# SPATIAL DETERMINANTS OF ANIMAL CARCASS PROCESSING IN POST-MEDIEVAL LONDON AND EVIDENCE FOR A CO-OPERATIVE SUPPLY NETWORK

Lisa Yeomans

#### SUMMARY

The manufacturing industries in post-medieval London utilised vast quantities of animal carcasses; these were intensively processed and converted into a wide variety of products forming essential articles of day-to-day life in the capital. The aim of this short article is to show how archaeological and historical evidence can highlight the co-operation needed between the many trades dependent on these raw materials and how this was achieved by using a processing sequence involving onward trade of by-products between craftsmen. Modifications identified on discarded animal bone waste, and faunal assemblage characteristics, can be used to substantiate collaborations between different craftsmen and to identify the sequence of carcass distribution. The large scale spatial arrangement of London affected the location of industrial areas but carcass supply chains also influenced the layout of local neighbourhoods. The leather industry became widespread, taking advantage of locations suited to its manufacture and influencing associated trades at the local level. The horn industry was more spatially restricted, and the conclusions reached in this paper suggest that the role of the Horners Company in protecting their trade was a major factor.

## INTRODUCTION

Certain animal products were specially imported into London for use in the manufacturing industries. These included high quality hides such as goatskin from rural areas and the Continent, furs, and horn imported from America and Africa, as well more exotic materials such as ivory. However, much of the animal material consumed by London's industries derived from two sources: carcasses of livestock driven into the city for meat, and animals living in the city as work animals.

Carcasses needed to be intensively processed to provide London's population with leather for shoes, tallow for candles, and horn for lanternpanes, cutlery handles, drinking vessels and combs, as well as bone that was manufactured into many items. Hence butchery waste was in much demand and regulations were instigated in the medieval and post-medieval periods to help ensure supply to the craftsmen requiring the materials. This is demonstrated by ordinances from numerous towns across England stating that butchers were to bring hides into market along with the flesh so leather producers could obtain raw materials (Clarkson 1960). Likewise the London Horners Company had purchase rights over all rough cattle horn sold within an increasing radius from the City. Some of these ordinances and concessions did not differ in nature from the laws governing supply in the Middle Ages when trade rights were much guarded privileges. Other industries were less constrained by trading rights, provided they did not infringe on other crafts and the quality of goods produced was controlled. The spatial distribution and expansion of the industries in

London witnessed a notable shift during the 16th and 17th centuries, the period in which the present study is set.

## POST-MEDIEVAL INDUSTRY RELOCATION

Towards the end of the medieval period the City authorities began imposing new legislation banishing many of the noxious animal processing industries that had previously taken place within the walls. For example, in 1455 the cutting of 'green horns' was prohibited in the City. Butchering of animals in the City had long been a cause for complaint and in 1361 the King, in a writ to the Mayor and Aldermen, protested against the slaughtering of animals within the walls and ordered that such activities be limited to Stratford or Knightsbridge (Sabine 1933). This did not conclude the matter as the butchers' activities in the City continued to be a subject for complaint. In 1391 another order by the King seems to have been more forcefully imposed, leading butchers to raise prices and thereby compelling the City to allow butchers' houses close to the Thames, into which the entrails could be directly cast. Numerous efforts, although ineffective at eliminating slaughtering in the City, would have increased the use of areas outside the City for this task. The saga of butchers causing nuisance, complaints against their activities and the effects of these, is covered by Sabine (1933) and Jones (1976). As the population began to expand rapidly in the later 16th century (Harding 1990), greater pressure would have been placed on the resources in the City. Access to the Fleet and Walbrook would have been reduced as the tributaries were paved over, limiting the tanners' all-important water supply. Gradually, therefore, the various trades processing animal carcasses shifted towards the suburbs. Additional factors, including cheaper rent, potential for expansion, good water supply, improved access to raw materials, and less stringent monitoring by the establishments, facilitated this relocation. Rebuilding after the Great Fire also provided an opportunity to remove industrial activity from the City.

A new spatial distribution of the industries which processed animal products was arranged to allow good communication routes between various crafts. For instance the developments around Aldgate, east of the City, grew up around the long established slaughterhouses. Their presence caused the horners, relocated from the City, to centre their trade within the adjacent streets (Keene nd). Horners' workshops could either prompt intensification of associated crafts or could be placed in response to rises in demand because other favourable conditions caused growth. Before describing how the livestock and meat markets served as the main points of entry for the animal carcasses and the other influential, spatial characteristics of suburban London, some discussion is required of the carcass processing sequence which reduced animal carcasses into the various constituent elements required by different craftsmen.

