Chapter 5: Environmental Evidence

ANIMAL BONES AND SHELLS

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Summary

The assemblage recovered is sufficiently large to enable a thorough analysis of spatial distribution patterns and species exploitation. In conjunction with related documentary evidence, it has also allowed some conclusions to be drawn about the economic regime practised by the arable manor.

Introduction

The material collected consisted of 11,105 bones of vertebrates and 2265 shells of marine molluscs, which were mostly hand-collected during the excavation. Small quantities of sieved soil yielded 1670 fragments of bone and shell. The general preservation of the bones was good, with the surfaces showing little sign of extensive leaching or encrustations of iron oxides or hydroxides. Cracking and whitening of bones deposited in the upper levels of the site indicate that leaching had begun but very few bones appeared to have disintegrated as a result of this factor. Some mechanical destruction from scavengers, such as dogs and rodents, was evident from gnawing marks.

The disparate classificatory groups of vertebrate bones and marine molluscan shells are treated together, since the bulk of the material is comprised of domestic and dietary refuse. Emphasis has been placed on variability in the distribution of waste from butchery, cooking and consumption within and around the domestic and farm buildings, based on a general model for the spatial distribution of bones developed for the Iron Age site of Mingies Ditch, Oxfordshire (Wilson 1993). Evidence for the farm economy is also discussed in order to facilitate comparison with the documentary evidence available for the organisation of medieval farms.

The faunal assemblage provides an opportunity to compare material from this relatively poorly-known medieval settlement type with that from other contemporary sites. Preliminary sampling during 1980 of the bones collected revealed potentially significant differences compared to other sites in the region. Pig was unusually well-represented (41%) while sheep (15%) was under-represented. Fallow deer and rabbit bones appeared to be more common than usual compared to other sites in the area. The frequency of general classes of bones and shells in the different phases of the site's use is presented in Table 5.1, that of fragments of different species in Table 5.2 (mammals), Table 5.3 (birds), Table 5.4 (fish) and Table 5.5 (marine molluscs). The author is grateful to Enid Allison and Mike Wilkinson who, respectively, identified the bird and fish bones and provided other interpretative information, and to Mark Robinson for identification of some of the molluscs.

Occurrence of species (Tables 5.2–5.6)

Most mammal bones were of domesticated and farm animals, with bones of pig unusually well represented and occurring more commonly than cattle, sheep and horse (Table 5.2). It is possible that wild pig occurs among the domesticated pig. Bones of fallow deer and rabbit were also relatively common. Red and roe deer bones were few but identifications were certain. No positive identifications of goat were made. An incomplete third phalanx from Phase 5 context 134 may be that of a donkey.

The small mammals present included black rat, house mouse and stoat but some of their skeletal remains could not be identified satisfactorily. The size ranges of black and brown rat are still uncertain but no rat bones were as robust as the author's comparative specimens of modern brown rat and no bones were attributed to this latter species. The least common species identified was a tibia of stoat *Mustela ermina* among the Phase 5 demolition debris of context 186. A tibia of hedgehog was noted among unstratified debris but was not recorded elsewhere.

Domestic fowl, goose and pigeon were abundant (Table 5.3), as well as probable occurrences of domestic duck; a bone of peafowl was also present. Modest numbers of wild bird bones included grey heron, mute swan, teal, tufted duck, peafowl, buzzard, partridge, moorhen, lapwing, golden plover, snipe, woodcock, barn owl, redwing and jackdaw. Chief species of interest among the identifications are quail *Coturnix coturnix* and the herring/lesser black-backed gull, which at the time of writing had not been previously recorded from excavations in Oxfordshire.

A variety of freshwater, migratory and marine species of fish were represented by small numbers of identifiable bones and greater numbers of unidentifiable elements or fragments, particularly fin rays (Table 5.4). Freshwater fish bones included tench, roach, chub and perch. Eel and salmon or trout were present. Seafish included spurdog, conger eel, cod, haddock and gurnard. Chief occurrences of note are those of bass (*Dicentrarchus labrax*), scad (*Trachurus trachurus*) and herring (*Clupea harengus*), which at the time of excavation not been recorded previously from archaeological contexts in Oxfordshire. Herring bones were later identified from Blackfriars, Oxford. The size range of bones within each species, and the number of species, in this small group of identified bones indicates that they represent only a fraction of the bones of fish which were originally present on the site. This was confirmed by the sieving results.

Table 5.1 Fragment frequencies of general classes of bones and shells at different phases (excluding sieved bones)

	Phase 1	Phase 2	Phase 3	Phase 4	Phase 3–5	Phase 5
Large and medium-sized mammal	12	227	275	783c	129	1333
Unidentified mammal	12	406	629	1474	217	2771
Total	24	633	904	2257	346	4104
% identified	50	36	30	35	37	48
Burnt bones		2	7	7		12
% burnt		0.3	0.9	0.3		0.4
Small mammal (ie, hare and rabbit)	1	4	11	38	2	65
Small mammal (chiefly rodent)		3	3	35c	6	163a
All birds recorded	9	33	366	630	92	860c
All fish recorded	1	2	20	204	3	98
Frog		14	1	8	3	32b
Marine molluscs	2	84	152	582	50	1392
Freshwater mussel *Anodonta* sp.						2

a: Including stoat (1).
b: Excluding toad (2).
c: Excluding skeletons.

Nearly all of the molluscan shells were marine in origin, with oysters, mussels, cockles and whelks present as expected (Table 5.5). Oyster shells were particularly abundant. Remains of edible crab (*Cancer pagurus*) were found in Phase 2 construction debris of Building A1 (892) and in Phase 5 demolition debris associated with Room A9 (512).

The abundance of selected mammal species as percentages of the total number of mammal bones in each phase group is presented in Table 5.6. In addition, remains of bird, fish, oyster and marine mussel are expressed as a percentage index of the number of mammal bones in each phase group. This facilitates comparison with species representation at other medieval sites in the region. It emerges that pig, fallow deer, rabbit, domestic and wild birds and oysters are relatively abundant while sheep is unusually less well represented. Some chronological changes in species representation are apparent, with possible increases in the abundance of sheep and oyster and a sudden decline in the frequency of pig bones at Phase 5. However, these results must be qualified to some extent by the variability of bone and shell debris across the site.

Table 5.2 Fragment frequencies of mammal bones from different phases (excluding sieved bones)

	Phase 1	Phase 2	Phase 3	Phase 4	Phase 3–5	Phase 5	Total
Cattle	1	85	81	259	47	532	1005
Sheep/goat	2	30	69	142	23	313	579
Pig	8	94	116	359	49	430	1056
Horse	1	9	1	3	3	18	35
Dog		3	5	6	1	11b	26
Cat		3		3b	3	10b	19
Red deer						4	4
Fallow		3	3	11	2	15	34
Roe					1		1
Rabbit	1	4	10	28	2	56	101
Hare			2	10		9	21
Stoat						1	1
Black rat		1	2	35b	5	22	65
Apodemus sp.					1	77	78
Mus sp.						9	9
Arvicola terrestris		1					1
Field vole		1				46	47
Shrew						6	6
Mole						2	2

a: No antler recorded for any species of deer.
b: Counts exclude part skeletons, except of rodents which were indeterminable.

Table 5.3 Fragment frequencies of bird bones from both sieved and unsieved deposits by species

	Phase 1	Phase 2	Phase 3	Phase 4	Phase 3–5	Phase 5	Sieved samples
Grey heron *Ardea cinerea* L.				2		8	
Mute swan *Cygnus olor* (Gmelin)				1 (?2)		?1	
Domestic/Greylag goose *Anser anser* (L.)	1	8	62	69	18	142a	8
Wild goose spp.	2	?1	?1			1 (2?)	
Indet. Goose						5	
Teal *Anas crecca* L.				4		4	1
Domestic/wild mallard *Anas platyrhynchos* L.			7	7		21	1
Pochard *Aythya ferina* (L.)						?1	
Tufted duck *A. fuligula* (L.)			1	?1			
Indet. duck sp.						1	
Buzzard *Buteo buteo* (L.)						1	
Domestic fowl *Gallus gallus* L.	6	15	130	273	28	348	50
Peafowl *Pavo cristatus* L.				1			
Partridge *Perdix perdix* (L.)			3	4 (5?)	1	13	
Quail *Coturnix coturnix* (L.)				1			1 (?3)
Moorhen *Gallinula chloropus* (L.)							2
Lapwing *Vanellus vanellus* (L.)			1	4			
Golden plover *Pluvialis apricaria* (L.)			1			1	
Snipe *Gallinago gallinago* (L.)				3		4 (?5)	1
Woodcock *Scolopax rusticola* L.			3	2			?1
Unidentified Scolopacid				1			
Indet, Wader sp.				1			
Herring/lesser black-backed gull *Larus argentatus* Pontoppidan/*L. fuscus* L.				1			
Domestic pigeon *Columba livia*	1	1	41 (?46)	33	4 (?5)	72	20
Barn owl *Tyto alba* (Scopoli)						4	
Blackbird/Fieldfare *Turdus merula* L./*T. pilaris* L.			1	1		4	4
Redwing *Turdus iliacus* Brehm						1 (?4)	
Song thrush *Turdus philomelos* Brehm			?1				?1
Unidentified small passerines				6		22	11
Jackdaw *Corvus monedula* L.						2	
Crow/rook *Corvus corone* L./*frugilegus* L.						5	
Indet. frags		8	102	213	40	194	169

a: Excluding 76 bones of one goose.
b: All bones identified by Enid Allison.

Intra-site distribution

Factors

A major objective of the study of the bone debris was to compare species abundance in particular areas of the manor. Distributions were studied in buildings, in rooms of the main building, in external areas and in peripheral areas. This would help to determine whether primary and secondary butchery and consumption of food occurred in the central area of the site or in more distant areas. Particular attention was therefore paid to internal and external building contexts, to particular structures and to deposits associated with other specific structures, such as ovens and hearths within a building. Centres of domestic activity would be identified by the presence of relatively high proportions of bones of most small or medium-sized species, particularly sheep, pig, rabbit, domestic fowl and all fish.

Certain potential complicating factors were recognised and have been considered in the results. Larger bones would tend to be removed from cooking and eating areas while smaller bones, and small fragments of large bones, would tend to be incorporated into deposits near to where food was prepared or where table refuse was cleared away. Therefore small bones would enter internal deposits such as postholes, pits, softer floor layers and even walls through rodent scavenging. Scavenging, trampling and weathering may also have destroyed small bones exposed in external contexts, such as courtyards.

A relative abundance of large bones would be an indicator of peripheral activity at the site although the factors outlined above would have an effect on their numbers. Scavenging would also tend to disperse larger fragments farther than small ones. Slaughtering and primary butchery of larger carcasses would take place some distance from the

Table 5.4 Frequencies of identified fish bones by phase (unsieved) and from sieved samples

	Phase 3	Phase 4	Phase 3–5	Phase 5	Total	Sieved samples P2–5 (see Table 22)
Freshwater species						
Tench *Tinca tinca*		1			1	1
Chub *Leuciscus cephalus*		1			1	
Roach *Rutilus rutilus*						1
Cyprinid sp.		14		2	16	20
Perch *Perca fluviatilus*		2		2	4	1
Freshwater/migratory species						
Salmon/trout *Salmo* sp.			1		1	1
Eel *Anguilla anguilla*	5		2		7	117
Marine species						
Spurdog *Squalus acanthias*			1		1	
Thornback ray/Roker *Raja clavata*						1
Elasmobranch			1		1	1
Herring *Clupea harengus*						156
Conger eel *Conger conger*	2	5	1	1	9	
Cod *Gadus morhua*		7	4	4	15	16
Haddock *Melanogrammus aeglefinus*		2		1	3	
Gadoid sp.			2	1	3	3
Gurnard sp.		1			1	
Bass *Dicentrachus labrax*				3	3	
Scad *Trachurus trachurus*						1
Flatfish sp.		1			1	1
Total	7	34	12	14	67	320

Results include 923 among sieved.
Results exclude unidentified fish remains which were not counted by identifier but incorporated in general results in Tables 5.1 and 5.7–5.13.
All bones identified by Mike Wilkinson.

kitchen and eating areas and these areas might not be easily locatable because of the intensity of scavenging or the intensive human use of larger bones for marrow, tallow or other products. There is a possibility that butchery and its associated waste disposal may have occurred outside the excavated area, such as outside the moat, at an adjacent farm or, as in the case of deer, in the chase.

Internal and external contexts

Although bones and shells were found in approximately equal quantities in internal and external contexts (Table 5.7), the bones of medium and small-sized animals, sheep, pig, rabbit, birds and fish, were relatively more abundant among deposits inside buildings (Table 5.8). Further evidence of this is given elsewhere (Wilson 1996, fig. 18; see also Wilson 1989). Unidentified bones are common in internal contexts which is to be expected considering that most unidentified bones are small. Sheep, rodents, fish and mussels are generally better represented in internal contexts but the figures display some variability which may be related to a variety of cultural factors, including changes of diet over time,

Table 5.5 Fragment frequencies of marine shells and minimum number of individuals (MNI)

		Phase 1	Phase 2	Phase 3	Phase 4	Phase 3–5	Phase 5	Total
Oyster *Ostrea edulis*	f	2	32	145	499	45	1243	1966
	MNI (a)	1	21	71	219	29	575	
Mussel *Mytilus edulis*	f		46	7	74	3	129	259
	MNI		10	4	29	2	64	
Whelk *Buccinum undatum*	f		1		11		11	23
	MNI		1		11		11	
Cockle *Cerastoderma edule*	f		5		1	2	9	17
	MNI		3		1	1	5	

a: MNI based on simple counts of adductor muscle scar. Estimates comparable to those of mammals might be equivalent to 110–130% of the figures given here.

Table 5.6 Percentage representation of bones and shells in different phase groups

Phase	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	All phases
No. of animal bones (n)	13	231	264	816	1398	2881
	%	%	%	%	%	%
Cattle	8	37	30	31	38	34.9
Sheep	15	13	23	17	22	20.1
Pig	62	41	40	44	31	36.7
Horse	8	3.9	0.4	0.4	1.3	1.2
Dog		1.3	1.9	0.7	0.8	0.9
Cat		1.3		0.4	0.7	0.7
Red deer					0.3	0.1
Fallow		1.3	1.1	1.3	1.1	1.2
Roe						+
Rabbit	8	1.7	3.8	3.4	4	3.5
Hare			0.4	1.2	0.6	0.7
Relative abundance of other groups of bones expressed as index % of n:						
Domestic fowl	46	6.5	44	33	25	27.8
Domestic goose		3.5	22	8.5	10	10.4
Other dom. spp. (max. est.)	8	0.4	18	5	6.7	6.7
Wild birds	16		3.4	3.8	7	4.4
Fish	8	0.9	3.8	25	4.4	11.4
Oyster	15	14	51	61	89	68.2
Marine mussel		20	3	9	9	9

and the destruction of domestic buildings and the alteration of habitats, such as of rodents.

