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Appendix

Technical report: The vertebrate remains from excavations at the Express Dairy site (Hertford Castle), Castle Street, Hertford

by

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Summary

An assemblage of hand-collected animal bone from 14th-15th century deposits within the outer bailey of Hertford Castle was examined. Though small it appears to represent table refuse, possibly the result of feasting. A range of wild mammals, and particularly birds, indicates an establishment of high status.

Keywords: Hertford Castle, medieval, vertebrate remains, high status.

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Introduction

Excavations at the Express Dairy site, Castle Street, Hertford were carried out in order to provide a clearer picture of the topography and history of the castle. The trenches, concentrated within what had been the outer bailey of the castle, produced features and finds dating from the tenth/eleventh century (or earlier) to the seventeenth century. One of the most significant features uncovered was a large pit (JC/JK), which appeared to have been used as a dump and contained, amongst other things, building rubble, pottery, tiles and animal bones. This pit was sealed in the late 15th century, possibly in the 1460s, when Edward IV built the gatehouse. Consequently, most of the material from this pit could be tightly dated between the 14th and 15th centuries, although a number of contexts contained small quantities of residual 12th-14th century pottery.

A small hand-collected assemblage of animal bones was recovered from the excavations in the outer bailey of the castle. Eighteen groups, selected from a total of 70 bone-bearing contexts, were recorded in detail. The material from these eighteen contexts made up the bulk of the animal bone assemblage, and as all but two contexts were fills of the pit JC/JK most are dated to the 14th-15th centuries. The remaining contexts have mostly been excluded from this analysis because of their broad date or the limited numbers of fragments recovered from them.

Methods

Where possible, all animal bones were identified to species using the reference

collection housed at the EAU, York. These were recorded by a method employing diagnostic zones, described by Dobney and Rielly (1988). Detailed butchery information was noted for each identifiable fragment, as was any evidence of pathology. There were very few mandibles with teeth, or loose teeth, but where they were present tooth eruption and occlusal wear was recorded as appropriate using methods described by Grant (1982).

Most of the measurements follow those set out by von den Driesch (1976) with additional measurements outlined by the sheep/goat working party (see Appendix 3). A record of all the measurements taken can be found in Appendix 2.

Additionally, a record was made of the preservation, angularity and colour of each assemblage for each context as was a semi-quantitative assessment of the proportions of butchery, dog gnawing and fresh breakage.

Results

The small assemblage of hand collected animal bone recorded amounted to a total of 1734 fragments (weighing 8938.2g), of which 387 (3257.9g) were identified to species (Table 1).

Similarities between the bones of sheep and goat often make it difficult to distinguish between them, particularly when the bones are fragmented. Whilst 18 (21%) out of 71 caprine fragments were identified as sheep, (using the reference material and criteria described by Boessneck 1969), no goat remains were recognised. It is therefore assumed, for the

purposes of this analysis, that all caprine remains were sheep.

The large and medium mammal fraction (Table 1) consisted mainly of cranium, vertebra, rib, and shaft fragments which can almost certainly be identified as cattle and caprine/pig respectively.

No sieving was undertaken, so it must be expected that there will be a bias towards the larger and more robust fragments. Smaller taxa, such as small mammals, fish and birds, and the bones of immature individuals, are likely to be under-represented in this assemblage.

Preservation

Preservation overall was good to fair and only a very small number of bones were recorded as 'battered'. The bone exhibited a variety of colours from fawn to dark brown, but most were brown and in most cases the colour was homogeneous throughout the material from single contexts. The condition of the fragments did not suggest the presence of residual material. Fragmentation was 'average' for archaeological material from occupation sites, with many of the bones falling in the range 5-20 cm. The dog gnawing and fresh breakage, present on the bones from each context, was recorded within the range of 0-10%. Few bones showed evidence of butchery.

Domestic species

Table 1 shows the total numbers of identifiable fragments. It is clear from these figures that the assemblage is limited in size and, for the most part, dominated by the remains of common domestic species, i.e. cattle, caprines (sheep/goat), pig, and domestic fowl. Of the three main domestic mammals, caprine and pig bones

are most numerous with cattle representing less than 17% of the total of all three. This general picture is corroborated when the unidentifiable fraction is considered. Here the medium mammal-sized fraction (comprising mainly caprine and pig rib, vertebra and shaft fragments) includes three times as many as the group identified as large mammal.

By far the most numerous identified elements are those of the domestic chicken. These represent 42% of the common domesticates and 60% of the diverse bird assemblage.

