19th century. There was a wide variety of birds consumed throughout the post-medieval period. The consumption of wild birds reached its peak in the 16th-17th century; however, by after the 17th century their appeared to have declined in frequency. Marine fish were more widely consumed, followed by migratory and fresh water species. Overall, there was a decline in the proportion of marine fish relative to migratory fish.

Carcass distribution and butchery evidence demonstrated that the majority of animals were transported to cities and towns as undressed or dressed carcasses. Joints or filleted cuts of meat

were purchased from the market and animal products such as horncores and metapodials were also distributed to be used in different industries.

Slaughter profiles for cattle suggested that husbandry strategies were focused towards meat and dairy production whereas for sheep/goat it was geared towards meat production and secondary products. The results also revealed that farmers focused their attention on increasing meat yields by introducing new breeds into the breeding stock. There was a temporal size increase in the mean of cattle, sheep/goat, pig and chicken and statistically significant size increases in sheep/goat and pig. Post-cranial measurements also showed that there were differences in the size of animals from northern, southern and central England and demonstrated the presence of different morphotypes.

6 Chapter Six - Urban Provisioning and Food Consumption Behaviours in Post-medieval England: An Integrated Approach

6.1 Introduction

This chapter interprets the results from the regional site comparison, to shed light on the role of animals and their products in the post-medieval period. It also presents a discussion of the first post-medieval regional synthesis, which reveals how the study of animals can contribute understanding to this dynamic phase in British history. The results from the zooarchaeological analyses are placed into context using sources pertaining to animal husbandry, the meat industry and Britain's urban and environmental history. The chapter will focus on five main themes: Animals in post-medieval England: an overview; Herd management in post-medieval England; Feeding and supplying post-medieval England and Food, Cultural and social identity in urban England, with the intention of understanding the nature of urban provisioning and food consumption behaviours.

6.2 Animals in post-medieval England: an overview

Major domesticates

Cattle, sheep/goat and pig were the most common animals in post-medieval England. The proportion of cattle and sheep/goat varied depending on the region (see Herd management in this Chapter); however, pig was consistently the least common animal. The frequency of cattle and sheep/goat attests to their importance within the agricultural economy as steady providers of meat and secondary products (i.e. milk, wool, hides and skins).

The increase in the proportion of cattle witnessed during the 16th to 17th century could be attributed to the growing popularity of beef in the early modern period. According to Andrew Boorde, the author of A Compendyous Regyment or Dyatorye of Healthe (1490?-1549), 'Beef is a good meate for an Englyssheman'. This regard for British beef was also described by Metcalfe (2012: 39) as a 'bond between Britons and beef'. The consumption of beef became a symbol of British national identity and the meat of the middle classes (i.e. yeoman, traders and artisans) (Roger 2004: 15, see Food, cultural and social identity in urban England). British cattle became internationally renowned for their superior flavour as a result of innovative farming techniques. The quality of British beef was praised by foreigners who visited the country (Metcalfe 2012: 40; Rogers 2004: 10-

11). The way beef was cooked was almost as important, if not more so, than the amount that was consumed. British beef was either boiled or roasted. The latter (roast beef) became a national dish from the mid-1600s (Roger 2004: 19-20). In addition, because of the growing popularity of beef, its consumption rivalled mutton (Rogers 2004: 13).

Another factor that contributed to the increase in cattle during the early modern period was the rising status of dairy foods, which also accounted for the increase in veal observed on archaeological sites (Thirsk 2007: 271; Albarella 1997b: 22; Maltby 1979; Luff 1993: 57; see also Herd management in this chapter). As discussed in Chapter Four, the English Civil War was a major catalyst for the increased production of dairy products, as there was a demand for butter and cheese to feed soldiers (Thirsk 1997: 49). The price of beef also decreased in the early modern period and was cheaper than other food products such as rye, egg and milk, which rose considerably in price due to inflation (Rogers 2004: 10; Brenner 1971; Outhwaite 1969). In addition, enclosure (the division and privatisation of commons and wastes) meant that more land was available for the production of beef, butter and cheese (Roger 2004: 12-13).

In the later medieval period, many faunal assemblages typically present a high proportion of sheep/goat, which is indicative of the successful wool industry (Grant 1989: 151; Sykes 2006). However, in the post-medieval period, there was a move away from wool to mutton production, which became important around the country (Albarella *et al.*2009 60; Bowden 1967: 9-10). There was a decline in the price of wool which also could have triggered this shift (Rogers 2004: 13). During the post-medieval period the price of mutton steadily increased along with its demand (Rogers 2004: 10; Albarella 1997b: 24; Dobney *et al.* 1996: 59; Thomas 2005a: 43).

In the 17th-18th century, there was an increase in the proportion of sheep/goat at some sites. Holderness (1989: 148) refers to an increase in the number of sheep in the 18th century and suggests that its consumption increased during periods when cattle were scarce or too expensive. The 18th century witnessed a number of cattle plagues that had a dramatic effect on the number of cattle sold at the market (Fussell 1937a: 102-103). Smithfield market in London saw a substantial reduction in the number of cattle sold during times when the plague had struck and one lady reports that only mutton could be bought at the market during these times (Fussell 1937a: 102-103). In the 17th-18th century, zooarchaeological data from London also showed that the proportion of cattle declined in relation to sheep/goat. Although these results should be considered cautiously, it is still worth contemplating whether it reflects the series of cattle plague during this century. Despite the focus towards the production of mutton, wool continued to be an important commodity and many

farmers directed their efforts towards breeding animals that could effectively provide both meat and good quality fleeces (Albarella 1997b: 25-26).

Goats all but disappeared in the post-medieval era. Their numbers started to dwindle in the medieval period, which has been noted in historical accounts and observed on archaeological sites (Albarella 2003; Dyer 2004b). The management and feeding requirements for goat differed from sheep. Britain's climate and vegetation was not suited for rearing goats as they preferred warmer environments and rocky regions (Grant 1988: 155; Luff 1993: 66). In addition, because of goats' destructive feeding habits, it was impractical to rear them on land used for cultivation (Albarella 1999: 213). Despite being restricted to mountainous regions, by 1795 most had disappeared from the country (Albarella 1997b: 26; Fussell 1937b: 196; Thirsk 1967: 195). Enclosure and the rise of the dairy industry has been considered as a possible cause for their decline; putting goat rearing and milk out of favour (Albarella 1997b: 26). Furthermore, although kid meat was seen as a delicacy, adult goat meat was not popular in Britain as it was considered to be tough (Albarella 1997b: 26; Thirsk 1967: 193). Based on archaeological evidence, most goat remains on urban sites were represented by horncores or foot bones. London had the highest proportion of goat remains which may reflect the trade of goat skins to the city. Historical evidence refers to the extensive trade of Scottish goats for the London market (Yeomans 2006: 198). In the early 17th century, 16,000-17,000 goat hides were produced in Scotland, which ended up in London (Yeomans 2006: 198). Goats were also common in central England, particularly in the West Midlands, which was a region well-known for goat herds (Albarella 1997b: 26).

The post-medieval period witnessed a decline in the proportion of pigs, which was a phenomenon that began in the late medieval period due to the rise in the wool trade, the decline of woodland/waste areas and growing use of land for grazing cattle and sheep at the expense of pig rearing (Albarella 2006; Hamilton and Thomas 2012: 249-250). Pigs were loosely managed, raised off roots, rhizomes, acorns and beech from the woodland. This was known as the pannage system (Albarella 2006: 77; Hamilton and Thomas 2012). However, this was a seasonal management strategy for pigs and therefore not reliable throughout the year (Hamilton and Thomas 2012: 235; Albarella 2006: 77). From the late medieval period, pigs began to be increasingly managed in sties and fed off legumes, cereals and household scraps (Albarella 2006: 79). Pigs increased in proportion during the late post-medieval period (e.g. 18th-20th century) which may represent changing attitudes towards the profitability of pigs as farmers began to invest time in breeding them to provide fat and meat for the urban market (Fussell 1937a: 207; Holderness 1989: 154; Breeze 1989: 354). By 1750, pig meat was considered as the poor man's meat, eaten by rural inhabitants and the

urban working class (Fussell 1937b: 207; Thirsk 1989: 149; Atkins 2012a: 44). Is it not surprising that the overall proportion of pigs on urban sites was low. Other than the commercial breeding of pigs in conjunction to other industries they were mainly kept as an additional food source, used to manage waste or make extra money (Velten 2013; Albarella 2006; Fussell 1937a: 210; Thirsk 1967: 47; Trow-Smith 1959: 220).

Minor domesticates

The horse remains found in the post-medieval period were largely disarticulated; although there were a few partial skeletons (see Chapter Five). Generally, horses were uncommon in urban assemblages (Langdon 1986); therefore, their increase in proportion during this period is noteworthy. Many cities and towns saw a major increase in the number of horses on the street by the 19th century (Atkins 2012a: 43). Coincidently, Velten (2013: 43) states that the horse population increased along with the human population. Horses were employed as working animals, pulling coaches, carriages and omnibuses and helping to transport and distribute goods (Velten 2013). The majority of horses were not treated with the utmost care (Velten 2013: 66). In London, around 400 horses died every week due to exhaustion and disease and it would not be long before their carcasses were taken to the knackers' yard (Simmond 1873 as cited by Atkins 2012b: 103). In south and east London alone, there were approximately 30 horse slaughter yards (Atkins 2012b: 103). The assemblage of disarticulated and dismembered horse remains from London Bridge City, Southwark (see Chapter Five), probably represents the remains of horses taken to the knackers' yard in south London (Reilly 2000). Horse breeding was concentrated in pastoral regions such as northern England and Scotland as well as areas with plenty of woodland (Thirsk 1967: 191-192; Perren 1989: 261). Regional comparisons showed that there were a higher percentage of horses in the North of England and the West Midlands. However, it should be noted that these were mainly represented by partial skeletons.

Donkey was a rare species in the post-medieval period. Even though its absence could reflect the difficultly in separating their remains from horse, written accounts suggest they were uncommon in Britain. In Gordon's *The Horse World of London*, he states that donkey was more prevalent in other European countries and the United States (1893: 168). In London, there were as few as 3,000 donkeys brought to the market on a yearly basis (Gordon 1893: 165). They were used to pull carts for costermongers and laundresses and were also ridden and milked (Velten 2013: 64; see Mayhew 1967: 13).

Dogs and cats were typical non-food animals that were frequently found in urban post-medieval assemblages. They would have taken on a range of roles which would have included pest control, guarding homes and companionship (Velten 2013; Thomas 2005c; Salmi 2012). Cats were also exploited for their fur; whilst dogs were employed as working animals (see Velten 2013). In addition, they both would have provided a meat source during times of stress and famine (see Chapter Four). Towards the end of the 19th century there was an increase in the proportion of cats and dogs. This could reflect the presence of partial cat and dog burials, which becomes more common towards the later post-medieval period. By the 19th century, there was a shift in the perception towards animals as Victorians development gentler inclinations towards animals (see Salmi 2012; Thomas 2005c). Cats and dogs were valued for the companionship they provided. During the Victorian period, there were moral and ethical discussions regarding animal souls, spirituality and animal immortality. Therefore, burying an animal was seen as a symbolic act that would ensure humans would be reunited with their animal companions in the afterlife (Howell 2002: 12).

