Remarks on the faunal evidence at the Merovingian site of Oegstgeest (Zuid Holland)

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A riverine settlement in the early medieval world system

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Habelt-Verlag | Bonn

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Bonn 2021

Merovingian Archaeology in the Low Countries 7

Series editor: F. Theuws (Leiden University)

The research project was financed by:
University of Leiden

European Research Council, Rural Riches project (grant nr. 741340).

Cover photograph: Rijksmuseum van Oudheden te Leiden
(National Museum of Antiquities, Leiden)

Graphic design and lay-out: Bregt Balk
Printing: druckhaus köthen GmbH & Co. KG | www.koethen.de

Die Deutsche Nationalbibliothek verzeichnet diese Publikation in der Deutschen Nationalbibliographie. Detailliertere bibliographische Daten sind im Internet über http://dnb.d-nb.de abrufbar.

ISBN 978-3-7749-4291-2

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Laura Llorente-Rodríguez, Inge M.M. van der Jagt and Kinie Esser

Introduction

The early medieval Merovingian site at Oegstgeest has produced a rich faunal collection since 2004, the first archaeozoological investigation being carried out by C. Cavallo in 2006.[1] However, since the site has been intensively excavated up until 2014, her analysis only included a small fraction of the faunal remains retrieved during that early stage of excavation (i.e. 2567 out of 16,784). This chapter will incorporate data from some of the subsequent excavation campaigns to provide a more complete dataset to reveal the most important roles that animals played in the settlement.

One of the main purposes in this chapter will be to offer an overview of the fauna and to evaluate the economic role of the different taxa identified at the site, particularly the main domesticates. This analysis will determine whether anthropic exploitation strategies other than farming may have been practised by the inhabitants of the Oegstgeest settlement. Additionally, despite evidence showing Oegstgeest to be an agrarian settlement (Bakels, this volume), the site seems to have played an important commercial role between Britain and the German Rhineland, with transportation of items along the Rhine.[2] Livestock trading might have taken place in Oegstgeest; we will investigate the surplus production of animals and/or animal products to study to what extent animals and secondary products were part of that exchange.

Material and methods

The faunal collection studied in this chapter derives from the 2009, 2010, 2011, 2012 and 2014 excavation campaigns and include a selection of 257 diverse features including wells, house trenches, boreholes and waste pits (appendix 19.1).[3] All material dates to the Merovingian phase of the site. The main reason for the selection of features are the time and money constraints given the huge amount of bones retrieved at Oegstgeest, estimated to be 68,000 for the hand collected remains to which we should add ca. 54,000 remains derived from the sieving experiment (chapter 22) and the remains of molluscs (chapter 21). Over the years, several students and archaeozoological specialists from Leiden University studied the remains. None of the reports produced have been published before. An overview of the authors and titles is given in appendix 19.2. This chapter gives an overview of a selection of this data gathered only from well documented features mostly from 2009 and 2010 excavation campaigns and some bird remains from the 2011, 2012 and 2014 excavations. All these selected features can be defined as refuse contexts in one way or another. However, when necessary for answering the research questions posed, the unpublished reports and other chapters in this volume about animal remains will be referred to.

The selected mammal and bird material was mostly collected by hand, but fish remains sieved from the 2009 and 2010 features (report by Kerklaan, see appendix 19.2) have been also incorporated in table 19.1. The more recent excavations and the sieving experiment extended the fish data which is presented in detail in chapter 20. The mammal and bird material derived from the sieving experiment was not included in our dataset in order to

(1) Cavallo 2006. (2) Kars *et al.* 2018; De Bruin 2013. (3) The 2013 excavations mostly concerned the uninhabited northern part of the site and the areas of gullies 3 and 4 (see chapters 2 and 3). (4) Schmid 1972; Cohen and Serjeantson 1996. (5) Lauwerier 1997. (6) Lyman 2008; Reitz/Wing 2008. (7) Boessneck 1969; Silver 1969; Grant 1982; Wilson *et al.* 1982; Ruscillo 2006; Johansson/Hüster 1987; Payne, 1973. (8) Von den Driesch 1976; Thomas 1988.

have uniformity in our results but differences will be mentioned both here and in chapter 22. Because the remains discussed in this chapter were collected by hand, the fraction of the small bones from larger sized animals and the microfauna are expected to be under-represented.

Mammal and bird bones were determined anatomically and taxonomically to the highest degree of identification with the help of the reference collection at the Laboratory for Archaeozoological Studies of the Faculty of Archaeology (University of Leiden) and the collection at the Amsterdam Archaeological Centre (AAC) in the case of the bird material. In addition, use was made of diagnostic features and descriptions reported in different seminal publications.[4] Small rodents and amphibians were only identified to Class level and fishes were determined by Kerklaan (chapter 20). The taxonomic lists follow common Dutch protocol criteria according to the *Laboratorium protocol archeozoölogie ROB.4*.

Mammal fragments that could not be identified taxonomically have also been categorized both anatomically and in animal size categories. In the case of the latter, there was established a large mammal category (animals the size of cattle, horse, large deer; i.e. above 50 kg), a medium mammal category (taxa the size of sheep, goat, pig, large dog and small deer; i.e. taxa whose weights range between 50-1 kg), a small mammal category (taxa the size of rodents, shrews; i.e. below 1 kg), and an 'unidentified' category for remains impossible to be allocated to any size group. The anatomical categories, in turn, included teeth, skull, ribs, vertebrae, appendicular bones and an 'undetermined' anatomical category.

The data recording followed the protocol by the ROB[5] and data was entered in an Access Microsoft database file developed by Eric Dullaart, Leiden University.

The NISP (Number of Identified Specimens) and secondarily the MNI (Minimum Number of Individuals) were used as abundance estimators.[6] MNI was calculated exclusively for the main domesticates (i.e. cattle, pig and sheep/goat category) by feature using the abundance of mandibles and cheek teeth taking into account left and right elements for each age group category whose data derived from the age estimation. Ageing itself was determined using both teeth wear stage and teeth emergence calendars whose criteria, alongside those to estimate sex, follow the general reference manuals and publications.[7] Additionally, the weight of remains of a specific taxon can provide useful information on fragmentation patterns when contrasted with other statistics (e.g. the NISP). This parameter has been provided for selected groups of mammals, namely ungulates and carnivores, as well as the unidentified mammal fraction of the faunal assemblages. All measurements were taken with a digital caliper Powerfix (estimated error ± 0.5 mm), and mainly follow von den Driesch and Thomas criteria.[8]

The indication of the general state of preservation of bones follows the weathering criteria by Behrensmeyer and Huisman et al. in the case of the degree of bone fragmentation.[9] Taphonomical traces on the surface of the bones were analysed both through ocular inspection as well as under a Leica M30 stereo microscope (x10; x40). These include post-mortem modification and survival of bone, anthropic marks, colour as proxy for thermo-alteration and biological marks.[10] All of these categories of traces, together with skeletal profiles, were used to assign items to the taphonomical groups.[11] In order to recognise surplus production of animals and animal products, skeletal profiles were used to explore whether complete animals were brought to the site or only selected parts of the carcasses. In the latter case, finding out which elements are over- or under-represented can provide crucial information about human exploitation patterns on the various species. There are many ways to obtain skeletal profiles, but here the anatomical classification proposed by Stiner[12] is applied that includes bone categories regardless of their strength or size and reflects carcass fragmentation that complies with data offered by experimental ethnoarcheology.[13]

General overview

From the contexts indicated in appendix 19.1, ca. 17,000 animal remains have been studied from 32 species or genera of vertebrates (table 19.1). Despite this very significant figure, this study only represents 25% of the total number of bones retrieved throughout all the excavation campaigns in Oegstgeest.