Cattle

The cattle bones mostly comprise those elements which are the major meat-bearing parts, in addition to high counts of ribs, vertebrae and shaft fragments. Counts for distal limb elements (i.e. metatarsals and phalanges) are low, whilst teeth mandible and cranial fragments are almost completely absent (Table 2). This indicates that the cattle remains probably represent domestic/household waste.

A substantial number of the vertebrae were chopped sagittally, indicating that carcasses were split into sides. Chop marks were also evident on several of the pelvises and some of the limb bones had been heavily butchered.

No cattle teeth were present and very limited numbers of elements providing epiphyseal fusion data were available (Appendix 1). However, most vertebral discs were unfused, indicating individuals of less than 4-5 years of age.

Sheep

Remains of sheep again reflect a similar deposit of household or table refuse. A

range of elements was present (Table 3), although, as with cattle, head elements were wholly absent. Scapulae, humeri and pelvis were well represented, while there were numerous rib, vertebra and shaft fragments. These elements are indicative of choice cuts of meat.

Vertebrae were chopped in a similar manner to cattle, i.e. split along the sagittal plane to divide the carcass. Some of the bones exhibited butchery marks, evidence of further sub-division of the carcass into usable joints. A single scapula showed characteristic damage to the blade consistent with the use of a butcher's hook.

Most of the long bones were fused (Appendix 1), suggesting that the sheep were skeletally mature i.e. greater than four years of age. This suggests that prime mutton was consumed at the castle from sheep primarily kept for their wool crop or milk.

It was possible to calculate withers heights from only three bones, a radius, a calcaneum and a metatarsal. They provided heights (52.8, 58.5 and 58.7 cm) consistent with sheep of unimproved Shetland size.

Pig

A range of elements was present and, unlike cattle and sheep, they include some metapodials as well as maxilla and mandible fragments (Table 4). Skeletal element representation may suggest pigs were killed and butchered within the castle, although trotters and heads were also commonly presented at table, the latter as a table decoration. Where fusion data were available, most indicated immature individuals.

Horse

A single horse femur was recorded from the assemblage. It showed considerable damage, characteristic of dog gnawing, and may have been lying exposed for some time before being incorporated into the pit deposit.

Domestic fowl

The bones of domestic fowl lend support to the theory that most of the material in pit JC/JK was table refuse. Bones of the head and feet are absent (Table 6), possibly having been removed prior to the birds' reaching the table. Three tibio-tarsi show chops through their distal ends, which had been removed when the carcass was prepared.

The birds represented are predominantly adult. Eighteen fragments, representing juvenile individuals, were recorded as belonging to the Gallus/Phasianus group and, although a single bone was definitely identified as pheasant, these juveniles were most probably chickens.

A comparison of log ratio plots of greatest length measurements with modern reference material indicates the chickens from Hertford Castle to be of a small 'bantam' sized breed consistent with the Old English Game Bird specimens from the EAU reference collection (Figure 1). This small sample shows most (16 measurements) fall within the female range for this breed although a few (4) could represent larger cockerels.

A single fowl ulna was recorded with a well healed fracture.

Geese and Ducks

The bones of geese are present in small numbers. Although these were identified as larger species of grey geese (*Anser* spp.), it was not possible to conclude whether they represent domestic or wild individuals.

Similarly, the small number of duck remains were identified as medium-sized duck (*Anas* spp.), although again these could not be attributed as either domestic or wild individuals. There were, however, no large geese or ducks.

Wild mammals

Deer are represented in the assemblage by the three common species, i.e. red deer (*Cervus elaphus* L., represented by a single sawn antler fragment), roe deer (*Capreolus capreolus* L., represented by a single primary phalanx) and fallow deer (*Dama dama* (L.) represented by tibia and metatarsal fragments, a single calcaneum and a second phalanx).

Numbers are very limited but the fact that most of the elements are from non-meat-bearing parts may suggest that carcasses were dressed at the castle.

The rabbit (*Oryctolagus cuniculus* (L.)) is well represented in the assemblage, the remains comprising a total of 45 fragments. In Westley's (1977) account of the animal bones from excavations at Bramber Castle, Sussex it is suggested that rabbit remains are best ignored when present in archaeological deposits because of their burrowing habits. However, the preservation and condition of the fragments from Hertford Castle, combined with the occurrence of obvious cut marks, suggests that they are contemporary with the rest of the assemblage.

All fragments came from meat-bearing bones and there was an almost complete absence of cranial, metapodial and phalanx fragments (Table 5). As with the chickens, the lack of head and lower limb elements suggests table waste from dressed carcasses.