Wild mammals

Fallow deer was the common deer species in the post-medieval period, while the proportion of red and roe deer dropped significantly after the 16th-17th century. As discussed in Chapter Four, fallow deer were able to forage and breed in constructed deer parks while red and roe deer faced habitat loss with the decline in woodland after the Norman Conquest due to population pressure (Albarella 2006: 77). Throughout the post-medieval period, the proportion of deer species declined over time. In the medieval period, deer hunting was practiced by the highest members of society whose money and status earned them the right to hunt (Thomas 2007: 138). This period also saw an increase in the number of deer parks that were established (Thomas and Vann 2015). However, during the latter half of the 16th century, landowners began to lose interest in deer parks and sought to make money by selling and converting their land for grazing cattle (Griffin 2007: 73; Thirsk 2008: 367). Although deer parks were licenced under the Crown, this did not deter others from pilfering and poaching deer during the Civil War when food was scarce (Thirsk 1985: 367; Griffin 2007: 73). Royalist deer parkland was also confiscated and sold during the war to be used for farmland (Williamson 2013: 67; Griffin 2007: 103). Because of the growing population, the demand for land made the keeping and maintaining of deer parks less economically viable (Griffin 2007: 103, 106). In the late 17th century, there was a renewed interest in hunting which was encouraged by the introduction of new legislation to help the gentry re-establish deer parks and put a stop to poaching (Thirsk 1985: 367, Griffin 2007: 108). This led to the creation of the Black Act (1723) which declared that anyone caught

poaching deer would be subjected to the death penalty. Despite this, deer numbers still continued to decline. Consequently, the nobility and gentry began to turn their attention towards hunting small game such as hare, pheasants, grouse and partridge (Griffin 2007: 74, 108; Williamson 2013: 68). In light of this, all these factors would have contributed to decline in deer parks and the reduction in the proportion of deer witnessed after the early modern period. Deer was more common at castle sites compared to urban sites, which is expected, given their high-status association (Thomas 2007: 138). As deer was a protected species, its presence in the urban assemblages would have been the result of either/or illegal poaching and being received as gifts. It was only in 1831, that venison was available to purchase on the urban market (Mayhew 1967: 120). Subsequently, a licence became a requirement to legally sell game, the price of which was 2 pounds and 2 shillings yearly (Mayhew 1967: 120).

Rabbits were the most common wild mammal in the post-medieval period as it was a popular form of meat that could be afforded by all members of society (Thirsk 2007: 242). They were down-graded as a luxury item after the Black Death, making them widely available. The early modern period witnessed the revival of rabbit warrens as landowners sought to make extra money from selling their meat and fur (Thirsk 1997: 53; Williamson 2013: 65-66). Rabbit warrens were established in Yorkshire, Lincolnshire, Norfolk, Suffolk, Sussex and Nottinghamshire (Thirsk 1967: 195; Thirsk 1967: 147; Williamson 2013: 66). There was an extensive trade of rabbit to London; apparently 600,000 rabbits were sold in London's markets alone (Mayhew 1967: 129; Thirsk 1984: 237). By the late 18th century, many warrens were destroyed for growing grain which proved to be more profitable venture (Thirsk 1997: 54). Renowned regions known for the commercial breeding of rabbits ceased trade by the early 19th century (Holderness 1989: 147). Although the rabbit trade still existed by the mid-19th century, it was on a small scale and mainly in southern England (Thirsk 1989: 147). As hare was an elite food item that was hunted for sport and consumption (Griffin 2007) they were not as common as rabbits. Based on figures provided in Mayhew (1967: 130), hares bought from London's markets accounted for around one third of the total amount of rabbits sold. In addition, the price of hare was quite high, ranging from £4-£6, as opposed to the price of rabbit at £1-£2. This shows that they were still a luxury food item up until the 19th century (Mayhew 1967: 130; Thomas, in press).

Other wild mammals occurred infrequently in the post-medieval period. The presence of badger, polecat/ferret, fox, otter, pine marten, stoat and red squirrel in urban contexts suggest that they were hunted or traded for their fur which was highly desired by furriers. The paucity of fox remains in urban assemblages has been a focus of discussion. O'Connor (2013: 72) suggests that foxes only

recently integrated themselves as urban commensal pests, which would account for their absence in the archaeological record. Indeed the abundance of stray cats in medieval towns prevented foxes from establishing their hold within the urban landscape because of competition for food and shelter (O'Connor 2013: 72). This same theory could be considered for post-medieval towns since cats were one of the most frequently occurring minor domesticate. The regard for fox fur may have also prevented their numbers increasing as they were selectively targeted. It is also worth taking into account the growing popularity in fox hunting in the 18th century. This grew due to the decline in the wild deer population and because of the 'improvement' of hounds bred specifically for hunting foxes (Griffin 2007: 125). Prior to this, fox hunting was deemed slow and arduous because hounds reared for hunting deer were too hefty and could not keep up with the speed of the foxes (Griffin 2007: 125). However, the breeding of foxhounds turned peoples' attention towards fox hunting and developed it into a fashionable sport. As a result, this popular pastime could have resulted in the low number of foxes at urban sites.

Although they were a rarity in the archaeological record, exotic species have been mentioned in documentary records (Thomas 2014). The exotic mammals found in this period included: guinea pig, tortoise, elephant, monkey and bear. However, the latter was indigenous to Britain until its extinction by the late Roman/early medieval (Hammon 2010). During the post-medieval period, the variety of animals that were brought to the country expanded as a result of the exploration of the New World. These strange, novel animals were bought for private ownership, kept as pets, provided entertainment and were displayed in menageries, zoos, exhibitions, circuses and even anatomy schools (Simons 2012; Kalof 2007: 89; Velten 2013; Morris 2014). In some cases body parts were brought back as curio, such as the elephant tibia at 25 Bridge Street, Chester (Smith 2008). Whale and dolphin were particularly rare probably because their consumption declined in the early modern period. More ambiguous species were hedgehog and bat. The hedgehog may have represented a garden intruder or an intrusive species. However, they were sold at Leadenhall market in London (Dodd 1945: 326). Bats are known to find solace in the rooftops of houses during the winter months (O'Connor 2013: 24). There were only a few wild pig remains found in this period. This species became extinct in the medieval period. Although it was reintroduced in the 16th-17th century, by the 18th century wild pig disappeared for good from Britain (Albarella 2010).

Domestic birds

Chicken was by far the most common bird in the post-medieval period. Its proportion steadily increased overtime reflecting its growing popularity and the emergence and expansion of the poultry industry (Albarella 1997b: 27; Godley and Williams 2010; Gordon *et al.*2015). Chickens provided a cheap and useful source of meat and egg protein and as a versatile animal they could be reared at an industrial and domestic level. After chicken, goose was the second most popular bird which would have provided meat, feathers and eggs. The large assemblages of goose wings from Castle Mall Barbican Well, Norwich, demonstrates the specialist trade in goose feathers (see Animal products in this chapter). There was an evident drop in the proportion of geese after the medieval period, thereafter their numbers continued to decline throughout the post-medieval period. Their decline was most likely the result of the Enclosure Act which, 'interfered with the liberty of geese' (Dodd 1856: 321), because they had previously grazed on common lands. Ducks only formed a minute proportion of the bird meat consumed at post-medieval site. In the medieval period, ducks were disliked because of their dirty feeding habits (Grand and Delatouche 1950, quoted in Albarella *et al.* 1997a). It would seem that this disdain towards ducks continued into the Victorian period as their meat was described as being 'penetrated with fat and difficult of digestion' (Mayhew 1967: 121). Mayhew does provide some insight into the scale of the supply of poultry to London's markets. He states that an average of c. 3 million chickens, geese and ducks were sold on a yearly basis (Mayhew 1967: 122). Chickens accounted for over half of the amount of poultry sold whereas ducks constituted to one tenth of the total amount of poultry sold.

Wild birds

There was a wide diversity of wild birds consumed in the post-medieval period which was attributed to the rise in their consumption during the early modern period (see Albarella and Thomas 2002; see Chapter Four). Waders and other water birds, wild galliforms and commensal birds made up the majority of wild birds in this period. Woodcock was clearly the most abundant bird. As mentioned in Chapter Four, woodcock was reasonably priced and therefore could the afforded by the middle and upper classes. This bird continued to be popular into the Victorian period. In Mrs Beeton's *Book of Household Management* (2000: 237), she describes woodcock as the most delicious bird. The size of the bird would also have made it more desirable, being one of the larger medium-sized waders; it would have had a good amount meat after storing up fat over the summer (Simon 1952: 612). Teal/garganey, swan, grey partridge and turkey also constituted for a large majority of the bird

species consumed. Teals are known for breeding in flocks, making it easy to catch many birds in one go (Sadler 2007: 176). Garganey was not viewed as highly as teal and was considered as the lower equivalent (Simon 1952: 562). Swan was a species that was associated with elite consumption; however, by the Victorian period it had fallen from grace and was very rarely seen on the dinner table (Albarella and Thomas 2002: 25; Beeton 2000: 225). Turkey on the other hand became increasingly popular after its initial translocation to Britain in the 16th century (Fothergill 2014). By the 19th century, the turkey became the prized centrepiece and epitome of the Christmas dinner as it would scarcely have been a Christmas feast without this 'noble dish' (Fothergill 2014; Beeton 2000: 226). The sale of turkey increased during the Christmas period as did the number of turkey thefts (Fothergill 2014). The price that turkeys fetched in 1861-2 London markets varied. At Leadenhall, a turkey-hen could sell for 4s.6d and one man sold several turkey-cocks for 30s each (Mayhew 1967: 123). Grey partridge was another common galliform and a prevalent species in the post-medieval period. It was considered to be the 'finest partridge of all' and was hunted for sport (Simon 1952:577). As a result, they were kept in parks and warrens which had restricted access (Thomas and Vann 2015). Rare galliforms included quail, which was only found at Spitalfields Market (Lamb Street) London (1800-1900). Cargos of quail was said to have arrived to Liverpool from Rome, which were then transported to London on the railways (Dodd 1856: 328). Plover, heron, lapwing and snipe were other waders that were moderately frequent. Golden and grey plovers were desirable food birds in England, which is not surprising given their occurrence on the dinner tables of the wealthy (Simon 1952: 591; Albarella and Thomas 2002: 34). Lapwing and snipe were also common dinner favourites for the wealthy (Albarella and Thomas 2002: 34; Furnivall 1868).

Commensal birds were the largest bird group in the post-medieval period, which mainly consisted of pigeon/stove dove and corvids; thrushes were less abundant. These birds are of an ambiguous nature because they are eaten but also inhabited cities and towns as pests and scavengers. Pigeons would have added dietary diversity and were used to make dishes such as pigeon pie (Beeton 2000: 221). Corvids included ravens, jackdaws, magpies, crows and rooks. Many of these species would have been scavengers, in fact crows and magpies were considered as nuisances (Sadler 2007: 178). That said however, crows (and rooks) were cooked into pies and rook meat was classified as good food for the poor (Sadler 2007: 178; Wilson 1973: 124). Thrushes were also a well-known aristocratic table bird (Serjeantson 2001). Blackbirds were 'fit for a king' and were served to the Lords of the Star Chamber (Simon 1959: 14; Simon 1952: 513). Larks were sold on the streets of London and could be bought in large numbers because they flock together during the winter. They were consumed by the wealthy classes in the form of pies or roasted whole and were also sold as singing birds (Mayhew 1968: 60).

Birds of prey were rare in the post-medieval period. As gun technology developed, hawking became less fashionable, especially as the time invested in training the bird to hunt was laborious (Serjeantson 2009: 239; Griffin 2007: 118-119; Williamson 2013: 124). Some hawks that were used for hunting were owned by different members of society and were graded according to a person's social status. As explained in the Boke of St Albans (c. 1486); 'An Eagle for an Emperor. A [gyrfalcon] for a King. A peregrine for an Earl. A [Merlin] for a Lady. A [Goshawk] for a Yeoman. A [sparrow-hawk] for a priest. A [Musket] for a holi water clerke.' Kestrels and osprey were also used for hunting; however buzzards and red kites were common opportunistic scavengers, although it has been suggested that buzzards were used for hunting (Cherryson 2002: 308; Sadler 2007: 178). Excluding scavengers, the presence of birds of prey in urban environments is most likely due to human activity and may represent the birds of falconers (Cherryson 2002: 310). There is a long history of birds of prey being adaptable to urban environments (Cherryson 2002: 310-311; Holmes 2011; Sykes 2007a).

Cormorant, kittiwake, auk, guillemot and scoter were infrequent species in the post-medieval period, which suggests they were not intensively exploited for food. The time and resources it would have taken to capture and transport these birds may have made it a fruitless investment. However, it may have reflected dietary tastes. In addition, species such as guillemot were specific to certain regions (i.e. the North and South West England) (Albarella and Thomas 2002: 33). Two guillemot bones were found in urban assemblages both of which were from sites in the South West (i.e. Dung Quay, Plymouth and Poole).