As a whole, bones at Oegstgeest fall into Behrensmeyer's stage 0 or 1 of weathering (i.e. little or no cracking bone surface) and class 2 of bone fragmentation (i.e. fragile but complete bone or bone fragment) according to Huisman et al. Even though there exist recent fractures derived from excavation and material transport to the laboratory, fragments of the same elements were associated whenever possible to minimize precisely the well-known over-abundance of remains derived from recent fragmentation. In this way, anthropic activity is the most likely cause of the breakage. In that sense, the estimated mean weight of remains (i.e. taxa weight/NISP) according to size groups can help to determine the degree of fragmentation and weathering that the bones experienced (table 19.1). Among the large mammals, horse mean value (42 gr/bone) is almost double of that of the cattle (28.1 gr/bone), the single red deer bone (antlers are not included for this purpose) weighed 197 gr and the mean for the unidentified large mammal fraction is 5.8 gr/bone. This suggests that there exist different preservation trajectories for these taxa, the cattle most

(9) Behrensmeyer 1978; Huisman *et al.* 2006. (10) Lyman 1994; Greenfield ; Shipman *et al.* 1984; Stiner *et al.* 1995; Andrews 1990, Fernández-Jalvo/Andrews 2000. (11) Gautier 1987; Lyman 1994. (12) Stiner 1991, 2002. (13) Binford 1978, 1981.

Table 19.1
NISP and number of fragments of the fauna studied from the selected contexts. Weight is only provided for the mammal bones. (A): analysed bird remains from 2008 and 2009 excavation campaigns. (B): analysed bird remains from 2011, 2012 and 2014 campaigns.

Taxa Latin name	Taxa English name	NISP		Number of fragments	Weight
Bos taurus	Cattle	1995		2398	56130
Ovis aries	Sheep	6		9	135
Ovis/ Capra	Sheep/goat	544		640	2386
Sus scrofa domesticus	Pig	1244		1462	9386
Equus caballus	Horse	174		229	7302
Canis familiaris	Dog	6		9	18
Felis catus	Cat	180		251	199
Total domesticated mammals		4149		4998	75556
cf. Sus scrofa	Possible wild boar	1		1	1
Cervus elaphus	Red deer	1+3		1+3	197+10
Capreolus capreolus	Roe deer	2		2	2
Mustela putorius	Polecat	14		14	26
Vulpes vulpes	Fox	1		1	5
Total wild mammals		22		22	241
Total indentified mammals		4171			75797
Mammal indet.	Large mammal	2265		2398	13166
	Medium mammal	1867		1916	1756
	Small mammal	54		57	9
	Mammal indet.	6870		6870	4764
Total mammal indet.		11056		11241	19695
Total mammals		15227		16261	95492
		(A)	(B)		
Gallus gallus domesticus	Chicken	23	13	66	-
Galliformes indet	Galliforms		2	2	-
Anser anser/ A. a. domesticus	Greylag goose/domestic goose	41		54	-
Anser sp.	Goose indet.	12	7	21	
Anas platyrhynchos/domesticus	Wild duck/domestic duck	72		72	-
Cygnus sp.	Swan	1		1	-
Haliaetus albicilla	Bald eagle	1		1	-
Corvus corax	Raven	2		4	-
Aves indet.	Bird indet.	124	2	126	-
Total aves		300		347	-
Anguilla anguilla	Eel	81			-
Abramis brama	Freshwater bream	126			-
Abramis sp.	Bream sp.	1			-
Cyprinidae indet.	Cyprinids	304			-
Esox lucius	Pike	5			-
Perca fluviatilis	European perch	168			-
Total freshwater fish		685		685	-
Accipenser sturio	Sturgeon	3			-
Alosa falax	Twait shad	1			-
Coregonus oxyrinchus	Houting	35			-
Salmo salar	Atlantic salmon	15			-
Salmonidae indet.	Salmonids	4			-
Total migrating fish		58		58	-

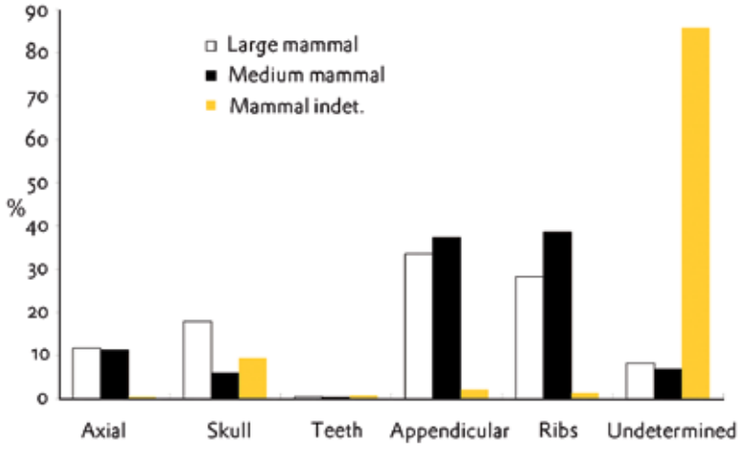
Taxa Latin name	Taxa English name	NISP	Number of fragments	Weight
Clupea harengus	Hering	6		-
Gadus morhua	Cod	1		-
Merlangius merlangus	Whiting	1		-
Mugil labrosus	Thicklip grey mullet	1		-
Pleuronectes platessa	European plaice	1		-
Limanda limanda	Common dab	1		-
Platichtys flesus	European flounder	9		-
Pleuronectidae indet.	Flounders	521		-
Total marine fish		541	541	-
Pisces indet.	Fish indet.	12		-
Total pisces		1296	1296	-
Anura	Toads/frogs	35	35	-
Vertebrata indet.	Vertebrates indet.	153	153	-
Total identified		5629	1505	75797
Total indet.		11382		19695
Total studied		17011		95492

probably subjected to a more intensive fragmentation that ultimately increased the number of the large mammal unidentified portion. As we will see below, this was indeed the case.

Regarding the medium size mammals, both the caprines (i.e. sheep+O/C category) and the pig were subjected to an intensive fragmentation as well, with values of 4.6 gr/bone and 7.5 gr/bone respectively. Noteworthy is the 0.9 gr/bone mean value from the unidentified medium mammal fraction, emphasising the intensive breakage for this size category of mammals.

Both medium and large mammal unidentified remains mimic patterns of anatomical categories and are similar to the theoretical profile derived from the relationship existing between density and bone preservation (fig. 19.1).[14] The most remarkable difference is that teeth are barely represented despite being the most mineralized elements. However, the low frequency of teeth within the unidentified fraction is explained by the fact that they are easy to identify taxonomically and only the most fragmented remains end up as unidentified specimens. The next category in terms of bone density, appendicular bones, is more frequent because splints are represented – the commonest part in this category – which can be easily determined anatomically but not taxonomically (fig. 19.1). Ribs are the third in terms of abundance despite their low density but, precisely because of that reason, post-depositional breakage is very common. Such breakage increases numbers without an effect in anatomical determination that, in the end, over-represent the ribs. Taken together, the anatomical pattern from the large and medium unidentified mammals suggests heavy fragmentation of the bones, more particularly the appendicular elements.

Fig. 19.1
Anatomical group frequencies from large and medium sized and unidentified mammal remains. Frequencies calculated from the total remains of each size category.



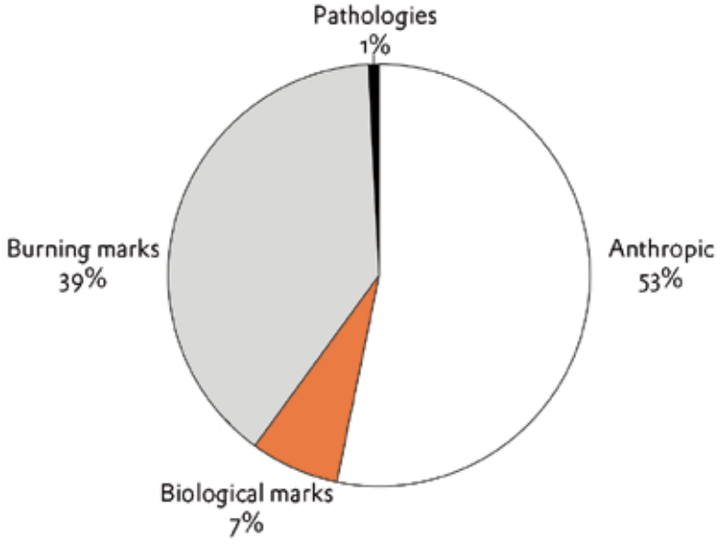
A look into the bone surface marks provides further information about the origin of the fragmentation. The unidentified fraction of the mammal assemblages has unidentified bones that are broken into small pieces (i.e. below one cm) and only 733 specimens (6.7% of the total unidentified remains) have any kind of bone surface trace (table 19.2 and fig. 19.2). Still, that same predominance of heavily fragmented bones and the fact that 53.2% of marks detected in unidentified remains larger than one cm are anthropic (i.e. cutmarks, chopmarks, etc.) shows that the main pre-burial agent of the unidentified assemblages was human

(14) Lyman 1994.