Conversely, a higher percentage of cattle bones, and likewise of identified bones, is attested in external than internal deposits. Generally, bone debris from outside tends to be coarse in composition in the courtyard and farm areas and also in overlying destruction levels. One consideration is that smaller bones might be more vulnerable to degradation in external areas, although it is unlikely that this factor alone adequately explains the relative frequencies observed. The bones from Chalgrove are far less degraded than the bones from Mingies Ditch, Oxfordshire (Wilson 1993; Wilson 1985, 81–94) but nevertheless the data from there appeared to provide reliable indications of some cultural or ecological

Table 5.7 Frequencies of bones and shells in internal and external building contexts

	Internal							External				
	Phase 1	Phase 2	Phase 3/1	Phase 3/2	Phase 4	Phase 5	All phases (a)	Phase 2	Phase 3	Phase 4	Phase 5	All phases
Burnt			7		7	3	17	2			9	11
Horse	1	1	1		1	7	14	8			11	19
Cattle	1	22	49	3	76	138	336	63	29	150	394	636
Pig	8	51	86	11	192	129	526	43	19	137	301	500
Sheep	2	5	41	8	73	106	258	25	20	61	207	313
Deer			2		5	6	16	3	1	4	13	21
Dog			4		3	2	10	3	1	2	9	15
Cat		2			1	5	11	1		2	4	7
Rabbit & hare	1	4	11	1	28	27	74			3	38	41
Rodent		3	1		17	129	138		1	1	33	35
Domestic fowl	6	2	83	13	240	228	572	10		20	139	169
Domestic goose		2	90	5	64	78	239	7	2	4	45	58
Other bird	3	5	115	51	259	232	665	4	2	31	125	162
Fish	1		10		202	86	302	2		1	12	15
Oyster	2	6	122	10	307	407	899	26	13	187	836	1062
Mussel		10	7		73	103	196	36		1	26	63

a: Including bones from contexts of wider phase.

Table 5.8 Percentage comparisons of bones and shells in internal and external contexts of buildings

	Internal							External				
	Phase 1	Phase 2	Phase 3/1	Phase 3/2	Phase 4	Phase 5	All phases	Phase 2	Phase 3	Phase 4	Phase 5	All phases
% of identification	50	32	29	19	25	31	28.1	38	39	48	33	36.7
% of burnt bones			1		1	+	0.5	1			+	0.3
Total of cattle, horse, pig, sheep (n)	12	79	177	22	342	380	1134	139	68	348	913	1468
% of horse	8	1	1		+	2	1.2	6			1	1.3
% of cattle	8	28	28	14	22	36	29.6	45	42	43	43	43.3
% of pig	67	65	49	50	56	34	46.4	31	28	39	33	34.1
% of sheep	17	6	23	36	21	28	22.8	18	29	18	23	21.3
Other groups Index % of n												
Deer			1		2	2	1.4	2	2	1	1	1.4
Dog			2		1	1	0.9	2	2	1	1	1
Cat		2			+	1	1	1		1	1	0.5
Rabbit and hare	8	5	6	5	8	7	6.5			1	4	2.8
Rodent		4	1		5	34	13.8		2	+	4	2.4
Domestic fowl	50	3	47	59	70	60	50.4	7		6	15	11.5
Domestic goose		3	51	23	19	21	21.1	5	3	1	5	4
Other bird	25	5	65	232	76	61	26.6	3	3	9	14	11
Fish	8		6		59	23	26.6	1		+	1	1
Oyster	17	8	69	46	88	107	79.3	19	19	54	92	72.3
Mussel		15	4		21	27	17.3	26		+	3	4.3

processes. Therefore, the comparison of internal and external contexts appears to confirm that the internal contexts of buildings were functionally and spatially related to the cooking and consumption of food. The results from Chalgrove indicate that this took place in or near the principal building. Bones were subsequently dispersed by refuse clearance and disposal and scavenging. Refuse removal from the house, particularly of larger bones, contributed to the distribution of coarse debris in the farm and courtyards, with finer debris being more likely to be left behind and become incorporated into floor deposits.

Internal contexts *(Tables 5.9–5.12)*

The comparison of fragment frequencies and percentages (Tables 5.9, 5.10 and 5.11) according to the rooms of buildings in which the bones and shells were found does not allow for any differences between phase groups which may have pointed to chronological changes. However, such influences are not believed to significantly affect the results. Most bones occurred in the foundations of the domestic range A1–A14, although some rooms (A2, A6, A7, A11 and A14) yielded few bones for a variety of reasons. The most important of the modest deposits of the remaining parts of the site were found in Buildings B, H, T and W, and Area F. The buildings further away from the domestic range, Buildings G, J and K, yielded a small quantity of bones approaching the coarseness of those in the adjacent yards. Table 5.9 presents the overall quantities of debris and the species representation, which initially indicate that the most important areas of cooking and consumption refuse are A1, A9, A10 and A12, followed by a less important group consisting of A3, A4, A5, A13, A14, T, F and W.

The results were subsequently evaluated systematically for all buildings. Percentages and percentage indices of bones and shells for each building were ranked for each of nine criteria considered to be the most relevant of results given in Table 5.10 and according to whether the lowest or highest values indicated the greatest association with cooking and eating. Individual rankings of buildings are presented in Table 5.11. These rankings allow for the varying size of buildings and rooms and of the random variation due to small sample size of some building groups. These results found that Building A1 and Room A9 have the lowest totals of rankings, followed by Room A10 and three others of the domestic range. These rooms therefore contained the smallest and finest bones and fragments and the best representation of small animal species. This confirms the earlier indication that cooking and eating occurred in or near these rooms. The results also confirm the architectural and documentary evidence that the 'A' range was domestic in function.

Results presented in Table 5.12 show that the density of bones and shells in most buildings was low; less than five fragments per square metre of building area. Densities were greater, up to

Table 5.9 Frequencies of bones and shells in buildings and rooms (all phases)a

	A1	A2	A4	A5	A6	A9	A10	A11	A12	A13	A14	B	D	F	G	H	I	J	K	M	P	Q	R	T	W
No. of bones (b)	609	69	149	534	1	808	153	15	735	34	20	166	18	275	47	107	1	23	17	3	5	7	3	59	84
Burnt	2			2		1			2	2				6						1				1	
Horse and cattle	13	3	15	83	1	30	6	6	77	3	2	24	3	34	7	15		3	2	1	1	1		4	7
Pig and sheep	74	15	30	127		150	35	4	170	7	13	27	5	41	16	20		4	2		4	1	3	16	24
Deer				3		1		1	5		2	2		2											
Dog				2		1			1			1		3			1	1							
Cat	2			8												1									
Rabbit and hare	10		1	5		23	7		14		1	1		3		2					1				2
Rodent	3	5		125		9			9			3	1												
Domestic fowl	71	2	25	24		310	43		75	1	6	5	1	9		9	8							1	5
Domestic goose	18	4	11	17		94	56		37		4	5	1	4			1								3
Other bird	173	11	17	57		238	77		77		3	4		15	1	2									4
Fish	115			12		156	14		6		2	1		3			5								
Oyster	102		18	69		514	12	10	73	6	8	11	1	23		6	1	2	1			1	1	27	6
Mussel	15	4		6		112	18	1	31		1			1		1									

a: Lack of structural definition of buildings or absence of bone evidence excludes some rooms from consideration (eg. A2 A7, A8).
b: Number of identified and unidentified animal bones excluding those of rodent.

Table 5.10 Percentage comparison of bones and shells in buildings and rooms

	A1	A3	A4	A5	A6	A9	A10	A11	A12	A13	A14	B	D	F	G	H	I	J	K	M	P	Q	R	T	W
% of identification	14	25	29	39	100	22	27	67	34	29	75	31	44	27	49	33	100	30	24	33	80	29	100	34	37
% of burnt bones	0.3					0.1			0.3	5.9				22						33				1.7	
Total of cattle, horse, pig & sheep	87	18	45	210	1	180	41	10	247	10	15	51	8	75	23	35		7	4	1	5	2	3	20	31
% cattle and horse	15	17	33	40	100	17	15	60	31	30	13	47	38	45	30	43		43	50	100	20	50		20	23
% pig and sheep	85	83	67	60		83	85	40	69	70	87	53	62	55	70	57		57	50		80	50	100	80	77
Other groups Index % of n																									
Deer				1.4		0.6		10	2		13	4		0.3											
Dog				1		0.6			0.4			2		4			>100	1.4							
Cat	2.3			3.8												2.9									
Rabbit and hare	11.5		2.2	2.4		12.8	17.1		5.7		6.7	2.0		4		5.7					20				6.5
Rodent	3.4	28		60		3.3			3.6			5.9	13												
Domestic fowl	82	11.1	56	11.4		172	105		30	10	40	9.8	13	12		26	>800							5	16
Domestic goose	21	22	24	8.1		52	137		15		27	9.8	13	5.3			>100								9.7
Other bird	199	61	38	27		132	188		31		20	7.8		20	4.3	5.7									13
Fish	132			5.7		87	34		2.4		13	2.0		4			>500								
Oyster	117		40	33		286	29	100	30	60	53	22	13	31		17	>100	29	25			50	33	135	19
Mussel	17	21		3		62	44	10	13		7			1		3									

Table 5.11 Rank order of frequencies, % and % indices given in Tables 5.9 and 5.10 to determine rooms/buildings most associated with cooking

	A1	A3	A4	A5	A6	A9	A10	A11	A12	A13	A14	B	D	F	G	H	I	J	K	M	P	Q	R	T	W
No. of bones (highest=1)	3	11	8	4	24	1	7	19	2	14	16	6	17	5	13	9	24	15	18	22	21	20	22	12	10
% identified (lowest=1)	1	4	7	17	23	2	5	20	14	7	21	11	18	5	19	12	23	10	3	12	22	7	23	14	16
% burnt (highest=1)	5	8	8	8	8	7	8	8	5	2	8	8	8	3	8	8	8	8	8	1	8	8	8	4	8
% sheep & pig (highest=1)	3	5	13	15	23	5	3	22	12	10	2	19	14	18	10	16	23	16	20	23	7	20	1	7	9
% rabbit and hare	4	13	11	10	13	3	2	13	7	13	5	12	13	9	13	7	13	13	13	13	1	13	13	13	6
% domestic fowl	4	12	5	12	17	2	3	17	9	14	6	15	10	11	17	8	1	17	17	17	17	17	17	16	9
% domestic goose	7	6	5	12	14	3	1	14	8	14	4	10	9	13	14	14	2	14	14	14	14	14	14	14	11
% fish	1	9	9	5	9	2	3	9	7	9	4	8	9	6	9	9	9	9	9	9	9	9	9	9	9
% oyster	3	20	7	9	20	1	13	4	12	5	6	16	19	11	20	8	20	13	15	20	20	7	9	2	17
Ranking totals	31	88	73	92	151	26	45	126	76	88	72	105	117	81	113	91	123	115	117	131	119	115	116	91	95
Order of rankings	2	8	5	12	25	1	3	23	6	8	4	14	19	7	15	10	22	16	19	24	21	16	18	10	13

Rooms or buildings most associated with cooking and eating in rank order: A9, A1, A10, A14, A4, A12, F, A3, A13, H, T, A5, W, B, G, J, Q, R, D, K, P, I, A11, M, A6

General notes

a: Total number of bones indicate the greatest long term accumulation of bones near eating and cooking areas.

b: % of burnt bones may indicate rooms associated with cooking.

c: The low % of identified bones, the high % of sheep and pig, and the high % indices of rabbit and hare, domestic birds, oyster and fish indicate highest % of small sized bones and fragments in or near rooms associated with cooking and eating.

approximately twelve fragments per square metre, in A1, A10, A12, F and T. Bones were very abundant in A5 and most of all in A9, with approximately fifty fragments per square metre. However, deposits in A9 were slightly deeper than in other buildings in the domestic range. The depth of deposits in the farmyard buildings was affected by deeper topsoil stripping. As yet such figures make no distinction, however, between deposits associated with the primary use of the buildings and those derived from their construction or destruction.

Internal and external contexts by phase

Tables 5.13a and b and 5.14a and b examine the largest groups of bones and shells from different phases and feature types, from within buildings and from the most significant of the external contexts. Only the results from Building A1, A12 and B, and Rooms A5 and A9, are worth splitting into phase groups. Building A1 gives consistent results for the medium and large mammal bones in Phases 2 to 5, although the presence of smaller bones varies. The relative absence of coarse debris of the bones of medium-sized species is only exceeded by those of Phase 4 in Room A9. However, the overall densities of bones in A9, and the relative abundance of bones of small animal species, greatly exceeds those of Building A1 in their respective phases, except where finely fragmented bird bones give a high value for A1 in Phase 4. Floor or occupation deposits therefore yielded the finest eating or cooking refuse, characterised with a relative abundance of pig, rabbit with hare, domestic fowl, fish and oyster. The results also indicate the clearance of coarse refuse from the floors of these buildings and this explanation can be applied to the interpretation of more variable results in other buildings.

The demolition phase of Room A5 contains a predominance of cattle bones but this does not preclude the possibility that such debris also accumulated during the earlier occupation of the building. The same is also true of the Phase 5 debris of Building A12. In this room coarse debris is particularly common in the robber trenches, suggesting that the debris was incorporated following the abandonment and demolition of A5. Building B differs in that the bone from Phase 4 is coarser than that from Phase 5, but this building should be treated as a more peripheral building away from the domestic range and where coarser debris is not unexpected.