Parrot and ostrich were the only two exotic bird species found in this period. In the 18th century there was an expanding trade in exotic animals, particularly in London. More merchants and traders were opening up shops that specialised in selling exotic animals during this time (Plumb 2010; Simons 2012). Charles Jamrach, dealer of wild beasts, had a shop in located at 179-180 St George Street East, London (Simon 2012: 21). In his shop he sold ostriches and parrots, which could be purchased at a hefty price. In 1879, one ostrich cost £80, which would have been the equivalent of £3,864.80. King parrots were cheaper, costing £4 for a pair which was roughly £193.24. In London, exotic birds could also be bought at Leadenhall market (Velten 2013: 164; Dodd 1856: 326).

It has already been mentioned that there was an increase in the consumption of wild birds in the 16th-17th century (see Chapter Four).The reason for this has been attributed to the wealthy seeking to increase the divide between the rich and poor by consuming wild birds that were difficult to obtain (see Thomas 2007). Serjeantson (2009: 248) suggests that the improvement in gun technology may have also contributed to this rise in wild bird consumption. After the early modern

period, it could be argued that the proportion of wild birds on urban sites gradually declined. The cause for this could be a consequence of environmental change, enclosure and the growing urban population. The process of enclosure meant that the reduction in common land, open fields and heaths caused the wild bird population to decline (Williamson 2013: 95, 96). Wetlands were also drained to create more land, and important vegetation such as heather was removed in attempts to improve pasture for grazing animals (Williamson 2013: 100-101). Species such as the hen harrier, stone curlew, golden plover, red and black grouse, dunlin, lapwing, snipe, redshank, bitter, dotterel, black-tailed godwit, marsh and harrier had all dramatically reduced in number by the end of the 19th century (Williamson 2013: 97,100, 102-103). The extent and impact of the wild bird population decline is best described by Lubbock (1847) who said 'oats are grown where seven or eight years back one hundred and twenty-three snipes were killed in one day by the same gun' (as cited by Williamson 2013: 102).

Enclosure was a key factor in the reduction of the wild bird population during this period and has been called the 'enemy of biodiversity' (Williamson 2013: 113). It did not escape notice that wild bird populations were declining. In the late 19th century, there was growing awareness of the conservation of wild bird species (Williamson 2013: 156). This resulted in the establishment of the Wild Bird Protection Act (1872, 1880) and Wild Fowl Preservation Act (1876). In some cases these Acts did little to protect wild bird populations as it was down to local authorities to choose which birds were in danger of extinction (Williamson 2013: 156). However, the formation of these Acts does demonstrate restrictions against capturing wild birds which may have also contributed to their decline.

Fish

Fish was an important food resource in the post-medieval period which added dietary diversity for all social classes. The expansion of England's fish trade notably began from the medieval period, influenced by the growth of urbanism, religious requirements, the long range trade of fish products and environmental changes (Barrett *et al.* 2004; Orton *et al.* 2014). In AD 1000, the 'fish event horizon' saw a marked increase in the number of marine fish on English sites, which was characterised by significant proportions of fish such as cod and herring in the archaeological record (Barrett *et al.*2004). This trend clearly continued into the post-medieval period which was dominated by marine fish.

Gadids were the most popular food fishes which included cod and whiting, and to a lesser extent haddock, pollock and ling. The abundance of cod is unsurprising, given the expansion of North Sea fisheries and the trade in stockfish (Hamilton-Dyer 2007: 181). As the fish trade continued to expand into the early modern and modern period, England's fishing boats ventured to the likes of Iceland and Newfoundland (Orton *et al.* 2014). By the 18th century, there were profound changes in the fishing industry, especially in the expansion of the distance water fisheries in Newfoundland where dried and shore caught fish from Newfoundland fisheries were brought back to England. (Robinson 2000: 72). After gadids, herring was the second most popular fish consumed in the post-medieval period. Herring was eaten in a variety of ways including smoked, salted, pickled or dried as well as fried, grilled or cooked in pies (Butcher 2000: 58; Simon 1959: 16-17; Drummond and Wilbraham 1939: 126). Plaice and flounder were typical marine food fishes and were seen as a lesser version of sole (Simon 1959: 16). Other popular fish such as turbot, sole and sea bass were rare, probably because they were more expensive and therefore not as widely consumed. For instance, turbot was believed to be of high gastronomic value. It cost 6 to 8 shillings in the 17th century, roughly £30 to £40 (Simon 1959: 16; Simon 1952: 384). Sole was cheaper than turbot, priced at 4 to 6 shillings for a pair, whereas four sea bass cost 8 shillings (Simon 1959: 16-17).

Eel and smelt were the most common migratory species. Eel was an important oily fish which was eaten fresh, salted or smoked (Locker 2009: 145). They were common throughout the post-medieval period and were in particular demand (Simon 1959: 21). Smelt had a notable smell that was similar to cucumber, which probably heighten its popularity as a food fish: 'The fragrant odor of smelt doth comment the wholesommenesse of them' (Venner 1628: 72 as cited by Simon 1959: 17). Less common migratory species included salmon and sturgeon. As discussed previously, the presence of salmon is difficult to assess due to the nature of its bone structure which is very fragile. However, considering how expensive salmon was to purchase it would not be surprising that they were not eaten commonly. Sturgeon was a royal fish and like other protected species, only the elite reserved the right to catch and consume them (Nicholson 2002: 393).

The contribution of freshwater species to the post-medieval diet was very minor. Cyprinids were by far the most common of this group, which increased in proportion in the post-medieval period. In the 18th century landowners began to see fish ponds for their economic potential and started to use their moats for breeding freshwater fish, in particular carp. The breeding of freshwater fish was highly regarded for its financial rewards as it could generate a return of £6, 5s an acre (Thirsk 2007: 52). This became a good way for gentlemen to earn extra income, which revived interest in fish ponds during this period (Thirsk 2007: 52; Williamson 2013: 65-66). Other freshwater species were

only present in small quantities, testifying to the limited availably of these species on the commercial market, and restricted access to a certain sector of English society. One can imagine that the people purchasing fresh fish from these landlords were extremely wealthy individuals. The price of pike, for example, was fixed costing double the price of salmon (Hamilton-Dyer 2007: 179). In the 18th century, freshwater fishing branched off into two types: 'game' and 'coarse' fishing (Locker 2014: 91). These distinct forms of fishing were carried out by different members of society, involving different techniques. Game fishing was enjoyed by the upper classes, which required the use of a fly to fish. Coarse fishing was practised by the labouring forces and required bait (Locker 2014: 92). Salmon and grayling were usually caught during game fishing whereas cyprinids were more common in coarse fishing (Locker 2014: 92). This may have also attributed to the increase in cyprinids during the post-medieval period. The popularity of coarse angling fishing increased dramatically in the 18th century, and concentrated around urban areas where there was access to canals, rivers and ponds (Locker 2014: 92).This social transformation witnessed in freshwater fishing was largely influenced by enclosure, industrialisation and urbanisation (Locker 2014).

6.3 Herd management in post-medieval England

There were major changes to England's agricultural system between 1500 and 1900, which strongly influenced herd management strategies. In order to understand how animals were husbanded, it is essential to understand what key changes affected agriculture during this period. The two main developments that had a greater impact on animal husbandry were parliamentary enclosure and the rise in agrarian capitalism. Enclosure was carried out as early as the 14th century; however, it was during the 18th century that parliamentary enclosure took off at a rapid pace (Chamber and Mingay 1966: 34). By 1850 there were more than 4,000 Enclosure Acts in Britain, which transformed the appearance of the rural landscape (Spencer 2004: 208). The benefits of enclosure were that is allowed for greater control over the management and feeding of livestock as they were now confined within a small area (Tarlow 2007: 42; Thomas *et al.* 2013: 3319-20).

The Enclosure Act went hand in hand with the rise of agrarian capitalism. In England, farmland could be owned in three different ways: (1) kept by the landowners, (2) rented to tenants who managed the land; or (3) owned by small family farmers (Shaw-Taylor 2012: 26; Spencer 2004: 208). However, following the early modern period this system shifted because the demand for food made agriculture a profitable investment as privately owned land became increasingly common (Spencer 2004: 209). The aftermath of this was that small family farms were divided up by enclosure and

replaced by large privately owned commercial farms. The primary aim of these farms was to make money and this financially-based incentive resulted in the rise agrarian capitalism.

Commercial farms were commonly located in areas with productive soils and in regions where there was an emphasis on commercialisation such as the South and East of England (Shaw-Taylor 2012: 35). The decline in small family farms was also brought about by engrossment; the creation of larger farms through the amalgamation of small farms (Shaw-Taylor 2012: 26). Although evidence suggests that engrossment began from the 14th century, it was between the 16th and 19th century where it becomes more frequently mentioned in historical documentation (Shaw-Taylor 2012: 28). Small family farms did not completely decline throughout the country; in fact farms in the north faired far better. This was largely because small family farming thrived in areas with poor soil conditions in regions that were not as commercialised (Shaw-Taylor 2012: 35, 56, 58). In the North West small family farms were prevalent and rivalled capitalist farming in the region (Shaw-Taylor 2012: 57).

Determining a motive for the change in England's agricultural system during this period is complex as it was most likely due to a number of factors. Commercialisation has been considered as one of the catalysts for capitalist agriculture (Shaw-Taylor 2012: 58). However, scholars are well aware it was probably a combination of causations including demographic change, industrialisation and commercialisation. All of these events would have influenced and fed into each other, contributing to the beginnings of the agricultural system we see today (Williamson 2012: 74; Shaw-Taylor 2012: 58) (see figure 6.1).

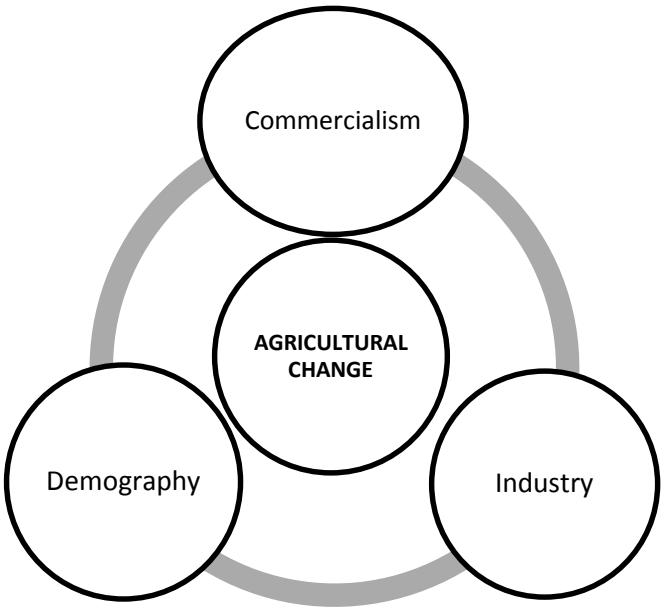

Figure 6.1: Cycle chart depicting the relationship between demography, industrialisation, commercialisation and agricultural change

Husbandry strategies for cattle were characteristic of a mixed economy; one which utilised them for meat and dairy products. This was a trend that has also been noted at urban post-medieval sites by other scholars (e.g. Albarella 1997b; Luff 1993; Dobney *et al.*1996; Maltby 1979). There was an increase in the proportion of veal from the 16th century, which was due to the rise in the status of dairy products (Thirsk 2007: 122). In the early modern period, the consumption of veal was not less common in England compared to the rest of Europe (Simon 1959: 4). People regarded its consumption as a waste of milk and good beef particularly as Britain had a reputation for producing good beef (Rogers 2004: 11). Despite these views, in the 18th century there was an intensive production of veal, which was destined largely for the London market (Trow-Smith 1959: 22). Faunal assemblages in London have been noted for their high proportion of veal. For example, 18th-century animal bones excavated from Kingston uncovered a distinctive assemblage of cattle metapodials, all of which derived from calves aged between three to five months (Serjeantson *et al.* 1986). The deposit represented a single event which was considered to be waste created by a tanner or fellmonger (Serjeantson et al. 1986). Similarly, in an 18th century assemblage at Eagle House (Cannon Street), London, there was also a notable proportion of calf bones (Gordon 2010). These remains were predominantly represented by meat-bearing bones which were clearly consumed as joints (Gordon 2010). These examples demonstrate the London's active veal trade for consumption and industrial purposes. Furthermore, from the 17th century, urban dairies started to emerge around London, which would have contributed to the number of calves in the city (Serjeantson *et al.* 1986). It is also worth noting that veal was highly regarded by the wealthy and would most likely have been supplied on the urban market to meet this demand (Holderness 1989: 155; Trow-Smith 1959: 24; see Burnett 1966: 60; Albarella 1997b: 22).