Table 19.2
Number of traces determined by taxa and categories. Skinning marks: cutmarks detected in the skull, mandible and autopodium; butchery marks: percussion, saw and chop marks; consumption and secondary butchery marks (*s.l.):* cutmarks on vertebrae, ribs, scapula, pelvis, humerus, femur, radius, ulna, tibia, fibula.

	Anthropic marks					Biological marks			Burning marks				Pathologies					
Taxa	Skinning	Consumption/ butchery	Butchery	Worked bone/tool	Total	Gnawing	Digested	Total	Burnt	Carbonized	Calcined	Total	Dental	Articular	Trauma	Total	ΣTotal	% traces/ NISP
Horse	3		13		16	4		4				0				0	20	11.5
Pig		53	28		81	37		37	2	2	4	8	2	1		3	129	10.5
Cattle	70	64	191		322	57		57	1	12	6	19	2*	15		15	413	20.9
Sheep			1		1			0				0				0	1	16.7
O/C	10	18	19		47	9		9			1	1	3			3	60	11
Red deer				2	2	1		1				0				0	3	75
Chicken		1			1			0				0				0	1	2.8
Large mammal		57	155		212	29		29		8	26	34	1	1	3	5	280	12.4
Medium mammal		42	61		103	12	1	13		7	16	23		1		1	140	7.5
Mammal	11	60	2	2	75	7	1	8	8	28	194	230				0	313	4.6
Subtotal	329	523	4	4	860	156	2	158	11	57	247	315	8	18	3	27	1360	
%	24.2	38.5	0.3	0.3	63.2	11.5	0.1	11.6	0.8	4.2	18.2	23.2	0.6	1.3	0.2	2.0	100	

Fig. 19.2
Percentage of bone surface traces categorized by modification agent in the different taxa and categories considered.



activity. In that respect, burning marks constitute the second most common detected trace (39.2%) which indirectly suggests, again, a human activity. Finally, even though there is evidence of biological activity affecting the bones (6.8%), – mostly chewing very likely carried out by dogs –, this seems to be an incidental source of fragmentation.

Among the identified taxa, frequency of the marks of any kind calculated over the total NISP for each species revealed an outstanding high value in the case of the red deer (75%), followed by cattle (20.7%), horse, caprines and pig – which have values around 11% – and finally, chicken (2.8%) (table 19.2). The patterns for each major mark category mirrored those described for the unidentified remains with anthropic marks being the most detected trace in the sample, stressing the human origin of the assemblages (fig. 19.2). The intensity and the purpose of such anthropic activities is hinted by the specific subcategories of traces within each general mark group (table 19.2). In this way, it is important to highlight the fact that two out of four identified red deer remains were worked bones or artefacts related with antler processing, a result that relates the exploitation of this species to manufacturing and not to meat consumption. The fact that only antlers and skull remains were determined could suggest that these body parts could have been brought to the site to be manufactured. This is further supported by the bone tool analysis in which at least four artefacts of red deer antler were determined (chapter 14).

Concerning the domestic ungulates, the presence of cutmarks on bones not used for meat, suggests that animals were skinned previous to being butchered. This indirectly suggests that animals were slaughtered and processed at the site (table 19.2). Butchery itself was intensively practised as evidenced by the frequency of

Table 19.3
Taphonomic classification of faunas from Oegstgeest according to the taphonomic group scheme introduced by Gautier (1987).

Type of assemblage	Taphonomic group	Taxa
Anthropic	1 (consumption refuse)	Cattle, pig, sheep, chicken, fishes mallard? Goose? Swan?
	2 (manufactures)	roe deer, red deer
	3 (burials)	Dog, horse
	4 (carcasses)	Cat
Natural	5 (intrusives)	Microvertebrata, Amphibia
Natural/ Anthropic	6 (unknown)	Polecat, fox, white tailed eagle, raven

these marks which are the highest determined. Such butchery activity seems to be heaviest in the case of cattle. However, there might be the possibility that some of these 'butchery' related marks were related with the production of bone artefacts that seem to have domestic ungulates as the main resource (chapter 14). One final category of cutmarks on bones from meat-rich body parts gives information about waste disposal of carcasses, mostly from consumption although some of the cutmarks can also be related with butchery processes. From that category is the only trace detected in chicken thus far (table 19.2). Biological marks within the identified specimens exclusively relate to chewing and puncture marks and represent the second mark category in the sample. This suggests an opportunistic access of gnawing animals, probably dogs, to the leftovers.

The frequencies of burning marks within the identified fraction of the collection were very low what would denote that bones exposed to fire were fragmented to an extent that they could be no longer be identified. In fact, the high frequency of calcined bones within the unidentified category reinforces such hypothesis (table 19.2 and fig. 19.2).

As a consequence of such degree of fragmentation, identified specimens constitute 34.1% of the total number of bones studied (table 19.1). Not surprisingly for this time period, this identified fraction is skewed towards mammals, at large, and domesticates, in particular which accounted for 72.5% of the identified specimens. In fact, wild mammals are very poorly represented by barely 0.4% of the identified NISP from which only seven remains belong to game taxa (i.e. ungulates), suggesting the marginal role of hunting at the site. The presence of the two identified small carnivores can be explained as intrusive commensals in the assemblages given that there is no evidence for fur production or trade.

It is the cattle-pig binomial that constitutes half of the identified bones with frequencies of 35.5% and 22.1% respectively, followed by caprines (9.8%). Domesticates that were not used for consumption (at least primarily) such as horses, cats and dogs, exhibit frequencies below 4%. As for the last of the domesticates in our collection, the chicken, its contribution hardly reaches 1%. Although such frequency might be skewed because of the hand collecting retrieval of bones, the sieving experiment shows that even when sieved not many chicken or other bird bones are retrieved (chapter 22). As a result, it is unlikely that bird values reached that of its mammalian counterparts.

Despite the overwhelming presence of mammals, fish remains constitute the second group of identified vertebrates with a frequency of 22.3%. Taking into account that just a few selected features were sieved, a practice that is known to especially affect fish bone retrieval,[15] means that our data can only hint at the economic importance of this group. If all the features had been sieved, a very different picture in terms of faunal exploitation at Oegstgeest might have been recorded as the sieving experiment suggests.

The frequencies of birds (4.6%) and amphibians (i.e. Anura 0.6%) were probably biased as well. Noteworthy in the case of the former is that only large (i.e. length> 50 cm) and medium (i.e. length 50-20 cm) size birds have been recorded. However, these birds are the most economically interesting, their contribution not being so dramatically affected as that of fishes for the interpretation of economic activities at the site. Interesting is the case of the chicken of which few bones exhibit cutmarks that confirm their anthropic exploitation at site. Besides the chicken, the identified bird assemblages consist largely of ducks and geese whose domesticated status is still under review. A preliminary osteometrical analysis on geese bones carried out by Gundy suggests that some of the specimens may represent domestic forms. The robustness of the leg bones is a result, theoretically, of an increase in weight due to the domestication of geese that inversely would atrophy the wing bones.[16] Although no traces of human processing were detected on bones of waterfowl taxa thus far and some wild forms cannot be ruled out, it seems plausible that a domestic or else managed geese flock could have been kept for eggs, meat and feathers.