Coarse debris of cattle and horse bones in external features is most evident for bones of Phase 5 in the sump 504 and gully 518 of the courtyard enclosed by Rooms A4, A9, Buildings A12, W and Area F. Similar debris occurred in the Phase 4 drain 115 between Buildings A11 and A12 and in the moat infill. Less coarse debris occurred in the Phase 2 moat upcast, in the Phase 4 dump 573 near Building E, and in the general Phase 5 demolition layers, 186, 189 and 119. The least coarse debris in external contexts occurred in the Phase 4 courtyard layer 519 and this should possibly be regarded as an extension

Table 5.12 Densities of bones and shells per square metre of deposits in rooms and buildings

	A1	A3	A4	A5	A6	A9	A10	A11	A12	A13	A14	B	D	F	G	H	I	J	K	M	T	W
Area of room/ building m^2	105	46	42	20	12	42	28	33	24	98	43	41	15	46	110	87	15	67	266	23	14	52
Densities of bones or shells																						
All mammal (a) exc. rodent	5.8	1.5	3.6	27	0.1	43	5.5	0.5	10	0.4	0.5	4.1	1.2	6	0.4	1.2	0.1	0.3	0.1	0.1	4.2	1.6
Rabbit and hare	0.1		+	0.3		0.6	0.3		0.2		+	+	+	0.1		+						0.1
Domestic fowl	0.7	+	0.6	1.2		7.4	1.5		1	+	0.1	0.1	0.1	0.2		0.1	0.5				0.1	0.1
Fish	1.1			0.6		3.7	0.5		0.1		0.1	+		0.1			0.3					
Oyster	1		0.4	3.5		12	0.4	0.3	1	0.1	0.2	0.3	0.7	0.5		0.1	0.1	+	+		1.9	0.1
Burnt	+			0.1		+			+					0.1							0.1	

a: Includes unidentified fragments.

of the fine debris found within the domestic range. A similar interpretation is likely for the higher values of bird bones in the sump and gully (518) of the courtyard.

Ovens and hearths yielded small quantities of bone and 8% of these were burnt. Other areas or layers containing material such as charcoal or ash yielded little evidence of burnt bones. Bones appear rarely burnt by accident unlike those at some prehistoric sites.

Distribution of skeletal elements

Objectives

The collection of data regarding the distribution of skeletal elements was restricted to an examination of the most productive contexts. The aim was to discover the composition of debris in deposits associated with the domestic area where food was cooked and consumed. Study of skeletal elements might indicate whether butchery had taken place in any of the buildings and what form it took and whether the bones mainly represented refuse left behind after eating.

Sheep were considered the most worthy species of investigation because proportions of skeletal elements were known to vary more than those of pig or cattle in urban medieval and post-medieval deposits. This allowed a crude division of the process of butchery and consumption into several stages. The first stage was primary butchery, involving the initial slaughtering, skinning and some dismemberment of the carcass. Secondary butchery consisted of the division of the main meat carcass by a commercial butcher (not at the site) or within the household prior to cooking. The third stage was the consumption and dismemberment of cooked joints at the meal table, followed by the breaking up and boiling of the bones as butchery or other waste for the extraction of tallow, glue and so on. Several smaller species were also selected, which might reveal butchery patterns different to those of sheep, and whose bones might be less susceptible to rubbish clearance than those of larger mammals. Rabbit and hare were obvious choices, although their bones were not numerous. The abundance of domestic fowl also offered an opportunity to discover whether the skeletal element distributions were determined by cultural factors other than rubbish clearance.

Rooms with the largest deposits of bone were chosen. Room A9 was selected because it appeared to be the main centre for deposition associated with cooking and consumption and was, perhaps, related to the preparation of food in the kitchen. Building A1, the hall, was of interest because its refuse might indicate the type of debris left after most waste from the table had been cleared away. Finally, Room A5 was chosen because this room stood away from the main centre and might indicate other kinds of dumped rubbish. In addition, several external contexts appeared to offer useful comparative information, such as the moat upcast (Phase 2), the dump debris 573 and drain 115 (Phase 4). Features from the demolition Phase 5 would yield information of less certain value because the sources of this debris are less easily determinable.

Skeletal elements of sheep (Table 5.15)

Sample sizes were small but a distinctive trend in the representation of skeletal elements is shown in Table 5.15. Skeletal elements of the body (eg the upper limb bones and especially vertebrae) are disproportionately abundant in Rooms A9 and A10, correlating with the concentration of refuse associated with food preparation and consumption. Head and foot debris became more common further away from this area. The number of body elements of sheep, compared to head and foot elements, was greater in Rooms A9, A10 and Building A1. They occurred in lesser quantities in external contexts and in Rooms A12 and A5, and in Buildings B, W and Area F (an intermediate distance from A9) and were found less frequently in Buildings H, I, J and K (the most distant group). The exact reverse was the case for the occurrence of head and foot elements which increased in abundance with distance from Room A9.

This pattern indicates that refuse from the primary butchery of the carcass was disposed of separately

Table 5.13a and b Frequencies of bones and shell among larger groups from internal and external contexts

Table 5.13a Internal contexts

Phase	A1			A5			A9			A12		B		Ovens
	2–3	4	5	2	3–5	5	3/1	4	5	4	5	4	5	3–4
No of bones (a)	105	307	167	224	145	164	181	407	208	459	276	78	76	102
Burnt		2				2		1		2				8
Horse	1					1					5		1	
Cattle	4	5	3	20	26	36	13	2	14	36	36	18	4	6
Pig	16	19	11	48	32	27	37	54	26	84	25	7	1	5
Sheep	9	12	7	4	4	12	12	7	10	36	25	5	13	8
Deer					3		1			3	2	2		
Dog					1	1	1			1		1		
Cat		1	1	2	3	3								
Rabbit and hare	1	7	2	4	1		1	13	9	5	9		1	
Rodent	1	b	2	3	1	121		3	6	9	1	3		
Domestic fowl	3	36	20		27	13	33	143	124	51	24	3	2	2
Domestic goose	3	5	8		18	7	34	30	26	19	18	3	1	1
Other bird c	6	93	24		45	25	19	91	133	63	14		3	
Fish	11	77	27	5	1	6		110	51	6		1		1
Oyster	11	68	23	10	9	50	102	200	212	18	55	1	10	6
Mussel		7	8			6		31	81	27	4			1

Table 5.13b Contexts over buildings

Phase	Moat upcast 2	Courtyard 3	Courtyard 4	Drain 115 4	Dump 573 4	Sump 504 4	Gully 518 4	Demo. 119 5	Demo. 186 5	Moat (infill) 5+	Topsoil 1
No of bones (a)	205	107	170	105	214	195	546	324	872	78	443
Burnt	1					1					
Horse	3						1	1	4	3	
Cattle	36	12	18	26	65	31	99	43	116	19	62
Pig	30	11	55	11	34	9	31	46	83	8	35
Sheep	16	14	11	7	16	6	24	25	115	3	28
Deer	1	1	1	2	1		2		7		
Dog	1				1			2	3	1	
Cat			1b		1		2	1	2b	1	
Rabbit and hare			1	1			6	9	8	1	
Rodent					1		1		32		
Domestic fowl	6	1	11	2		9	22	7	65	4	15
Domestic goose	7		2			2	8	2	21		9
Other bird c	4	1	19	7	3	3	23	7	66		13
Fish					1		5		3		
Oyster	2	7	51	7	22	1	185	34	282	6	196
Mussel			1	1	1		11		6	34	5

a: Number of identified and unidentified bones of mammals except rodents.
b: Excluding part skeleton.
c: Including unidentified bird bones.

and further away from the refuse from kitchen preparation and consumption, as represented by body elements. Bone debris in Room A9 and its vicinity appears to represent waste from cooking and, primarily, consumption.

An index of bone degradation was calculated as a crude measure of the extent to which sheep bones had been degraded by processes such as leaching, scavenging or trampling (Table 5.15). This consists of the percentage presence of four skeletal elements (mandible, radius, tibia and loose teeth) in groups of sheep bones. A low percentage indicates that bones are well preserved and a high percentage indicates highly degraded bones. For those contexts in which

Table 5.14a and b   Percentage comparisons among larger feature groups of bones and shells from internal and external contexts

Table 5.14a   Internal contexts

	A1			A5			A9			A12		B		Ovens
	Mixed Features			Layers		Layer/ pit	Floor/occupation layers		Mixed features	Occup. layers	Robber trenches	Layer	Robber trenches	
Phase	2–3	4	5	2	3–5	5	3/1	4	5	4	5	4	5	2–3
% of identification	29	12	13	32	43	46	34	16	24	34	33	39	25	13
% of burnt bones	–	0.7	–	–	–	1.2	–	0.3	–	0.4	–	–	–	7.8
Total of cattle, horse, pig & sheep	30	36	21	72	62	76	62	63	50	156	91	30	19	19
% of horse	3	–	–	–	–	1	–	–	–	–	6	–	5	–
% of cattle	13	14	14	28	42	47	21	3	28	23	40	60	21	32
% of pig	53	53	52	67	52	36	60	86	52	54	28	23	5	26
% of sheep	30	33	33	6	7	16	19	11	20	23	28	17	68	42
Index % of n														
Deer	–	–	–	–	5	–	2	–	–	2	2	7	–	–
Dog	–	–	–	–	2	1	2	–	–	1	–	3	–	–
Cat	–	3	5	3	5	4	–	–	–	–	–	–	–	–
Rabbit & hare	3	19	10	6	2	–	2	21	28	3	10	–	5	–
Rodent	3	–[b]	10	4	2	159	–	5	12	6	1	10	–	–
Domestic fowl	10	100	95	–	44	17	53	277	248	33	26	10	11	11
Domestic goose	10	14	38	–	29	9	55	48	52	12	20	10	5	5
Other bird[c]	20	258	114	–	73	33	31	144	266	40	15	–	16	–
Fish	37	214	129	7	2	8	–	175	102	4	–	3	–	5
Oyster	37	189	110	14	15	66	165	318	424	12	60	3	53	32
Mussel	–	36	38	–	–	8	–	49	162	17	4	–	–	5

[a] Number of identified and unidentified bones of mammals except rodents.
[b] Excluding part skeleton.
[c] Including unidentified bird bones.

Table 5.14b External contexts

	Moat upcast		Courtyard		Drain	Dump	Sump	Gully	Above buildings: Yard	Above buildings: Domestic	Above buildings: Farm
					F115	F573	F504	F578	F119	F186	F189
Phase	2	2	3	4	4	4	5	5	5	5	5
% of identification	42	42	35	49	42	54	24	28	35	36	29
% of burnt bones	–	0.5	–	–	–	–	0.5	–	–	–	0.5
Total of cattle, horse, pig & sheep	33	85	37	84	44	115	46	155	115	318	130
% of horse	9	4	–	–	–	–	–	1	1	1	4
% of cattle	58	42	32	21	59	57	67	64	37	37	48
% of pig	24	35	30	66	25	30	20	20	40	26	27
% of sheep	9	19	38	13	16	14	13	16	22	36	22
Index % of n											
Deer	–	1	3	1	5	1	–	1	–	2	2
Dog	3	1	–	–	–	1	–	–	2	1	–
Cat	3	–	–	1[b]	–	1	–	1	1	1[b]	–
Rabbit & hare	3	–	–	1	2	–	–	4	8	3	2
Rodent	–	–	–	–	–	1	–	1	–	10	–
Domestic fowl	12	7	3	13	5	–	20	14	6	20	12
Domestic goose	–	8	–	2	–	–	4	5	3	7	4
Other bird[c]	–	5	3	23	16	3	7	15	6	21	10
Fish	–	–	–	–	–	1	–	3	–	1	–
Oyster	18	2	19	61	16	19	2	119	30	89	151
Mussel	103	–	–	1	2	1	–	7	–	2	4

Table 5.15 Percentage of grouped skeletal elements of sheep from selected context groups

	Internal							External				
	A9	A10	A12	A1	A5	BFW	G–K	MU	CY	Dump 573	Demo. 186	Demo. 189
Phase	3–5	3	4–5	2–5	2–5	3–5	3–5	2	4	4	5	5
n	30	9	58	27	21	45	20	19	30	15	78	28
	%	%	%	%	%	%	%	%	%	%	%	%
Head	4	22	19	11	29	33	50	16	17	33	27	29
Foot	13		10	11	19	13	15	11	10	20	19	7
Body	83	78	71	78	52	53	35	74	73	47	54	64
Mandible	3		9	4	10	13	10		10	13	8	18
Loose teeth		22	7		5	7	30	11	3	13	13	7
Vertebrae	43	22	12	11	5	4		5		7	5	11
Small bones	7		5	7		11					3	4
Metapodials	7		5	4	19	2	15	11	10	20	17	4
% index of degradation a	20	40	48	33	24	51	65	58	63	60	42	54

MU: Moat upcast.
CY: Central courtyard.
a: Percentage of loose teeth and fragments of mandible tibia and radius.

bones are highly degraded (*cf.* 72–93% of bones at Mingies Ditch, Oxfordshire) the percentage index is considered to be related to both the type of deposit and the depth to which the bones were buried in the ground (Wilson 1985 and 1993). Similar results with less degraded material (34–72%) were obtained at Mount Farm (Wilson 1995).

The percentage index at Chalgrove ranges from 20–65% and confirms that the bones from this site are relatively well preserved. Sheep bones from inside buildings (20–65%), especially Room A9 (20%), tend to be better preserved than those from external deposits (42–63%). The variable pattern from individual buildings parallels the distribution of fine and coarse debris (see above). One way to bypass the extent to which differential degradation affects the observed pattern of skeletal element distribution is to study elements which are known to be particularly resistant to degradation (see below).

Skeletal elements of pig (Table 5.16)

A different pattern emerges with pig, including a marked difference between Room A9 and neighbouring contexts. Higher percentages of loose teeth, partly indicating greater disintegration, contribute to a larger amount of head debris than occurred generally for sheep. Metacarpals and metatarsals occurred in relatively high quantities in A9 and, in contrast to sheep, bones from head and limb extremities generally predominate over body elements. However, the head, neck and trotters of pig offer more edible tissues than the same parts of sheep and it is therefore not surprising that bones from these parts of pigs feature more prominently in debris from food preparation and consumption.

Skeletal elements of cattle (Table 5.17)

Bones of cattle show a different distribution pattern with few elements in and around the centre of food preparation and consumption. Parts of foot and head were most common in external contexts, notably 504, 518, 573 and 115. This patterning could derive from practices of rubbish clearance or from scavenging, with large bones being more likely to be redistributed outwardly after butchery or cooking. In addition, boneless meat was probably brought to the places of cooking and eating with most bones disposed of elsewhere.