The production of veal and dairy products in the post-medieval period also reflects growing specialisation in farming. From the 17th century, Essex was famous for its specialisation in veal production and was acclaimed for its production of England's 'fattest' cattle (Trow-Smith 1959: 23). Dairying was also practiced in counties such as Somerset, Suffolk, Cheshire and Derbyshire and East Anglia (Trow-Smith 1959: 159; Thirsk 1997: 49; Fussell 1937a: 98). Cattle fattening took place on a commercial scale in Somerset and Dorset (Thirsk 1984: 358).

Regional variation in cattle husbandry could be detected to a certain extent in the zooarchaeological data. For instance, dairying districts such as the North West had a higher proportion of cattle. London typically had a high proportion of cattle, which is to be expected given the city's growing population and demand for meat, making cattle highly valuable because of its ability to provide more meat (Fussell 1937a: 104). The sex composition within livestock is difficult to determine based

on the limited amount of zooarchaeological evidence; however, it is likely that this would have varied depending on the regional specialisation. Bulls and oxen would have been more common when the focus was geared more towards meat, and cows and where the focus was on dairy production. Zooarchaeological evidence from London showed that cattle were mainly represented by bulls and castrates, which is in-keeping with husbandry strategies geared towards the production of meat (Thomas *et al.* 2013: 3314, 3323)

Metrical data for cattle (see Chapter Five) showed that they experienced a change in size in the post-medieval period. Farmers had invested their efforts in the 'improvement' of livestock to produce larger animals with more meat and fat. Meat production transformed into a large-scale commercial business as farmers sought to produce more and better quality meat. It was innovative developments in selective breeding and feeding regimes that paved the way for the modern day husbandry that can be witnessed today. Size increase in cattle can be observed between the 16th and 17th century, which evidently coincided with historic accounts referring to the importation of larger and 'long legged' Dutch cattle. These breeds were introduced into breeding stocks around the country and had their blood injected into native cattle (Trow-Smith 1957; Trow-Smith 1959). Although farmers were at the early stages of understanding genetics, they at least understood the significance of selective breeding to produce larger animals (Thomas *et al.* 2013: 3320). Examples of congenitally absent second premolars and reduced or missing hypoconulid in post-medieval assemblages (see Appendix Four, table 4.31) provides tentative evidence for the selective breeding that was taking place during this period (Thomas 2005b: 74).

Many farmers made their wealth from cattle rearing (e.g. Chester) and by the 18th century, beef production was on the rise (Metcalfe 2012: 35; Thirsk 2007: 237). Its size, meat/fat content, offal and dairy products made cattle a highly profitable animal (Metcalfe 2012: 35). Breeding efforts were also directed towards rearing cows that produced high-quality milk. The 18th and 19th century saw improvements in the management and productivity of the dairy industry (see Chapter Four). Longhorn breeds were well-known for producing good quality milk with a high butter and fat ratio (Holderness 1989: 160; Moore 1989: 338). However, by the 19th century, long horn cattle declined as the breeding techniques focused towards producing early maturing breeds and animals that could be used for dual purposes (i.e. beef and milk) (Moore 1989: 338, 342; Trow-Smith 1959: 177).

There were many different regional variations of cattle in England. There was no ideal or standardised shape as long as they were the right size (i.e. large, long-legged, strong and well-built) (Fussell 1937a: 100; 106-107). Various cattle breeds were particular to certain areas. For instance, the North East was dominated by short horns and in central and southern England red middlehorns

were more common (Moore 1989: 336). In the North West and in some parts of the Midlands, longhorns dominated. Certain breeds were favoured more than others (Moore 1989: 336; Fussell 1937a: 98). In the early 1700s, cattle from Yorkshire, Lincoln, Stafford and Lancashire were considered to be the best cattle breeds for providing good quality beef (Fussell 1937a: 98-99). The presence of regional types has been confirmed by current zooarchaeological evidence, which also shows the introduction of new morphotypes into different regions (Thomas 2005b; Thomas *et al.*2013; Albarella 1997b; Albarella and Davis 1996; Davis and Beckett 1999). It has also been noted that animals from the North and South West of England were smaller than those from other regions (Albarella 1997b: 20); a trend that was also been observed in the metrical results in Chapter Five. For instance, cattle from the North West consisted of a mix of breeds including Welsh cattle, which were smaller than those in England (see for example Trow-Smith 1957, figure 60; Albarella 1997b: 21). The smaller animals in northern England could also be attributed to the prominence of small family farmers in the region who may not have been as focused on the 'improvement' of cattle in the same way as commercial farmers. We know that the farmers from Chester were largely sceptical of 'improvement' techniques and preferred to breed cattle 'by eye'. It is possible that other farmers in the North held similar views. Furthermore, in Cheshire, where the primary aim of cattle husbandry was to produce dairy products, other characteristics such as size may have been considered as a secondary priority. Metapodial data from post-medieval sites also clearly depicted regional differences in the cattle (see Chapter Five). For instance, cattle metacarpals from Lincoln appeared to be more slender when compared to cattle from other archaeological sites. This is interesting as cattle from Lincoln were described as tall and long-legged (Fussell 1937a: 99).

Sheep husbandry in the post-medieval period focused primarily on the production of meat and wool. Mortality profiles (see Chapter Five) show that the majority were killed around prime meat age and older. Therefore, most sheep would have provided at least two or more fleeces before they were slaughtered for meat. This is also supported by the paucity of lambs in comparison to older sheep. In the 16th and 17th century, English mutton was held in high esteem (Trow-Smith 1957: 247; Fussell 1937b: 190; Spencer 2004: 111). According to Muffett (1655: 61), the best mutton were sheep with a large body mass, no more than four years of age (as cited by Simon 1959: 5) (Albarella *et al.*2009: 60). Sheep specialisation existed in Norfolk, Suffolk, Kent, Wiltshire and Oxfordshire (Thirsk 1967: 41, 64; Thirsk 1984: 358; Fussell 1937b: 190, 199). There was a high proportion of sheep/goat in the South West and South East which could be indicative of the specialisation of sheep in these areas (see Chapter Five). Scholars have observed that sheep increased in size during the post-medieval period as mass meat production became more important (Albarella 1997b; Thomas *et al.* 2013). Similar observations were seen in the biometric results in Chapter Five, which reveals that

sheep/goat changed in size during the course of the post-medieval period. Breeding larger sheep during this period was clearly important as contemporary agricultural commentators commonly describe the ideal sheep as large with big bones (Markham 1648; Skeat 1882; Mascall 1587).

The Leicestershire farmer, Robert Bakewell, had a significant influence in the selective breeding of sheep in England. Bakewell successfully created his "New Leicester" breed in the mid-18th century, which was a cross between old Leicester sheep with Lincoln (and Ryland) sheep (Trow-Smith 1959: 60, 62). By separating the early maturing and 'meatier' animals from this crossbred stock, he was able to produce animals which matured quicker with a greater muscle mass (Moore 1989: 318). His primary aim for the creation of this breed was to produce 'mutton for the masses' (Trow-Smith 1959). His sheep were criticised for their poor quality wool and taste; however, this was never his concern as producing meat suitable for the urban market was his main intention (Moore 1989: 318; Fussell and Goodman 1930: 150). The increase in mutton consumption also influenced the development of early maturing breeds. In the 18th century, it was observed that more sheep were being culled around two years of age instead of the usual four to six years (Fussell 1937b: 194). The decreasing slaughter age towards the end of the post-medieval period has also been noted at 25 Bridge Street, Chester (see Chapter Four), which could indicate the presence of early maturing breeds as sheep husbandry shifted more towards meat production (Thomas *et al.* 2013:3323; Albarella 1997b: 24). In fact, some farmers became increasingly disgruntled that more attention was being given to the carcass size rather than the wool (Fussell 1937b: 198).

Following the creation of the "New Leicester" breed, farmers around the country had introduced this breed into their stock. This did not always yield successful results, however, as some breeding attempts produced sheep that had poor quality wool, or breeds that were too small or susceptible to adverse environmental conditions (Moore 1989: 319-320). There were successful attempts, however, such as the "Cheviot breed", whereas the Teeswater sheep was bred out of existence (Moore 1989: 320; Trow-Smith 1959: 68). In the late 18th century, when Merino rams (with finer quality wool) came to the British Isles, many farmers were excited by the potential prospects of crossbreeding this animal. However, most attempts proved unsuccessful as farmers struggled to create sheep that had both fine wool and a large muscle mass (Moore 1989: 323).

In Chapter Five, the archaeological evidence demonstrated the presence of sheep morphotypes. The evidence also reveals the presence of sheep breeds in different regions in England, particularly from the North. Similar to cattle, some sheep breeds were more popular than others, for example Lincolnshire sheep, which was famous for its large size (Fussell 1937b: 198). Sheep from Herefordshire were praised for its fine quality wool and those from Hampshire and Dorset had the

'finest and sweetest' mutton (Fussell 1937b: 190). There was no general consensus on what was the 'best' breed, as farmers differed in opinion on the physical characteristics that made a good sheep and this mostly depended on whether they were reared for meat or wool (Fussell 1937b: 200). Pathologies and non-metric traits observed in post-medieval period sheep provides evidence for the 'improvement' of sheep. The presence of the sheep with achondroplasia, the Ancon sheep and non-metric traits (i.e. congenital absence of the second premolar and polled sheep) also supports historical and archaeological evidence for selective breeding. Agricultural commentators have mentioned the existence of polled sheep in places like Cornwall and Oxford (Fussell 1937b: 193; Trow-Smith 1959: 36-37).

There is less information on pig husbandry in comparison to cattle and sheep, probably because they received little attention in terms of 'improvement' until the 18th century, although pig measurements from Dudley Castle provide evidence against this statement (see Thomas 2005b). They were generally considered as a low status animal, in comparison to the two major domesticates, which may have also accounted for their lack of attention by farmers (Trow-Smith 1959: 216; Fussell 1937b: 207). They were predominantly kept as domestic animals where they were '…the Husbandman's best scavenger and the Huswives most wholesome sink…' (Markham 1648). Pigs were largely consumed in the form of pork and bacon, although there would have been a market for suckling pig as they were delicacies for the rich (Holderness 1989: 154). In the late medieval period there were changes to how pigs were husbanded, as they were increasingly managed in pig sties as opposed to the pannage system (Hamilton and Thomas 2012). They were generally not bred on the same scale as cattle and sheep as most farmers kept only a few pigs (Hey 1984: 154). Pigs were sometimes kept in breweries and dairies, feeding off the waste products produced from these industries; however, this was on a small commercial scale (Thirsk 1967: 47; Trow-Smith 1957: 250; Trow-Smith 1959: 41).

Pigs were kept in large number in regions such as Hertfordshire and York (Thirsk 1967: 193). In the early modern period, the biggest pigs were supposedly from the Midlands (Thirsk 1967: 194). The West Midlands had a high proportion of pigs, which may reflect the large amounts of woodland in the area where pigs could be kept. Leicestershire and Northamptonshire were also known for their specialisation in pig husbandry and the superior quality of their pig meat (Thirsk 2007: 242; Fussell 1937b: 207). Their taste was attributed to the feeding regimes in this region which fed pigs on pulses (Fussell 1937b: 208; Moore 1989: 353). Pigs that fed on milk products also produced good pork and those that fed on woodland produced the best bacon (Holderness 1989: 154; Thirsk 1967: 104, 193).