## CARCASS REDUCTION SEQUENCE

O'Connor (1993) proposed a hypothetical model (Fig 1) to convey possible carcass reduction/ utilisation sequences which shows the various processes animal carcasses can undergo to yield different raw materials, and illustrates the potential uses of carcasses and possible resulting faunal assemblages. Developing the model for post-medieval London by adding details on how different craftsmen procured raw materials from carcasses at different stages in the sequence, and the sources where they gained them, helps increase the understanding of one variable influencing industry location. This can then be compared to both the large scale and local spatial distribution of craftsmen to assess the extent to which easy access to raw materials influenced craft location.

### ZOOARCHAEOLOGICAL EVIDENCE FOR A CARCASS UTILISATION SEQUENCE IN POST-MEDIEVAL LONDON

Some modifications to bones and faunal assemblage characteristics allow links between craftsmen to be interpreted, providing additional, case specific details to the model of the carcass utilisation sequence. Evidence from post-medieval London is described to show the potential of such analytical methods.

## Use of waste cattle horncores

Historical evidence, in the form of the 1641 list of the Company of Horners and occupations given in the parish registers, proves that many members of the Horners Company lived on or close to Petticoat Lane in Aldgate in the mid-



Fig 1. Hypothetical flow diagram to illustrate carcass/skeleton utilisation (from O'Connor 1993, 64)

17th century. Large accumulations of cattle horncores recovered from sites in the vicinity are confirmed as horners' waste because the tips of some horncores were sawn-off and other cores were sawn into segments. Removing the tips in this manner would have helped accelerate the breakdown of the bond connecting the core to the horn-sheath, whilst sawn segments of horncore provide evidence that the horners were readily preparing horn sections of the desired length. The evidence indicates that the horners were, at least some of the time, purchasing complete horns and preparing them at their workshops. Inventories of horners' premises corroborate this and describe large quantities of unwrought horn; for instance, the inventory of Thomas Mann's property in 1673 describes 'a pcell of white pieces unwrought cont 800, a pcell of dozen pieces unwrought cont. 300, a pcell of black pieces cont 4000 and a pcell of shavings' stored in the 'presse shope behind the howse' (Fisher 1936). Such unwrought items would have been obtained at the nearby slaughterhouses,

whilst additional horn-sheaths seem to have been purchased in a ready state from the tanners south of the Thames or in other parts of East London.

Cattle horncores still had their uses even after the horners had removed the sheath. Fig 2 shows the positions of post-medieval sites producing assemblages interpreted as horners' waste and indicates where horncores have been reused to line pits; horncores would have provided support to the sides of the pits without compromising drainage. Supply of horns to horners did not, therefore, end the supply sequence. This fact is reinforced by the description of Holtzapffel (1843) who informs us that after the removal of the horn-sheath the horncore 'is not thrown away, but burnt to constitute the bone earth used for the cupels for assaying gold and silver'. The porous structure of horncores allows them to burn easily to ash which, when made into crucibles for the assaying of gold and silver, absorbs lead oxide. Furthermore Kalm (1748) notes a method of constructing earthen walls



Fig 2. Characteristics of archaeological assemblages of horners' waste

from horncores, demonstrating the wide range of uses for horncores.

## Supply of sheep horn

Use of sheep horn was also common in post-

medieval London and faunal evidence shows that the horns were removed from the skull in a standardised manner by chopping the complete horn from the frontal bone. Traces of this process are detectable on both removed horncores and frontal bones. Whilst these clearly demonstrate that sheep horn was being used, the presence of such bones alone does not indicate who was responsible for preparing and trading the horn. A number of options may have existed: the butcher could have sold either the complete horn or the horn-sheath, separate from the hide, direct to the horn user; alternatively, the skull may have remained attached to the hide when it was distributed to the leatherdresser who could then sell on the horn-sheath, again either removed from the horncore or complete, to craftsmen using it as raw material.