Cut marks were noted on the diaphyses of three limb bones, and two pelvis appeared to have been chopped through.

Wild birds

A diverse assemblage of wild birds was identified. It included grey heron (*Ardea cinerea* L.), mute swan (*Cygnus olor* (Gmelin)), teal (*Anas crecca* L.), partridge (*Perdix perdix* (L.)), pheasant (*Phasianus colchicus* L.), woodcock (*Scolopax rusticola* L.), pigeon (Columbidae) and a number of Turdidae and Sturnidae. All are species which were almost certainly consumed.

Fish

In total, 95 fishbone fragments were recovered and, of these, 17 were identified to family or species (Table 8 and Appendix 4). The marine species are all typical of this period. Pike, the only freshwater species in the assemblage, was probably caught from the local river Lea.

Discussion

Although limited in number, the animal bone remains provide some interesting information about the economic life at the castle. All elements of this small assemblage, dated to just one period in the castle's existence, point to the high status of the inhabitants living there. As most of the bones are indicative of table waste, it is

possible that they may represent a single feast and may not be representative of the typical diet. This assemblage presumably represents a minor part of the bone debris resulting from occupation at the site. Noxious butchery and other kitchen waste were doubtless dumped elsewhere, perhaps in the moat or nearby river.

It is possible that beef and mutton were brought into the castle as sides of meat and prepared for cooking by chopping into smaller joints. The age of slaughter of the sheep suggests that, at this time, wool was still more important than meat. Their small size probably indicates that they were from stock which resembled small unimproved breeds similar to Shetland sheep.

Pigs remains tend to be more common from rural sites and in particular from higher status establishments such as castles and religious institutions (Astill and Grant 1988). This is not surprising since noble and religious estates usually contained large tracts of woodland, suitable for pannage.

Not surprisingly, domestic fowl were well represented. They were a small bantam sized breed which might have been kept free-range within the castle precinct, perhaps as important for their eggs as for their flesh.

Few deer bones were recovered from Hertford Castle, in contrast to similar sites. At Barnard, Sandal, Okehampton and Launceston, for example, cervid remains tended to be numerous (Jones *et al.* 1985; Griffith *et al.* 1983; Maltby 1982; Albarella and Davis 1994).

Venison was a prized commodity in the medieval period, usually available only to individuals of high status either through hunting in their own parks or through gifts

provided by patronage (Neave 1991). Hunting deer was an important and popular activity, and a prerogative of the upper classes.

Rabbits, introduced into this country in the twelfth century, were by the fourteenth and fifteenth centuries kept as a managed resource in specially constructed warrens, built and maintained at the instigation of members of the nobility. The rabbits could easily be hunted in the enclosures with ferrets (Van Damme and Ervynck 1988) and could be used for food or furs. From being relatively scarce in the thirteenth century, their numbers appear to have increased fairly rapidly as a consequence of their popularity as a delicacy and their meat was reserved for banquets and feasts (Faull and Moorhouse 1981).

Remains of rabbits have been recorded from other castle sites, for instance from period 6 (late 13th century) at Launceston Castle (Albarella and Davis 1994) and post 14th century deposits at Okehampton (Maltby 1982). However, they were not extensively exploited on a wider scale until the post-medieval period.

The range of wild bird taxa recovered from Hertford Castle is quite large in relation to the size of the assemblage, and there are a number of the species present, albeit mostly represented by single fragments, reflect the high status of the site.

An account of a banquet given at Cawood, York, in 1465 by the Earl of Warwick, in honour of his brother's enthronement as Archbishop of York, lists a great many items including 400 heronshawes (i.e. herons) (Nelson 1907). Also included in the list are 608 pykes and bream, 400 swans, 400 woodcocks, 500 partridges, 4000 mallards and teals, 2000 chickens, 6 wild ducks and 4000 coneys. This was a vast and sumptuous feast and probably

somewhat atypical even for the nobility, but it includes many of the taxa found at Hertford Castle, and indeed at other castle sites, e.g. Launceston (Albarella and Davis 1994).

Records from the Household book of the Earl of Northumberland (Drummond and Wilbraham 1939) dated 1512 again demonstrate the range of game being prepared for a 'principall feeste', including cranys (cranes), hearonsewys (herons), fesauntes (pheasants) and smale byrdes.

Hérons were formerly regarded as royal game and, like deer, rabbits, doves and to a certain extent swans, were semi-managed. Markham (1614) in his book on 'Cheape and good husbandry' states that herons were maintained for two purposes: for hawking quarry and for eating at great feasts.