It seems clear that the majority of taxa from Oegstgeest represent fauna accumulated by humans, natural accumulated deposits being marginal in our collection and represent mostly a few intrusive commensals (table 19.3). For a better understanding of the presence of rodents/insectivores and amphibians see the sieving experiment chapter (chapter 22). It is important, however, to differentiate within this anthropically accumulated fauna, which taxa mainly represent consumption refuse, manufacture items and carcasses (table 19.3).

(15) Zohar/Belmaker 2005. (16) Reichstein/Pieper 1986.

Assessment on the main domesticates

Skeletal representation and age at death of the main domesticates – cattle, pig and sheep-goat – can provide a more detailed picture on how these animals were exploited and which were the most important activities in Oegstgeest. In this way, analysing selected age groups or parts of the carcasses, that were exploited at the site can provide crucial information about herding and 'commercial' strategies.

In the case of the skeletal profile of the main domesticates, the first feature to note is that all elements from the whole skeleton have been retrieved, indicating that at least part of the animals were slaughtered and processed at Oegstgeest (table 19.4). It is also not possible to tell if there were any animals transported to the site while alive, this needs to be addressed by other methodologies such as stable isotope analysis. The skeletal frequency distribution by anatomical units (fig. 19.3) could give information on possible transport of meat parts to the settlement. The most represented unit is that of the skull, mandible and teeth (head). This frequency is easily explained by the fact that teeth are highly mineralized and likely to be preserved in archaeological assemblages besides their relatively easy taxonomical identification. Besides that, cranium and mandible are more fragile elements which consequently increase the NISP. The variation in the frequencies of the limb parts can be explained by the variable number of elements present in the four limb categories. The combination of the upper and lower limb frequency categories from the forelimb does not differ from the upper and lower parts of the hindlimb either, suggesting again that there is no difference in the frequency of the limb parts. Elements classified within the axial skeleton presented high frequencies despite the fact that these bones are not easy to identify to species level and most ribs and vertebrae were categorized among the unidentified fraction (fig. 19.3). All in all, there is no differential body part accumulation, other than what might occur for taphonomical reasons, which could indicate that a specific human activity was preferentially practised but only that animals at Oegstgeest seem to have been slaughtered at the site.

This takes us to the age at death of animals at the settlement. In the case of cattle, the mortality profile derived from a total of 95 individuals (MNI) show that 52.7% of them were slaughtered before they reached prime maturity (i.e. below 42 months; fig. 19.4, table 19.5). All age class categories within this non-mature group were represented but the peak seems to be reached within the subadult and young adult categories (fig. 19.4). This coincides with the optimal slaughter age aimed at meat exploitation between 24 and 42 months[17] and is also correlated with the amount of butchery marks observed on cattle remains (table 19.2). The slaughtering of calves, on the other hand, is additionally related to milk and dairy production. Given the low frequency of this category, it would constitute a secondary or even marginal economic activity operating at Oegstgeest. Finally, there is another slaughtering peak in the category of old adults. Considering the hypothesis of milk production, it is possible that these older animals were cows that could no longer produce milk or calves. It seems likely that individuals within this category were used as draught animals as well. In fact, a few samples with pathologies may suggest that cattle was indeed used for traction work. The first type of the

Table 19.4
NISP by skeletal element identified for the main domesticates at Oegstgeest.

Taxa/Element	Cattle	Pig	Sheep/goat
Horn	89		1
Cranium	195	90	32
(pre)maxilla	79	76	28
Mandible	181	149	86
Teeth	262	286	92
Hyoid	5		
Sternum	2		
Costa	6		
Atlas	18	5	
Axis	13	11	7
Cervical vertebrae	25	20	3
Thoracic vertebrae	28	18	8
Lumbar vertebrae	24	21	5
Sacrum	8	3	2
Caudal vertebrae	3	2	
Vertebrae	1		
Scapula	86	55	23
Humerus	77	50	24
Radius	55	45	27
Radius/ulna	2		
Ulna	36	54	9
Metacarpus	80	33	23
Carpalia	31	13	5
Pelvis	106	47	19
Femur	57	24	14
Tibia	74	67	33
Patella	12	3	3
Fibula	7	22	2
Astragalus	79	24	4
Calcaneum	52	29	7
Tarsalia	21	8	3
Metatarsus	118	31	41
Metapodia	25	22	22
Phalanges	126	36	24
Sesamoidea	9		2
Long bone	2		1
Total	1995	1244	550

(17) Uerpmann 1973; Prummel 1983.

Fig. 19.3
Skeletal profile of the main domesticates at Oegstgeest categorized according to anatomical units described by Stiner (1991).

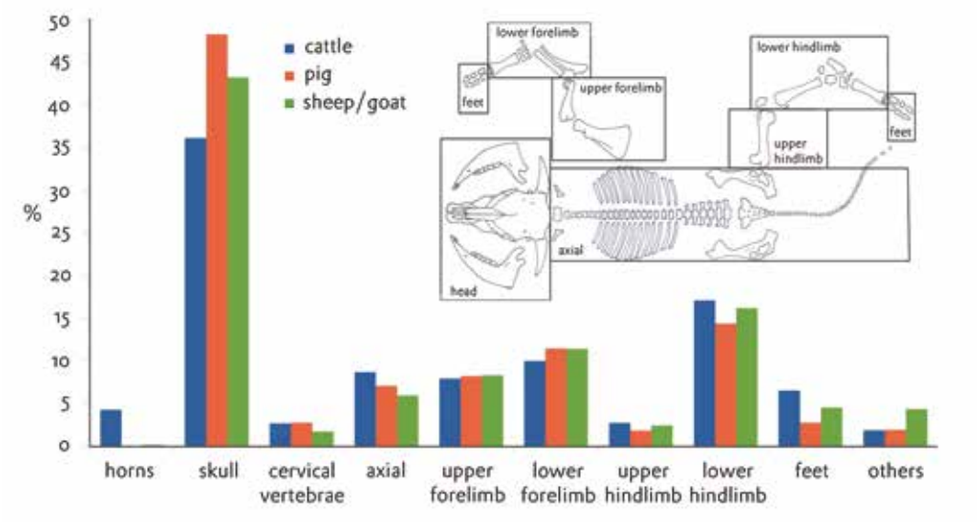


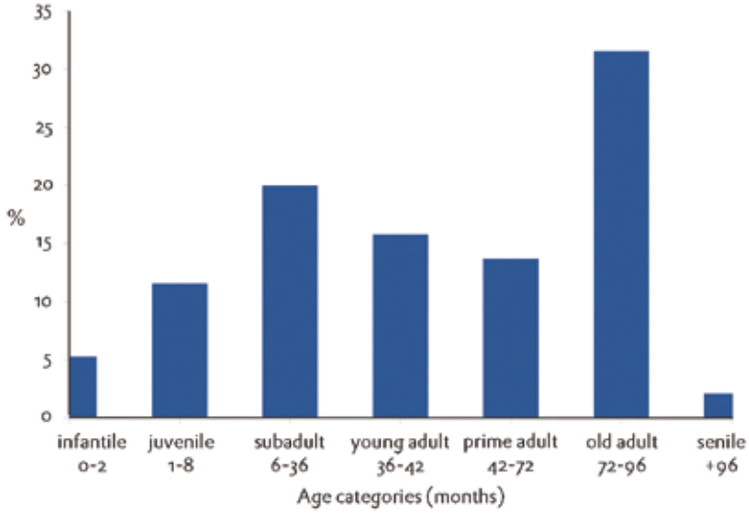
Table 19.5
MNI and % MNI per cattle age group category.

	Age range (months)							
	Infantile 0-2	Juvenile 1-8	Subadult 8-36	Young adult 36-42	Prime adult 42-72	Old adult 72-96	Senile +96	Total
MNI	5	11	19	15	13	30	2	95
%	5.3	11.6	20	15.8	13.7	31.6	2.1	100

draught-related pathologies refers to the presence of eburnation (polishing) in two pelvis acetabula and one femur head. It is possible that this polishing might have been produced either by the old age of the specimens or else by attrition at the pelvis-femur joint caused by the ploughing work these animals were subjected to. Likewise potentially indicative of such exploitation of cattle is the abnormally width of the medial condyle in the distal metacarpus, or the extra bone growth in both the proximal and distal ends of a first phalanx.[18] Up to 8 more bones exhibited joint diseases that if not linked with draught work might relate to old age, including porosity of proximal articulation in 3 metatarsals or exostosis in two tarsal bones (table 19.2).