The distribution sequence used to supply sheep horn can be determined by examining additional characteristics of the faunal remains. A flow diagram (Fig 3) indicates how various attributes of a faunal assemblage can be used to interpret the processing sequence that led to the removal of sheep horn, and the trade between craftsmen. Four important attributes are used: (1) the part of the skull discarded with evidence of horn removal; (2) the presence of naturally polled animals in the sample - important since it demonstrates that waste is not that of a hornworker who would have had no use for such animals; (3) the relative frequency of mandibles compared to the horncores; (4) the relative frequency of metapodials compared to the horncores. A high proportion of mandibles and possibly metapodials is typical of primary butchery waste, whilst a high proportion of metapodials without frequent mandibles is typical of leatherdressers' waste. The use of these multiple attributes aids the interpretation of zooarchaeological patterning, suggesting one process amongst many possibilities.

Sheep skulls and horncores chopped to remove the sheath have commonly been found in Bermondsey and other parts of Southwark associated with leather producing or associated industries. Summarising the zooarchaeological evidence from this district a number of observations can be made about the supply of sheep horn. Much of the sheep horn appears to have been prepared by the butchers, by chopping the complete horn from the frontal bone and allowing the bonds between the horncore and the horn-sheath to rot, possibly aided by soaking. This process allowed sheaths of horn to be detached and it was generally just this part that was sold on to craftsmen working with the raw material. Where the butcher sold the skin to the leatherdresser with the skull still attached, the leatherdresser would assume

a similar supply role providing horn to other craftsmen. There are few assemblages that could be interpreted as the horn user purchasing more than just the sheath and undertaking to separate the two before using the horn. This differs from the specialist hornworkers described above who resided north of the river and purchased cattle horn both on and off the horncore, resulting in the numerous accumulations of cattle horncores.

## Tanners supplying the bone working crafts

Cattle hides which were distributed to tanners often had the horn and lower limbs still attached. The fact that these craftsmen sold horn to hornworkers is reflected in historical documents which indicate that the tanners drew some of their revenue from the sale of horn. Accumulations of cattle horncores have also been found at sites associated with the tanning industry. The distribution of horn and the use of waste horncores represent just one of many forms of by-product distribution that took place. Additionally, tanners either sold, or made available, cattle metapodials to the various craftsmen who worked in bone. These bones were probably used as handles to aid the movement of skins in the tanning pit and stretching the hides. After the transformation to leather was complete the tanners had no further use for the metapodials and they would have been added to the waste products in need of disposal. As with the spent oak bark that could be pressed into fuel blocks for sale to potters and clay pipe manufacturers, the bone was also of use in other crafts. Fortunately for tanners metapodials were sought after since the thick bone of the diaphysis provided a good raw material and the regular cross-section of the metatarsal in particular made it suitable for working. Off-cuts from bone working are frequently found in the archaeological record; some of these provide direct evidence that they were obtained from tanners. Tanners drilled holes through the proximal articulation of the bone, probably to allow the stretching of the hide; where these holes are identified on bone working off-cuts or on artefacts such as pinners' bones, the supply route from tanners is indisputable.

#### Use of horse carcasses

The carcasses of work animals in London were in



Where h=horncores with basal areas surviving, f=frontal bone with horncore chopped off, m=mandibles (MNE-minimum number of elements) and mp=metapodials (MNE).

Fig 3. Flow diagram used to aid interpretation of the supply of sheep horn to craftsmen from faunal assemblages.<sup>1</sup>

just as much demand as those of animals driven into the city to meet the population's nutritional requirements. Horsehide, although not of the same quality as cattle hide for making leather, was frequently obtained by leatherdressers. The body-part distribution of horse skeletal elements found at leatherdressers' sites indicates that the entire carcass was taken to the leather producer who skinned the animal, and occasionally seems to have defleshed the carcass, perhaps selling the meat as dog food to places such as the bear baiting rings. The horses that the leatherdressers had access to were old work animals whose bones often display pathological modifications caused by a long life of hard work.

#### Summary

These examples briefly demonstrate how the sequence of carcass supply can be interpreted using zooarchaeological evidence and suggest that the working lives of the different craftsmen were intertwined through the need to obtain one another's by-products. Access to raw materials as a carcass was reduced was, however, only one influence on the spatial location of industry. The roles of other factors in determining the positioning of industry in post-medieval London need to be considered.