Table 5.16 Percentage of grouped skeletal elements of pig from selected context groups

	Internal						External	
	A1	A9	A10	A12	BFW	G–K	Dump 573	Demo. 189
Phase	2–5	3–5	3–5	4	3–5	3–5	4	5
n	45	113	22	85	42	11	34	35
	%	%	%	%	%	%	%	%
Head	56	26	41	59	55	64	60	46
Foot	11	44	23	11	12	9	3	11
Body	33	30	36	31	33	27	47	43
Mandible	11	4	5	15	24	18	18	9
Loose teeth	33	14	32	27	26	27	9	26
Vertebrae	7	9	9	6	10		3	9
Small bones	9	12	9	7	5	9	3	6
Metapodials	2	32	14	4	7			6

Table 5.17 Percentage of grouped skeletal elements of cattle from selected context groups

	Internal			External		
	A9	BFW	G–K	504 & 518	573 & 115	189
Phase	3–5	3–5	3–5	4	4	5
n	29	30	61	125	67	62
	%	%	%	%	%	%
Head	21	23	20	15	36	21
Foot	24	18	17	13	24	18
Body	55	54	63	72	40	61
Mandible	14	8	5	9	24	6
Loose teeth	3	8	10	6	6	11
Vertebrae	28	15	10	24	10	21
Small bones	14	11	10	8	11	13
Metapodials	10	7	7	5	7	5

Skeletal elements of rabbit and hare *(Table 5.18)*

Cranial and metapodial debris of rabbit and hare was generally uncommon, while bones from the main meat carcass were relatively abundant. Table 5.18 indicates a trend for the metapodial and head elements to be found away from the centre of food preparation and consumption where the vertebrae and upper limb bones predominate. This is significant because any mandibles and metapodials should have been more prominent among the small bones of Building A1. Since this contradicts the general pattern whereby small bones occur in the centre of the site, it suggests that, as for sheep, the dumping of feet and head parts took place outside the central buildings. Therefore, as for sheep carcasses but in contrast to pig, the heads and feet of rabbit and hare appear to have been separated from the carcass and dumped elsewhere before most of the bones reached Room A9. Heads and paws might have been removed at the same time as the skin and this most probably took place in the kitchen prior to cooking.

Fewer rabbit bones survive compared to sheep and cattle but the complete humeri and femuri recovered nevertheless outnumber those from the larger species. This suggests (though not conclusively because cattle and sheep bones may have been rendered further for tallow, glue and so on) that owing to its small size the main meat carcass of rabbit was disjointed little before cooking.

Table 5.18 Percentage of grouped skeletal elements of rabbit and hare from selected context groups

	Internal				External
	A1	A9	A10	A12	573 & 189
Phase	2–5	3–5	3–5	4–5	4–5
n	12	23	7	15	9
	%	%	%	%	%
Head	8				11
Foot	17		29		33
Body	75	100	71	100	56
Mandible					11
Loose teeth	8				
Vertebrae	8	26	14		11
Small bones			14		
Metapodials	8		29		33

Skeletal elements of domestic fowl *(Table 5.19)*

Results presented in Table 5.19 show that, as for rabbit and hare, the head elements of domestic fowl are scarcely represented, and that the bones from the head and feet tended to occur more frequently in external contexts and with distance from room A9. The evidence again suggests that the bones in A9 and nearby are refuse from food processing and consumption.

Site distribution of mandibles *(Table 5.20)*

Mandibles and teeth of the larger mammals are relatively resistant to bone degradation, although at Chalgrove there is a tendency for some pig and sheep mandibles and maxillae to have disintegrated. To minimise the possibility of bias arising from such disintegration, the presence of certain teeth was used as a control. The presence across the site was plotted of individual mandibles, loose fourth deciduous premolars and loose third molars where these could not be assigned to mandibles from the same feature. The teeth showed very little sign of mechanical damage or leaching and mandibles of immature animals, even if disintegrated, should therefore each be represented by a single deciduous tooth and those of mature animals by the third molar. Too few mandibles were recovered to enable comparison between the buildings, but there were sufficient for the examination of frequencies of cattle, sheep and pig mandibles in external and internal contexts.

Statistical testing indicates that the distribution of mandibles is anomalous and the frequencies of

Table 5.19 Percentage of grouped skeletal elements of domestic fowl from selected context groups

	Internal				External		
	A1	A5	A9	A12	504 & 518	186	189
Phase	2–5	3–5	3–5	4–5	4	5	5
n	43	24	289	74	27	41	15
	%	%	%	%	%	%	%
Head		4					
Foot a	7	13	5	8	22	15	13
Body b	93	83	95	92	78	85	87

a: Metatarsus and phalanges.
b: Excluding ribs.

Table 5.20 Frequency by context of complete mandibles, 4th deciduous premolars or 3rd molars of other mandibles

	Cattle	Pig	Sheep
Internal			
A9	(2)	3	
A12		4	1
A1		1 (1)	
A3		1 (1)	
A4	(2)		
A5	(3)	1 (4)	
A14			(1)
F		3	1
G			(1)
H		(1)	1
W		1	
Total	0(+7)=7	14(+7)=21	3(+2)=5
External			
Phase 2	3	4	1
Phase 3	1	3	2
Phase 4	7	6	4
Phase 5	9	10	5
Phase 5 (186)b	3	2	5
Phase 5 (119)b	3	4	5
Total	26	29	22
Indeterminate	4	6	2

a: Bracketed figures include records which may represent intrusive debris during construction/demolition of buildings.
b: Contexts 186 and 119 are demolition debris layers.

mandibles in particular indicate a relative deficiency of cattle and sheep mandibles in internal deposits, as indicated in the trends of Tables 5.15 and 5.17. Although the percentage of cattle mandible fragments in Room A9 (Table 5.17) is anomalously high, few mandibles are actually represented there. As might be expected, the frequencies of mandibles in internal and external deposits vary most for cattle and sheep, and least for pig.

Some of the mandibles present in internal contexts appear derived from construction debris, or from intrusive debris following abandonment and demolition. This implies that the number of mandibles found in internal contexts, especially of cattle, were over-represented. However, some of the demolition debris from Phase 5 contexts 186 and 119 (Table 5.20) might have been derived from later activities within the buildings.

Bones from sieved samples (Tables 5.21–5.23)

Deposits were not extensively sieved, however, some useful information was obtained by the sieving of material from the moat infill (279) and from two contexts in Room A9, namely, occupation layer 639 (Phase 4) and Phase 5 floor layer 512. This enables further comparison between external and internal deposits.

Table 5.21 Fragment frequencies of bones and shells from sieved debris a

Phase	Moat infill (279) Phase 2	A9: 639 and 512 Phases 4 and 5
Cattle	2	
Sheep	2	2
Pig	2	15
Hare	1	1
Rabbit	1	1
House mouse		4
Black rat	1	
Unident. Mammal	66	438
Domestic fowl	8	33
Domestic goose	1	7
Domestic pigeon	1	9 (?10)
Quail		1 (?3)
Snipe		1
Woodcock		1?
Passerine		14
Unident. Bird	7	162
Shark or ray		1
Thornback ray		1
Herring		156
Eel		117
Salmon/trout	1	
Tench		1
Roach		1
Cyprinid sp.	2	16
Cod	1	15
Gadoid		3
Perch		1
Scad		1
Flatfish		1
Unident. fish	nc.	nc
Oyster		*c* 265 (frag.)
Mussel	15	*c* 210 (frag.)
Cockle		7
Eggshell (bird)	*c*5	36

a: Each group of results is from the sieving of between 1–2 buckets of soil (10–20 litres).

The frequencies of bone fragments in these samples is shown in Table 5.21. Bones of smaller species, small unidentifiable bones and broken marine shells were more abundant in the samples from A9, though less frequent in the demolition phase than in the earlier occupation deposit. The percentages of animal bone and shell representation by weight are shown in Table 5.22 and again, although the samples are small, the smaller animals are best represented in samples from Room A9. The weights of marine mussels indicate that this species is under-represented by routine collection because their shells are more fragile than oyster shells. The fragment size distributions of mammal bones are shown in Table 5.23. Material from the moat is relatively coarse compared to that from Room A9, although debris from demolition 512 is coarser than that from occupation deposit 639.

Table 5.22 Weight of sieved bones from internal and external contexts

	Moat 279 Phase 5	A9: 639 and 512 Phases 4 and 5
Total weight	0.181 kg	0.131 kg
% by weight	%	%
Cattle	21.8	
Sheep	6.4	0.5
Pig	5.5	6
Rabbit and hare	0.2	1.5
Rodent	+	0.2
All mammal	95.5	63.6
All bird	2.1	17.6
All fish	2.4	18.8
Index % of shell weight compared to bone weight	%	%
Oyster		38.7
Mussel	3.5	20.9
Cockle		0.8
Eggshell (bird)	+	0.5

The evidence from the sieved samples confirms that the representation of bones of smaller species and unidentifiable bones is greater in sieved deposits than in unsieved material. In the former, foetal or juvenile pig bones, herring and freshwater fish species are quite prominent. The differences observed among the sieved material confirm conclusions that material from internal deposits is finer and smaller than that from external deposits.

Articulated bones and skeletons

Skeletons

Articulated remains, and relatively complete bones, of the larger mammals were not common, probably because most were broken up by butchery, scavenging and other processes during the occupation of the site. However, five part skeletons from smaller mammals were recorded, in addition to a goose skeleton that was found in association with rodent bones (see below). The bones of the goose showed no signs of butchery, indicating that the animal was probably a domestic goose that died of natural causes. More unusual material included a pelvis and an os penis from a dog.

Semi-articulated debris and relatively complete crania are disproportionately associated with the few pits on the site, with Rooms A4 and A5, and perhaps also with Phase 5. The distribution suggests that bones deposited in pits and in these rooms were less disturbed by depositional processes or by other activities than bones from other contexts. This is partly confirmed by the presence of clusters of rodent bones and the goose skeleton among the demolition debris. In layer 726, the rodent bones were found over the crania of cattle and pig.

Table 5.23 Fragment size distribution of all mammal bones in sieved samples a

Context No	Location	Phase	0–1	1–2	2–3	3–4	4–5	5–6	6–7	10–11
279	Moat	5	13	12	9	6	3	1	1	
639	A9	4	197	129	18	6	2	1		1
512	A9	5	11	49	10	4	1			

a: Excluding new breaks.

Part skeletons

Cat: 7 newly broken vertebrae, 13 rib pieces, 3 limb bones, small-sized; ti. GL 95 mm (Ctx 561, Ph 4)
Cat: 11 limb bones with fused epiphyses except of prox. hu. Medium-sized individual: ti. GL 109, ra. GL 89, hu. Bd 16.5 mm. (Ctx 186, Ph5)
Puppy: 7 vertebral and 23 rib fragments. (Ctx 228, Ph3)
Black rat: crushed cranium, 20 vertebrae, 9 limb bones. Molars erupted but slightly worn. All epiphyses unfused except for dis. hu. (Ctx 548, Ph4 Building A1)
Black rat: Articulated hu., ra. and ul. of immature individual. (Too few bones to be noted in Table 5.2) (Ctx 512, Ph5)
Domestic goose: 76 bones of a mature or old goose. One cervical vertebra shows eburnation on the articular surface. Bone proliferation on skull, some vertebrae, dis. ul., prox. metacarpals and on posterior phalanges. (Ctx 186, grid reference 787/290, Ph5)

Crania

Cattle: unfused elements from juvenile. (Ctx 935 Ph3–5 Room A5)
Cattle: matching mandibles (Ctx 980 Ph3, Room A5)
Cattle: much of a half cranium, divided in the midline by butchery. (Ctx 726, Ph5 Room A5)
Pig: half cranium divided in the midline (Ctx 120 (grid reference 770/280), Ph4)
Pig: much of a whole cranium lacking mandibles, probably male. MWS of maxillae teeth is 35. Measurements (45) 124, (40) 30, (21), 57.5, (31 Length of M3) 31 mm (Ctx 726, Ph5 Room A5)
Sheep: (Ctx140, Ph4)
Sheep: (Ctx 124, Ph5)

Thoracic vertebrae

Pig: (Ctx 600 Ph3–5 Room A4)

Pelves

Horse: unfused portions of left and right pelves which must be from same juvenile individual (Ctx 206 and 207, Ph2 – also layer 204, Ph1)

Limb bones

Cattle: mc-phl (Ctx189, Ph5)

Pig: matching ulnae (Ctx717, Ph5 Room A5)

Sheep: Hu-ra-ul (Ctx 599 Ph5 Room A4)

Other rodent bones *(Table 5.24)*

Among the diffuse scatter of rodent bones recovered from the site, several clusters of their bones were found with other fine debris. The most prominent concentrations of bones came from a demolition layer (186, grid reference 787/290) and from a charcoal layer in Room A5 (126), both Phase 5. Retrieval of bones from these deposits was biased in favour of large rodent bones, especially the tibia of field or wood mouse (*Apodemus* sp.), and this tends to distort the counts of fragments, as does the inability to identify all skeletal elements (Table 5.24). Frog bones were common in these two deposits, as were bones of small passerines, especially in context 726. The same context also produced a humerus of a male buzzard (GL 98.1 mm). The rodent bones in demolition layer 186 were closely associated with the bones of one goose (see above).

The rodent bones are mainly complete and were from both mature and immature individuals. They do not appear to have been eaten or digested by predators unless the bones were regurgitated whole. It is possible that the bones represent detritus from owl or buzzard droppings deposited near roosts among the ruins of the buildings. It is also possible that the remains are caches of food made by larger carnivores. A third alternative is that the rodents burrowed intensively among the demolition and rubbish deposits or occupied gaps between tumbled debris. The latter two factors might also explain the presence of frog bones. The activity of predators might also account for the bones of passerines, or they may simply have roosted and died amongst the ruins.

Table 5.24 Abundance of rodent bones in two similar deposits (186 and 126)

	No of fragments	No of mandibles
Black rat	10	1
Apodemus sp.	76	11
House mouse	9	5
Field vole	46	12
Shrew	6	3
Mole	1	
Also present		
Frog (24)		
Small passerine birds (23)		
Buzzard (1)		
Other scattered bones		
Domestic goose remains (context 186)		

Rabbit

The probability that some rodent bones represent later intrusions into medieval deposits raises the question of whether other bones are also intrusive. The status of rabbit bones, therefore, may affect the interpretation regarding the role of rabbit as part of the diet of the inhabitants.

Rabbit-sized burrows were not observed during the excavation and no whole skeletons were found to indicate that rabbits had died in their burrows, as did at least some of the rodents. Rabbit bones were not conspicuously associated with the rodent bones and their occurrence did not indicate any successive occupation of previously dug animal burrows or other holes. The distribution of rabbit bones is consistent with the distribution of small, fragmented rubbish and with anomalies in the presence and absence of skeletal elements. It indicates that the bones were from butchered carcasses and are therefore contemporary with the other medieval bones.

Minimum Number of Individuals (MNI)
(Table 5.25)

The minimum number of individuals was estimated from age estimate records of Mandible Wear Stages (MWS, see below) and other data of mandible and loose teeth presence following, in principle, the comparative method of Chaplin (1971, 69–75). This method did not entail re-examination of the mandibles themselves as a separate group, except where information was incomplete for the minor species. The method was not applied to unstratified remains.