Large and impressive birds were, however, not always eaten. Peacock was often prepared, mounted and presented in its own plumage, but rarely consumed (Ervynck 1992). This sort of extravagance might be an explanation for the presence of the beak and phalange elements of heron recovered from Hertford Castle.

Swans were kept during the medieval period in a state of semi-domesticity (Allison 1985). Young birds were removed from their parents at 'swan-upping' and put into special enclosures for fattening for special occasions such as weddings or for Christmas entertaining (Kear 1990). Seen as a status symbol both alive and dead, no medieval feast was complete without a swan.

Other birds present in the Hertford castle assemblage, i.e. partridge and woodcock, were plentiful in the medieval period. Partridges were generally caught by hawks, whilst woodcock tended to be snared or caught in spring traps. Both

woodcock and partridge were very common amongst the bones from Okehampton Castle (Maltby 1982).

The smaller birds may represent the remains of individuals which died of natural causes. However, documentary evidence exists to suggest otherwise. Fieldfare, a winter visitor, features in the account rolls for the monastery of Durham (Ticehurst 1923), and Markham (1614) explains how to keep fieldfares and thrushes (and other small birds) in cages and suggests feeding them with 'Heps & Hawes, fome with Hempte-feed, fome with Rape-feed, fome with Linfeed, and fome with water.....they willgrow exceeding fat and fit for the ufe of the Kitchin'. Starlings perhaps appear the most unlikely to be eaten and indeed their flesh is said to be 'distasteful and rather bitter' (Cott 1946; Cott and Benson 1970). Opinions do differ, however, since Simon (1944) reports on an acquaintance who assured him that freshly caught starling was excellent once cooked.

Fish, too, were important at formal banquets in the fifteenth and sixteenth centuries. There were usually six courses, of which three were fish (Drummond and Wilbraham 1939). At the marriage of Henry IV and Joan of Navarre in 1403 some of the fish dishes included pyke (pike), gurnade (gurnard) and congre (conger eel) (Drummond and Wilbraham 1939). This same menu also mentions venison, conynge (rabbit), woodecokke (woodcock), and feldfare (fieldfare), all species recorded from Hertford Castle.

Some of the bird species represented in this assemblage were probably caught and eaten during the winter months. Several of the documentary sources mention the consumption of swans at Christmas feasts. Gidney (1993) quotes (from the Northumberland household book) seven dates around Christmas on which swans

were eaten. One hundred and twenty-five young swans were prepared for Henry III's court for their Christmas dinner in 1251 (Kear 1990). Teal is classed as an irregular breeding species and is a common autumn and winter visitor in Hertfordshire (Gladwin and Sage 1986). Simon (1952) suggests the best time to eat teal is just prior to Christmas. Fieldfares are also winter visitors, today arriving towards the end of October (Gladwin and Sage 1986).

The marine fish present must have been transported directly from the coast or via the large markets of London. Eryvynck (1992) suggests that long distance trade is another indicator of the privileged nature of castles.

Conclusions

In view of its limited size, it would be foolish to use the proportions of individual taxa in this assemblage as an indication of the relative importance of any species. However, the material, particularly the remains of wild birds, provides a wealth of information relating to the status of the establishment and gives a valuable insight into at least one aspect of the diet of medieval noble households.

Archive

All paper and electronic archives pertaining to the work described here are currently stored at the EAU, York, along with the animal bone.

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Table 1. Total bone fragment counts from recorded contexts (* represents contexts with residual pottery).

Taxon		14-15 century	14-15* century	Total
<i>Bos f. domestic</i>	cattle	16	10	26
Caprine	sheep/goat	53	18	71
<i>Sus f. domestic</i>	pig	26	28	54
<i>Equus f. domestic</i>	horse	-	1	1
<i>Cervus elaphus</i> L.	red deer	1	-	1
<i>Dama dama</i> (L.)	fallow deer	-	4	4
<i>Capreolus capreolus</i> L.	roe deer	1	-	1
<i>Lepus</i> sp.	hare	1	-	1
<i>Oryctolagus cuniculus</i> (L.)	rabbit	27	18	45
<i>Ardea cinerea</i> L.	grey heron	2	-	2
<i>Cygnus olor</i> (Gmelin)	mute swan	1	-	1
<i>Anser</i> spp.	goose	12	12	24
<i>Anas</i> spp.	duck	7	1	8
<i>Anas crecca</i> L.	teal	1	-	1
cf. <i>Anas crecca</i> L.	? teal	1	-	1
<i>Perdix perdix</i> (L.)	grey partridge	7	1	8
<i>Gallus f. domestic</i>	chicken	77	32	109
<i>Phasianus colchicus</i> L.	pheasant	1	-	1
Fowl/pheasant		9	9	18
Small wader unident		1	-	1
<i>Scolopax rusticola</i> L.	woodcock	2	-	2
Columbidae	dove species	1	-	1
<i>Turdus pilaris</i> L.	fieldfare	1	-	1
cf. <i>Turdus philomelus</i> Brehm.	thrush	-	1	1
<i>Sturnus vulgaris</i> L.	starling	2	-	2
cf. <i>Sturnus vulgaris</i> L.	? starling	1	-	1
<i>Rana temporaria</i> L.	frog	-	1	1
Sub total		251	136	387
Large mammal		106	156	262
Medium mammal		481	203	684
Small mammal (rabbit/cat size)		24	15	39
Unidentified bird		33	19	52
Unidentified		187	123	310
Sub total		831	516	1347
Total		1082	652	1734