## **INFLUENCES ON LOCATION**

#### **Resource input: livestock markets**

Livestock was driven to markets, fairs, and grazing areas relatively close to London where farmers and graziers purchased the animals to fatten them before sale either at London's livestock markets or through private arrangements with butchers. Although it is difficult to estimate the number of animals sold at the markets, McGrath (1948) provides an approximation of 500,000 sheep per year passing through Smithfield market during the early 18th century. This quantity had certainly increased since the preceding centuries as it was found necessary to add Mondays to the official trading days, which were confined to Wednesdays and Fridays before 1613 (McGrath 1948; Passingham 1935).

Smithfield was not the only livestock market: Barnet market had been established at the end of the 16th century; a patent allowing cattle to be sold was granted to Rotherhithe market a century later; and a cattle market was permitted in Houndslow in 1686. Unlicensed markets had operated since at least the early 17th century at Paddington, Kensington, Mile End, and in the lanes around Smithfield market; by the end of the century a substantial portion of the cattle trade took place in Islington. Brookfield market reportedly supplied thousands of people living in Westminster, Southwark, Lambeth, Wandsworth, Putney, Fulham, and Chelsea (McGrath 1948).

## Primary butchery location: slaughterhouses and butchers

Animals entered London through the livestock markets but they would have subsequently been dispersed to slaughterhouses and butchers. In the 17th century the intermediate role of carcass butcher developed - a person employed in buying livestock and selling meat to retailing butchers. The authorities objected to such men as they provided an unnecessary link in the supply chain and many butchers preferred to use the slaughterhouses themselves or else slaughter the animals behind their own shops. The sale of meat to the public took place at butchers' shops or in markets. The City's six main markets were Newgate market, Honey Lane or Milk Street market, Woolchurch or the Stocks market, Leadenhall market, the Beef market, and the Herb market (Armitage 1978; Masters 1974). Additionally butchers would gather at shambles found on the City margins at Temple Bar, Smithfield Bars, Bishopsgate Bars, Aldgate Bars, Field Lane, Fleet Street, Cripplegate, and St Katherines (McGrath 1948). The population of Westminster could purchase meat on King Street, and that of Southwark used the market on Borough High Street in addition to butchers' shops. It would have been at the slaughterhouses that other craftsmen could gain straightforward access to raw materials in large quantities. By necessity these were distributed throughout London, but concentrations clearly existed such as that around Aldgate.

## Land: cost and suitability

Space was at a premium in the expanding city, and tanning, for instance, whilst not providing a substantial return for men practising the trade, required sizeable plots of land. Power (1986) used the hearth tax assessments of 1662, 1664, and 1666 to provide an estimation of building size and therefore wealth in most parishes. The study demonstrated that buildings of the East End and Southwark were generally the smallest in London. Similar investigations (*eg* Jones 1980) corroborate these results, suggesting that overall the populations of these two districts were the poorest to be found in 17th-century London. These conditions provided cheap rental and a high concentration of unskilled labour that could be employed as and when required.

These were not, however, the only important determining factors. A plentiful water-source was required for some of the carcass processing industries, particularly tanning. The marshy environment of Southwark provided the ideal conditions, with the numerous watercourses and drainage channels aided by the tidal currents close to the Thames which both supplied water and drained away effluents. The area was also well located to take advantage of oak bark supplied from parts of Surrey.

Areas of the eastern suburbs adjacent to the Thames could also supply sufficient water and a few tanneries utilised this environment. Compared to the tanning industry, there were less physical constraints on other carcass processing industries, although places where discard of unpleasant waste was possible would have been advantageous.

# Distribution: transport costs and specialist markets

Specialist markets aided the distribution of some raw materials. A leather market had long existed at Leadenhall, but by the 17th century it was clear that the City resented its presence. In 1603 an attempt was made to move the market to Aldgate but this lasted just three weeks; continued complaints about the stench caused the Court of Aldermen to contemplate moving it to Smithfield, but again the move never happened (Clarkson 1960). A second leather market was set up in Southwark, but trade through these specialist markets formed only part of the hide distribution system. Many tanners and leatherdressers would have made separate arrangements with butchers to help ensure supply, and butchers benefited from not having to take hides to market. Although there is evidence of some long distance trade in hides, the majority were bought locally, allowing the tanner to inspect his purchases. Other supply routes to the leatherdressers included the fellmongers who brought numerous skins into London and middlemen were common in the light leather trades to the extent that Clarkson (1960, 131) argued that 'the bulk of sheep skins must have originated from animals dying naturally or by accident in the countryside rather than in the meat markets'. Although such sources were undoubtedly important, the concentrations of sheep bones associated with leatherdressers' workshops found during excavations clearly demonstrate the frequent direct trading between butchers and leatherdressers.