This evidence suggests that cattle were exploited for multiple purposes at Oegstgeest and that each livestock practice was as much important as the others. The analysis of complementary data would be necessary to provide a definitive answer and to generate a more reliable picture of the exploitation of the cattle. A first step in this direction was preliminary addressed by Nagels who combined data available to asses cattle sex ratio concluding that the adult population was largely represented by cows with a small numbers of males (and/or castrates).[19] Likewise of interest is to analyze morphometrically the sample in order to characterize past populations. A first approach to this end is to estimate the height at the withers that could be calculated in our sample on the basis of one radius and two metatarsals, all three providing

Fig. 19.4
Cattle kill-off pattern in Oegstgeest. MNI=95.



heights of 1.1 m.[20] This is in line with the average of 1.15 m Nagels mentioned in her thesis, based on the measurements of 26 metapodials with a range of 1.05-1.25 m.

Regarding pig, the analysis of age at death over 56 individuals reconfirm that it was primarily exploited for meat -and grease-, with 66.1% of individuals slaughtered below the age of 24 months (fig. 19.5 and table 19.6). The mortality peak corresponded to the

(18) Bartosiewicz *et al.* 1997; Cupere *et al.* 2000. (19) Nagels 2016. (20) Following Bergstrom/Van Wijngaarden-Bakker, 1983; Boesneck/Von den Driesch, 1974.

Table 19.6
MNI and % per pig age group category.

	Age range (months)							
	Infantile 0-6	Juvenile 6-12	Subadult 12-24	Young adult 24-36	Prime adult 42-36-48	Old adult 48-72	Senile +72	Total
MNI	1	5	21	10	14	4	1	56
%	1.8	8.9	37.5	17.9	25	7.4	1.8	100

Table 19.7
MNI and %MNI per sheep/goat age group category.

	Age range (months)							
	Infantile 0-2	Juvenile 1-8	Subadult 8-36	Young adult 36-42	Prime adult 42-72	Old adult 72-96	Senile +96	Total
MNI	0	5	16	11	6	12	3	53
%	0	9.3	30.2	20.8	11.3	22.6	5.6	100

Fig. 19.5
Age profile of pig at Oegstgeest. Data derived from MNI=56.

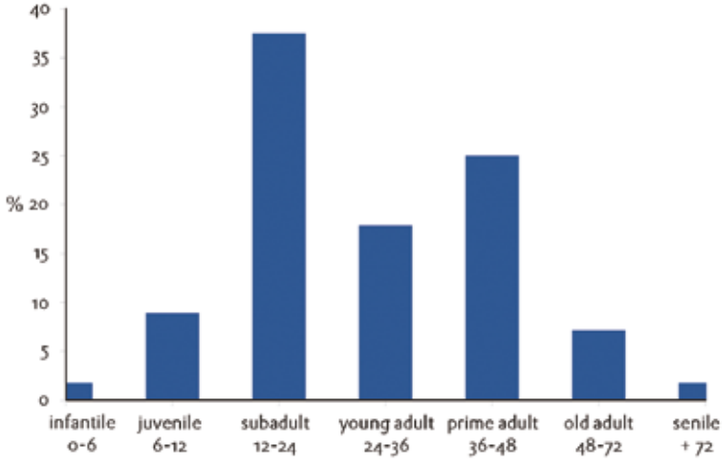
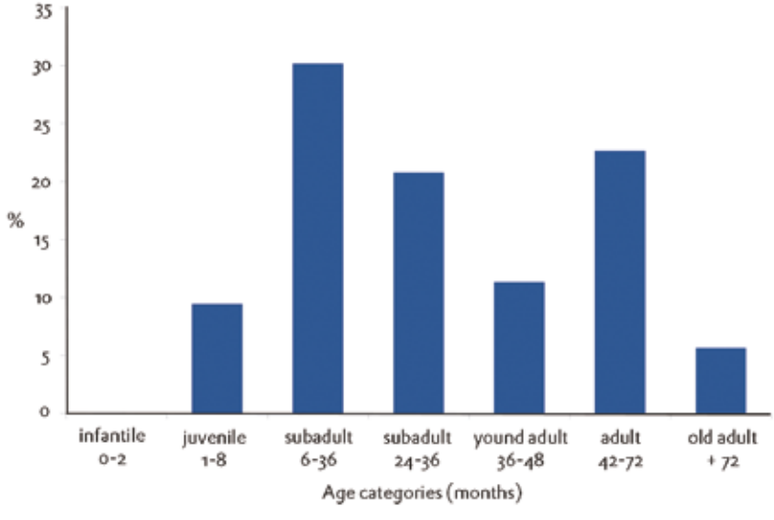


Fig. 19.6
Age profile of sheep-goat from Oegstgeest. Data derived from MNI=53.



12-24 months group, the infantile sub-category frequency being the lowest within this non-mature group (1.8%). The individuals from this latter group actually corresponds to two piglets found in a well (WA17; trench 1; feature 18).

The presence of canines allowed to sex determine 13 of the pig individuals. Not surprisingly, 10 corresponded to males, either adults or subadults, and only 3 to females. Such sex ratio indicates that males were slaughtered preferentially and the adult herd was constituted mostly by reproductive females to produce more animals for consumption.

In the case of the exploitation of caprines, it should be noted first that the Ovis/Capra group is assumed to represent preferentially sheep because indisputable specific identification at Oegstgeest concerns only sheep, on the one hand, and because there is little evidence of goat being kept in large numbers in the Dutch early medieval period, on the other.[21] The age at death of caprines includes individuals of a wide range of ages, except for infantiles (i.e. 0-2 that are not represented in our graph (fig. 19.6 and table 19.7). However, this category was detected in the post-cranial collection not yet incorporated into the mandibular teeth-derived mortality profile. At any rate, their frequency could not be very significant when these individuals were not detected by the dental age estimation. The kill-off pattern of caprines would indicate a meat-producing economy based on the fact that 51% of individuals culled at Oegstgeest were aged between 12-36 months, the optimum category for killing surplus animals for meat exploitation[22] (table 19.5 and fig. 19.6). Assuming that the large fraction of caprines are indeed sheep, the contribution of wool production to the economy could have been important as well given the fact that prime adult animals are fairly well represented with a frequency of 22%, a slaughtering age preferentially aimed for wool exploitation. In fact, the low frequency of juveniles (9%) would support such hypothesis given that animals would be slaughtered either at their

(21) Lauwerier 1994. (22) Payne 1973. (23) Hemminga/Hamburg 2008, Dijkstra 2011. (24) Grant 2002. (25) Cavallo 2006, 2008. (26) Van der Jagt *et al.* 2012. (27) Van der Jagt 2012 (28) There is also unpublished strontium isotope data that shows that the analyzed remains of six cats have a local strontium ratio.

optimum body growth (i.e. 18-30 months; subadults) for meat consumption, or else once the wool quality starts to deteriorate (i.e. +48 months; prime adult and old adult categories). Although the presence of juveniles may also indicate some milk and dairy exploitation, the low frequency of lambs suggests that it was not the primary exploitation for sheep in Oegstgeest.

Faunal signatures at Oegstgeest

Regarded as a rural site but with a key role in commercial activities,[23] characterizing the social and economic status of Oegstgeest from an archaeozoological perspective can help to frame this settlement within a regional and supra-regional exchange network. In this respect, animal mortality patterns not only can identify exploitation strategies but can discriminate assemblages (or sites) of production (eg. meat) from those that are exclusively of consumers, ultimately suggesting the possibility of an economic or social stratification.[24] Assemblages from production sites where a surplus of animals is expected usually present all age groups in their mortality profiles, in contrast to consumer deposits where age group representation can be biased to those from young (i.e. not yet prime adult) animals in the case of domesticates. In Oegstgeest, previous publications suggested the possibility of cattle exportation on account of the absence of subadults.[25] However, age groups from all the main domesticates in our analyses -including cattle- are diverse with the slaughtering peaks precisely on the group of fully grown yet not prime adult individuals in order to exploit the most amount of meat (figs. 19.4-6). The presence of all age classes suggests local livestock production. The abundance of the optimum age individuals for meat, – that would be expected to be those to be transported –, suggests that the production was not meant for export. This is additionally supported by the presence of all skeletal elements of the ungulates (table 19.4) that evidences that no or few body parts left the settlement.