Table 2. Representation of cattle skeletal elements (* represents contexts with residual pottery).

Element	14-15 century	14-15* century	Total
Horncore	-	-	-
Maxilla	-	-	-
Mandible	-	-	-
Scapula	1	-	1
Humerus	-	1	1
Radius	-	-	-
Ulna	-	-	-
Metacarpal	-	1	1
Pelvis	6	-	6
Femur	1	4	5
Tibia	-	-	-
Fibula	-	-	-
Calcaneum	-	-	-
Astragalus	-	-	-
Metatarsal	-	4	-
Metapodial	-	-	-
Phalanx 1	1	-	1
Phalanx 2	5	-	5
Phalanx 3	-	-	-
Loose teeth	-	-	-
Carpal	1	-	1
Patella	1	-	1
Total	16	10	26

Table 3. Representation of caprine skeletal elements (* represents contexts with residual pottery).

Element	14-15 century	14-15* century	Total
Horncore	-	-	-
Maxilla	-	-	-
Mandible	-	-	-
Scapula	9	4	13
Humerus	10	2	12
Radius	4	1	5
Ulna	6	1	7
Metacarpal	-	-	-
Pelvis	12	8	20
Femur	8	-	8
Tibia	2	-	2
Fibula	-	-	-
Calcaneum	-	1	1
Astragalus	-	-	-
Metatarsal	1	-	1
Metapodial	-	-	-
Phalanx 1	-	1	1
Phalanx 2	-	-	-
Phalanx 3	-	-	-
Loose teeth	-	-	-
Cuboid	1	-	1
Total	53	18	71

Table 4. Representation of pig skeletal elements (* represents contexts with residual pottery).

Element	14-15 century	14-15* century	Total
Maxilla	1	2	3
Mandible	1	1	2
Scapula	5	2	7
Humerus	1	2	3
Radius	1	-	1
Ulna	3	1	4
Metacarpal	2	4	6
Pelvis	1	1	2
Femur	1	1	2
Tibia	2	1	3
Fibula	-	-	-
Calcaneum	1	-	1
Astragalus	-	1	1
Metatarsal	3	6	9
Metapodial	-	1	1
Phalanx 1	-	3	3
Phalanx 2	1	-	1
Phalanx 3	-	-	-
Loose teeth	1	2	3
Carpal	1	-	1
Patella	1	-	1
Total	26	28	54

Table 5. Representation of rabbit skeletal elements (* represents contexts with residual pottery).

Element	14-15 century	14-15* century	Total
Maxilla	-	-	-
Mandible	1	2	3
Scapula	2	-	2
Humerus	6	2	8
Radius	1	2	3
Ulna	4	1	5
Metacarpal	-	-	-
Pelvis	7	4	11
Femur	3	5	8
Tibia	3	1	4
Fibula	-	-	-
Calcaneum	-	-	-
Astragalus	-	-	-
Metatarsal	-	1	1
Metapodial	-	-	-
Phalanx 1	-	-	-
Phalanx 2	-	-	-
Phalanx 3	-	-	-
Total	27	18	45

Table 6. Representation of chicken skeletal elements (* represents contexts with residual pottery).

Element	14-15 century	14-15* century	Total
Coracoid	11	4	15
Scapula	5	1	6
Humerus	14	5	19
Radius	13	2	15
Ulna	10	4	14
Carpo-metacarpus	3	-	3
Pelvis	-	1	1
Femur	6	11	17
Tibio-tarsus	6	3	9
Fibula	4	-	4
Tarso-metatarsus	3	1	4
Phalanx	1	-	1
Sternum	1	-	1
Total	77	32	109

Table 7. Total fragment counts for fish (* represents contexts with residual pottery).

