Analecta Praehistorica Leidensia 37/38 / Schipluiden : a neolithic settlement on the Dutch North Sea coast c. 3500 CAL BC
Kooijmans, L.P.L.; Jongste, P.; et al., ; Jongste, P.F.B.; Kooijmans, L.P.L.

ANALECTA PRAEHISTORICA LEIDENSIA 37/38

PUBLICATION OF THE FACULTY OF ARCHAEOLOGY
LEIDEN UNIVERSITY

SCHIPLUIDEN

A NEOLITHIC SETTLEMENT ON THE DUTCH NORTH SEA COAST *c*. 3500 CAL BC

EDITED BY LEENDERT P. LOUWE KOOIJMANS
AND PETER F.B. JONGSTE

LEIDEN UNIVERSITY 2006

The publication of this volume was made possible by financial and organisational support from:

Hoogheemraadschap van Delfland

Archol
Archeologisch Onderzoek Leiden BV

Translation by Susan Mellor

Series editors: Corrie Bakels / Hans Kamermans

Copy editors of this volume: Leendert Louwe Kooijmans / Peter Jongste

Editors of illustrations: Walter Laan and Alastair Allen, Archol BV

ISSN 0169-7447

ISBN-10: 90-73368-21-9
ISBN-13: 978-90-73368-21-7

Subscriptions to the series *Analecta Praehistorica Leidensia*
and single volumes can be ordered exclusively at:

Faculty of Archaeology
P.O. Box 9515
NL-2300 RA Leiden
the Netherlands

Contents

Preface *IX*
Leendert Louwe Kooijmans

PART I INTRODUCTION *1*

1 **Discovery and working method** *3*
Peter Jongste
Leendert Louwe Kooijmans

2 **Stratigraphy and chronology of the site** *19*
Joanne Mol
Leendert Louwe Kooijmans
Tom Hamburg

3 **Features** *39*
Tom Hamburg
Leendert Louwe Kooijmans

4 **The archaeological remains: a critical spatial approach** *67*
Milco Wansleeben
Leendert Louwe Kooijmans

PART II MAN AND MATERIALS *89*

5 **Graves and human remains** *91*
Liesbeth Smits
Leendert Louwe Kooijmans

6 **The Schipluiden pottery** *113*
Daan Raemaekers
Michiel Rooke

7 **Flint, procurement and use** *129*
Annelou van Gijn
Veronique van Betuw
Annemieke Verbaas
Karsten Wentink

8 **Stone, procurement and use** *167*
Annelou van Gijn
Rob Houkes

9 **Ornaments of jet, amber and bone** *195*
Annelou van Gijn

10 **Implements of bone and antler: a Mesolithic tradition continued** *207*
Annelou van Gijn

11 **Wooden artefacts** *225*
Leendert Louwe Kooijmans
Laura Kooistra

12 **Fabrics of fibres and strips of bark** *253*
Laura Kooistra

13 **Birch bark tar** *261*
Annelou van Gijn
Jaap Boon

PART III ECOLOGY AND ECONOMY *267*

14 **Coastal evolution of Delfland and the Schipluiden microregion in relation to Neolithic settlement** *269*
Joanne Mol

15 **Diatoms** *285*
Hein de Wolf
Piet Cleveringa

16 **Molluscs** *297*
Wim Kuijper

17 **Coprolites, macroscopic analysis** *301*
Mark van Waijjen
Caroline Vermeeren

18 **Pollen analysis and the reconstruction of the former vegetation** *305*
Corrie Bakels

19 **Botanical remains and plant food subsistence** *317*
Lucy Kubiak-Martens

20 **Roots, tubers and processed plant food in the local diet** *339*
Lucy Kubiak-Martens

20a **Analytical report on some archaeological charred residues from Schipluiden** *353*
Jaap Boon

21 **Wood and charcoal** *363*
Laura Kooistra

22 **Mammals** *375*
Jørn Zeiler

23 **Birds** *421*
Jørn Zeiler

24 **Background fauna: small mammals, amphibians and reptiles** *443*
Jørn Zeiler

25 **Fish** *449*
Dick Brinkhuizen

26 **Insects** *471*
Tom Hakbijl

PART IV SYNTHESIS *483*

27 **Schipluiden: a synthetic view** *485*
Leendert Louwe Kooijmans

22 Mammals

Jørn Zeiler

The dune occupants met their meat demand via both stock farming and the hunting of wild mammals. The main focus of their stock-farming activities was cattle, while their hunting efforts concentrated on wild boar and red deer. They also kept pigs and supplemented their diet via the more incidental hunting of a broad range of fur animals and marine mammals. Although the proportion of cattle decreased with time, cattle farming remained the main source of animal protein until the end of the period of occupation.

The species spectrum shows that the occupants exploited different ecozones throughout the entire period of occupation: the swamps to the east of the dune, the beach plain and other nearby dunes, the coastal zone and the estuary of the former Meuse.

22.1 Research questions

The numerous, mostly well-preserved animal bones that were found at the Schipluiden-Harnaschpolder site play an important part in the study of the site's Neolithic occupation. This chapter covers the remains of large mammals (domestic animals and hunted wild animals); small mammal remains (rodents and insectivores) will be dealt with in chapter 24. In the context of the main research questions (chapter 1) the data can be used in answering the following questions:

- how important were stock farming and hunting, and how were the different populations of domestic and wild animals exploited?
- what information do the bones provide with respect to the question whether the site was occupied on a seasonal or a permanent basis?
- what information do the mammal remains provide on the former landscape and on the exploited ecozones?
- did any changes take place in the aforementioned aspects throughout the period of occupation?