## LARGE SCALE SPATIAL PATTERNING

The factors discussed in the preceding section affected the industrial areas of London on the large scale, since the industries using animal products were broadly grouped together allowing the distribution of carcass parts. Craftsmen of this type were primarily found in two areas of London, although occasionally small separate groups would have been situated to supply a specific market or to take advantage of other small scale industries. Generally the two districts where the processing of animal carcasses took place were the eastern suburbs and south of the river in the parishes of St Olave, St George, and particularly Bermondsey.

In both areas, cheaper land was a key factor in the placement of the industries. The tanning industry was further constrained by the natural environment leading to its placement in Southwark, and the less densely occupied Bermondsey being particularly suitable. The effect of inertia is perhaps visible in the case of the Horners Company with members continuing to reside north of the river even if moved from their original dwellings inside the City walls. The prevailing wind and the downstream locations of the areas would also have played a decisive part.

# LOCAL DISTRIBUTION CASE STUDY 1: BERMONDSEY

The parish of Bermondsey forms the basis for a localised case study. Numerous industrial faunal assemblages have been recovered from this parish and relatively good historical evidence for occupations is available in the form of parish registers. Fathers' occupations are given in baptism records from the end of the 17th century, throughout much of the 18th century, and into the 19th century. Spatial data is provided in the form of the



Fig 4. Map of Bermondsey showing the eleven zones used to provide a spatial indication of industry location within the parish

period and these can be used to approximate trade location since place of work was normally within the immediate vicinity of place of residence, if not actually on the premises. Apart from a few entries in the parish register that did not provide a place of abode, or cases where the place of residence was outside the parish, the data was divided into eleven spatial zones as indicated on Fig 4. This division of the parish is based on broad occupational differences observed in the data and on cartographic and archaeological representations of industry, as well as access from the main roads. The occupations given in the baptism register were analysed by these zones to investigate how changing proportions of men employed in the animal carcass processing industries clustered spatially.

During the years containing the relevant data between 1698 (when occupation was first recorded) and 1850 over 8,000 entries in the Bermondsey baptism register were of craftsmen employed in the processing of animal carcasses, from butchers to tanners and tallow chandlers. The accumulated totals of the main trades are shown by zone in Fig 5 to provide an indication of the areas most intensively engaged in such trades. Unfortunately it is not possible to calculate the proportion of the population within the zone that was employed in the respective industries without recording the place of abode of each entry in the Bermondsey baptism register regard-



Fig 5. Total number of entries in the Bermondsey parish baptism register between 1698 and 1850 for craftsmen involved in the processing of animal carcasses. Occupations towards the beginning of the carcass consumption sequence are shown on the left of the graph



Fig 6. Seven-year moving average of the number of entries in the Bermondsey baptism register with the father's occupations recorded as butcher, skinner, fellmonger, leatherdresser, tanner, or vellum/parchment maker

less of trade. Fig 5 can be used to suggest the zones that are more significant; the fellmongers and leatherdressers were commonly situated in Zones 3 and 5, whereas tanners could most frequently be found in Zones 2, 7, and 8. What is interesting is the number of butchers who resided in Zone 11 whilst other sectors of

the industry were rarely found in the vicinity. Analysis of the data compressed into a single graph dismisses the chronological variation that would have been an important feature of the expanding industries. Fig 6 displays data as a seven year moving average from the more important zones: Zones 2, 3, 5, 7, and 8.

Close spatial associations between different craftsmen using animal carcasses at different stages in the consumption sequence are evident in Fig 6. For instance, the number of fellmongers follows similar periods of growth to the leatherdressing industry, especially in Zone 3. This pattern tends to diminish after c.1800 suggesting that the leatherdressers were supplied by another source, and interestingly the number of butchers occupying the same zone increases after this date. Not illustrated in the graphs are comb makers who would have utilised the sheep horn provided by the leatherdressers and butchers; these craftsmen also tended to live close to their source of raw material. The graphs demonstrate a certain degree of specialisation within zones, which would have allowed demand for raw materials to be concentrated, which in turn facilitated distribution. Cost of land and local environment would also have been important, but the data does seem to suggest a neighbourhood where supply to related crafts was important for the spatial arrangement of industry and where expansion in one industry had knock-on effects in related land use.