Taxa	Common name	14-15 century	14-15* century	Total
<i>Esox lucius</i> L.	pike	5	-	5
<i>Conger conger</i> (L.)	conger eel	-	1	1
Gadidae	cod family	2	1	3
<i>Gadus morhua</i> L.	cod	2	3	5
<i>Aspitrigla cuculus</i> (L.)	red gurnard	1	1	2
Pleuronectidae	flatfish family	1	-	1
Indeterminate		61	17	78
Total		72	23	95

Appendix 1

(* represents contexts with residual pottery)

Sheep epiphyseal fusion data ((age categories after O'Connor 1984); (d = distal, p = proximal.)

Age category	Element	14-15 century		14-15* century	
		Fused	Unfused	Fused	Unfused
Early	Humerus - d	9	-	2	-
	Radius - p	1	-	1	-
Intermediate 1	Phalanx 1 - p	-	-	1	-
Intermediate 2	Tibia - d	1	-	-	-
	Metatarsal - d	1	-	-	-
	Ulna - p	4	1	1	-
	Femur - p	5	1	-	-
	Calcaneum - p	-	-	1	-
Late	Radius - d	3	1	-	-
	Humerus - p	1	1	-	-
	Femur - d	2	-	-	-
	Tibia - p	-	1	-	-

Cattle epiphyseal fusion data (age categories after O'Connor 1984); (d = distal, p = proximal.)

Age category	Element	14-15 century		14-15* century	
		Fused	Unfused	Fused	Unfused
Early	Humerus - d	-	-	1	-
	Phalanx 1 - p	1	-	-	-
	Phalanx 2 - p	5	-	-	-
Intermediate	Metapodial - d	-	-	2	-
Late	Femur - p	-	-	-	2
	Femur - d	1	-	-	3

Appendix 2

All measurements are in millimetres.
 All measurements in parentheses are estimates.
 (* represents contexts with residual pottery)

Sheep measurements

Phase	Element	Measurements					
		GLP	SLC	ASG			
14-15	Scapula	32.7	19.2	21.1			
14-15	Scapula	-	19.1	20.5			
14-15	Scapula	29.1	18.5	19.4			
14-15	Scapula	32.0	21.1	22.0			
14-15*	Scapula	31.1	19.1	19.9			
14-15*	Scapula	32.5	20.0	21.0			
14-15*	Scapula	(21.6)	15.4	16.0			
14-15*	Scapula	30.6	18.7	21.5			
		BT	HTC	HT	SD		
14-15	Humerus	27.5	13.9	18.1	14.2		
14-15	Humerus	28.0	13.7	18.4	16.3		
14-15	Humerus	28.1	13.8	18.5	13.7		
14-15	Humerus	28.3	14.3	17.7	14.6		
14-15	Humerus	26.6	13.7	17.0	-		
14-15	Humerus	29.6	15.0	(18.5)	-		
14-15	Humerus	(27.7)	14.2	(18.0)	15.5		
14-15	Humerus	25.6	12.6	16.3	-		
14-15*	Humerus	27.7	13.5	17.1	-		
		GL	BFp	SD			
14-15	Radius	146.7	28.7	16.4			
		LO	SDO	DPA	BPC		
14-15	Ulna	39.5	21.7	26.1	18.5		
14-15	Ulna	40.2	23.0	27.1	18.7		
14-15*	Ulna	44.6	26.5	(29.2)	-		
		Bd	Dd				
14-15	Tibia	26.0	19.7				
		GL	DS	C	C+D		

14-15*	Calcaneum	51.6	17.2	12.9	22.0						
		GL	BFd	Dd	SD	Dem	Dvm	Dim	Dil	Dvl	Del
14-15	Metatarsal	129.7	25.1	16.5	11.6	10.1	16.7	13.8	14.0	15.7	9.4

Other mammal measurements

Phase	Species	Element	Measurement								
			BT								
14-15*	Cattle	Humerus	76.8								
			Bd	Dd	Dem	Dvm	Dim	Dil	Dvl	Del	
14-15*	Cattle	Metatarsal	51.7	28.5	21.2	29.0	-	26.1	28.3	19.5	
			BT	HTC	SD						
14-15*	Pig	Humerus	32.2	18.8	14.1						
			GLI	GLm							
14-15*	Pig	Astragalus	39.7	37.1							
			GLC	SD	Bd						
14-15*	Horse	Femur	355.0	34.9	93.2						

Greatest length (GL) of modern comparative chickens

Element	EAU 518	EAU/KD	EAU 519	EAU 611	EAU 528
Coracoid	55.7	50.2	42.8	59.3	73.0
Humerus	69.4	65.2	53.0	80.8	97.4
Radius	60.8	54.7	46.9	72.5	87.0
Ulna	67.9	62.3	51.4	80.2	96.1
Femur	79.0	71.3	60.5	88.9	108.2

EAU 518 Old English Game Bird (female, the standard bird).
 EAU/KD Old English Game Bird (female).
 EAU 519 Red Jungle Fowl (female).
 EAU 611 Old English Game Bird (male).
 EAU 528 Dark Dorking (male).