The answers to these questions may lead to further insight into issues such as permanence versus mobility, site function and the community's position in the neolithisation process.

22.2 Methods

The bones were collected according to the general excavation routine (chapter 1). Different recovery techniques were used with the aim of obtaining a well-controlled group of remains: the entire manually collected fraction of >2 cm and a sample of the 'fine' fractions from the 4-mm sieve and the 'ecosieves' (mesh widths of 1 and 2 mm). The extent to which this aim was realised has been discussed in chapter 4.

The standard procedure was not followed in the analysis of the mammal remains as it would have been impossible to study the vast quantity of remains in that manner within the overall project limits. In view of the large size of the assemblage it was decided to inspect all the remains, but to select only readily identifiable fragments for further analysis. The categories commonly employed in archaeozoological research – 'indeterminate mammal', 'small mammal', 'medium-sized mammal' and 'large mammal' – were not distinguished. This procedure did however yield all data on seasonality, butchering methods and the ages at which the animals were slaughtered, the carving of bone and antler and the spatial distributions of specific categories (including human remains).

So a selection of readily identifiable fragments was made from all the manually collected remains and all the remains recovered from the 4-mm sieve fraction. The same procedure was followed for the remains recovered from the ecosieve residues (1 and 2 mm). The identifiable remains were selected from 138 of the total of 300 samples. In this way more than a quarter of the total number of around 80,000 manually collected remains (of mammals, birds and fish) were selected for identification and just under 10% of the approximately 61,000 remains recovered from the 4-mm sieve fraction. The total number of remains recovered from the ecosieve samples was not counted, but the fraction of identifiable bones among those remains will of course have been smaller than that among the 4-mm sieve residues.

The great majority of the identified mammal remains (approx. 92%) were collected by hand. A little under 8% came from the 4-mm sieve residues and less than 1% from the 1-2-mm sieves. Contrary to what was observed in the case of the bird remains (chapter 23), sieving of the excavated soil through a 4-mm sieve did not prove particularly productive.

The identifications to species/genus/family level were conducted with the aid of the reference collection of present-day bones of the Archaeological Institute of Groningen

University. After the identifications, the fragments were counted and weighed. The identifications and numbers and weights per species yields information on the proportions of the different species in the overall faunal spectrum, and hence on the importance of animal husbandry and hunting in the subsistence system. The species spectrum also provides information on seasonal activities and on the landscape in the site's surroundings.

Noteworthy characteristics (traces of burning, butchering and gnawing) were recorded in order to obtain an impression of taphonomic processes. Pathologies (skeletal deviations caused by sickness, ageing, *etc*.) were also recorded where observed.

Information on the ages at which the animals were slaughtered was obtained via analysis of the fusion stages of the postcranial ('non-skull') bones and of the eruption patterns of teeth and molars. In these analyses use was made of the data published by Habermehl (1975, 1985), Iregren/Stenflo (1982), Iregren *et al*. (2001), Mariezkurrena (1983) and Zeiler (1988).[1]

Information on butchering methods was obtained from the ratios of skeletal elements per species and from the positions of traces of butchering on the bones. Data on the ages at which animals were slaughtered and the employed butchering methods can show how and for what purposes (meat, skins, *etc*.) the different species were exploited. The ages at the time of slaughtering can also yield information on seasonal activities. The criteria formulated by Uerpmann (1973) were used to obtain an impression of the importance of the various skeletal elements in the consumption of meat.

Finally, the method developed by Von den Driesch (1976) was used to measure remains of a limited number of species (dog, wolf, cattle, aurochs, pig and boar) to obtain an impression of the animals' sizes and to distinguish the domestic from the wild species. In some cases the animals' withers height could be calculated on the basis of the measurements. This was done using Harcourt's data for dog (1974), Matolcsi's cattle data (1970) and Teichert's pig and wild boar data (1969). Cattle and aurochs were distinguished on the basis of the data of Degerbøl/Fredskild (1970), and pig and wild boar on the basis of (partly unpublished) data, which were made available by Umberto Albarella (University of Sheffield, UK). The following procedure was followed. First of all, all pig remains were grouped under the heading of 'pig or wild boar'. Then domestic pig remains were distinguished from wild boar remains on the basis of metric data relating to Mesolithic boars from Western and Central Europe (Albarella *et al*. forthcoming). The measurements related to 42 skeletal elements (humerus, astragalus, calcaneus and mandibula), four of which could not be unambiguously attributed to one of the two forms. Of the other 38 measurements, 14 were assigned to pig and 24 to wild boar.[2] To these were added three associated (fitting) elements: one of domestic pig and two of wild boar. The domestic:wild ratio of around 1:1.7 thus obtained was then extrapolated to the 'pig or wild boar' category.

The same procedure was followed for the skeletal fragments that could not be indisputably attributed to cattle or aurochs. As the number of indisputable identifications of cattle greatly outnumbered those of aurochs, all cattle/aurochs remains were categorised as cattle remains.