## LOCAL DISTRIBUTION CASE STUDY 2: THE EAST END

A second geographical spread of industries processing animal carcasses was found in the eastern suburbs. Analysis of the baptism registers from the mid-17th century indicates that this concentration, compared to the overall employment structure of the area, was substantially lower than in Bermondsey. On the local scale there were tight clusters of specific industry types, an extreme example being the horners who were more or less limited to the Petticoat Lane area in the mid-17th century (see the list of Horners Company members dated to 1641 reproduced in Fisher 1936). Supply was evidently still important, with the slaughterhouse at Aldgate providing an important source of raw material. Work in progress on the parish registers, and corroborated by archaeological data, is demonstrating that expansion in the industry in the later 17th century led to new workshops operating further north in streets in Spitalfields. This was presumably a response to renewed demand for horn instigated by the development of street lighting and the expansion of the export trade (Fisher 1936).

Petticoat Lane and the surrounding area

was no better situated for the horners than other parts of east London or indeed, more importantly, other suburbs. The horners did not cluster immediately around the slaughterhouses of Aldgate but spread northwards away from the area. An absence of horners in Southwark and Bermondsey is particularly curious for they would have been served by the same factors that drew the leather industry to the area and they would have had a readily available source of horn. The parish registers of the area mention craftsmen presumably working in horn, but references to actual horners are all but absent. The Horners Company records may offer an explanation for the spatial distribution of the horners. Throughout the 15th, 16th and 17th centuries the Company continued to play an active role in ensuring the supply of raw materials to its members. In 1465, for instance, a statute was passed restricting the right to purchase unwrought horns within 24 miles of London to freemen of the Company (Compton 1879). Then in 1590 a co-operative purchasing system was instigated by only allowing horners to purchase horn within the 24 miles for use of the whole Company. In 1638 a number of by-laws and ordinances were passed which, in effect, made the horners a joint-stock trading company. Although the only restriction on company members was that they had to live within seven miles of the City, close contact with the storehouse and sheds rented in Wentworth Street from 1604 would have been practical.

The presence of horners in the vicinity of Petticoat Lane seems to have attracted other craftsmen working in horn into the area. The typological development of combs during the post-medieval period suggests that horn was frequently used as a raw material (Dunlevy 1972). This is corroborated by the prosecution of a London comb maker in 1689 for pressing horns and thereby breaching the rights of the horners (Compton 1879). Fig 7 displays the decadal occurrence in the St Dunstan baptism register of different tradesmen who used animal products or, in the cases of cutlers, buttonmakers, and comb-makers, may have used the horn produced by the horners in crafting their finished articles. The graphs are separated into the hamlets covered by the St Dunstan registers for the period and provide a crude estimate of the importance of various industries in the hamlets of Spitalfields, Wapping, Shadwell, Mile End, and Ratcliff. Data extracted from parish



Fig 7. Occurrence of different craftsmen in the baptism registers of St Dunstan, Stepney, by decade, separated by hamlet. Graphs for Bethnal Green, Limehouse, and Popular are excluded because they do not present data relevant to the arguments discussed in the text

registers indicates that by the 1670s hornworkers were starting to occupy Spitalfields. Although the population of this parish increased overall, the number of craftsmen in related trades, presumably relying on the horners to supply them with some of their raw materials, also increased within Spitalfields. Cutlers, for instance, increased in both Spitalfields and Wapping, where horn could have been obtained from horners in Whitechapel. The presence of ivory workers is also interesting given the evidence from Cutler Street (CUT78) where approximately 340 pieces of waste ivory were recovered from the fill of a pit lined with horners' waste dated to between 1650 and 1750 (Drummond-Murray nd). At Aldgate (AL74) two off-cuts of ivory, including one identified as waste from bead or button manufacture, and bone working off-cuts were found with cattle horncores in deposits dating to the 17th or early 18th century (Armitage 1984). Although the horncores displayed cleaver chops intended to remove the horn from the skull, and others had cut-marks visible around the base, the assemblage was interpreted as slaughter waste as opposed to exclusively horners' waste (Armitage 1984). Combining the historical data obtained from the parish registers and the archaeological evidence, it is clear that trades involved in processing various parts of animal carcasses were closely related spatially. Spitalfields, in the later part of the 17th century, is an example of this. Whitechapel would have been equally important, although the historical data of occupation from the parish registers is not sufficiently complete for the parish to be used as a case study here. Further data collection from the areas surrounding this parish will provide details on the spatial patterning witnessed so far.