When the 'improvement' of pig breeds took place, the focus was on producing animals with large joints, more fat with an early maturation rate (Holderness 1989: 154; Moore 1989: 354). By the 19th century, there was a greater demand for pigs which probably resulted in their increase in proportion by the late post-medieval period. Desirable characteristics of pigs included those with large bodies, thick thighs, neck and chine (Fussell 1937b: 207). Crossbreeding of British and the imported Chinese pigs took place intensively in late 19th century (Moore 1989: 354). This created animals with larger joints which were preferable for the urban market (Moore 1989: 354). There was a wide variety of pig breeds by the modern period; however, the cross between the Berkshire and Chinese pigs was the most notable. The crossbreeding of British and Chinese pigs resulted in early maturing animals which were small but could produce more fat (Trow-Smith 1959: 155). This mix was bred with other pigs from different areas including: Derby, Hampshire, Leicester and Warwick (Fussell 1937b: 209; Moore 1989: 355; Trow-Smith 1959: 155-156). Berkshire breeds could be found all over England, in some parts of Scotland and were imported as far as Ireland (Trow-Smith 1959: 41).

There is limited knowledge regarding poultry husbandry during the post-medieval period. Thus far, much of the information regarding this subject has been addressed by Thirsk (1967; 1984; 1997; 2007) and Fothergill (2012; 2014). As a result, the discussion that follows will largely address chicken and geese as they were the main domesticated birds that were abundant in the archaeological results. Despite the lack of information on poultry-keeping, early modern publications concerning poultry husbandry in Europe highlight an interest in the subject (e.g. Aldrovandi 1598; le Choyselat 1580; di Herrera 1513; Mascall 1581). Poultry would have provided meat, eggs and feather, although there was a greater emphasis on meat production by the post-medieval period (Albarella 1997b: 27). Recent investigations have also brought to light the crucial involvement of women in egg and poultry husbandry (see Fothergill 2014).

From the 16th century, East Anglia was well-known for poultry-keeping and was said to be abundant with geese (Thirsk 1997: 50; Thirsk 1967: 43-44). Large numbers of poultry were driven on foot from East Anglia to the London markets (Thirsk 1997: 50). However, with the development of the railway, driving poultry on foot soon became redundant (Fothergill 2014: 216-217). It is clear from the archaeological evidence that geese were more common in Central and Northern England. In the North, goose was more popular and was preferred over turkey for Christmas dinner (Broomfield 2007: 152).

From the 17th century onwards, efforts were directed towards improving meat yields which saw the emergence of poultry specialisation and the establishment of the poultry industry (Albarella 1997b; Godley and Williams 2010). Selective breeding of chickens resulted in a size increase in the post-

medieval period which demonstrates the focus towards meat production (Albarella 1997b; Thomas *et al.* 2013). In addition, archaeological evidence reveals there were higher instances of new breeds and morphotypes of chickens after the early modern period (see Chapter Five). Inherited traits have also been noted in this period, such as cerebral hernia and the creeper mutation (see Appendix A; Chapter Five). These lines of evidence are signs of 'improvement' of poultry and the introduction of new breeds. It is clear that poultry husbandry changed in intensification and focus during this period. These changes were similar to those witnessed for cattle, sheep and pig which aimed to meet the increasing demands for food by developing new husbandry techniques to 'improve' livestock.

6.4 Feeding and supplying post-medieval England

Urban provisioning and production

Meat provisioned to cities and towns included beef, veal, mutton, lamb, pork and bacon. Beef and mutton comprised the majority of the meat, in terms of weight. Veal was supplied as a by-product of the growing dairy industry and also for an urban population that developed a taste for its meat. Live and dead poultry would have been transported to the markets or raised in towns, as well as pigs. The majority of animals would have arrived as undressed and dressed carcasses facilitated by the various individuals employed within the meat industry (see figure 1.1). Most of the meat would have been bought from the butchers and sold as pre-butchered joints and filleted cuts.

The representation of major meat-bearing bones at many post-medieval sites suggests that meat was consumed as portions. The body parts representation for cattle suggest that cuts such as the rump, buttock, aitchbone, mouse-round and chuck rib were popular (Beeton 2000: 159-160). The rump, buttocks and chuck were typical prime cuts whereas the aitchbone and mouse-round was a cheaper cut (Beeton 2000: 160). Sheep body parts indicate that the leg, loin and shoulder were common meat cuts. There was a dominance of sheep/goat forelimbs at some sites. The shoulder of mutton was considered to be 'one of the joints far better understood in England' (Simon 1945: 84). Butchers also deliberately procured large sheep so they could sell shoulder of mutton (Metcalfe 2012: 35). In the Stuart period, roasted shoulder of mutton with oysters was a classic dish (Colquhoun 2007: 143). In the 19th century, roasted shoulder of lamb was a dish served at religious holidays such as Easter and Michaelmas and 'hot shoulder of mutton' was a meal that would be served during lunch (Beeton 2000: 183; Metcalfe 2012: 42; Drummond and Wilbraham 1939: 129). In addition, the leg of mutton was also a very popular cut of meat (Beeton 2000: 180, 184; Brears 1985a: 33). Typical cut for pig included head, leg (i.e. ham) and shoulder. Pig head was a dish served

at meals, dinners and feasts from the medieval to the Victorian period (Sim 1997; Hammond 2005; Simon: 1959; Brears 1985b; Beeton 2000; Sim 1997: 115; Tames 2003: 19). Collared pig's face was a Victorian dish that was served at breakfast or lunch (Beeton 2000: 194).

Wild animals provided dietary diversity. They would have been supplied via various means, including hunting, poaching and wildfowling. The re-emergence of rabbit warrens meant that they could be bred commercially for the urban market. The presence of deer in urban sites is worth discussing because, as previously mentioned, they were not a commercial product until the early 19th century. It has been observed by scholars that deer was less common on urban sites and more prominent on high-status sites (i.e. castles) (Thomas 2007; Sykes 2007b). The presence of this species shows that urban populations had access to this high-status animal and that was not wholly restricted to the urban elite. The animal bones from Chester middle class merchants from 25 Bridge Street are proof of their access to luxury food items. The middle classes grew in number and prosperity during the post-medieval period and their new financial freedom allowed them to enjoy the same privileges as the elite. Therefore, pastimes such as deer hunting could also be appreciated by the middle classes (Thirsk 1984: 371). For that reason, it is highly possible that they brought back deer for consumption. Post-cranial deer bones on urban sites were represented by deer hind limbs and forelimbs; a pattern which has also been observed by Sykes (2007b, figure 11.6). On elite sites, deer hindlimbs tend to prevail because during the hunt, the hunting party followed the rules of the 'unmaking', which involved cutting up and distributing the carcass according to a strict set of rituals (Hands 1977: 76). This meant that the lord was left with the hindlimbs. It is possible that the middle class did not adhere to the rituals of the 'unmaking', in the same way as the elite, which could be why fallow deer forelimbs are more common on urban sites. Another reason for the presence of forelimbs could be poaching.

Wild birds would have been procured from a range of ecological niches (e.g. wetlands, commons, fenlands, parks, rivers, lakes, coasts), using an array of equipment and techniques (see Chapter Four). Most of the edible wild birds fell into two categories: water and game birds. The supply of these wild bird species on the urban market would have catered to a higher clientele (see England's urban social and cultural identity, in this chapter).

Fish would have been procured from fishponds, rivers, estuaries, streams and the sea. Marine fish was supplied in large quantities, whereas freshwater were seldom consumed (Beeton 2000: 105). The consumption and demand for fish was also driven by religious doctrine, which declared that fish should be eaten during Lent and on non-meat days, although fish days were later abandoned under the Commonwealth (Thirsk 2007: 270). Supply of fish differed depending on the region and the

access to water sources (Thirsk 2007: 265). Pilchards and herring, for instance, were typical in the South West region (Thirsk 2007: 265; Robinson 2000: 83). With the expansion of North Sea fisheries, marine fish were sourced from Newfoundland and Iceland. Fish bought from the market would have been fresh, dried, salted, pickled and smoked. In comparison to meat, the fish trade was not considered as important, therefore, in terms of progression it failed to keep up with the meat industry (Robinson 2000: 72). The availability of fish also depended on the season. Around autumn, salted and dried cod were supplied around the country (Robinson 2000: 73). Eel was considered to be in season from December to March and smelt from January to June (Beeton 2000: 50-54). Following the introduction of the railways, perishable fish could arrive at the market fresh, which enhanced its trade and distribution (Robinson 2000: 75, 80). As a result, fresh fish could be eaten everyday rather than be treated as a once in a while luxury (Black 1993: 269).

The availability of livestock animals also depended on the season. For example, the rabbit trade was more active during autumn and winter (Mayhew 1967: 129). During Christmas, sales of turkey and geese increased and both birds were in season between September and March (Serjeantson 1998: 26; Fothergill 2014: 215; Broomfield 2007: 151-152). In 1861, Mrs Beeton states that pigs bred for pork were in season from September to February (Beeton 2000: 50-54). Other animals such as cattle and sheep were said to be in season all year round (Beeton 2000: 50-54). Wild birds, although consumed throughout the year, were more widely available during autumn and winter; the official wildfowling season.

Post-medieval cities and towns were not solely dependent on food supplied by the hinterland and would have produced their own food. Urban farming was not uncommon as it was relatively easy to raise poultry and pigs in backyards. Urban piggeries established in London were associated with dairies and breweries (Trow-Smith 1959: 217; Thirsk 1985: 337). It was estimated that 2,000 hogs were in distilleries in Deptford, London. ‘Kept drunk and fat’, these grain-fed pigs were prevalent in London’s market (Thirsk 1985: 337; Trow-Smith 1959: 183; Aktins 2012: 40). Urban dairies became prevalent from the 17th century; around the time of the rise of the dairy industry (Trow-Smith 1959: 182). These urban dairies were restricted to cities like London and Liverpool (Trow-Smith 1959: 182-183). A staggering 20,000 plus dairy cows were believed to be in London alone (Atkins 2012a: 39). The benefit of having dairies in cities was that they were nearer to the commercial market, which also reduced the chances of the milk spoiling before it could reach the consumer (Atkins 2012a: 39). The majority of these cows were kept until they produced no more milk and then were fattened and sold for meat (Atkins 2012a: 40). In the 19th century, however, urban farming had reached its peak and this practice began to it decline due to sanitation restrictions (Atkins 2012a: 38).

Provisioning strategies differed depending on the needs of the city and town, which in turn affected what food was supplied from the hinterland. As explained in Chapter One, meat suppliers paid particular attention to the demands of consumers to ensure they put their hard earned money back into the meat industry. The London market had a significant influence on animal husbandry, particularly in regions that were in close proximity to the city (i.e. Kent and Sussex) (Thirsk 1967: 55). Consequently, the city had a fundamental impact on farming systems and contributed to the growth and development of commercialised farming in the South (Holderness 2000: 367). The trade of veal and dairy products to the London market is a prime example of how the capital city controlled the trade of animals and animal products (see in this chapter and Chapter Five). Meat cuts and their price also differed depending on demand within a region (Perren 1978: 25). As London was inhabited by wealthy individuals, it was in the best interest of butchers to cater to that demand by ensuring the availability of high-quality meat cuts (at premium prices) (Perren 1978: 25). Butchers sourced the animals that would produce large cuts and made sure they divided the carcass as efficiently as possible (Perren 1978: 26; Thomas *et al.* 2013: 3312; Beeton 2000: 159). In London, there was a disparity in the price of prime cuts and low quantity meat cuts, whereas, in other cities the price difference between these cuts was not as great (Perren 1978: 25). This was because popular meat cuts also differed regionally. For instance, in Edinburgh, what would be classified as low-quality cuts in London, were more expensive as Scottish consumers had an appreciation and preference for broths and boiled meat rather than roasts. Newcastle also preferred similar cuts to Edinburgh (Perren 1978: 26).

Animal products

The disposal of selected animal bones (i.e. skull, horncores, and feet), observed in the post-medieval assemblages provide insight into the provisioning of animal parts for industrial and craft activity. These body parts are representative of a number of trades as well as their use for different crafts. Animal parts were bought from the butcher or provided by working animals that died in the city (Yeomans 2004). Because butchers' waste was extremely valuable in supplying these trades, in London provisions were put in place to ensure animal parts were provided to those in crafting professions (Yeomans 2004: 69). Craftsmen also supplied other trades, for instance, tanners would sometimes sell horncores and metapodial to horners and pinners (Yeomans 2004: 73). Although animal products were distributed and redistributed all around the city, over time, certain trades were banished to the outskirts of cities/towns to the suburbs because of the noxious smells they produced (for example in London and Chester).