22.3 Materials

22.3.1 Contexts

The bones were recovered from different contexts. They were first of all the aquatic deposits and the colluvium on

	N=							W=						
phase	1	1-2a	2a	2b	3	1-3	totals	1	1-2a	2a	2b	3	1-3	totals
collected by hand														
Units	185	329	3768	1539	1495	939	8255	7.498	8.094	72.993	13.704	11.797	4.585	118.671
features	5	–	110	–	–	484	599	145	–	5.837	–	–	15.300	21.282
Totals	*190*	*329*	*3878*	*1539*	*1495*	*1423*	*8854*	*7.644*	*8.094*	*78.830*	*13.704*	*11.797*	*19.885*	*139.953*
4-mm sieve														
Units	–	39	4	270	106	321	740	–	16	1	383	50	145	594
features	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Totals	*–*	*39*	*4*	*270*	*106*	*321*	*740*	*–*	*16*	*1*	*383*	*50*	*145*	*594*
1- and 2-mm sieve														
Units	6	1	37	7	6	8	65	57	2	173	5	9	7	252
features	–	–	2	–	–	6	8	–	–	1	–	–	351	352
Totals	*6*	*1*	*39*	*7*	*6*	*14*	*73*	*57*	*2*	*174*	*5*	*9*	*358*	*605*

Table 22.1 Identified mammal remains excluding microfaunal remains, arranged according to recovery technique, context and phase. Weights in grams.

the southeastern and northwestern flanks of the dune. They can be regarded as two variants of the same context, notably the swampy zone at the foot of the dune (chapter 2). The great majority of the identified mammal remains came from these layers (table 22.1) – *i.e.* 93% of the manually collected remains and 89% of the remains recovered from the 1-2-mm sieved samples. All the identified remains from the 4-mm sieve fraction came from these deposits.

The other remains were recovered from features – postholes, ditches and hearth pits, but above all pits and wells. The latter two contexts together accounted for almost 75% of the total number of remains and approximately 87% of the overall weight of the remains manually collected from features. The relatively small numbers of bones found in features indicate that features were relatively rarely used for discarding refuse. Wells were evidently incidentally used for that purpose after they had lost their original function, for example having become saline following a storm flood (see also chapters 25 and 26).

The remains recovered from the aquatic deposits and the colluvium accumulated there over a period of many years, during a long series of depositions, and they therefore

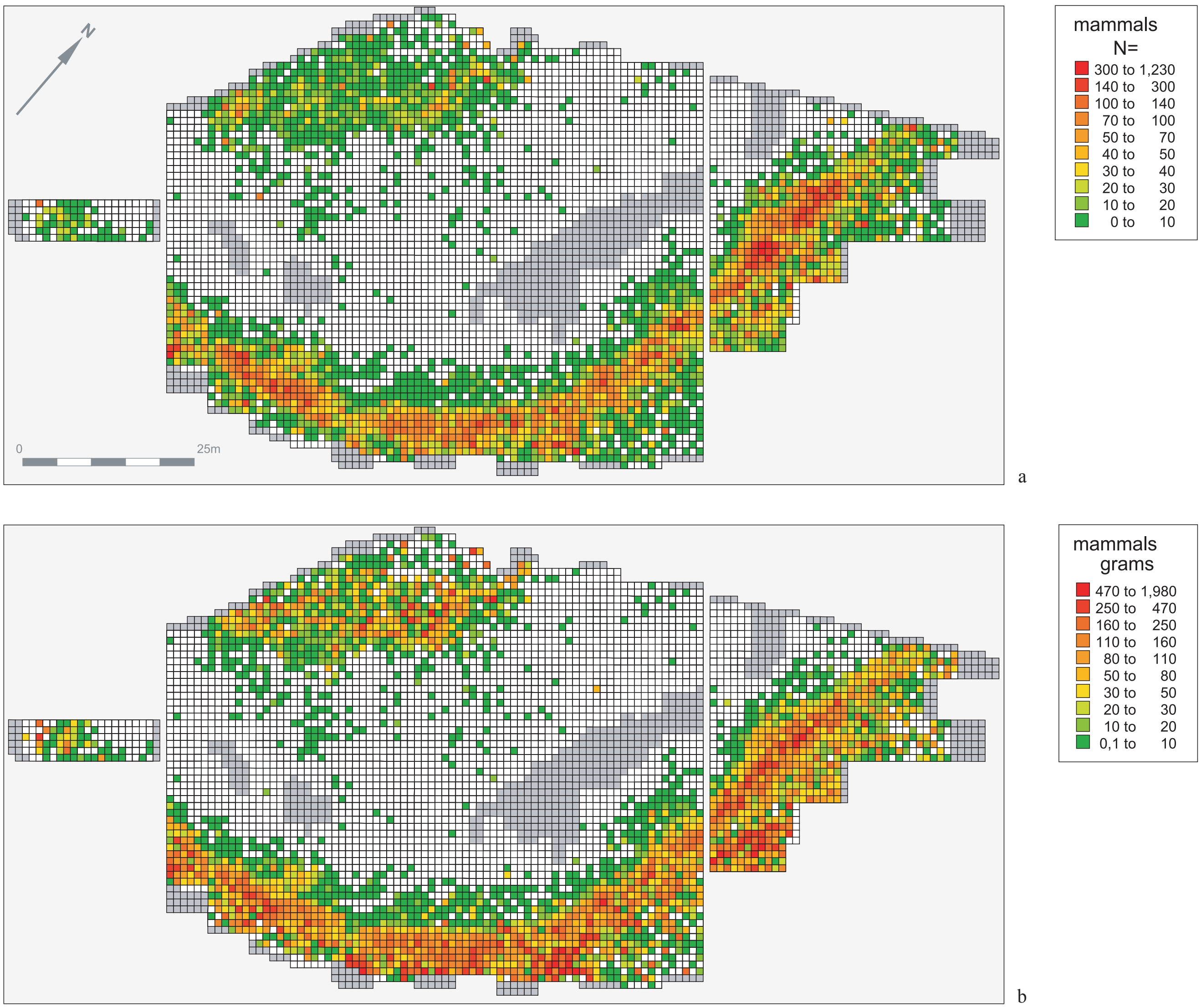


Figure 22.1 Distribution patterns of manually collected mammal remains per square metre.
a number of identified bones
b bone weight