The leather producing industry was fairly well represented in the Stepney hamlets. Power (1986) provided evidence of tanners in Shadwell and this is supported by the data displayed in Fig 7. Other tanners could be found in the riverside areas of Ratcliff, Wapping, and, to a lesser extent, Limehouse (data not displayed). There seems to have been a balance between access to the water from the Thames and the distance to the slaughterhouses around Aldgate. Registers at St John of Wapping and St Mary of Whitechapel would have covered parts of Wapping close to the river and these have not yet been analysed; tanners could be found in the part of Wapping within Stepney and these men presumably worked at tanneries supplied with water from the Thames. Tanning was an important trade in Shadwell, at least until the 1670s when the hamlet became a parish. Further to the east, in Ratcliff and Limehouse, tanneries do not appear to have been as common. Leatherdressers, without a need for a plentiful water source, occupied other hamlets where there was no access to the Thames.

## CONCLUSIONS: THE INFLUENCE OF SUPPLY ON POST-MEDIEVAL URBAN INDUSTRIAL LOCATION

The 16th century witnessed the beginning of the rise of capitalism; those who would have once used land could become the owners of

land. Additionally, as some of the guilds were becoming less powerful, the requirement to work within the area controlled by the guild, where the establishment could oversee the conduct of business, was diminishing (Vance 1971; Langdon 1975). The economic productivity of land became more important and as suburban production increased the control of the guilds was further undermined (Kellett 1957). The initial complaints and attempts to remove the carcass processing industries from the City towards the end of the Middle Ages set the scene for more profound changes than relocation. Specific suburbs began specialising in certain industries and the trade network between craftsmen working with animal carcasses at various stages in the carcass reduction sequence was reinforced. Not all of the guilds went into decline at the same stage, and the Horners Company continued to dominate the business of its members. This effectively led to a rather unusually clustered concentration of horners in post-medieval London compared to the other industries manufacturing goods from animal products. The leather producing industry, although substantially larger, was also more widespread. Factors other than the availability of raw materials were important. There does not appear to have been any shortage of the raw hides; Clarkson (1960, 73) notes that 'supplies of hides coming into London on the backs of animals, in relation to supplies of tanning materials, [was so great] that the capital was able to supply raw hides to other parts of the country'. Tanners could arrange their own supplies with butchers or otherwise purchase materials at the markets of Leadenhall and Southwark, so supply was not constrained. The locations used for the production of leather needed to meet many criteria, with open space, water resource, and oak bark supply all evidently important. The horn industry, however, seems to have congregated because of the need to obtain supplies from the Horners Company. Proximity to the operations of the company became more important, since becoming an active member of the company entitled a horner to additional stock.

Zooarchaeological evidence has been shown to demonstrate links between different industries that may not be detectable in the historical documents. It also reinforces the spatial association between crafts which must be seen to partially result from their trade networks. Specific zooarchaeological methods have been developed for this aspect of the project, although application to large datasets is as yet incomplete. When finished, the zooarchaeological study will provide an additional source of information on trade links between industries in post-medieval London.

#### ACKNOWLEDGEMENTS

This research was funded by a student grant from the AHRB. The resources of the London Metropolitan Archive, Guildhall Library, and LAARC were used. Additional information was provided by Pre-Construct Archaeology and Kevin Rielly of the Museum of London Specialist Services. Supervisors of the work are Dr Jane Sidell and Dr Louise Martin.

#### NOTES

<sup>1</sup> The interpretation of the horn distribution network using the combined faunal assemblage characteristics highlighted in the text is achieved by following the flow-chart. Additional explanations of the formulae are given here.

The formulas in the third column all provide an index for the representation of mandibles compared to skulls or parts of skulls. Where only horncores and no frontal bones are present the representation of mandibles (m) is calculated compared to the number of horncores (h). If frontal bones but no horncores are present the number of mandibles is compared to the number of frontal bones (f). Where both horncores and frontals are present an average of the MNE of the two is used.