Livestock was predominantly exploited for meat production as we already made clear, but it is not the sole focus of the inhabitants of Oegstgeest. The mortality profiles of cattle and sheep show that besides meat, traction and wool played a significant role in the economic activities as well. Milk production, however, appears to have been minimal. Although there is no evidence of animal surplus export or animal body parts by the inhabitants of early medieval Oegstgeest or the import of meaty parts from elsewhere, the data does not rule out the possibility that living animals were brought to the settlement from elsewhere. Without large scale osteometric or isotopic analysis it is difficult to prove this. At the moment there is only evidence that some of the pigs were not raised locally: strontium isotope analysis on ten pig molars evidenced that four out of ten molars had a non-local strontium ratio. These deviant ratios correspond to ratios from eastern Netherlands to Germany, France, Scotland and/or England.[26] This does not directly imply that the non-local pigs were items of large-scale trade because the archaeozoological data does not provide evidence for substantial import or export of livestock animals. However, it does suggest that on a smaller scale, animals were exchanged. Pigs may have been part of a social (gift-) exchange in feastings to strengthen social relationships between settlements, an hypothesis supported by the results from features from the same house plot. Most of the bones retrieved from these features (a house ditch, a well and a waste pit) were pigs. In two layers of the waste pit (feature number 11.24), pig mandibles and a few other pig skeletal elements were deposited.[27] The isotope analysis of four pig individuals (two individuals from the waste pit and other two from the other features) showed that half of the pigs were not from a local origin.

Animal exploitation at Oegstgeest was beyond mere ungulate husbandry though. The fact that a reasonable fraction of the osseous artefacts and some waste products were made exclusively on antler from wild species (one should include here the elk artefact; chapter 14) and not postcranial bone suggests, as stated before, that these raw materials were brought to the settlement. The origin of these resources is still a pending issue that may contribute to understand better the exchange network developed at Oegstgeest. These raw materials were complemented with bones from the most abundant mammal bones, i.e. domestic ungulates, incorporating an additional use to the already wide range of exploitation strategies of these animals at the site. The worked antlers/bones within our collection would indicate the presence of workshops at Oegstgeest, although no particular feature studied thus far exhibited the high abundance of small bone and antler waste. If the items manufactured at the workshops remained at the site or a fraction were later reintroduced again into the interchange network would be an interesting topic to research.

Besides the transport of raw materials for the manufacture of artefacts, furs were also an important commodity in the early Middle Ages in general. Apart from the presence of fur species such as European polecat, fox and cat, no evidence, such as overrepresentation of foot bones or presence of cut marks, have been found to support the idea that the furs of these animals were indeed traded.[28] But it must be said that a notable number of cat bones have been found at Oegstgeest; the bone record from the excavations of 2009 and 2010 yielded a NISP of 175 (ca. 33 individuals).[29] Compared to the percentage of cat bones from medieval sites of which a list is presented in Johansson and Hüster 1987 and to other early medieval sites from the Rhine delta, the percentage of cats in Oegstgeest is unusually high.[30] How this must be explained is still unclear.

(29) Buhrs 2012. (30) Clason 1976 NISP: 2; Van Dijk 1995 NISP: 9; Saberolles 1990 NISP: 1; Cavallo 2008 and Cavallo, Van der Heiden/Kolfschoten 2008 NISP: 1; Esser 2009 NISP: 2.

Further research would also be needed on the role of birds at the site, particularly on ducks and geese for which a domestic status seems plausible on the basis of our preliminary osteometrical study.[31] Alongside chicken, these birds are very well known not only to supply meat and eggs to human settlements but also feathers whose use extends from the collection of down feathers while the bird is alive to that of the use of the primary and secondary feathers of the wing to be used as quill pens, among other uses.[32] The presence of wild birds such as the White tailed eagle, the Swan or the Raven might well be due to natural or anthropic actions. For this reason, additional studies on these taxa might give further insight into such accumulations within the assemblages.

The fish are a special case in point in Oegstgeest because of the outstanding number of remains in such a restricted number of sieved features. The importance of fishing activities seems to have been significant in the economy of the inhabitants. The diversity of taxa which include marine, brackish and freshwater species, suggest the exploitation of aquatic resources for local consumption but some species might have been part of a commercial network. We are talking mostly about the marine species, in general, and cod, in particular, a fish whose trade started to acquire commercial importance throughout the North Sea precisely in the early Middle Ages.[33] The incidental cod sample identified in Oegstgeest could not only be due to the retrieval methodology but to the fact that the species was mostly fished to be traded.

Oegstgeest in a larger context: an approach to a regional overview

The discussion on the animal production economies from historical periods has usually targeted the main ungulate domesticates to assess signatures of primary local strategies that can later be framed into larger spatial or temporal contexts. However, the archaeozoological investigations of the Merovingian period are not as numerous as those from other periods in the Netherlands, making this as an interesting subject to study but limiting the comparative possibility. In addition, the few publications available in Zuid Holland are mostly site reports that provide restricted information on a small number of faunal remains (i.e. below 2500 identified remains; table 19.8). The fact that most animal remains from these excavations were hand-collected and only few contexts were sieved makes archaeozoological interpretation difficult but at least they have the same taphonomical biases that operated at Oegstgeest. Located in a settlement cluster surrounding mostly the Old Rhine delta, for this regional framework seven contemporary settlements were selected from this important geographical location with minimal archaeozoological information to carry out this simple comparison: Katwijk-Zanderij, Valkenburg de Woerd, Leiderdorp Plantage, Leiderdorp Kastanjelaan, Leidsche Rijn, A2. Utrecht Appellaantje and Dorestad Veilingterrein (table 19.8).[34] Because of the skewness of the assemblages, the regional assessment fails to discuss matters such as taxonomic diversity and relies on a focus of the most represented faunal remains, i.e. cattle, pig, sheep-goat. In order to make a first assessment on the exploitation of non-mammal fauna, some general observations on waterfowl and fishes are presented as well.

Oegstgeest stands out among its regional counterparts on account of the abundance of animal remains analysed and determined (tables 19.1, 19.2 and 19.8). In terms of relative frequencies, values are heterogeneous as a whole, those from Leidsche Rijn being the most similar to those from Oegstgeest (table 19.8). Interestingly, this site comes in second place in terms of identified NISP abundances. Although cattle is the most frequent species at all sites independently of sample size and relative frequency values ranging from 52.7% to 80.9%, pig follows in abundance not only in Oegstgeest but also in Katwijk (northern area), Leiderdorp Plantage, Leidsche Rijn and Utrecht. In other settlements sheep/goat takes in second place. Why do settlements differ in this respect? Looking at the ratios of cattle, sheep/goat and pig in Merovingian settlements in the Netherlands it seems that a relatively high percentage of pig bones is also found in the regions along the river Rhine and in Dorestad. Given the proximity of the settlements compared it does not seem that environmental constraints are behind the opposite relationship between pig and sheep-goat abundances but rather a preferential exploitation of pig in the settlements along the river Rhine. In terms of domesticates' exploitation activities, cattle mortality profiles from all Old Rhine settlements seem to roughly conform to those described from Oegstgeest, although a prominence of subadults and young adults have not been observed for the other settlements. The sheep-goat group would have a multi-purpose exploitation though meat seems to have been just as important in sites such as Leiderdorp Kastanjelaan, Utrecht and Dorestad as in Oegstgeest. Pig is usually mainly exploited for meat and as such is recorded in all the Merovingian contexts available in the region where animals between 1.5-3 years are mostly represented in the sample.