		N=							%						
	phase	1	1-2a	2a	2b	3	1-3	totals	1	1-2a	2a	2b	3	1-3	totals
livestock															
cattle	*Bos taurus*	94	135	1386	486	319	859	3279	54.0	41.8	38.5	36.3	33.3	63.3	42.3
pig	*Sus domesticus*	18	42	493	182	109	89	933	10.3	13.0	13.7	13.6	11.4	6.6	12.0
	Subtotal	*112*	*177*	*1879*	*668*	*428*	*948*	*4212*	*64.4*	*54.8*	*52.2*	*49.9*	*44.7*	*69.8*	*54.3*
dog	*Canis familiaris*	5	44	414	126	187	121	897	2.9	13.6	11.5	9.4	19.5	8.9	11.6
wild ungulates															
aurochs	*Bos primigenius*	2	–	8	–	–	4	14	1.2	–	0.2	–	–	0.3	0.2
red deer	*Cervus elaphus*	25	20	311	121	108	91	676	14.4	6.2	8.6	9.0	11.3	6.7	8.7
roe deer	*Capreolus capreolus*	–	–	1	–	–	–	1	–	–	+	–	–	–	+
wild boar	*Sus scrofa*	28	71	838	304	191	156	1588	16.1	22.0	23.3	22.7	20.0	11.5	20.5
	Subtotal	*55*	*91*	*1158*	*425*	*299*	*251*	*2279*	*31.6*	*28.2*	*32.2*	*31.8*	*31.2*	*18.5*	*29.4*
fur animals															
beaver	*Castor fiber*	2	1	59	38	19	10	129	1.2	0.3	1.6	2.8	2.0	0.7	1.7
otter	*Lutra lutra*	–	5	59	63	17	19	163	–	1.5	1.6	4.7	1.8	1.4	2.1
marten	*Martes sp.*	–	–	1	1	–	–	2	–	–	+	0.1	–	–	+
polecat	*Putorius putorius*	–	3	2	5	1	–	11	–	0.9	0.1	0.4	0.1	–	0.1
fox	*Vulpes vulpes*	–	–	–	–	2	–	2	–	–	–	–	0.2	–	+
wolf	*Canis lupus*	–	–	3	1	–	–	4	–	–	0.1	0.1	–	–	0.1
brown bear	*Ursus arctos*	–	–	9	1	–	–	10	–	–	0.3	0.1	–	–	0.1
wildcat	*Felis silvestris*	–	–	9	9	2	2	22	–	–	0.3	0.7	0.2	0.1	0.3
lynx	*Lynx lynx*	–	–	2	–	–	1	3	–	–	0.1	–	–	0.1	+
	Subtotal	*2*	*9*	*144*	*118*	*41*	*32*	*346*	*1.2*	*2.8*	*4.0*	*8.8*	*4.3*	*2.4*	*4.5*
sea mammals															
common seal	*Phoca vitulina*	–	–	4	–	–	–	4	–	–	0.1	–	–	–	0.1
grey seal	*Halichoerus grypus*	–	2	–	1	–	1	4	–	0.6	–	0.1	–	0.1	0.1
bottle-nosed dolphin	*Tursiops truncatus*	–	–	1	–	1	5	7	–	–	+	–	0.1	0.4	0.1
whale sp.	*Cetaceae*	–	–	–	–	1	–	1	–	–	–	–	0.1	–	+
	Subtotal	–	*2*	*5*	*1*	*2*	*6*	*16*	–	*0.6*	*0.1*	*0.1*	*0.2*	*0.4*	*0.2*
	Totals	*174*	*323*	*3600*	*1338*	*957*	*1358*	*7750*	*100*	*100*	*100*	*100*	*100*	*100*	*100*
red deer, antler		16	6	278	201	538	65	1104							

Table 22.2 Manually collected mammal remains, numbers of identifications per phase.

present an impression of the overall range of activities in the fields of the butchering, consumption and processing of mammals. Individual disposal activities, in particular of dog remains, were here and there archaeologically visible in the form of concentrations of bones. The remains recovered from pits may have made their way into those pits from surrounding areas or they may have deliberately been discarded there, in which case the pits' contents may reflect short-term specific activities. During the research, efforts were made to identify special deposition patterns. The data relating to the features were however also combined with those obtained for the deposits. In view of their relatively small sizes (6.8% in terms of numbers and 15% in terms of weight), the feature assemblages have fairly little influence on the overall picture.

22.3.2 Spatial distribution

The spatial distribution of the bones shows two concentration zones along the flanks of the dune. There are two explanations for this: the (wet) preservation conditions were most favourable in those parts, and the find situation shows that this peripheral zone of the settlement was used as a waste-disposal area (fig. 21.1). The largest concentrations were in the south and southeast, where 76% of the identified manually collected mammal remains were found. A smaller cluster was observed in the northwestern part. Virtually no animal bones were found higher up the dune. This is largely attributable to the unfavourable preservation conditions in that area. The occupants may moreover have kept their settlement (fairly) clean (see also section 3.4).