The formulas in the fourth column provide similar indices for the representation of metapodials compared to horncores/frontal bones. Since there are four metapodials in the skeleton of a single animal and only two horncores (with the exception of the rare four-horned sheep), the metapodia MNE values are divided by two in the formula.

The horncores, mandibles, and metapodia are typically discarded during primary butchery and therefore the over-representation of one or more of the elements indicates that part of a butchery assemblage has been removed or that the bones were discarded further down the carcass utilisation sequence. An index of approximately 50 indicates equal representation of mandibles or metapodials to skulls.

The index values together with the characteristics in the first two columns allow interpretation of the stage in the carcass utilisation sequence when the faunal assemblage was discarded and which craftsmen removed different usable parts of the carcass. For instance, if a context contained frontal bones with the horncores chopped off, a similar representation of mandibles compared to frontal bones, but few metapodials, the assemblage is interpreted as butchery waste where the butcher was selling the entire horn and horncore to craftsmen and also, although not shown on the diagram, probably selling hides with the metapodia still attached to leatherdressers.

#### BIBLIOGRAPHY

- ARMITAGE (1978), P L Armitage 'Hertfordshire cattle and London meat markets in the 17th and 18th centuries' *London Archaeologist* 3, 217–23
- ARMITAGE (1984), P L Armitage 'The faunal remains' in A Thompson, F Grew & J Schofield 'Excavations at Aldgate, 1974' Post-Medieval Archaeology 18, 130–43
- CLARKSON (1960), L A Clarkson 'The organization of the English leather industry in the late sixteenth and seventeenth centuries' *Economic History Review* 30, 245–56
- COMPTON (1879), C H Compton 'The Horners of the City of London' British Archaeological Journal 35, 372–9
- DRUMMOND-MURRAY (nd), J Drummond-Murray Excavations on the Site of the East India Company Warehouses at Cutler Street, Narrow Lane, E1, unpub report in LAARC
- DUNLEVY (1972), M Dunlevy 'Some comb forms of the fifteenth to eighteenth centuries' North Munster Antiquarian Journal 15, 22-7
- FISHER (1936), M A Fisher A Short History of the Worshipful Company of Horners
- HARDING (1990), V Harding 'The population of London, 1550–1700: a review of the published evidence' London Journal 15, 111–28
- HOLTZAPFFEL (1843), C Holtzapffel Turning and Mechanical Manipulation Intended as a Work of General Reference and Practical Instruction on the Lathe and the Various Mechanical Pursuits followed by the Amateurs
- JONES (1980), E Jones 'London in the early seventeenth century: an ecological approach' *The London Journal* 6, 123–33
- JONES (1976), P E Jones The Butchers of London: A History of the Worshipful Company of Butchers of the City of London
- KALM (1748), P Kalm A Finnish Visitor to the Chilterns
- KEENE (nd), D Keene Industrial Clustering in London, c.1300–1930 (Accessed on 11/03/04 at http:// www.dicboldinstitute.org/paper27.pdf)
- KELLETT (1957), J R Kellett 'The breakdown of Guild and Corporation control over the handicraft and retail trade in London' *Economic History Review* 10, 381–94
- LANGDON (1975), J Langdon 'Residential patterns in pre-industrial cities: some case studies from seventeenth century Britain' *Transactions of the Institute of British Geographers* 65, 1–27

Spatial determinants of animal carcass processing in post-medieval London and a co-operative supply network 83

- MASTERS (1974), B R Masters The Public Markets of the City of London Surveyed by William Leybourn in 1677 London Topographical Society Publication 117
- MCGRATH (1948), P V McGrath The Marketing of Food, Fodder and Livestock in the London Area in the Seventeenth Century unpub MA thesis University of London
- O'CONNOR (1993), T P O'Connor 'Process and terminology in mammal carcass reduction' International Journal of Osteoarchaeology 3, 63–7
- PASSINGHAM (1935), W J Passingham London's Markets: their Origin and History
- POWER (1986), MJ Power 'The social topography of Restoration London' in A L Beier & R Finlay (eds) London 1500–1700: The Making of a Metropolis, 199–223
- SABINE (1933), E L Sabine 'Butchering in medieval London' Speculum 8, 335–53
- VANCE (1971), J E Vance 'Land assignment in the precapitalist, capitalist, and postcapitalism City' *Economic Geography* 47, 101–20