Birds and fishes are semi-pervasive elements in our Merovingian assemblages depending on the sample size and (partial) sieving practice. In the case of waterfowl, their frequency is even higher than that of chicken in some cases which highlights the importance of these animals during this time period. It is well known in other Dutch and European quarters that geese and ducks become more important during the Middle Ages[35] and even though Oegstgeest does not have any subsequent layers, some of the Old Rhine delta sites do increase bird remain numbers, especially those of geese such as the case of Leiderdorp.[36] At any rate,

(31) Gundy 2019. (32) Moreno García 1995; Serjeantson 200.2 (33) Barret *et al.* 2008, 2011. (34) Cavallo et al 2008; Sablerolles 1990; van Dijk 1995; Esser 2009; Dijk *et al.* 2011. (35) Albarella 2005; Zeiler 2013. (36) Moesker/Cavallo 2016.

Table 19.8
Ratios of Cattle, Sheep/Goat and Pig and Mammals, Birds and Fish from Merovingian contexts of settlements in the Rhine Delta (after Carkirlar *et al.*, in press: supplementary table 4).

Archaeological region	Site	Merovingian period (525-725 AD)								References
		ΣNISP Cattle, Sheep, Pig	% Cattle	% Sheep/ goat	% Pig	ΣNISP mammal/ bird/fish	% mammal	% bird	% fish	
Dune area Holland along the river Rhine	Katwijk Zanderij-northern area	392	59.0	18.6	22.4	1669	99.8	0.2	0.0	Cavallo *et al.*, 2008
	Katwijk Zanderij - central area	216	75.9	13.9	10.2	450	98.9	1.1	0.0	Cavallo, 2008
	Valkenburg - de Woerd	370	70.5	18.1	11.4	380	99.2	0.8	0.0	Sablerolles, 1990
Holland (clay and bog area) allong the river Rhine	Leiderdorp Plantage gulley	545	85.5	4.6	9.9	609	52.4	3.3	44.3	Moesker and Cavallo, 2016
	Leiderdorp Kastanjelaan	252	54.8	31.1	13.9	2667	34.7	0.5	64.8	Meijer, 2014
	Oestgeest-Rijnfront	680	60.9	12.1	27.0	2567	99.3	0.5	0.1	Cavallo, 2006
	Oegstgeest Rijngeest Zuid	674	68.4	15.1	16.5	1793	98.4	0.6	1.0	Van der Jagt, 2011
	Oegstgeest- this study	3789	52.7	14.5	32.8	16750	90.6	1.7	7.7	this study
Utrechts-Gelders river area	Leidsche Rijn-A2	664	61.9	9.5	28.6	2477	67.9	2.0	30.1	Esser, 2009
	Utrecht Appellaantje	577	80.9	4.7	14.4					Meijer, 2010
	Dorestad-Veilingterrein	412	55.1	23.8	21.1					Esser *et al.*, 2012
	Dorestad-Veilingterrein	296	60.8	22.0	17.2					Esser *et al.*, 2012

it seems that the exploitation of waterfowl was an important part of the economy during Merovingian times, the details still being a pending issue in Zuid Holland.

Last but not least, fishes appear in the regional scene as the neglected group again. As it was the case in Oegstgeest, other partially sieved assemblages such as Leiderdorp Plantage, Kastanjelaan and Leidsche Rijn exhibit also high frequencies of fishes (table 19.8). These 'high' abundances are indeed in agreement with settlements being located within the delta. Fishes might have well been the largest faunal collections if a thorough sieving procedure and study of these remains would have been applied as evidenced by the sieving experiment in this publication (chapter 22). If this was the case it could completely overturn the entire economical interpretation of the region.

Conclusions

This study is based on a large amount of animal bone material, but it is only the tip of the iceberg if the number of remains found during the excavation is considered. The analysed remains show us that Oegstgeest is a production site for mainly meat of all three livestock species. Additionally, cattle were used for traction and sheep for wool production. The meat was primarily intended for local consumption. It could be speculated that this might mean that not only farmers lived at Oegstgeest but also people with other occupations such as fishers, sailors, traders or artisans. This would not be strange given the strategic locality of the settlement along the river Rhine. It would also explain similar patterns of prominent pig consumption at other settlements along the Rhine and the high abundance of fish. However, it is important to keep in mind that no large-scale evidence for trade of animals and animal products has been found. The data is limited to evidence that suggests contacts and exchange with others. More research needs to be done on a range of topics to get an idea about the scope and size of this network.

Appendix 19.1
Selected features for archaeozoological analysis by excavation project. A remark is provided for those features of which only birds have been studied.

Project	Trench	Feature
ONRZ09	1	2
ONRZ09	1	5
ONRZ09	1	18
ONRZ09	3	1
ONRZ09	3	2
ONRZ09	3	6
ONRZ09	3	20
ONRZ09	3	30
ONRZ09	4	1
ONRZ09	4	2
ONRZ09	4	3
ONRZ09	4	9
ONRZ09	4	16
ONRZ09	4	17
ONRZ09	4	22
ONRZ09	4	25
ONRZ09	4	26
ONRZ09	4	31
ONRZ09	4	33
ONRZ09	4	36
ONRZ09	4	37
ONRZ09	5	14
ONRZ09	5	15
ONRZ09	5	16
ONRZ09	5	17
ONRZ09	5	18
ONRZ09	5	20
ONRZ09	5	21
ONRZ09	5	24
ONRZ09	5	25
ONRZ09	5	26
ONRZ09	5	27
ONRZ09	5	29
ONRZ09	6	1
ONRZ09	6	2
ONRZ09	8	1
ONRZ10	8	7
ONRZ09	9	2
ONRZ09	9	3
ONRZ09	9	11
ONRZ09	9	18
ONRZ09	9	19
ONRZ09	9	22
ONRZ09	9	27
ONRZ09	9	28
ONRZ09	9	29
ONRZ09	9	37
ONRZ09	9	38
ONRZ09	10	11

Project	Trench	Feature
ONRZ09	10	13
ONRZ09	10	14
ONRZ09	10	17
ONRZ09	10	25
ONRZ09	10	29
ONRZ09	10	30
ONRZ09	10	33
ONRZ09	11	8
ONRZ09	11	17
ONRZ09	11	18
ONRZ09	11	21
ONRZ09	11	24
ONRZ09	11	29
ONRZ09	11	30
ONRZ09	12	7
ONRZ09	12	27
ONRZ09	12	38
ONRZ09	12	43
ONRZ09	12	46
ONRZ09	12	51
ONRZ09	12	67
ONRZ09	12	74
ONRZ09	12	83
ONRZ09	12	90
ONRZ09	12	95
ONRZ09	13	2
ONRZ09	13	14
ONRZ09	13	18
ONRZ09	13	19
ONRZ09	13	23
ONRZ09	13	24
ONRZ09	13	25
ONRZ-09	13	25
ONRZ-09	13	26
ONRZ09	13	27
ONRZ09	13	32
ONRZ09	13	32
ONRZ-09	13	32
ONRZ09	13	33
ONRZ09	14	1
ONRZ09	14	2
ONRZ09	14	3
ONRZ09	15	4
ONRZ09	14	7
ONRZ09	14	8
ONRZ09	14	9
ONRZ09	14	10
ONRZ09	14	10
ONRZ09	14	10

Project	Trench	Feature
ONRZ09	14	11
ONRZ09	14	12
ONRZ09	14	13
ONRZ09	14	14
ONRZ09	14	15
ONRZ09	14	16
ONRZ09	14	17
ONRZ09	14	19
ONRZ09	14	20
ONRZ09	14	24
ONRZ09	15	20
ONRZ09	15	21
ONRZ09	15	24
ONRZ09	15	25
ONRZ09	15	27
ONRZ09	15	29
ONRZ09	15	31
ONRZ09	15	32
ONRZ09	15	33
ONRZ09	15	37
ONRZ09	15	40
ONRZ09	15	43
ONRZ09	15	47
ONRZ09	15	53
ONRZ09	16	1
ONRZ09	16	2
ONRZ09	16	6
ONRZ09	16	12
ONRZ09	16	14
ONRZ09	16	25
ONRZ09	16	27
ONRZ09	16	29
ONRZ09	17	7
ONRZ09	17	10
ONRZ09	17	20
ONRZ09	17	33
ONRZ09	17	45
ONRZ09	18	4
ONRZ09	18	11
ONRZ09	18	13
ONRZ09	18	14
ONRZ09	18	15
ONRZ09	18	17
ONRZ09	18	32
ONRZ09	18	49
ONRZ09	18	52
ONRZ09	18	56
ONRZ09	18	61
ONRZ09	18	62