22.3.3 Phasing

More than half (52.2%) of the stratified mammal remains date from phase 2a, but a large sample is also available for phases 2b and 3. Only from phase 1 do we have few remains, but nevertheless sufficient for analysis (table 22.1). Insofar as the remains could be dated to a specific phase, phases 2b

		W=							%						
	phase	1	1-2a	2a	2b	3	1-3	totals	1	1-2a	2a	2b	3	1-3	totals
livestock															
cattle	*Bos taurus*	4.908	5.472	46.440	6.632	4.148	14.098	81.697	67.3	67.9	61.5	52.2	42.0	73.7	61.6
pig	*Sus domesticus*	459	363	4.919	1.197	559	949	8.446	6.3	4.5	6.5	9.4	5.7	5.0	6.4
	Subtotal	*5.367*	*5.835*	*51.358*	*7.828*	*4.708*	*15.047*	*90.144*	*73.6*	*72.4*	*68.1*	*61.6*	*47.7*	*78.6*	*68.0*
dog	*Canis familiaris*	144	400	2.751	579	749	565	5.188	2.0	5.0	3.6	4.6	7.6	3.0	3.9
wild ungulates															
aurochs	*Bos primigenius*	120	–	855	–	–	113	1.088	1.6	–	1.1	–	–	0.6	0.8
red deer	*Cervus elaphus*	1.061	761	10.900	1.979	2.983	1.934	19.618	14.6	9.4	14.4	15.6	30.2	10.1	14.8
roe deer	*Capreolus capreolus*	–	–	1	–	–	–	1	–	–	0.0	–	–	–	0.0
wild boar	*Sus scrofa*	545	1.037	8.709	1.967	1.169	1.312	14.738	7.5	12.9	11.5	15.5	11.8	6.9	11.1
	Subtotal	*1.726*	*1.797*	*20.466*	*3.946*	*4.152*	*3.359*	*35.445*	*23.7*	*22.3*	*27.1*	*31.1*	*42.0*	*17.6*	*26.7*
fur animals															
beaver	*Castor fiber*	51	7	462	217	51	60	847	0.7	0.1	0.6	1.7	0.5	0.3	0.6
otter	*Lutra lutra*	–	16	115	100	38	25	294	–	0.2	0.2	0.8	0.4	0.1	0.2
marten	*Martes sp.*	–	–	1	+	–	–	1	–	–	+	+	–	–	+
polecat	*Putorius putorius*	–	1	2	3	1	–	7	–	+	+	+	+	–	+
fox	*Vulpes vulpes*	–	–	–	–	10	–	10	–	–	–	–	0.1	–	+
wolf	*Canis lupus*	–	–	60	9	–	–	69	–	–	0.1	0.1	–	–	0.1
brown bear	*Ursus arctos*	–	–	131	3	0	–	134	–	–	0.2	+	–	–	0.1
wildcat	*Felis silvestris*	–	–	19	18	4	3	44	–	–	+	0.1	+	+	+
lynx	*Lynx lynx*	–	–	1	–	–	1	1	–	–	+	–	–	+	+
	Subtotal	*51*	*24*	*791*	*349*	*102*	*88*	*1.406*	*0.7*	*0.3*	*1.1*	*2.8*	*1.0*	*0.5*	*1.1*
sea mammals															
common seal	*Phoca vitulina*	–	–	8	–	–	–	8	–	–	+	–	–	–	+
grey seal	*Halichoerus grypus*	–	8	–	2	–	42	53	–	0.1	–	+	–	0.2	+
bottle-nosed dolphin	*Tursiops truncatus*	–	–	85	-	17	32	134	–	–	0.1	–	0.2	0.2	0.1
whale sp.	*Cetaceae*	–	–	–	–	148	–	148	–	–	–	–	1.5	–	0.1
	Subtotal	–	*8*	*93*	*2*	*165*	*75*	*343*	–	*0.1*	*0.1*	+	*1.7*	*0.4*	*0.3*
	Totals	*7.288*	*8.065*	*75.459*	*12.705*	*9.875*	*19.133*	*132.525*	*100*	*100*	*100*	*100*	*100*	*100*	*100*
red deer, antler		356	29	3.372	999	1.922	752	7.429							

Table 22.3 Manually collected mammal remains, bone weights in grams per phase.

and 3 were best represented in the 4-mm sieve fraction. This is due to the fact that the clay soils of Units 19 and 18 were not, or virtually not sieved on a large scale. More than half of the identified remains recovered from the 1- and 2-mm sieve fractions, finally, date from phase 2a while only a small number of remains date from the other phases. This unbalanced distribution of the remains from the sieve fractions is attributable to an unequal distribution of samples from the different occupation phases. The same was observed in the case of the bird remains (chapter 23) and the background fauna (chapter 24).

22.3.4 Species spectra

In total, almost 10,000 mammal remains were identified.[3] The identifications of the manually collected bones and the bones recovered from the various sieve fractions are summarised in tables 22.2-6. As already mentioned above, the majority of the identified bones are manually collected remains. On the one hand, these remains show a great diversity, representing twenty species in total, and on the other they are strongly dominated by five species: three domestic species (cattle, pig and dog) and two wild species (red deer and wild boar). They together account for 95% of the identifications. The numbers and weights of pig and wild boar remains are based on the ratio of the two species as inferred from the metric data (see section 22.4.1). The remains recovered from the 4-mm sieve fraction represent eleven species. The diversity of the remains from the 1- and 2-mm sieve samples is the smallest, comprising six species.