Chicken measurements

Phase	Element	Measurements					
		GL	Lm	BF			
14-15	Coracoid	59.3	57.2	12.4			
14-15	Coracoid	52.3	-	-			
14-15	Coracoid	48.2	46.1	10.0			
		Dic					
14-15	Scapula	11.2					
14-15	Scapula	12.6					
14-15	Scapula	12.8					
14-15*	Scapula	13.0					
		GL	SC	Bp	Bd		
14-15	Humerus	-	-	-	14.4		
14-15	Humerus	-	7.2	20.5	-		
14-15	Humerus	-	6.9	20.8	-		
14-15	Humerus	-	-	-	16.6		
14-15	Humerus	-	7.2	-	16.2		
14-15	Humerus	-	-	-	15.6		
14-15	Humerus	68.9	6.3	18.3	14.3		
14-15	Humerus	72.5	6.7	-	-		
14-15	Humerus	-	-	-	13.9		
14-15	Humerus	74.7	7.2	20.0	16.1		
14-15	Humerus	75.6	7.1	19.3	15.0		
14-15*	Humerus	71.1	7.6	19.8	16.2		
14-15*	Humerus	-	7.3	20.5	-		
14-15*	Humerus	-	6.6	17.7	-		
14-15*	Humerus	-	-	-	13.5		
		GL					
14-15	Radius	58.3					
14-15	Radius	54.6					
14-15	Radius	53.8					
14-15	Radius	55.8					
14-15*	Radius	62.5					
		GL	SC	Bp	Dip	Did	
14-15	Ulna	-	-	8.5	12.0	-	
14-15	Ulna	67.0	4.2	8.4	12.5	9.3	
14-15	Ulna	60.3	3.7	8.1	11.4	8.5	
14-15	Ulna	-	-	8.7	12.8	-	
14-15	Ulna	-	-	8.6	12.1	-	
14-15	Ulna	-	3.8	8.2	-	-	
14-15	Ulna	-	-	8.4	11.9	-	

14-15	Ulna	60.5	4.0	8.6	11.6	8.9		GLSC
14-15*	Ulna	70.2	4.3	9.3	13.2	9.5		
14-15*	Ulna	-	3.6	7.9	11.5	-		
14-15*	Ulna	-	3.9	7.8	11.6	-		
14-15*	Ulna	-	-	-	-	8.2		
		GL	L	Bp	Did			
14-15	Carpo-metacarpus	36.7	33.0	11.1	8.1			
14-15	Carpo-metacarpus	41.1	-	13.0	9.2			
14-15	Carpo-metacarpus	32.0	-	10.1	6.1			
		GL	Lm	SC	Bp	Dp	Bd	Dd
14-15	Femur	(70.5)	66.3	6.0	13.1	9.7	13.1	11.9
14-15	Femur	72.1	67.7	6.1	13.4	10.4	14.3	11.8
14-15	Femur	-	-	-	12.8	9.7	-	-
14-15	Femur	-	-	-	13.6	10.5	-	-
14-15	Femur	-	-	-	(14.1)	11.0	-	-
14-15	Femur	-	-	-	15.1	10.1	-	-
14-15*	Femur	-	-	7.8	17.8	13.5	-	-
14-15*	Femur	-	-	-	16.6	11.1	-	-
14-15*	Femur	-	-	-	13.7	9.7	-	-
14-15*	Femur	-	-	-	-	-	13.1	10.7
14-15*	Femur	-	-	-	-	-	12.9	10.7
14-15*	Femur	-	-	-	-	-	13.5	11.0
14-15*	Femur	-	-	-	-	-	13.3	10.3
14-15*	Femur	-	-	-	-	-	13.1	-
14-15*	Femur	68.6	64.6	5.4	13.2	10.2	12.7	10.5
14-15*	Femur	-	-	-	-	-	14.6	12.3
		Dip	SC	Bd	Dd			
14-15	Tibio-tarsus	19.8	-	-	-			
14-15	Tibio-tarsus	20.9	-	-	-			
14-15	Tibio-tarsus	-	-	11.8	12.6			
14-15	Tibio-tarsus	-	-	12.6	(14.6)			
14-15	Tibio-mtarsus	19.2	-	-	-			
14-15*	Tibio-tarsus	18.1	5.5	-	-			
14-15*	Tibio-tarsus	-	-	9.9				
14-15*	Tibio-tarsus	17.2	-	-	-			
		Bd						
14-15	Tarso-metatarsus	17.6						
14-15*	Tarso-metatarsus	13.7						