Project	Trench	Feature
ONRZ09	18	68
ONRZ09	18	69
ONRZ09	18	70
ONRZ09	18	72
ONRZ09	18	73
ONRZ09	18	74
ONRZ09	18	75
ONRZ09	18	76
ONRZ09	18	80
ONRZ09	18	82
ONRZ09	18	89
ONRZ09	18	93
ONRZ09	18	94
ONRZ09	18	96
ONRZ09	18	101
ONRZ09	18	103
ONRZ09	18	104
ONRZ09	20	1
ONRZ09	21	8
ONRZ09	21	9
ONRZ09	21	10
ONRZ09	21	11
ONRZ09	21	21
ONRZ09	21	25
ONRZ09	21	37
ONRZ09	21	37
ONRZ09	21	48
ONRZ09	21	58
ONRZ09	21	58
ONRZ09	21	97
ONRZ09	21	98
ONRZ09	23	1
ONRZ09	23	3
ONRZ09	23	4
ONRZ09	23	21
ONRZ09	23	26
ONRZ09	24	35
ONRZ09	24	36
ONRZ09	25	1
ONRZ10	25	2
ONRZ09	25	3
ONRZ09	25	5
ONRZ09	25	7
ONRZ09	25	17
ONRZ09	25	19
ONRZ09	25	20
ONRZ09	25	24
ONRZ09	25	25
ONRZ09	25	45

Project	Trench	Feature
ONRZ10	26	32
ONRZ10	27	4
ONRZ10	27	10
ONRZ10	27	12
ONRZ10	28	2
ONRZ10	28	8
ONRZ10	29	1
ONRZ10	29	4
OSLP10	31	5
OSLP10	31	9
OSLP10	32	20
OSLP10	32	21
OSLP10	33	6
OSLP10	33	18
OSLP10	33	57
OSLP10	34	1

Project	Trench	Feature
OSLP10	34	11
OSLP10	36	30
OSLP10	36	35
OSLP10	39	1
OSLP10	59	6
OSLP10	39	9
OSLP10	39	10
OSLP10	39	38
OSLP10	39	29
OSLP10	39	45
OSLP10	39	63
OSLP10	39	36
OSLP10	39	74
OSLP10	39	77
OSLP10	39	111
OSLP10	40	6

Project	Trench	Feature
OSLP10	40	7
OSLP10	40	35
OSLP10	42	45
OSLP10	42	51
OSLP10	44	21
OSLP10	44	2
OSLP10	46	4
OSLP10	46	59
OSLP10	46	87
OSLP10	46	4
OSLP10	47	42
OSLP10	47	5
OSLP10	47	6
OSLP10	47	7
OSLP10	47	27
OSLP10	49	1

Project	Trench	Feature
OSLP10	49	3
OSLP10	49	4
OSLP10	55	9
OSLP10	50	1
OSLP10	50	21
OSLP10	60	22
OBSP11	69	1 *only birds
OBSP11	81	1 *only birds
OBSP11	86	1 *only birds
OBSP12	112	2 *only birds
OBSP12	127	*only birds
OBSP12	131	*only birds
OBSP14	199	1 *only birds

Appendix 19.2
A list of unpublished student thesis and site reports.
Some of the data are published in this volume.

Author	Year	Title	Type of report
Erik Louwe	2007	De vindplaats Oegstgeest-Corpus. Een archeozoölogische analyse van een Merovingische nederzetting aan de Oude Rijn	Master thesis
Sebastiaan Reinstra	2013	Oegstgeest: handelsplaats of oevernderzetting? Een vergelijkend zoöarcheologisch onderzoek naar de veestapel en handelsrelaties binnen de Rijnmondregio, 525-720	Bahelor thesis
Sebastiaan Reinstra	2012	De veestapel van de Merovingische handelplaats te Oegstgeest. Een vergelijking met de Rijnmondregio	Master thesis
Annemarijke Windig	2012	De 11de eeuw in zoölogisch materiaal in Oegstgeest	Bachelor thesis
Samira Nagels	2012	Exchange and surplus production of animals and animal products at the Early Medieval settlement of Oegstgeest	Master thesis
Elfi Buhrs	2012	De katten van Oegstgeest en vroeg-middeleeuwse handesscheepvaart. Een archeozoölogische analyse	Bachelor thesis
Inge van der Jagt	2012	Archeozoölogie van de vroegmiddeleeuwse nederzetting Oegstgeest (Projecten ONRZ09 en OSLP10)	LAB-report 7
Elfi Buhrs	2013	Old Companions, Noble Steeds: Why dogs and horses were buried at an early medieval settlement along the Old Rhine.	Master thesis
Franka Kerklaan	2013	De vis van Oegstgeest (OSLP-10 & ONRZ 1255)	Unpublished fish report
Yuki Beets	2016	Medieval animal bone waste at Oegstgeest: An exploration of the animal bones bound in waste pits at Oegstgeest	Bachelor thesis
Sander Aerts	2015	The feathered inhabitants of Oegstgeest. The avifaunal remains of the Merovingian settlement of Oegstgeest	Bachelor thesis
Cynthia Kromotaroeno	2015	Osseous objects of Oegstgeest. A functional analysis of the bone and antler objects of the Early Medieval settlement of Oegstgeest (Nieuw-Rhijngeest Zuid)	Master thesis
Bryan Leek	2015	Geulen en Putten. Een vergelijking tussen zoölogisch materiaal in geul 2 en de waterputten van Merovingisch Oegstgeest	Bachelor thesis
Bryan Leek	2018	Method to the Madness: A comparative study of traditional identification and recording methods and the Diagnostic Zone method in Zooarchaeology	Master thesis
Ellen Gundy	2019	An analysis of the avian assemblage of the Merovingian site of Oegstgeest, the Netherlands	Bachelor thesis

Abbreviations

AAC	Amsterdam Archeologisch Centrum
AAS	Amsterdam Archaeological Studies
Archis	Archaeological Information System
AWN	Archeologische Werkgemeenschap Nederland
BROB	Berichten van de Rijksdienst voor het Oudheidkundig Bodemonderzoek
DAR	Delftse Archeologische Rappoorten
FDI	Fédération Dentaire Internationale (World Dental Federation)
GAS	Groningen Archaeological Studies
HOP	Haagse Oudheidkundige Publicaties
JALC	Journal of Archaeology in the Low Countries
NAR	Nederlandse Archeologische Rapporten
NO	Nederlandse Oudheden
OBSP	Oegstgeest Bio Science Park
OMROL	Oudheidkundige Mededelingen uit het Rijksmuseum van Oudheden te Leiden
ONRZ	Oegstgeest Nieuw Rhijngeest Zuid
OSLP	Oegstgeest SL Plaza
RA	Rheinische Ausgrabungen
RAD	Rapportages Archeologie Deventer
RAM	Rapportage Archeologische Monumentenzorg
RCE	Rijksdienst voor het Cultureel Erfgoed (Cultural Heritage Agency of the Netherlands)
v.	vondstnummer (find number)

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17 Merovingian leather and footwear from Oegstgeest (2010-2014)

Carol van Driel-Murray

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18 The textiles from the early medieval settlement of Oegstgeest

Chrystel R. Brandenburgh

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Laura Llorente-Rodríguez, Inge M.M. van der Jagt and Kinie Esser

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20 Fish remains
Franka Kerklaan

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21 Shell finds from a Merovingian settlement along the Rhine at Oegstgeest
Wim J. Kuijper

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