The results, with percentages of species in the total, are presented in Table 5.25. The most obvious source of bias is the absence of any mandibles of fallow and roe deer. Compared with the percentages of bone fragments in Phase 5 (Table 5.6), cattle are underestimated by MNI (35% against 27%) while the less common species, except fallow and rabbit, are

Table 5.25 Minimum number of individuals (MNI) estimated from mandible data and loose teeth (Phases 1–5)

	MNI	%	Fragments/Individual
Cattle	19	27.1	33.5
Sheep	16	22.9	19.6
Pig	27	38.6	18.5
Horse	2	2.9	10.5
Dog	3	4.3	5
Cat	2	2.9	3.5
Rabbit	1	1.4	c34
Total	70	100.1	

Red, roe and fallow deer, hare and stoat are all represented by skeletal elements other than mandibles. Rabbits and hare almost certainly under represented by MNI. Rodent bones are not considered here (see Table 5.24).

better represented by MNI. Percentages of pig and sheep are very similar.

Age information from mandibles and comparison with other sites (Figs 5.1–3)

Eruption and wear stages of the mandible teeth of cattle, sheep and pig were recorded. The Mandible Wear Stages (MWS) were calculated following the method of Grant (1982), with the exception that MWS were not estimated for broken mandibles where there is a degree of uncertainty of more than two places of the most probable MWS. The frequencies of age-staged mandibles are given in Figures 5.1–5.3.

Ageing of sheep *(Fig. 5.1)*

The data indicates that nearly all of the sheep were killed after MWS 30, by which stage the third molar was in wear. Many of these sheep would have matured skeletally. Their mandibles range between Stages E to I of Payne's scheme (1973). The sample of mandibles is small (15) but their age-stage distribution is probably typical of the kill-off pattern of the site. Twenty-four third molars between stages E–I and eighteen between F–I were recorded, compared to two p4 of a lamb and a hogget. A small sample with a similar distribution of old mandibles is recorded for 12th-century Middleton Stoney, Oxfordshire, and of somewhat younger mandibles, for sizeable groups from the 12th- to 16th-century site of the Hamel, Oxford, and a 16th- to 19th-century group from Church Street and other sites in Oxford (Rahtz and Rowley 1984; Wilson and Bramwell 1980; Wilson and Locker 1989).

Although the sample sizes are not entirely satisfactory, most of these medieval distributions differ statistically (Siegal 1956: Kolmogorov-Smirnov test, Ho p-.0.5) from those from the Iron Age and Romano-British periods at other local sites such as Ashville, Barton Court Farm, Abingdon, and Mount Farm (Wilson *et al*. 1978; Wilson 1986; Wilson 1995). In these earlier samples many sheep were killed at much younger ages than during the medieval period. This difference with the earlier sites is true for both rural and urban medieval sites, suggesting that the medieval pattern may be best explained by the keeping of older sheep for wool and less by marketing strategies for meat. However, a greater abundance of relatively immature sheep were marketed from farms to towns (Wilson 1994).

Ageing of cattle *(Fig. 5.2)*

Figure 5.2 shows the distributions of age data of cattle for Chalgrove compared to unpublished evidence from medieval and post-medieval sites in Oxford. Over half of the cattle at Chalgrove were slaughtered at late age stages, when the third molar was well worn. However, approximately one quarter died, or were slaughtered, as calves before or as the first molar began to erupt (TWS V–E).

The presence of a high proportion of calf mandibles is characteristic of post-medieval urban deposits (Fig. 5.2), although it is probable that this urban pattern results from the domestic consumption of calf heads and the dumping of the crania of older cattle in uncommon but dense concentrations associated with tanneries, fellmongers or other industrial concerns. Nevertheless, the presence of the calf mandibles in post-medieval deposits and at Chalgrove,

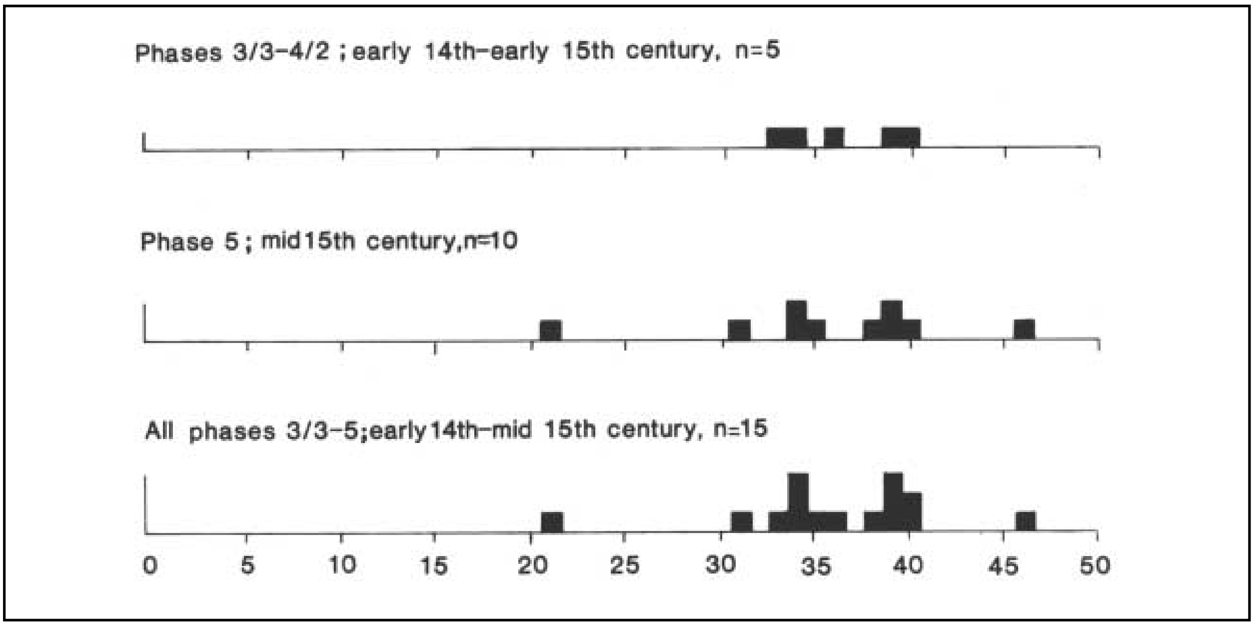

Figure 5.1 Mandible Wear Stages of sheep.

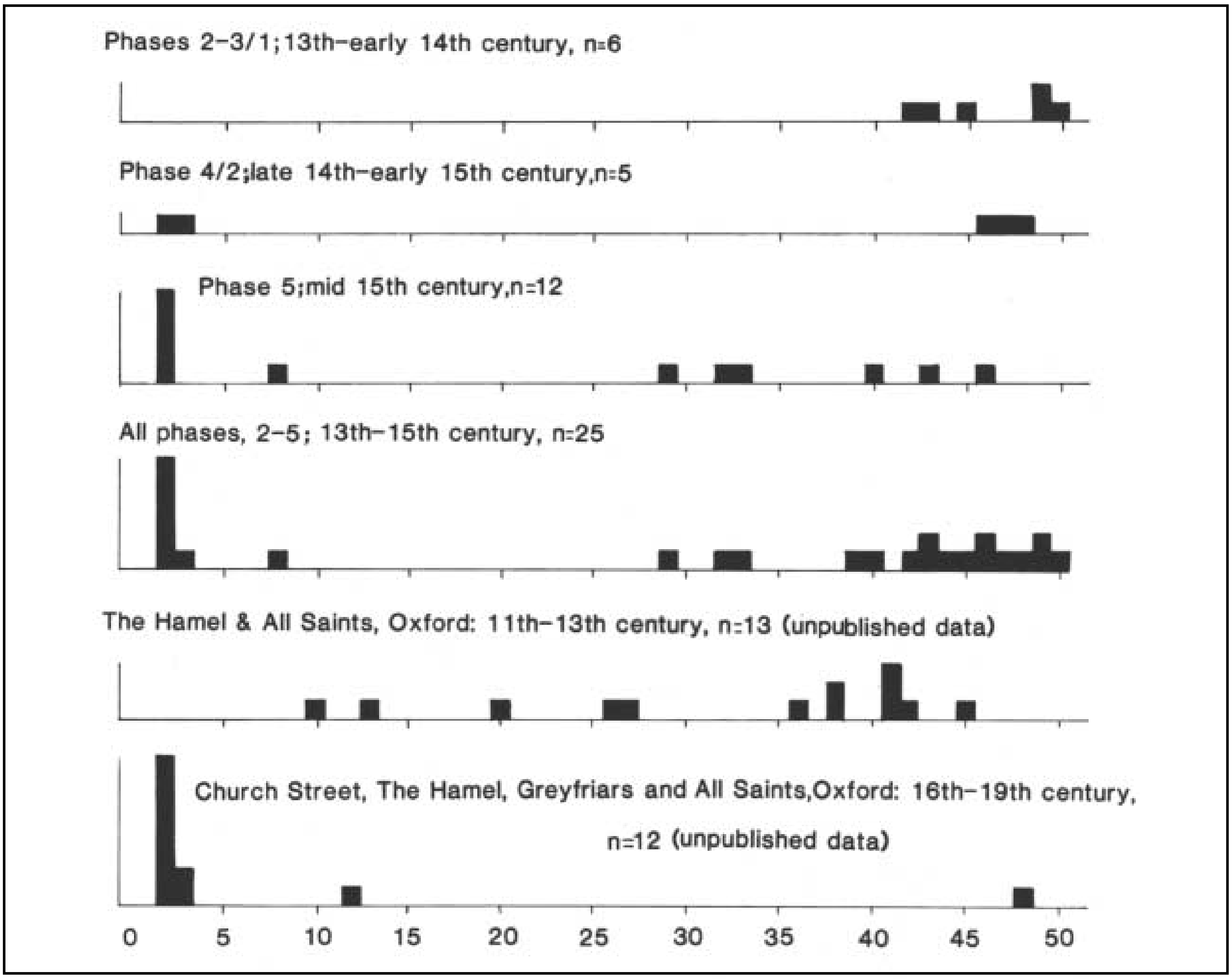

Figure 5.2 Mandible Wear Stages of cattle.

particularly in the destruction and later deposits, suggests that there is some similarity and continuity of farm husbandry between these groups which differs in some degree from that during the earlier medieval period when calf remains are less apparent. Further evidence of this trend is seen among medieval mandibles from Church Street, Oxford (Wilson and Locker 1989). The presence of calf mandibles is indicative of a milking economy, stimulated by the birth of calves, males of which were frequently killed young. This type of husbandry may, therefore, have had greater emphasis during the late medieval and post-medieval periods.

Mandibles of the oldest cattle (MWS 39–50) probably represent oxen and dairy cows. These animals tend to predominate at the earlier medieval period. Three intermediate aged mandibles (MWS 28–33) were probably of immature castrates. In the medieval group of mandibles from urban Oxford, immature cattle (MWS 10–30) are more evident than at Chalgrove. This observation is supported by the data from medieval Church Street (Wilson and Locker 1989). The presence of these immature cattle indicates steers, unwanted bulls or sterile cows which were sent from farms to market and butchers in Oxford. Such marketing could explain the few immature cattle (excepting calves) being butchered at Chalgrove. Another possible explanation is that economic or environmental pressure severely constricted animal husbandry and farm prosperity at Chalgrove.

Sample sizes of cattle mandibles from other sites in the region are usually too small to test against the modest Chalgrove sample. Although the Romano-British sample (64) from 3rd- to 4th-century AD Barton Court Farm, Abingdon, is not statistically different to that of Chalgrove, those from Iron Age sites certainly have a greater proportion of younger animals present overall. On the earlier sites, particularly Barton Court Farm, a greater proportion of calves were kept to greater ages but short of maturation before being slaughtered, presumably with the relatively successful aim of maximal meat production (Wilson 1986). This deduction may imply that both the economy and husbandry of medieval sites was much more constricted than on earlier ones.

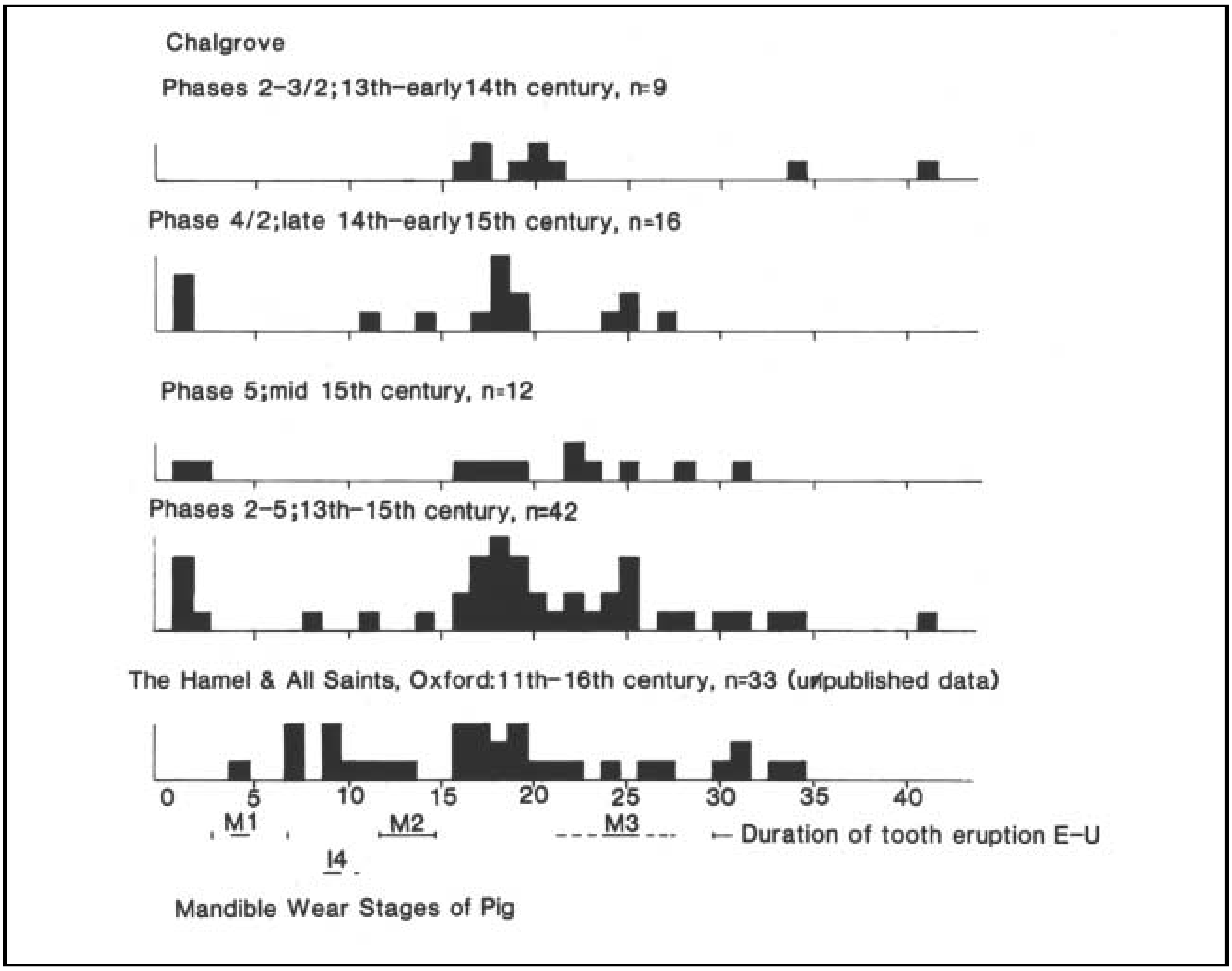

Figure 5.3 Mandible Wear Stages of pig.