Other bird measurements

Phase	Species	Element					
			GL	SC	Bp	Bd	
14-15	Goose	Humerus	-	11.1	-	23.6	
			Bp	Dip	Did		
14-15	Goose	Ulna	15.5	20.0	-		
14-15	Goose	Ulna	-	-	16.0		
14-15*	Goose	Ulna	12.5	19.2	-		
			GL	Bp	Did		
14-15*	Goose	Carpometacarpus	89.1	21.5	13.5		
			Bp	Dp			
14-15*	Goose	Femur	17.9	16.0			
			Dip				
14-15*	Goose	Tibio-tarsus	24.7				
			GL	Lm	BF	Bb	
14-15	Duck	Coracoid	51.9	46.7	19.2	20.6	
14-15	Duck	Coracoid	56.2	51.1	20.3	22.4	
14-15	Duck	Coracoid	53.8	50.3	19.7	-	
14-15	Duck (Teal)	Coracoid	34.0	32.5	12.5	-	
			Die				
14-15	Duck (Teal?)	Scapula	7.8				
14-15	Duck	Scapula	11.6				
14-15	Duck	Scapula	12.1				
			GL	SC	Bp	Bd	
14-15	Grey partridge	Humerus	47.5	4.5	13.3	9.4	
14-15	Grey partridge	Humerus	-	-	13.1	-	
			GL	Lm	SC	Bp	Dp
14-15	Grey partridge	Femur	55.6	(53.7)	4.1	9.6	7.8
14-15	Grey partridge	Femur	-	-	-	9.5	8.0
			GL	La	Dip	Bd	Dd
14-15	Grey partridge	Tibiotarsus	74.1	71.3	-	7.3	7.2
			-	-	11.1	-	-
			GL	Lm	BF		
14-15	Pheasant	Coracoid	49.5	46.7	10.9		
			GL				
14-15	Woodcock	Coracoid	29.0				
			Bp				
14-15	Woodcock	Femur	8.5				
			GL	SC	Bp	Dip	Did
14-15*	Thrush	Ulna	32.2	2.0	3.8	4.2	4.0

Appendix 3

Representation of fish skeletal elements from Hertford Castle by context. (L= left, R= right, I= indeterminate.)

Context	Number	Side	Taxon	Common name	Skeletal element
JC3	1	I	<i>Gadus morhua</i> L.	cod	caudal vertebra
JC3	12	I	Indeterminate		fin spine
JC4	1	L	<i>Esox lucius</i> L.	pike	dentary
JC4	1	L	<i>Esox lucius</i> L.	pike	cleithrum
JC4	1	R	<i>Esox lucius</i> L.	pike	dentary
JC4	2	I	<i>Esox lucius</i> L.	pike	caudal vertebra
JC4	2	I	Indeterminate		cranial fragment
JC4	13	I	Indeterminate		rib
JC6	1	L	<i>Gadus morhua</i> L.	cod	dentary
JC6	8	I	Indeterminate		parasphenoid
JC7	1	L	<i>Aspitrigla cuculus</i> (L.)	red gurnard	opercular
JC7	1	L	Gadidae	cod family	post temporal
JC7	2	I	<i>Gadus morhua</i> L.	cod	caudal vertebra
JC7	5	I	Indeterminate		rib
JC8	1	I	Indeterminate		cranial fragment
JC8	1	L	Gadidae	cod family	ceratohyal
JK1	1	I	Pleuronectidae	flat fish family	caudal vertebra
JK1	1	I	Indeterminate		cleithrum
JK1	1	R	<i>Gadus morhua</i> L.	cod	dentary
JK1	4	I	Indeterminate		cranial fragment
JK1	6	I	Indeterminate		fin spine
JK1	22	I	Indeterminate		rib
JK4	1	R	<i>Aspitrigla cuculus</i> (L.)	red gurnard	preopercular
JK4	4	I	Indeterminate		rib
JK7	1	I	Gadidae	cod family	post temporal
JK8	1	L	<i>Conger conger</i> (L.)	conger eel	maxilla