Evidence for processing animal hides and skins was the most visible form of industrial processing in the archaeological record. Animal hides and skins processed by tanners and tawyers resulted in the accumulation of horncores and metapodials and occasionally horse remains, if horse hides were also processed. Horses sent to the knackers' yard were utilised for their bones, tail/mane, meat as well as skin. The accumulation of horncores was another product that was visible in the archaeological record, which would have been used by hornworkers. Metapodials were particularly useful for bone-working, because of their density; craftsmen and pinners used them to make objects (see Yeomans 2007). Pinners' waste was identified at sites in London (e.g. Creedy's Yard and Battle Bridge Lane) and horncores and metapodials were also used for structural purposes at 67-69 St Thomas' St, Oxford, St Marys Guildhall 82-3, Lincoln and 25 Bridge Street, Chester. Deer would also have been exploited for their hides, although because of their restricted access, this would have been a minor industry. Antlers found on urban sites demonstrate their use as a resource for manufacturing to make items such as combs, playing pieces and handles (MacGregor 1989: 107, 110). The presence of small wild mammals (i.e. badger, polecat, red squirrel, otter, etc.), outside their natural habit is proof of their capture and procurement to urban environments. These small wild mammals were popular as their fur would have been traded for the furrier industry. The unique deposit of goose wings from Castle Mall, Barbican Well (Norwich) provides evidence for the supply of goose feathers. Geese were plucked up to five times a year to make quills and goose feather beds (Wilson 1973: 119).

These animal deposits illustrate how tradesmen and craftsmen controlled the distribution of animal products for their various professions and crafts. Evidence for craft and industrial activity was more common for cattle and sheep than pig, which suggests that the trade and distribution of pig body parts for industrial uses was infrequent. It is worth noting that not all activities involving animal products will leave archaeological signatures. There are a number of activities that would have taken place regularly (i.e. soap making, glue making and producing bone fertiliser) that will be archaeologically invisible (see Atkins 2012b, table 4.4; Yeomans 2007, table 8.11). In various parts of England, some places specialised in trades such as leather making. It is likely that trades would have established due to the availability of animals in the region (i.e. Chester). Therefore, it is perhaps not a coincidence that evidence for the trade of goose feathers was found in the Midlands, a region known for poultry-keeping.

6.5 Food, cultural and social identity in urban England

The British placed immense importance on meat. Beef and mutton were the principle meats consumed by urban inhabitants in post-medieval England; this was supplemented by veal, lamb,

pork, bacon, poultry, wild resources (e.g. rabbit, hare, deer, and wild birds) and fish. English cooking was characterised by its simplicity and plainness. Meat was flavoured with its own juices rather than spices and was cooked by boiling and roasting (Roger 2004: 19, 23; Spencer 2004: 105-106). European visitors to England referred to the amount of meat that was consumed by the British population. A Dutch writer described how the English indulged in a 'great deal of meat' (Rye 1865: 70, as cited by Roger 2004: 12). In 1562 London, one Italian merchant was overwhelmed by the meat consumed in England and said, 'It is extraordinary to see the great quantity and quality of meat…it is impossible to believe that they could eat so much meat in one city alone' (Barron *et al.*1983: 136-152, as cited by Roger 2004: 11). From the early modern period, there was a strong association between beef and British national identity. The British prided themselves on their ability to produce fine quality cattle that produced tasty beef. The roast beef became popular during this period and was a common staple of the Sunday dinner (Roger 2004: 20; Metcalfe 2012: 42). In London, Smithfield's meat suppliers made a conscious effort to supply enough cattle for the weekly Sunday dinner (Metcalfe 2012: 41; Roger 2004: 13). Mutton was also a popular meat that was a source of British pride (Spencer 2004: 111).

Beef, veal and mutton consumption increased among urban populations and were considered as the meat of the middle classes (Roger 2004: 15, 17; Holderness 1989: 154). Sixteenth-century household accounts of the Willoughby family showed that beef and mutton were the most common meats consumed (Dawson 2008: 22). Interestingly, household accounts before the 1540s showed that veal consumption was rare, however, after this date its consumption increased, which would have been the direct result of the emerging dairy industry (Dawson 2008: 22-23). Cheese, cream and milk were also a vital food source for the urban population and an important ingredient in British cooking (Hey 1984: 153; Thirsk 1997: 167; Spencer 2004: 105). Although vast quantities of meat were eaten, so was fish. Despite the end of the Reformation, Parliament still enforced the consumption of fish during non-meat days (Spencer 2004: 105). Wednesday and Saturday were introduced as official fish days by Parliament and Elizabeth I in 1563 (Thirsk 2007: 265).

The early modern period was marked by the rise of the middle class. This group was made up of the farmer, merchant, tradesmen, yeoman, shop owner, artisan, clerk and accountant (Spencer 2004: 158). There were a number of reasons for the rise of this social group including: urbanisation, the industrial revolution, agrarian capitalism, commercialisation and economic growth. The dissolution of the monasteries also encouraged the development of this social class. The wealth and land that was gained following the dissolution trickled down the social ladder from the Crown, providing

opportunities for individuals to own land (Spencer 2004: 102). Land equalled wealth, and what was once monastic land was being transformed into domestic holdings and used for farms.

The middle classes had a strong presence in urban centres, where they ran their successful businesses in trade and merchandise and had their homes. These driven and business-minded individuals began to grow rapidly in power and wealth and soon became the new consumer power (Spencer 2004: 127). By the 18th century, with the industrial revolution creating more jobs and work opportunities, England's middle class were becoming wealthier which propelled their propensity to purchase goods (Overton *et al.* 2004). Historians have observed a direct correlation between the Industrial Revolution and an increase in consumer demand and material consumption attributed to the 18th-century consumer revolution (Dyer 2005: 126; Berg 2007: 26-28). Shops were emerging on almost every street corner selling an array of fashionable and luxurious domestic goods including; carpets, gilded mirrors, tea sets, furnishings, ornaments, clocks, silverware and wallpapers (Berg 2007). The middle class sought out these commodities out of a necessity to demonstrate social standing (Berg 2007: 19).

Amid these social and economic developments it raises the question, how did this effect consumption habits and can they be discerned in the archaeological record? The urban middle class aspired to live an elite lifestyle and could now afford to make this a reality (Spencer 2004: 100-101; Dyer 2005: 126). Food became a powerful tool through which they sought to portray their identity. Thus social mobility and imitation was actively demonstrated through the use of food to showcase their new persona (Burnett 1966: 2, 4; Spencer 2004: 101). This desire undoubtedly influenced the urban market, which is evident by the diversity of edible wild birds at post-medieval urban sites (Metcalfe 2012: 41). One common characteristic of elite sites (e.g. castles, palaces, manors) is the greater range of wild bird species compared to non-elite sites (Thomas 2007; Albarella and Thomas 2002; Ervynck *et al.*2003b). Wild birds were actively used as a social excluder (see Chapter Four). Their increased consumption in the early modern period marked attempts by the elite to distinguish themselves from the rest of society (Thomas 2007). Wild birds required specialist skills/equipment to obtain and were also available on a seasonal basis. This increased their desirability as well as price, making them ideal for aristocratic dinners and feasts (Sim 1997: 114-115; Furnivall 1868; Simon 1959). Given the desire of the middle classes' to emulate the behavioural habits of the elite, it is not surprising that many of the wild birds associated with aristocratic consumption were found at urban domestic sites (see Albarella and Thomas 2002; Thomas 2005a; Albarella and Davis 1996). In the 19th century, dinners enjoyed by the urban middle class included high-status birds such as partridge, woodcock and turkey (Burnett 1966: 60-61, 66-67). Game was eaten by the gentry as well as the

middle class (Rogers 2004: 15). As stated beforehand, the middle class also began to enjoy the same privileges as the elite, such as hunting game. Because game was restricted on land owned by aristocrats and gentry, the middle class demanded a lift on this controlled access so they could also enjoy this form of entertainment. Therefore, the presence of game (e.g. pheasant, hare and deer) at urban sites is most likely indicative of animals hunted and brought back for consumption by the upper and middle classes.

The variety of wild species at urban sites visibly shows that the distribution of wealth was changing during the post-medieval era. In the 19th century, while the middle class was gaining social and political influence, the aristocracy were facing loss of land and diminished power and wealth (Burnett 1966: 52; Beckett 1986: 468-469; Perren 1995). The presence of wild species not only illustrates luxury consumption on urban sites but the wealth, power and social position of England's urban middle class.

After the Tudor period, good cooking was no longer about grand feasts and dinners. Now, because of the middle class, there was a gradual appreciation towards simple, domestic home cooking (Spencer 2004: 116). From the early modern period, literacy was on the rise throughout the country and during this time there was an influx in cookery books which were extremely popular with the general public, especially the middle class (Spencer 2004: 117; Stead 1993: 227). Celebrated publications included: *The Boke of Cokery* (1500); *Proper New Booke of Cookery* (1576); *The Good Huswifes Jewell* (1610) and *The Accomplisht Cook* (1678). These books contain recipes of aristocratic dinners and dishes that could be cooked in the home, instructions on how to cut and prepare meat, medicinal recipes and even details on how to brew beer, make wine and cheese (Spencer 2004: 117; Stead 1993: 227). These cook books were aspirational for many middle class families who could now practice habits and behaviours of nobility in their households (Spencer 2004: 118).

In the Victorian period, the urban middle class placed great value on how food was prepared, the order of service and the time a meal was served, as these practices embodied high society (Burnett 1966: 54). Women played a huge role in household affairs and were in charge of upholding the social rules of dining etiquette (Wall 2000). Manuals such as Mrs Beeton's *Book of Household Management* were popular among this generation of housewives since it contained a practical guide on how to practice and uphold these standards (Spencer 2004: 271). Based on these cook books it was clear that carving techniques were an accomplished art form. The carver not only had to ensure that everyone had an equal portion but the joint also had to look presentable after the meat was served (Spencer 2004: 278). In the pages of Mrs Beeton (2000), there is detailed information on how to carve beef, veal, mutton, goose, turkey and fish. The fine cut marks observed on the sheep scapula

at 10 Commonhall Street, Chester, and the goose sternum at 10 Commonhall Street and Eagle House (Cannon Street), London, closely resemble carving techniques described in Mrs Beeton (Sykes and Wan n.d.: 3-4; Gordon 2010, see Chapter Four). Although these examples can be perceived as circumstantial evidence, it does illustrate the extent to which social classes attempted to follow the prescribed literature and the importance that was placed on social dining and etiquette. Cook books and manuals provide insight into the importance that was placed on food and food preparation during the post-medieval period. The recipes and instructions in these publications not only symbolise British identity but how food acted as a conduit to a new identity for the urban middle class.

In stark contrast to the middle class, the food of the labouring poor was very basic: it lacked in dietary variety and was 'stodgy and monotonous' (Burnett 1966: 50). Most could afford very little meat and ate mainly bread, potatoes and porridge (Black 1993: 267; Drummond and Wilbraham 1939: 388; Spencer 2004: 267; Metcalfe 2012: 35). Those that could afford some meat ate pork and bacon; the typical meat of the poor (Roger 2004: 15; Thirsk 2007: 241; Drummond and Wilbraham 1939: 50). They also consumed some beef, mutton, rabbit, poultry and fish (Roger 2004: 12; Spencer 2004: 266). In the late 19th century, canned meats (e.g. corned beef) exported from America, Australia and Argentina also provided another form of protein for the poor (Black 1993: 268; Spencer 2004: 282). In most cases, the small amount of meat that was consumed was just to add flavour to soups, stews and broths (Spencer 2004: 294; Black 1993). Smithfield butchers accommodated for the poor by providing inexpensive cuts of meat and offal which were in high demand in the city (Perren 2006: 25). Cheap cuts were eaten such as sheep's trotters (Burnett 1966: 185). Faunal assemblages from urban slums at Hungate, York, St Giles Court, London, and Hamilton Place, Chester, had woodcock, fallow deer and hare (although in very small quantities) (Hunter-Mann 2008; Pipe 2009a; see Chester Four). It is highly likely that the poor would have captured their own wild animals or benefited from illegally poaching as a means to add variety to their diet (Thirsk 2007: 222). In 15th-century Staffordshire, bird traps could be hired for a small fee, which would have made it possible for small birds to be accessible to all members of society (Sadler 2007: 179).