These species ratios agree well with those of the nearby contemporary sites of Wateringen 4 (Raemaekers *et al.* 1997) and Ypenburg (De Vries 2004). The more limited species spectra of the latter two sites must be attributable to the fact that the assemblages of those sites are much smaller than that

		N=						%					
	phase	1-2a	2a	2b	3	1-3	totals	1-2a	2a	2b	3	1-3	totals
livestock													
cattle	*Bos taurus*	11	–	72	30	154	267	28	–	27	29	54	38
pig	*Sus domesticus*	5	–	43	16	42	106	13	–	16	16	15	15
	Subtotal	*16*	–	*115*	*46*	*196*	*373*	*41*	–	*43*	*45*	*68*	*53*
dog	*Canis familiaris*	10	1	32	22	7	72	26	–	12	21	2	10
wild ungulates													
red deer	*Cervus elaphus*	–	–	9	–	2	11	–	–	3	–	1	2
wild boar	*Sus scrofa*	9	1	73	28	72	183	23	–	28	27	25	26
	Subtotal	*9*	*1*	*82*	*28*	*74*	*194*	*23*	–	*31*	*27*	*26*	*28*
fur animals													
beaver	*Castor fiber*	–	1	–	–	1	2	–	–	–	–	+	+
otter	*Lutra lutra*	2	1	24	4	4	35	5	–	9	4	1	5
marten	*Martes sp.*	2	–	–	–	–	2	5	–	–	–	–	+
polecat	*Putorius putorius*	–	–	1	–	3	4	–	–	+	–	1	1
weasel	*Mustela nivalis*	–	–	1	–	–	1	–	–	+	–	–	+
brown bear	*Ursus arctos*	–	–	–	–	1	1	–	–	–	–	+	+
wildcat	*Felis silvestris*	–	–	10	3	2	15	–	–	4	3	1	2
	Subtotal	*4*	*2*	*36*	*7*	*11*	*60*	*10*	–	*14*	*7*	*4*	*9*
	Totals	*39*	*4*	*265*	*103*	*288*	*699*	*100*	–	*100*	*100*	*100*	*100*
red deer, antler		–	–	5	3	33	41						

Table 22.4 Mammal remains from the 4-mm sieve residues, numbers of identifications per phase.

of Schipluiden. A comparably broad species spectrum is incidentally characteristic of many Neolithic sites in the Dutch delta area, such as Vlaardingen (Clason 1967), Hekelingen III (Prummel 1987) and Hardinxveld-Giessendam De Bruin (Oversteegen *et al*. 2001).

It should be borne in mind that the tables give only the numbers and weights of the identified remains, and that they provide a biased, indirect picture of meat consumption. The meat of certain species, such as dog, will not have been consumed (section 22.5). Antler was classed as a separate category and antler remains were not included in the totals. The remains in question may after all represent collected shed antler and have nothing to do with meat consumption (section 22.8). Had we counted the (readily identifiable) antler fragments, the score ultimately obtained for deer would moreover have been proportionally much higher than the scores of the other animals.

Another separate class, finally, consists of a few human remains and carved bone and antler fragments, which were all found predominantly among the manually collected remains.[4] They have already been discussed in chapters 5 and 10, respectively.

22.3.5 Differences in identifications between the differently collected remains

The numbers of species identifications of the manually collected remains differ from those of the remains recovered from the sieve fractions (tables 22.2-6; fig. 22.2). In the first place, in terms of percentages, the remains from the 4-mm sieve fraction comprise more than twice as many identified remains of fur animals as the manually collected remains (9% and 4%, respectively). Secondly, the average weight of the remains from the 1-2-mm sieve fractions is much higher than that of the remains from the 4-mm sieve fraction: 8.5 g as opposed to 0.8 g. This is attributable to the difference in sampling method: the sieving (through a 4-mm mesh width) of soil that had already been searched as opposed to the sieving of freshly dug 5-litre samples. This explains why 21 (comparatively) large bone fragments of cattle, pig, wild boar, dog and red deer with a total weight of 588 g. were found among the remains recovered from the 1-2-mm sieve fraction. These fragments are not representative of the fine sieve fractions. Without this component of larger remains the average weight of the remains from the 1-2-mm sieve fraction is 0.3 g.

The low average weight of the remains from the 4-mm sieve fraction is largely due to the large number of fragments of teeth and molars (approximately two-thirds of the total number of identified remains). This high proportion is attributable to the fact that dental elements can be relatively easily identified, even when they are quite small.