Ageing of pig (*Fig. 5.3*)

Figure 5.3 compares data from pig mandibles at Chalgrove with unpublished data from medieval Oxford. The two kill-off patterns are similar and a significant difference in the results is unlikely. These patterns also resemble those of local Iron Age and Romano-British sites. There is little evidence of marketing patterns.

Age information on domestic birds (*Table 5.26*)

The frequencies and percentages of immature and fully ossified bones of domestic birds are presented in Table 5.26. Domestic goose and duck were mainly eaten as old birds and, to a lesser extent, this is also true of domestic fowl. Domestic pigeon, however, were eaten immature as squabs, presumably from a dovecote.

Table 5.26 Frequency and percentage of immature and ossified bones of domestic bird species

Phase	1–3 Imm	Oss	% of adults	4–5 Imm	Oss	% of adults
Fowl	60	92	61	196	452	70
Goose	5	65	93	15	277	95
Duck/mallard		7	100	4	24	86
Pigeon	1	42	2	106	1	1

Bone measurements: size and sex (Tables 5.27–31)

A selection of the more common skeletal elements were measured and the results are summarised in Tables 5.27–31 which also include some information on other regional sites. Although nearly all of the measurements are specified with reference to the work of von den Driesch (1976), they correspond closely to those taken on other regional sites. General evidence of size differences between urban and rural sites, and the observation of size decreases in animals during the early medieval period, suggests environmental causes such as the general deprivation of human and animal populations in or near towns, as opposed to rural populations, reflecting also differences in social status.

Table 5.27 Selected measurements of sheep bones (mm)

	n	r	x̄	s
Width of distal humerus (Bd)				
CHHF	13	28–33	29.54	1.71
OX12–15 (a)+A29	37	25–31	29.16	1.42
Width of distal tibia (Bd)				
CHHF	27	22–26	23.33	2.4
OX12–15	33	22–27	24.3	1.29
Width of distal metacarpal (Bd)				
CHHF	6	21–26	23.67	(1.86)
OX12–15	31	21–26	24.09	1.39
Length of metacarpal (GL)				
CHHF	4	104–130	114.5	
Ox12–15	8	107–126	115.9	
Width of distal metatarsal (Bd)				
CHHF	4	21–23	22	
OX12–15	28	21–24	22.46	0.95
Length of metatarsal (GL)				
CHHF	5	117–124	121.4	(2.88)
OX12–15	3	114–132	124.3	
Width of distal radius (Bd)				
CHHF	6	24.29	26.5	(1.64)
OX12–15	11	24.29	25.86	1.22
Length of radius (GL)				
CHHF	4	129–146	137.3	
OX12–15	2	128–143	135.5	

a: Data from the Hamel (OXH) and All Saints (OXS) Oxford (Wilson 1980). Period refers to 12–15th centuries.

Sheep *(Table 5.27)*

Ranges, means and standard deviations indicate a general similarity in the size of sheep bones to those found in medieval Oxford (Table 5.27). They are smaller than Romano-British and Saxon sheep bones. In the Chalgrove group, the raw data from the more abundant elements, such as distal tibia, do not show polymodal peaks indicative of sexual differences in bone size. Any potential bimodal trend may have been obscured by the effects of castration on males, or possibly by their early slaughtering, although there is little evidence of the latter.

Two medium-sized horn cores, with outer circumference lengths of 75 and 90 mm, were found in addition to a large, robust, curved and broken horn, probably from a ram or wether, which measured 123 mm long and 122 mm around the base. No polled crania were noted although they might have been present in a larger sample overall.

Cattle *(Figs 5.4–5.5; Table 5.28)*

The bones of the Chalgrove cattle are larger, particularly in their distal widths, than those from medieval Oxford (Table 5.28), and some approach the size of large Romano-British stock. Sexual dimorphism is more evident among cattle bones, however, and the comparison of data between sites may be biased therefore by quite different proportions of larger and smaller sexes and as a result of differences in animal husbandry. Few complete bones survived to measure at Chalgrove but some interesting points emerge.

Figures 5.4–5.5 are scattergrams of data from metapodials at Chalgrove against a background plot of data from medieval Oxford. The bones of calves, or the recently fused bones of immature cattle, are not represented. Clustering of data appears to be restricted to the denser scatter of measurements of relatively small bones which, in Iron Age and Romano-British samples, appear to represent cows. The diffuse spread of data from larger bones probably derives from steers, oxen or bulls. This interpretation is supported by the presence of larger

Table 5.28 Selected measurements of cattle bones (mm)

	n	r	x̄	s
Width of distal humerus (Bd)				
CHHF	2	76–92	84	
Width of distal tibia (Bd)				
CHHF	6	51–63	57.5	(5.61)
OX11–16	13	55–66	56.15	4.62
Width of distal metacarpal (Bd)				
CHHF	8	56–63	60.63	(2.18)
Ox12–16	12	44–67	53.33	6.27
Length of metacarpal (GL)				
CHHF	1	184		
OX 12–16	1	205		
Width of distal metatarsal (Bd)				
CHHF	13	48–58	53.07	3.94
OX12–16 (a)	19	42–62	49.3	4.95
Length of metetarsal (GL)				
CHHF	4	192–220	205.5	
OX12–16	2	204–209	206.5	
Length of radius (GL)				
CHHF	6	57–67	62	(4.20)
OXH12–16	11	56–62	58.6	2.06

a: Previously unpublished data from the Hamel, Oxford.

Table 5.29 Selected measurements of pig bones (mm)

	n	r	x̄	s
Width of distal humerus (Bd)				
CHHF	3	36–44	40.7	
OXA 12 (a)	15	33–49	37.8	4.11
Length of astragalus				
CHHF	6	38–48	43.3	(3.78)
OXH 12–16	8	35–40	39.6	(2.50)
Length of 3rd metacarpal (GL)				
CHHF	4	73–80	75.3	(3.20)
OXA 11–15 (a)	5	64–89	75.8	(11.10)
Length of 4th metatarsal (GL)				
CHHF	2	98–101e	99.5	
OXA 11-14 (a)	8	75–92	84.9	(6.03)

a: Previously unpublished data from medieval Church Street, Oxford.

Table 5.30 Selected measurements of bones: Fallow, rabbit, cat, stoat and black rat (mm)

	n	r	x̄	s
Fallow				
Astralagus GLl	2	36–38	37	
tibia dw	1	32		
Rabbit (GL)				
humerus	6	58–65	61.5	(2.26)
femur	4	79–85	81.3	
tibia	1	89		
Cat a				
Humerus Bd	2	16–17	16.5	
Stoat				
tibia GL	1	37		
Black rat (GL)				
humerus	2	25–26	25.5	
femur	2	31–33	32	

a: See also measurements of cat skeletons.

bones showing deformations (see below), indicating the presence of draught oxen which are normally expected to be castrated males.

The evidence suggests that at least some, and possibly most, of the largest cattle at Chalgrove were draught oxen and castrates. Examination of fragmentary pelves indicated that three were of castrates or possibly bulls and one other was female. The metapodial samples are small but indicate that castrates and intact males outnumbered females. It is possible that some of the small cattle represented in the urban Oxford group are not cows, but steers or bulls which were given less favourable feeding and shelter than oxen and consequently their growth was stunted. However, it is suspected that these small Oxford animals were mainly cows, which suffered poorer environmental conditions than cattle at Chalgrove.

Table 5.31 Selected measurements of bird bones (mm)

	n	r	x̄	s
Domestic fowl (GL)				
humerus	22	61–88	71	5.54
femur	11	67–90	78.5	6.47
tibiotarsus	8	85–117	102.8	(10.85)
metatarsus	9	62–85	76.8	(8.53)
Domestic goose (GL)				
femur	5	80–86	82.6	(3.13)
metacarpus	4	90–103	96.3	
metatarsus	1	93		
tibiotarsus	1	102		
radius	1	148		
Mallard/domestic duck (GL)				
metacarpus	3	59	59	
metatarsus	2	47–50	48.5	
Domestic pigeon (GL)				
femur	1	44	44	

Pig, rabbit and cat *(Tables 5.29–5.30)*

As with cattle, and compared to sites in medieval Oxford (Table 5.29), pig bones tend to be larger at Chalgrove, with two very long metatarsals, one unfused, in evidence in Phase 5. The measurements for other domesticated species, when compared with unpublished data from Oxford (Table 5.30), suggest that they were slightly larger in size at Chalgrove. For medieval urban samples, a decline in the size of bones of cat, and other extant species, is evident following the late Saxon period.

Bird bones *(Figs 5.6–5.7; Tables 5.31–5.33)*

The results for selected measurements of bird bones are presented in Table 5.31 and in Figure 5.6 which gives additional information on sex. Figure 5.7 compares metatarsal measurements of bones from Chalgrove with some of known sex from black leghorn cross bantams. Contrary to West (1982), the metatarsi which show spur scars are considered to be of males that were killed before the spur had become fully ossified and fused to the shaft. The largest bones, therefore, appear to be from males as cocks or capons. Slightly fuller evidence of sex from complete and incomplete bones is presented in Tables 5.32–5.33 which indicate a predominance of males in the samples and possibly during the later phases (information from Enid Allison).

Pathology

Several bird and mammal bones showed slight abnormalities of little pathological significance. These mainly consisted of slight outgrowths of bone and worn bones and teeth. One sheep, probably castrate, horncore had slight depressions in the surface which are possibly indicative of nutritional deficiencies during life. Most of the abnormalities are related to minor injuries or to long term mechanical stress on the bones of old or working animals. Some pathology, particularly of the mouth, was more evident than among sheep bones at Church Street, Oxford (Wilson and Locker 1989).

Butchery

No systematic study was made of the butchery marks on bones but some observations were made. One dog pelvis (from a Phase 4 context in the vicinity of Building A12) showed an oblique chop through the ilium and other parallel cuts which indicate that either dog meat was eaten or that dog carcasses were cut up and boiled or rendered for other purposes, such as for fat. Cutting marks were observed on the ulna of a black rat (535, a Phase 4 occupation layer of Building A12). This suggested at least the skinning, and possibly the cooking, of this animal. Many small fragments of bird bones, possibly of goose, were found in clusters, for instance Phase 3 context 1009,

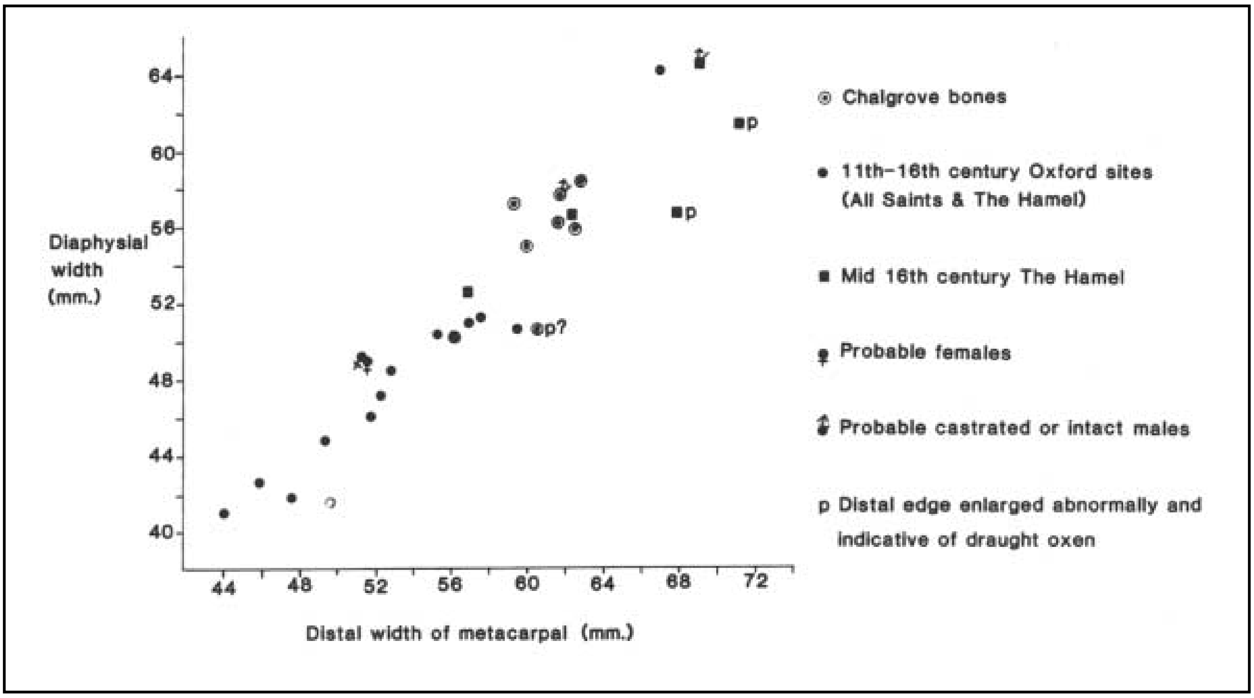

Figure 5.4 Scatter diagram of measurements of cattle metacarpals.

and it is possible that some of these bones were deliberately broken and boiled for fat. Alternatively, they may have been crushed by trampling. Butchery marks were also noted on fowl metatarsi, suggesting that the aim of cutting was to remove the feet from the rest of the carcass.