Although the Industrial Revolution brought with it significant economic benefits, not everyone gained from the financial developments the country was experiencing (Burnett 1966: 50). On the contrary, industrialisation and urbanisation had a negative effect on the lives of millions, leading them to destitution (Spencer 2004: 266). In the 19th century, the poor heavily relied on food hand-outs by social reformers who set up soup-kitchens giving out pies and soup (Black 1993: 299-300).

Heavily butchered cattle bones from the 'slum court', Hamilton Place, Chester, would have been characteristic of the meat used in similar soup recipes (see Chapter Four).

Cookery books were also written for the working class, although these did not have the same grandeur as recipes aimed at the middle and upper classes. Popular titles included *A Shilling Cookery for the People* (1855) and *A Plain Cookery Book for the Working Class* (1882) (as cited by Burnett 1966: 145). These cook books were written with the intention of showing the poor how to cook meals with limited resources (Black 1993: 271). However, these books were probably not very helpful as many of the poor lacked basic kitchen equipment and did not have a fire or a stove to cook on (Spencer 2004: 267; Burnett 1966: 144).

Towards the end of the 19th century there was a significant decline in traditional British cooking. This has been largely attributed to the introduction of French cooking. Burnett (1966: 60) proposes that the popularity of French cuisine was due to an influx of French chefs who emigrated to England for work or as refugees during the French Revolution. It was not long after the Revolution that having a French chef was the 'trendy thing' to do and by the 19th century, British class identity was now 'mediated through French food' (James 1997: 75; Spencer 2004: 280). The transfer from British to French cooking is particularly evident by the increasing amount of French recipes appearing in British cookery books in the 18th and 19th centuries (see Brears 1993).

Although English and French cooking stemmed from medieval origins, by the late 17th century the two had split apart. While English cooking was known for its simplicity, French cooking was notable for its refined style, which incorporated a combination of sweet and savoury ingredients, spices and stock used for stewing and braising (Roger 2004: 31-33). It was most likely the birth of nouvelle cuisine in the late 17th century, which sparked the attention of the British public (Roger 2004: 33). This form of cooking emerged from the kitchens of Louis XIV's palace of Versailles, where mountains of food were presented sky high, forming a pyramid of meats and fresh vegetables in the centre of the table (Roger 2004: 33). Because of the grandeur of French cooking, British cooking was seen as uninspiring and started to be disregarded by the wealthy classes (Spencer 2004: 281).

Spencer (2004: 288-292) claims that the decline in British cooking was due to a number of factors and not solely the influence of French cooking. These reasons included: the commercialisation of food which provided cheaper imports and convenience food; the attitude towards female domestic cooks, who were viewed as unsophisticated in comparison to French chefs; the lack of literate cooks trained in British cooking and the general loss of interest in British food. In addition, this adoration for French chefs meant that English chefs became out of practice with British cooking styles and

techniques and, unlike French chefs, were paid low wages (Spencer 2004: 281; Colquhoun 2007: 164). For those reasons, by the 19th century British cooking was viewed as an inferior cuisine (Spencer 2004: 281).

6.6 Summary

Cattle, sheep and pig were the main domestic mammals in the post-medieval period which were consumed in the form of beef, veal, lamb, mutton, bacon and pork. Chicken and geese were the most common domestic birds which provided meat and eggs. The consumption of beef and mutton increased as did the production of dairy products. The rise in the dairy industry stimulated the trade in veal, particularly for the London market. Minor domestic mammals in urban England included horse, dog and cat. There was an increase in the proportion of horses due to their prominent presence in urban environments and an increase in cats and dogs which may be due to changing attitudes towards these animals.

Wild mammals included deer, rabbit and hare. Rabbit was the most common wild resource and fallow deer was the most common species of deer. There was a wide variety of birds consumed at post-medieval sites. However, while there was an increase in the proportion of fallow deer and wild birds during the early modern period, these species gradually declined towards the end of the post-medieval period as a consequence of agrarian and environmental change. Marine fishes were the main fish group consumed due to the expansion of the North Sea fisheries.

Livestock husbandry strategies showed that cattle were reared for beef and dairy products and sheep for mutton and wool. There was an increase in the commercialisation and specialisation of meat and secondary products which coincided with the rise of agrarian capitalism. To meet the growing demand for food, farmers carried out selective breeding techniques to 'improve' their livestock to produce more meat. Zooarchaeological analysis revealed that there was a gradual increase in the size and shape of animals throughout the post-medieval period which began as early as the 16th-17th century. This rejects the claim that the agricultural revolution coincided along with the industrial revolution, showing that size change in animals differed both temporally and regionally and did not occur as a singular event.

Wild species were supplied to accommodate the growing middle classes who aspired to consume similar foods to the elite. Post-medieval cities and towns also acted as net-consumers, producing their own pork, bacon, eggs and dairy products. British inhabitants placed a great deal of importance

on their ability to raise high quality beef and mutton, which was tied up into their national identity. Despite this, towards the end of the post-medieval period there was a decline in British cuisine, as French chefs and cuisine rivalled the humble British cook.

7 Chapter Seven - Conclusion: A New Beginning

7.1 Introduction

This thesis was developed with the intention of advancing and demonstrating the potential of, post-medieval faunal studies, which has been a much neglected topic in British zooarchaeology. The research aims were developed to gain a better understanding of agricultural production and food consumption behaviours in English cities and towns, with the use of primary and secondary faunal data and literary sources pertaining to animals. The research conducted for this thesis has illustrated the strength of zooarchaeological enquiry in informing upon livestock innovation, urban provisioning, the meat industry, food consumption behaviours and urban identity. These themes have been considered within the wider framework of topics such as: urbanisation, industrialisation, commercialisation, agricultural specialisation, consumerism and capitalism. As a result, this has allowed for a comprehensive understanding and acknowledgement of the role and importance of animals in the post-medieval era.

Before summarising the key findings of this research, attention will be given to the issues confronted during this study, some of which have already been discussed in earlier chapters and will be briefly reiterated here. No form of research comes without its caveats and this investigation was no exception. The uneven representation of data was a particular problem when carrying out the regional inter-site comparisons. As a consequence of the paucity of sites in different parts of England, this prevented a detailed comparison of husbandry strategies by county. As highlighted in Chapter Five, sites in southern England were better represented than those from northern England. In addition, there were clear temporal differences in the availability of faunal data. For instance, the 16th and 17th century had the largest data set, whilst the 19th century was poorly represented. As regional site comparisons aim to identify broad trends and patterns, this did put a restriction on the extent to which research themes could be explored in detail, such as social status and urban identity, which instead was presented as a broad overview. Lastly, as pointed out in Chapter Two, variance in the assemblages (e.g. taphonomy, recovery biases, site formation, etc.) will influence how the data are interpreted. Although this is beyond the control of any analyst, it does not detract from the value of conducting site comparisons. Fortunately, historical and agricultural sources assisted in filling in the gaps of the zooarchaeological evidence.

7.2 Key findings and endeavours

This research has brought to light a number of key trends and discoveries, which have enhanced the understanding of the five research themes: urban provisioning and production, innovations in livestock husbandry, food and social status, Britain's urban cultural identity and Britain's urban history and meat trade.

In Chapters Four and Six, observations of post-medieval assemblages have emphasised the importance of domestic livestock throughout this period as core providers of primary and secondary products. The increase in cattle and veal attests to the rise in the dairy industry and specialisation in cattle and dairy production in different parts of England (e.g. Chester), as well as the growing importance of cattle as a symbol of Britain's national identity. Regional variations in the faunal record point to the specialisation of other livestock animals such as sheep in the South, pig in the West Midlands and geese in the East of England. These regional patterns are also supported by accounts relating to agrarian histories (see Chapter Six). The diversity of wild species demonstrated that urban inhabitants had a varied diet, benefiting from the exploitation of animals from a range of ecological niches. The presence of wild birds and mammals shows that there was an active market for these species for wealthy urban dwellers. Furthermore, their presence demonstrates the significance of animals as a symbol of wealth and prestige. Animal products were just as essential as meat, both of which were supplied and distributed throughout cities and towns, controlled by an intricate network of meat suppliers, consumers, craftsmen and tradesmen.

There was a growing focus on meat production which coincided with a national population boom in urban centres along with the growth of industries and commercialisation. This saw the development of the thriving meat industry and brought about a shift in agricultural practices and animal husbandry, which now focused on intensification and specialisation of food production. In Chapters Five, the zooarchaeological evidence reveals a change in the size and shape of livestock. This provided direct proof for the manipulation of livestock genetics and selective breeding to improve the ratio of meat, fat and muscle tissue for the growing masses. Urban growth and industrialisation prompted the creation of new breeds and morphotypes. Moreover, the increase in the size and shape of livestock shows that the term 'agricultural revolution' is fundamentally flawed. The gradual increase in livestock size is reflective of an 'agricultural evolution'; one that changed and developed over time. This discovery contributes to the mounting zooarchaeological evidence, which shows that livestock 'improvement' took place in England before the 18th and 19th century (see Chapter One, Innovations in livestock husbandry).

Investigations reveal that this period witnessed environmental change, prompted by the growing urban population, urbanisation and industrialisation. The Enclosure Act had a fundamental effect on the biodiversity of wild species in Britain's countryside, which was also reflected in the proportion of these species at urban post-medieval sites. Although this act successfully created more land for the production of meat and animal products, it also led to the destruction of natural habitats, which in effect, contributed towards the decline of wild animal populations throughout the post-medieval period.

7.3 The analysis of urban post-medieval assemblages: the good, the bad and the ugly

Part of this investigation was to assess the strengths and weaknesses of post-medieval zooarchaeological analyses. Chester was an ideal case study because of the availability of post-medieval faunal data and the dearth in knowledge of animals from the North West (Huntley and Stallibrass 1995). Furthermore, it provided an opportunity to critically assess the methodologies and approaches used in this study and to examine their usefulness in helping to achieve the research aims.

Chapters Three and Four showed that the detailed analysis of post-medieval animal bones can be highly informative in the investigations of urban provisioning and food consumption behaviours from a single city. The zooarchaeological enquiry of Chester faunal data provided unique insights into husbandry practices and revealed the adoption of specific provisioning strategies during times of stress and political upheaval. The investigations showed that the supply of meat and animal products shifted during the English Civil War which was 'fuelled' by the supply of dairy products to feed the soldiers. As Cheshire was a dairying district, farmers responded to this demand by producing large amounts of dairy products. This resulted in a distinctive surplus of calves in the 17th century context at Chester's Roman Amphitheatre (and maybe 25 Bridge Street). The accumulation of faunal remains representative of industrial waste produced by the leather industry highlighted the importance of animal products in the city and how these industries powered the local economy. The consumption of wild species in the city also indicated the social significance of these animals for wealthy Chester inhabitants.

Overall, it is evident that the analysis of primary and secondary faunal data has provided new insights into the role and function of animals in Chester city. This investigation has proven that the zooarchaeological enquiry of a single city can disentangle aspects of urban life through the use of animal remains.

One issue encountered when conducting this analysis was the overlapping chronological phases when comparing multiple sites from Chester. This made direct comparison of the faunal data problematic. Whereas some sites had consecutive phases (e.g. 16th-17th, 17th-18th century etc.) others had broader chronological phases (e.g. 17th-19th century), which may have disguised trends in the data. This was not helped by the lack of periodisation for the post-medieval period. For example earlier periods (e.g. Roman, Saxon, Norman and medieval), benefit from the use of chronological groups that are widely accepted and used by scholars which undoubtedly aids in the interpretation and comparison of data, which the post-medieval period is lacking.

Residuality is a common problem confronted when analysing post-medieval urban assemblages. For that reason, one of the objectives of this study was to assess the extent to which residuality affected the interpretation of animal bones from this period. Animal bones from Chester's Roman Amphitheatre (Area A) had high levels of residuality and were therefore excluded from this investigation (see Chapter Two). Residual pottery found in 19th and 20th century deposits at 12 Hamilton Place was also a key concern which prevented the analysis of substantial quantities of animal bone from this site. However, this 'problem' was not as simple as initially perceived, as residual material from 12 Hamilton Place appeared to represent contemporaneous deposits of 'out of fashion' ceramic wares (see Chapter Two).