An interesting question is how the collection method influenced the ratios of the various species. It goes without

		W=						%					
	phase	1-2a	2a	2b	3	1-3	totals	1-2a	2a	2b	3	1-3	totals
livestock													
cattle	*Bos taurus*	4	–	215	19	101	338	.	.	58	42	73	59
pig	*Sus domesticus*	3	–	36	5	11	55	.	.	10	11	8	10
	Subtotal	*6*	–	*251*	*24*	*112*	*393*	.	.	*68*	*53*	*81*	*69*
dog	*Canis familiaris*	5	+	22	10	2	39	.	.	6	22	2	7
wild ungulates													
red deer	*Cervus elaphus*	–	–	24	–	2	26	.	.	7		2	5
wild boar	*Sus scrofa*	4	+	61	9	19	93	.	.	17	19	14	16
	Subtotal	*4*	+	*85*	*9*	*21*	*119*	.	.	*23*	*19*	*15*	*21*
fur animals													
beaver	*Castor fiber*	–	+	–	–	+	1	.	.	–	–	–	+
otter	*Lutra lutra*	1	–	11	2	1	14	.	.	3	3	1	2
marten	*Martes sp.*	+	–	–	–	–	+	.	.	–	–	–	–
polecat	*Putorius putorius*	–	–	+	–	1	1	.	.	–	–	1	+
weasel	*Mustela nivalis*	–	–	+	–	–	+	.	.	–	–	–	–
brown bear	*Ursus arctos*	–	–	–	–	1	1	.	.	–	–	1	+
wildcat	*Felis silvestris*	–	–	2	1	+	3	.	.	+	2	–	+
	Subtotal	*1*	+	*13*	*2*	*3*	*19*	.	.	*3*	*5*	*3*	*3*
	Totals	*16*	*1*	*370*	*45*	*139*	*570*	.	.	*100*	*100*	*100*	*100*
red deer, antler		–	–	13	5	6	24						

Table 22.5 Mammal remains from the 4-mm sieve residues, bone weights in grams per phase.

saying and is quite understandable that sieving leads to a bias in remains of smaller species, in particular fur animals. It is however not possible to make a direct comparison of the remains collected according to the different methods because the remains recovered from the sieve fractions, coming from a volume of 8% – or 1/12 – of the total volume of soil, were intended to *supplement* the manually collected remains. What the ratios would have been if *all the* soil had been sieved we see if we add the data relating to the sieve residues, multiplied by 12, to those relating to the manually collected remains. Then, all the soil has actually been 'virtually sieved'. The result is presented in table 22.7. Comparison of the outcome of this calculation with that obtained for the manually collected remains reveals only slight differences. The numbers of identifications show a decrease in red deer and increases in pig and wild boar. The fur animals viewed as a group rise from 4.4% to 6.6%, but that is not a dramatic difference either. The weights understandably show virtually no differences: the small bones recovered from the sieve fractions have hardly any influence on the totals. The conclusion is that the collection method does have some influence on the number ratios of the various species, but very little or no influence on the weight ratios. This is something that should be borne in mind in comparing the Schipluiden assemblage with other assemblages, and in comparing sites where remains were exclusively recovered from sieve fractions (Hardinxveld for example) or were exclusively collected by hand (Vlaardingen, Hekelingen).

The remains from the 1-2-mm sieve fraction represent an even smaller sample of the remains originally present (less than 0.1% of the soil volume of the manually collected remains). Small fur animals are surprisingly not as amply represented in the 1- and 2-mm fractions as we would expect (table 22.6). The relatively high weight proportion of cattle, pig, wild boar and red deer is as already mentioned attributable to a number of (comparatively) large bone fragments that are not representative of these fine sieve fractions. All in all the 1- and 2-mm sieve samples yielded little extra qualitative and quantitative information on the large mammals on top of that provided by the manually collected remains and the remains from the 4-mm sieve fractions. So the zoological importance of sieving concerns predominantly birds, the microfauna and fish (chapters 23, 24 and 25).

22.3.6 Differences in identifications between remains recovered from different contexts

There are differences in terms of the composition of the manually collected remains between those from the deposits (units) and those from pit fills. The latter remains for example represent a much narrower range of species than the former (9 as opposed to 20), which will be attributable to

	N=							W=						
phase	1	1-2a	2a	2b	3	1-3	totals	1	1-2a	2a	2b	3	1-3	totals
livestock														
cattle (*Bos taurus*)	–	–	3	1	1	2	7	–	–	14	3	8	327	351
pig (*Sus domesticus*)	2	–	9	2	2	2	17	21	–	3	1	+	2	27
Subtotal	*2*	–	*12*	*3*	*3*	*4*	*24*	*21*	–	*17*	*3*	*8*	*329*	*378*
dog (*Canis familiaris*)	–	–	1	–	–	1	2	–	–	3	–	–	6	9
wild ungulates														
red deer (*Cervus elaphus*)	–	–	8	–	–	1	9	–	–	149	–	–	20	169
wild boar (*Sus scrofa*)	4	–	16	4	3	6	33	36	–	5	1	+	3	46
Subtotal	*4*	–	*24*	*4*	*3*	*7*	*42*	*36*	–	*154*	*1*	+	*23*	*215*
fur animals														
otter (*Lutra lutra*)	–	–	1	–	–	–	1	–	–	+	–	–	–	+
wildcat (*Felis silvestris*)	–	–	–	–	–	2	2	–	–	–	–	–	+	+
Subtotal	–	–	*1*	–	–	*2*	*3*	–	–	+	–	–	+	*1*
Totals	*6*	–	*38*	*7*	*6*	*14*	*71*	*57*	–	*174*	*5*	*9*	*358*	*603*
red deer, antler	–	1	1	–	–	–	2	–	2	1	–	–	–	2

Table 22.6 Mammals remains from the 1- and 2-mm sieve residues, numbers of identifications and bone weights in grams per phase.