Discussion

Abundance of species

Pig was the most abundant mammal represented in terms of MNI estimates, although many did not live

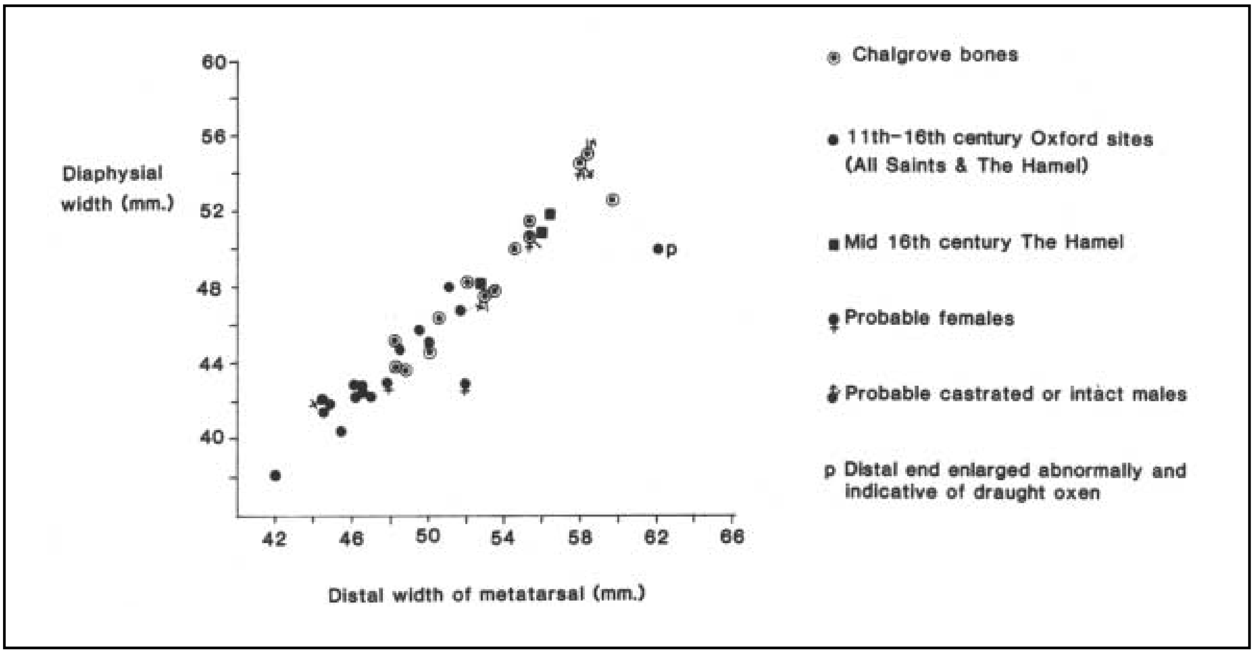

Figure 5.5 Scatter diagram of measurements of cattle metatarsals.

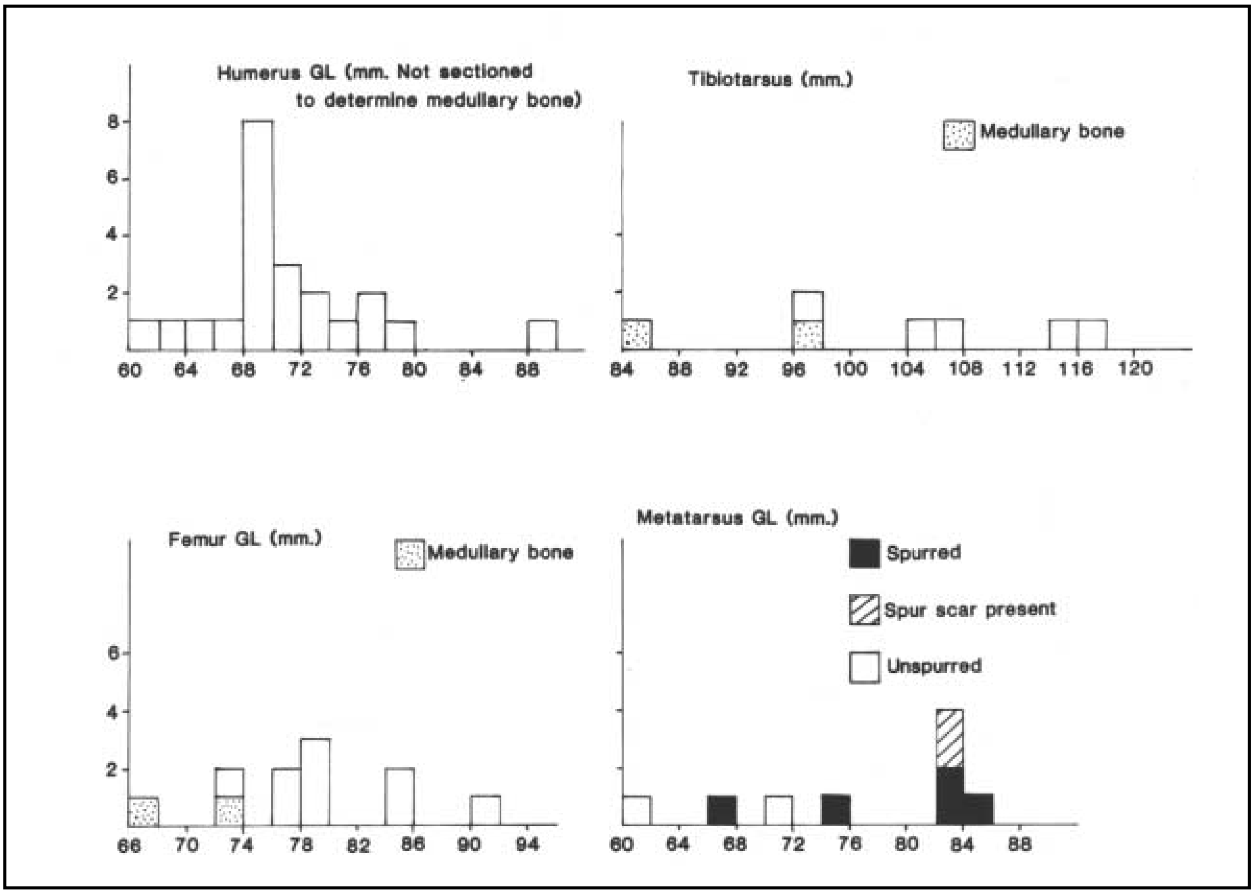

Figure 5.6 Measurements of domestic fowl bones and evidence of the sex of birds.

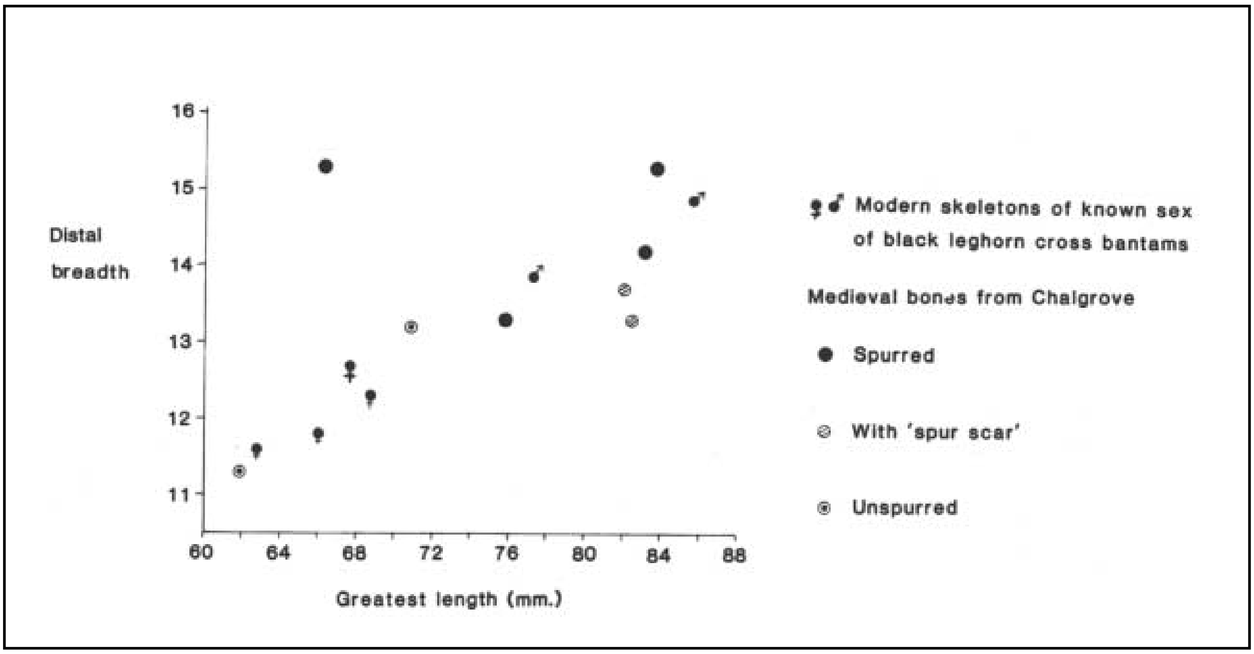

Figure 5.7 Comparison of measurements of Chalgrove metatarsi with those of modern Black Leghorn Cross bantams of known sex.

Table 5.32 Presence of medullary bone in domestic fowl

Phase	Femur Present	Absent	% present	Tibiotarsus Present	Absent	% present
P1–3	2	4	33	3	9	25
P4–5	3	25	11	5	50	9

long. Cattle were the second most abundant mammal species but they may be under-represented if dumps of bone extended much beyond the excavated area. Unusually, sheep were less common than cattle or pig. Individuals were relatively small and were generally slaughtered as mature or old individuals. Wether and ewe sheep appeared equally abundant, if pelves of sheep sent from manors to market are a good guide (Wilson and Locker 1989).

Small and large dogs were present. The cat bones indicate small to medium-sized animals. Domestic fowl of bantam size, geese and ducks were abundant and tended to be killed off as mature or old birds. Domestic pigeons were killed immature.

Diet

Although relatively more pork was eaten at Chalgrove than was usual at medieval sites, especially urban ones, the amount of beef consumed would still be much greater than pork. Less mutton was consumed than usual, while the consumption of venison, rabbit and domestic birds, including pigeon squabs, is better attested here than at many sites. Marine and freshwater fish, wild fowl and fowl eggs were also eaten. Marine shellfish were commonly eaten, especially oyster, but also mussel, whelk and cockle.

Fragments of edible crab are of interest, as is a butchered pelvis of dog, though fat extraction may have been the intention of the butchery. No butchery marks were seen on horse or cat bones. At times food may have been in short supply, either for the servants or for the entire household. The quantity of meat consumed relative to dairy products and to the arable harvest is difficult to determine, but a consideration of animal husbandry (see below) suggests that both cereal and dairy produce were important.

The diversity of species that were eaten is not unusual for the medieval period but implies an increased level of exploitation of animal resources compared with previous periods. The greater consumption of pork, ham or bacon, venison and rabbit and the diversity of birds and fish imply a diet of high quality compared to most urban households in Oxford, or at least a greater degree of access to less common food sources.

Table 5.33 Evidence of spurred metatarsal a of domestic fowl

Phase	Spurred	With scar	Unspurred	% male
P1–3	2	2		100
P4–5	6	3	5	62

a: Fully ossified bones only.

Animal husbandry and use

Management of cattle was the most important element of animal husbandry at the site. Although their meat yield was the largest of all the animal species, cattle were more important for other purposes. There is limited evidence of steers or bulls being raised and killed at optimal ages for meat production, although some such individuals may have been sent to market. Keeping cattle until they were mature or old indicates that husbandry was directed toward the maintenance of the herd for dairy production and the keeping of draught oxen. It appears that draught oxen were more abundant than cows and also horses (see below). The economy appears, therefore, to have centred on arable farming rather than pastoralism. However, the abundance of calves slaughtered during the final phase may indicate some change away from arable production to a greater emphasis on dairying.

Ewes and wethers appeared to be present in approximately equal numbers, and were kept until maturity or old age. This suggests that sheep were mainly kept for wool production. Occasionally lambs were slaughtered but the kill-off is not comparable to that of young calves, and dairying of sheep would appear insignificant beside the productivity of cows. The kill-off patterns also indicate that some younger sheep were marketed.

Certainly the rearing of pigs for meat was more important than at other sites, though the kill-off pattern indicates that less pork, ham or bacon was eaten than the abundance of bones might at first suggest. Pigs may well have been kept at the manor, although no pigsties have been identified. The abundance of pig need not necessarily imply that they were kept in woodland, since rough wet land would suit their feeding. The presence of fallow deer suggests the exploitation of some woodland terrain.

Horse comprises a low percentage of the identified bones, indicating that it figured less prominently as a beast of burden and transport at medieval Chalgrove than elsewhere, for example at the Romano-British villa at Barton Court Farm, Abingdon, which yielded a several fold higher percentage of horse (Wilson 1986 fiche).

The rabbit bones are thought to represent primary rather than intrusive deposition, and the rabbits were probably obtained from locally kept warrens. A comparable find is of 52 well-stratified bones recovered from a 12th-century garderobe at Middleton Stoney, Oxfordshire (Levitan 1984, 108–24). The historical consensus is that rabbits were commonly associated with the post-conquest houses and estates of the nobility (Lever 1977, 62–75).

Modestly abundant remains of fallow deer and the scarcity of red and roe deer suggest that most venison was obtained from emparked herds of fallow deer, and that red and roe deer were rarely kept in any local parks. Deer may occasionally have strayed over greater distances. In order to keep and hunt deer, or to receive venison, substantial connections with royalty were required (see Blair above; Bond 1984, 125–27). In general, both red and roe deer bones become very scarce in urban Oxford deposits after the 12th and 13th centuries, while bones of fallow persist in low numbers (Wilson 1980, 198, F08–F11; Wilson *et al*. 1983, 68–69; Wilson 1984, 1989). Red deer did survive in some abundance up to around the 12th century in the vicinity of Ascot D'Oilly near Wychwood and at Middleton Stoney, both in Oxfordshire. Documentary evidence indicates that emparkment protected and conserved this species at Wychwood, Woodstock and, to a lesser extent because it had to be restocked, at Middleton Stoney (Bond 1984, 125–27; Levitan 1984, 108–24; Jope 1959, 269–70). Hare was also almost certainly hunted for sport and food.

Domestic fowl, geese, pigeon and duck were probably common farmyard animals. Although hens appear less common than cockerels or capons among the dietary refuse, eggshell indicates the importance of egglaying by hens. The presence of a dovecote is probable since nearly all of the pigeons or doves were eaten as squabs. The latter would most conveniently be taken from the pigeonholes.