Scholars have long been investigating the rise in consumerism in the 18th century and the changing relationship between people and material culture (Berg 2004; Berg 2007; Burnett 1966). This period witnessed people developing a greater desire to obtain goods out of want rather than necessity, which resulted in the acquirement on more material goods. Subsequently, when assessing residual material from the later post-medieval period, changing perceptions towards material culture have to be taken into consideration. This is because of the possible 'curation' of wares and objects, which can complicate methods of dating later post-medieval deposits. This could mean that our traditional concept of residual material could be redundant when working with later post-medieval sites. If one was to consider the 'mixed' deposits from 12 Hamilton Place, the out of fashion wares may be a mere reflection of acquiring and holding onto goods as a result of new capitalist and consumer habits. Consequently, using pottery as a proxy for identifying assemblages of mixed origin could be potentially erroneous. Issues with verifying the origins of the material from 12 Hamilton Place impacted on the interpretation of the zooarchaeological material, thus inhibiting the research potential of the animal bone. In light of this, archaeologists need to reassess how they interpret post-medieval assemblages in order to fully appreciate and maximise the research potential of this period.

Residuality is clearly a complex issue that is not going to be resolved instantaneously. It stems from the acute lack of understanding and research into ceramics and other forms of material culture (Matthews 1999: 166) as well as the formation of deposits and use of space in this period. This is not helped by the fact that urban sites are already difficult to interpret as they are deeply stratified, truncated by modern development and often have multiple activities taking place, creating mixed deposits. Therefore, different approaches to identify residuality may be needed because of the unique formation processes involved in the creation of urban sites.

Studies investigating the association between high levels of residuality in pottery and animal bone have revealed that the taphonomic pathways for these two materials differed and showed very little correlation (Rainsford and O'Connor 2015: 4; Dobney *et al.* 1996). A further complication with using pottery as a proxy for detecting residual animal bone is that it is easier to identify residual pottery than it is to identify residual animal bone (Rainsford and O'Connor 2015: 4). On the contrary, identifying redeposited bone is more straightforward and can be done by examining the bone's surface condition, level of fragmentation, weathering, abrasion, gnawing and colouration (Rainsford and O'Connor 2015; Dobney *et al*. 1996). However, past investigations involved in the detection of residuality have confused the aforementioned characteristics as signs for residual material (Albarella 2015: 3). It is evident that measuring two different processes on pottery and animal bone to inform upon the same thing can lead to inaccurate interpretations (Dobney *et al*. 1996; Rainsford and O'Connor 2015: 4). Taking this into consideration it should ultimately mean that one should not be used to inform upon the origin of the other. Nevertheless, as it is difficult to identify residual bone, to do so without the use of pottery would be near impossible; unless ^{14}C dating was employed. A better approach would be to use pottery to assist in the recognition of residual animal bone, but not as the only method. It has been suggested that careful examination of the condition of pottery sherds may help to distinguish between residual pottery versus pottery that has been redeposited (Rainsford and O'Connor 2015: 4). Perhaps by using strategies such as this, alongside other forms of evidence (e.g. other artefacts, taphonomic and contextual information) archaeologists can begin to devise improved techniques and approaches to detect the level of residuality. With more large scale analyses of urban sites and better collaboration between field teams and specialists, hopefully positive steps can be made towards addressing the issue.

7.4 Recommendations for future research

Chapter One has shown that there have been a lack of zooarchaeological investigations conducted in the post-medieval era, which has resulted in a paucity of comparative data. Although 148 sites were consulted for the regional review, this is by no means an inclusive compilation of every post-medieval zooarchaeological report in England. There are clearly gaps in the data which can only be addressed with the inclusion of more sites. Despite the fact that this thesis contains the largest synthesis of post-medieval faunal data, it is obvious that the number of reports represented is low in comparison with other reviews (e.g. Hambleton 1999, Holmes 2011; Maltby 2010; Sykes 2007a). With more data it will be possible to fill in the missing gaps within the dataset and allow for a more thorough interpretation of animal husbandry strategies in this period. The comparatively low number of post-medieval sites is in large part due to previous and current commercial excavation strategies, which tend not to target sites of this date, as they are deemed to have less research potential (Chapter One).

The comparison of faunal data from other countries such as Northern Ireland, Éire, Wales and Scotland would greatly contribute to our knowledge of animal husbandry, provisioning and consumption behaviours in the United Kingdom. This would facilitate the exploration of the differences (or similarities) in provisioning strategies in these countries. There would also be a unique opportunity to see whether cultural distinctions in how animals are managed and utilised are recognisable in the faunal record. Furthermore, it would be interesting to explore what impact the commercialisation and industrialisation of food had on the diet of rural inhabitants, and whether their consumption habits became more 'urban' in character because of changes in the agrarian economy (Shaw-Taylor 2012).

Further examination of the spatial and temporal distribution of animal bones can be used to detect divisions between domestic and industrial space, and thus gain an understanding of the organisation of urban cities (O'Connor 1989b: 21-22). Contextual spatial analysis and site formation studies have seldom been applied to later periods in archaeology (for an exception, see Puputti 2010; Yeoman 2006; Rainsford and O'Connor 2015). Nonetheless, the few studies that have been conducted have been effective in demonstrating how the disposal and distribution of animal carcasses assist in our understanding of site formation practices and inform upon spatial organisation. By studying the disposal strategies of faunal remains from urban sites there is an opportunity to understand how individuals from various social classes disposed of their waste. Archaeological studies have highlighted ways to detect social variances through the formation of rubbish. The disposal of waste on two medieval urban sites in Southampton revealed different methods in how waste was disposed

of, which illustrated the status of the inhabitants (Jarvis 2013). The two sites were Bull Hall and York Buildings; the former was occupied by merchants whereas the latter was occupied by craftsmen (Jarvis 2013). Waste from Bull Hall was deposited in pits whereas waste from York Buildings was scattered throughout backyards and gardens to use as fertilizer. The explanation for this was that waste produced by merchants was disposed of in an orderly fashion, while craftsmen utilised and redeposited their waste. For the latter, this method of deposition represented a chaotic manner of waste disposal (Jarvis 2013). Secondary use of bones was also observed at the slum court Hamilton Place, Chester, which shows the use of bones as a raw material to make buttons. The surface condition of bones at Hamilton Place also suggested their redeposition after consumption (Harrison 1995a). Similar disposal strategies have been practiced by low-status metalworkers at sites in Norwich and Hereford, where rubbish was disposed of across tenement plots instead of in features (Jarvis 2013). The evidence has therefore illustrated that waste disposal at wealthier sites showed a higher degree of waste management in parallel to poorer sites. Martin Hall (2006: 186, as cited by Jarvis 2013) claims that, 'urban landscapes are an expression of identity and also shape the identity of those who live in them'. Evidently there is a great deal to be gained through the exploration of the spatial and temporal distribution of animal bone disposal. The research conducted by Jarvis (2013) highlights its ability to help us understand the decision-making process behind waste disposal practices and how it shaped peoples' urban and social identities.

Although urban animals have been receiving more attention in human geography and urban history in the last two decades (e.g. Palmer 2010; Philo and Wilbert 2000; Atkins 2012c) there has been little research into how archaeology can contribute to the study of humans and urban animals in a post-medieval context. By using historical documentation, spatial analysis of bone refuse, species proportion and mortality profiles, we can illuminate on the various roles of animals and human-animal relationships in urban environments. This can be explored by investigating: the movement of animals throughout the city; their impact on urban infrastructure (i.e. urban dairies, pet cemeteries); how they contributed to the transformation of the human-environment and how humans and other animals negotiated the same spaces. There is also scope to explore human-animal relationships and perceptions towards animals by using a contextual approach to track the rising popularity of companion animals in the post-medieval period. We know that by the 17th century attitudes towards animals were starting to change; the following centuries witnessed the establishment of animal welfare and laws which stated that animals were private property as well as the establishment of animal rights (Thomas 2005c: 96; Thomas 2014). Archaeology and history can be employed to understand the complex relationships that people had with animals as well as the rising status of some animals (e.g. cats, dogs and horses). In addition, investigating the attitudes that led to

the removal of animals from urban environments can help us gain a better understanding of the processes that created the urban landscape we see today; where animals are absent and on the periphery of the everyday human experience.

The development of the zooarchaeology of ethnicity has been slow compared to other disciplines within archaeology (Sykes 2007a: 3). England has a long history of migration (see Merriman 1993), however, this increased with the expansion of oversea colonies and trade in commercial goods. A number of migrants came to England, from various parts of the world, for work, financial opportunities and to escape persecution and famine. Irish and Jewish people were living in England from as early as the 12th century and European merchants came to Britain throughout the medieval period (Merriman and Visram 1993: 3). In the 16th century there was an influx of French Protestants and Black African merchants and servants who lived and worked in the capital (Merriman and Visram 1993: 3; Dresser 2007; Habib 2008). Henry Mayhew (1967, 1968) refers to the presence of Jewish, Irish, Black, Indian, French and Polish people living in Victorian London. Thus, urban centres would have represented a cultural melting pot, where people of varying ethnic, social and religious identities were brought together. As food is a medium through which people express themselves; what people decide to eat and how they prepare food is influenced by their ethnic and cultural identity (Franklin 2001: 91; Gumerman 1997: 109). For that reason, animal bones can act as a powerful investigative tool that can be used to identify different cultural groups in the past. It is not unsurprising that investigations of food and ethnicity have been limited as archaeological investigations in Britain have focused on the earlier periods where it is generally more difficult to identify cultural groups without the help of historical documents (Twiss 2012). There are currently no studies that focus on post-medieval ethnic identities in Britain; thus, the extent to which these identities are visible archaeologically remains to be fully explored. Although the exploration of ethnic identities can be a complex process, studies of identity have yet to be applied to the post-medieval period. Therefore, there is a unique opportunity to establish a methodological approach to attempt to identify these groups' in urban communities employing the use of animal bones.

The 19th century saw the beginnings of the trans-continental food-trade network and the international trade of live animals from North America, South America, Australia and New Zealand (see Chapter One). The trade in foreign livestock was intensive during the 19th century as British farmers were struggling to keep up with the demand for food. There is, therefore, an opportunity to carry out stable isotopic analyses on 19th century faunal remains to assess the extent to which international livestock can be detected in the archaeological record. The use of stable isotopic analyses on historic or post-medieval assemblages has yet to be exploited fully (Guiry *et al.* 2014).

Yet, there has been a growing interest in the use of stable isotopes to inform upon the trade of livestock overseas (Guiry *et al.* 2014; Guiry *et al.* 2012). An example of this has been carried out on faunal remains recovered from the shipwreck of the William Salthouse, which transported supplies of salted beef, pork and fish from Canada to Australia (Guiry *et al.* 2014). The results showed that livestock from the ship came from a number of origins including Europe and North America, which demonstrates the value of stable isotope analysis to inform upon the international meat trade (Guiry *et al.* 2014). Conducting similar procedures on later post-medieval faunal remains would allow for the identification of foreign livestock in British faunal assemblages.

7.5 Closing thoughts

This study has shown the enquiry of animals in the post-medieval period to be a worthwhile and efficacious endeavour. By pulling together primary and secondary faunal data and contextualising the results drawing upon various forms of evidence (e.g. urban history, agrarian history, Britain's meat trade etc.), it has brought to light the significance of animals in this period. Their centrality in the formation and transformation of modern England should neither be undermined nor ignored. As illustrated throughout this thesis, animals and their respective products not only played an integral role in the development of England's urban economy but were embedded in the social construction of Britain's cultural identity.

My intention for this thesis was to establish a foundation for the study of post-medieval animals, and showcase how zooarchaeological studies can complement our understanding of this progressive period in British history. In part, I have attempted to create a body of work that I wish existed while I was completing my Masters dissertation [in 2010], when analysing the 18th century animal bone assemblage from London. I hope that this research signifies a new beginning for the advancement of this expansive topic.

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