Freshwater fish like roach, chub, perch and tench were fished, presumably from the moat, stream and local fishponds, but probably most of the fish eaten were imported as marine or migratory species.

Change of husbandry and economy

The arable economy of the site appears to have undergone some modification towards a greater emphasis on the dairying of cattle. Pig was partially replaced by sheep, which is a trend evident in urban Oxford from an earlier period (Wilson 1980, 198, F08-F11; Wilson *et al*. 1983, 68–9, Wilson 1984). This change reflects an increased interest in wool production. The general trend towards a deterioration in the level of subsistence identified for the medieval period does not seem to be in evidence at Chalgrove (Robinson and Wilson 1987, 68–70).

Site and environment

The abundance of pig and deer indicates a greater degree of exploitation of woodland or scrub than is usual for sites in the Thames Valley, although a variety of cultural factors may, of course, determine species presence and abundance. Some of this woodland probably took the form of deer parks, and was perhaps much altered by management. Woodland species are not abundantly represented among the bird bones so these parks may not have been large and could have been some distance away from the site. The extent of any 'woodland' associated with pig keeping may have been reduced by its conversion to pasture when sheep replaced pigs in the later medieval period.

Wet or dampland grazing appears to have been prominent, to judge from the abundance of cattle, pig and the wetland birds, and this may help to explain why sheep played a smaller part in the economy. A similar pattern of medieval environment and land use is evident further north at Sadlers Wood, Lewknor, and Tetsworth (Marples 1973, 161; Pernetta 1973, 112–14) and seems to have been related there to the presence of heavier ground. Such environmental factors probably influenced the type of husbandry practised when such marginal sites were first occupied. However, the changing relative frequencies of sheep and pig, noted above, indicate that social and economic factors influenced land use and animal husbandry, so that environmental factors did not wholly prevail.

In general, the indications from evidence of animal bone size, diet, and social and environmental conditions are somewhat more favourable for Chalgrove than for urban Oxford and elsewhere during the medieval period.

Besides being a pest and carrier of disease, the black rat seems to have had the further ecological effect of virtually excluding water vole from the vicinity of this low-lying site. Water vole is relatively common on rural sites of earlier periods. As the buildings on the site were abandoned or demolished, field voles and field mice appear associated with the reversion of the settlement to a field. House mouse occurred less commonly and most probably dispersed to other human habitation. Bones of small passerines, barn owl, buzzard and jackdaw also occurred in the last deposits and such birds may have roosted or nested in the abandoned and possibly overgrown buildings before their final demolition.

Trade and marketing

The best evidence for trade is provided by the marine fish, shellfish and crab imported deep into the centre of England. They may have been the only meat purchased since other exotic items, such as venison, might have been brought in by other forms of exchange, for example as gifts.

Some live animals or animal products were probably exported, but this is difficult to demonstrate. Immature animals might have been sent to other manor farms, or sold to butchers along with older animals. There is some evidence that more immature cattle and sheep were slaughtered at medieval urban sites in Oxford than at Chalgrove, and this indicates a regional trend of selling younger animals to towns. However, the emphasis of the manor animal economy seems to have been on the production of arable and secondary animal products, and the export of surplus animals was probably limited. The small size of flocks and herds would also tend to limit the surplus of dairy products, wool and other items, though the emphasis on arable farming would have provided the manor with a substantial income. The relative increase in the abundance of sheep suggests that wool increased in value and implies the production of a larger wool clip in the later period.

A virtual absence of cattle horn cores indicates that these were set aside, probably with the skins, and were sold for leather and horn working. An absence of antlers indicates similarly that such material was not worked here. Some or most of this material would be sold to craftsmen in towns like Oxford where antler fragments are found. However, the owners, keepers, or other people associated with the deer herds who benefited from the sale of antler may not have lived at the manor.

Status and prosperity

The relative abundance of pig and deer bones is related not only to a varied meat diet and some prosperity in marketing farm produce, but also to the relative abundance of these species at regional sites of high social status (Levitan 1984, 108–24; Jope 1959, footnote 11; Pavry and Knocker 1960, 177–78). This is despite the general impression that the medieval period is not a prosperous one for English society as a whole (Robinson and Wilson 1987, 68–70).

The economy of the manor in a historical context

The manor is the first site in the region to be excavated which has its acreage of landuse documented. In 1279 the manor is recorded as having 311 ¾ acres of arable land, 30 acres of meadow and 30 acres of pasture (see Blair above).

The 30 acres of grass pasture allowed at around 1–3 acres per cattlebeast indicates that the farm livestock included 10–30 cattle. The pasture would cover their feeding for much of the year and the meadow would provide summer grazing and winter hay. However, the higher estimate of cattle needs to be reduced to allow for the grazing of other species, namely horse and sheep. The acreage of arable land indicates that at least two plough teams of up to eight animals would be required. Thus around half to all of the cattle present would have been draught oxen, chiefly as castrates. The remainder of the herd would mainly have been cows for dairying, breeding and completing the plough teams if necessary.

The numbers of cattle required to support an arable farm economy and the limited acreage of pasture available would restrict the numbers of sheep and pigs which could be kept, even with the availability of additional browsing. Grass and hay requirements for the ruminants would largely preclude pigs from using and damaging these resources, and suggest that they were kept in sties and/or on woodland or rough pasture elsewhere.

Evidence from the wild bird bones suggests that they were hunted in a wide landscape and that the environment was open and not much wooded. Damp or wetland birds predominate, though they may be over-represented in comparison with those of the relatively uniform and sparse arable habitat. While wetland indications are appreciable, the acreage of arable land shows that any wetness or heaviness of ground was not sufficient to preclude an emphasis on cereal cropping.

The nearby manor of Cuxham is a well documented parallel for the 13th and 14th centuries (Harvey 1965, 17–19, 57, 96). There was a larger acreage of arable land at Cuxham than at Chalgrove. A quarter of the estate consisted of pasture or meadow and this was greater than the one sixth at Chalgrove, yet extra hay was purchased, oats were fed to the horses and cattle, and livestock was also taken elsewhere to stubble feed or pannage. The arable economy predominated at Cuxham, producing five to eight times as much income from corn as from sales of livestock and animal products such as wool, cheese and hides. The activities of the villagers and their livestock were incorporated into it, as well as those of the manor household.

The manor at Cuxham employed two to three plough teams which sometimes included horses and even a bull, as well as oxen. One to four other horses were used as cart animals. Most oxen and horses were bought elsewhere. Cows retained were usually fully grown and less numerous than oxen, and calves were often sold in their first year. Sheep numbers fluctuated greatly from none to around 150. They were used to produce cheese and wool, but sometimes the entire flock appears to have been sold when it is absent from the manor records. At least once it suffered badly from murrain. A variety of economic and environmental factors seem, therefore, to have determined the presence of sheep. Some pigs were always present, mainly as porkers bred from a few sows and sold between one and three years of age. Domestic fowl, geese, ducks, and pigeons were kept and there was a dovecote which provided many squabs. Fish such as roach and bream were used to stock the 'vivorium'.

Such documentation yields many enlightening details and provides a more reliable socio-economic context for discussion of the faunal remains. Economic factors appear to have been more important than environmental ones in the management of the manors, although this emphasis depends on the level at which the organisation of medieval society is examined.

We may conclude that the orientation of animal husbandry at Chalgrove, especially that of cattle, was directed towards cereal production. Pasture left over from this process was used largely for producing secondary products from cattle, sheep and domestic birds and this livestock was sold or slaughtered after their usefulness was diminished. Only the rearing of pigs, pigeon squabs and perhaps rabbits was undertaken primarily for meat production, and much of this was probably destined for home consumption.

These factors, the fecundity of pigs and their killing at early age stages, should explain the high percentages of their bones at the manor. It is ironic that the abundance of pig at the site must be interpreted within the context of an arable economy, rather than as evidence primarily for the exploitation of woodland or wetland resources, though the latter were used where possible. More flexible explanatory principles are required in the interpretation of bones where history stays silent.

ENVIRONMENTAL EVIDENCE
by Mark Robinson

Sampling for preserved environmental remains was limited in scope, concentrating on the examination of the fill of the large moat for plant and molluscan remains. Other significant conclusions are drawn from analysis of charcoal deposits from the final period of the manor's occupation.

Invertebrate and seed remains from the moat
(Tables 5.34–5.37)

The preservation of organic remains in the moat was poor and was only recorded in a sample from the very bottom of the moat (moat infill 279). The sample, which consisted of grey, and somewhat organic, sandy silt with some gravel, charcoal fragments, *Mytelus* (mussel) shell fragments and pieces of rotten wood, was sieved to 0.2 mm and sorted under a binocular microscope.

Insect preservation was poor but included an example of *Xestobium rufovillosum*, the death watch beetle. Seeds from 31 species of plants and trees were identified, among which were walnuts, plums and grapes. Fifteen species of land and freshwater mollusca were present. The results are shown in Tables 5.34–5.37, with the exception of the insect remains.

Interpretation

The non-marine mollusca (5.37) are mostly aquatic species which presumably lived in the waters of the moat, along with a few terrestrial species which probably fell into the deposit. The aquatic species *Bithynia* spp and *Valvata piscinalis* are species of streams, rivers and lakes which require relatively clean, oxygenated water (Boycott 1936, 139–41). Their presence suggests that the moats, which were not very wide or deep, were fed from a diverted stream. Table 5.34 includes seeds of aquatic species but none of them are from substantial plants, *Lemna* spp. (duckweed) being the most abundant. It is possible that the moats were kept weeded of the large emergent species which would otherwise have choked them.

The other seeds are from plants from a range of terrestrial habitats. Some scrub or trees seem to have

Table 5.34 Quantification of seeds by species

Species	Common name	No
Brassiceae gen. et sp. indet.		3
Agrostemma githago L.	Corn cockle	1
Stellaria media gp.	Chickweed	2
Chenopodiaceae gen. et sp. indet.		1
Vitis vinifera L.	Grape vine	1
Filipendula ulmaria (L.) Maxim.	Meadow-sweet	1
Rubus fruticosus agg.	Blackberry	4
Prunus domestica L.	Plum	1
Anthriscus sylvestris (L.) Hoffin	Cow parsley	2
Polygonum aviculare agg.	Knotgrass	1
Rumex sp.	Dock	3
Urtica urens L.	Small nettle	1
U. dioica L.	Stinging nettle	132
Juglans regia L.	Walnut	1
Corylus avellana L.	Hazel	1
Fraxinus excelsior L.	Ash	2
Solanum cf. dulcamara L.	Woody nightshade	1
Lycopus europaeus L.	Gypsy-wort	9
Stachys sp.	Woundwort	1
Labiatae gen. et sp. indet.		1
Sambucus nigra L.	Elder	10
Anthemis cotula L.	Stinking mayweed	7
Arctium sp.	Burdock	2
Carduus or *Cirsium* sp.	Thistle	2
Sonchus oleraceus L	Sow-thistle	6
S. asper (L.) Hill	Sow-thistle	1
Alisma sp.	Water-plantain	1
Zannichellia palustris L.		1
Juncus sp.	Rush	10
Lemna sp.	Duckweed	23
Carex sp.	Sedge	1
Total		233

Table 5.35 Other plant remains

Other plant remains
Bud scales
Deciduous tree leaf fragments
Leaf abscission pads
Rosa (rose) prickle
Salix (willow) capsule
Wood and twig fragments

Table 5.36 Carbonised seeds

Species	Common name	No
Vicia faba L.	Field/broad bean	1
Triticum sp.		1
Total		2

been present in the vicinity of the manor. The identified agricultural weeds included *Agrostemma githago* (corn cockle) and *Anthemis cotula* (stinking mayweed). The evidence for the arable crops of wheat and field/broad bean, each represented by a

Table 5.37 Land and freshwater molluscs

Species	No
Valvata cristata Mull.	1
V. macrostoma Morch	2
V. piscinalis (Mull.)	1
Bithynia tentaculata (L.)	3
Bithynia sp.	14
Carychium sp.	1
Planorbis planorbis (L.)	1
Bathyomphalus contortus (L.)	1
Cochlicopa sp.	1
Discus rotundatus (Mull.)	2
Limax or *Deroceras* sp.	2
Clausilia bidentata (strom)	1
Trichia hispida (L.)	5
Pisidium sp.	2
Total	37

single carbonised seed, was only to be expected, but there were also some more interesting cultivated species. Walnuts, plums and grapes were either grown on the estate or imported by the manor.

The poor preservation of organic remains in the moat system may have resulted from the moat having been drained after the abandonment of the site. Subsequently, the water table of the site was raised, probably above the medieval level. A possible cause of the high modern water table was the construction, probably in the 18th century, of the overshot watermill at Mill Lane.

Death watch beetle tends to infest large hardwood structural timber such as oak and is likely to have been derived from one of the major buildings.

The charcoal (Table 5.38)

Forty hand-excavated fragments of charcoal were examined from selected contexts. The vast majority of the fragments were of beech. Oak, elm, ash and another unidentified species were also represented.

Only one of the unidentified fragments (context 279) was definitely not from beech, oak, elm or ash. Almost all the beech charcoal was of slow-grown contorted branch-wood, even allowing for the shrinkage caused by drying, aged between about 12 and 24 years. For example, one sample (context 600) contained a 13-year-old charcoal, 12 mm in diameter, and a 21-year-old charcoal, 50 mm in diameter. In contrast another sample (context 535) had a charcoal 12 years old which was 100 mm in diameter. The oak, elm and ash charcoal included fragments from both substantial timbers and small-diameter slow-grown branches.

Table 5.38 Quantification of charcoal by phase and type

Context	Phase	*Fagus* Beech	*Quercus* Oak	*Ulmus* Elm	*Fraxinus* Ash	Unident
1022/1015/600	3–5	13	2			
535	4	5			1	
508	3					1
509	3	3	1		1	1
279	5	1		2		1
534	2	2				
518	5	5				1

Most of the charcoal from the manor represents wood brought to the site as firewood. Few of the fragments were from timbers substantial enough for structural use and the slow-grown small diameter pieces were probably from branches too crooked for use as stakes or wattles. It is interesting that the assemblage is dominated by beech rather than oak and this probably represents a regional variation owing to the proximity of the Chilterns beech woods. The absence of charcoal from understorey species, such as hazel, is also noticeable.

It is probable that the firewood consisted mostly of the trimmings from felled standards in a wood dominated by beech, the timber going elsewhere, or the pollarding of elderly parkland trees, or that it was the result of the clearance of badly grown beech scrub. If it had come from a well-managed pollard wood or coppiced trees, there ought to have been more rapidly grown pieces, with the character of the charcoal described above from context 535.