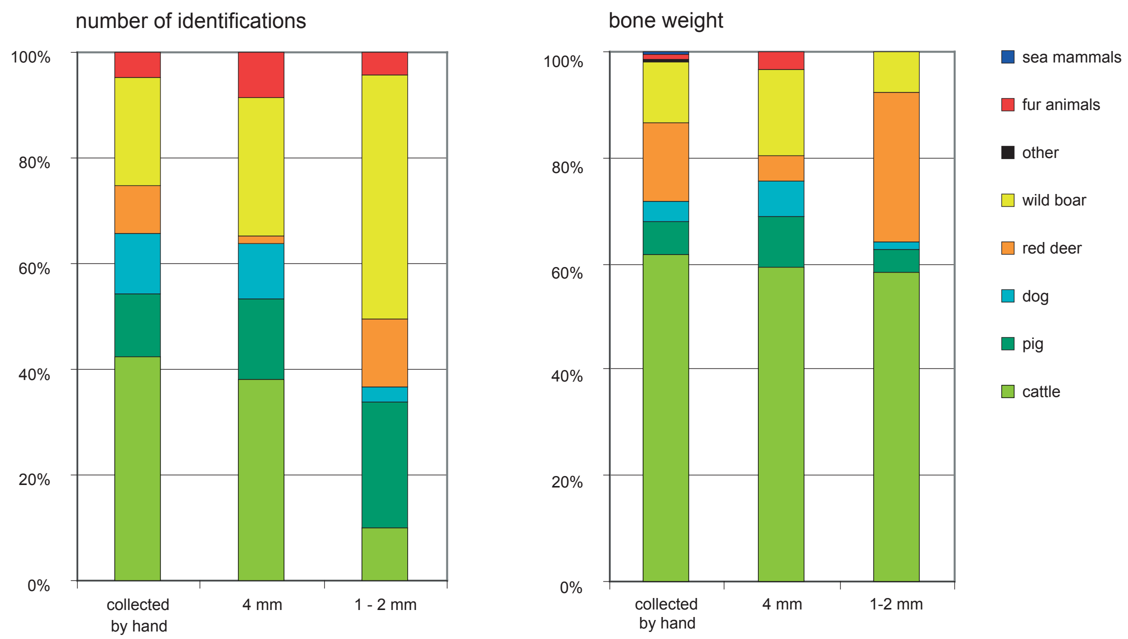


Figure 22.2 Ratios of the most important species and groups of mammals expressed as numbers of identifications and as bone weight, presented according to recovery procedure; all manually collected remains, excluding antler.

the smaller size of the assemblage from pit fills (6.8% in numbers of identifications). Secondly, the average weight of the remains from the pit fills is almost 2.5 times as high as that of the remains from the units (35.5 g as opposed to 14.4 g). An obvious explanation for this is a difference in taphonomy: the remains from the pits will have become incorporated in the soil much sooner, and will have been much less affected by trampling. What will however also be influential factors are differences in the species ranges (fig. 22.3). Remains of smaller mammal species (fur animals)

		N=			%			W=			%		
	phase	hand-coll.	4mm corr. (×12)	totals	hand-coll.	4mm corr. (×12)	totals	hand-coll.	4mm corr. (×12)	totals	hand-coll.	4mm corr. (×12)	totals
livestock													
cattle	*Bos taurus*	3279	3204	6483	42.3	38.2	40.2	81,697	4,055	85,752	61.6	59.2	61.6
pig	*Sus domesticus*	933	1272	2205	12	15.2	13.7	8,446	656	9,103	6.4	9.6	6.5
	Subtotal	*4212*	*4476*	*8688*	*54.3*	*53.4*	*53.9*	*90,144*	*4,711*	*94,855*	*67.4*	*68.8*	*67.5*
dog	*Canis familiaris*	897	864	1761	11.6	10.3	10.9	5,188	469	5,657	3.9	6.9	4.1
wild ungulates													
aurochs	*Bos primigenius*	14	–	14	0.2	–	0.1	1,088	–	1,088	0.8	–	0.8
red deer	*Cervus elaphus*	676	132	808	8.7	1.6	5	19,618	316	19,933	14.8	4.6	14.3
roe deer	*Capreolus capreolus*	1	–	1	–	–	–	1	–	1	–	–	–
wild boar	*Sus scrofa*	1588	2196	3785	20.5	26.2	23.4	14,738	1,116	15,854	11.1	16.3	11.4
	Subtotal	2279	2328	4607	29.4	27.8	28.5	35,445	1,432	36,876	26.7	20.9	26.5
fur animals													
beaver	*Castor fiber*	129	24	153	1.7	0.3	0.9	847	8	855	0.6	0.1	0.6
otter	*Lutra lutra*	163	420	583	2.1	5	3.6	294	164	458	0.2	2.4	0.3
marten	*Martes sp.*	2	24	26	–	0.3	0.2	1	2	4	–	–	–
polecat	*Putorius putorius*	11	48	59	0.1	0.6	0.4	7	12	19	–	0.2	–
weasel	*Mustela nivalis*	–	12	12	–	0.1	0.1	–	1	1	–	–	–
fox	*Vulpes vulpes*	2	–	2	–	–	–	10	–	10	–	–	–
wolf	*Canis lupus*	4	–	4	0.1	–	–	69	–	69	0.1	–	–
brown bear	*Ursus arctos*	10	12	22	0.1	0.1	0.1	134	11	144	0.1	0.2	0.1
wildcat	*Felis silvestris*	22	180	202	0.3	2.2	1.3	44	32	77	–	0.5	0.1
lynx	*Lynx lynx*	3	–	3	–	–	–	1	–	1	–	–	–
	Subtotal	*346*	*720*	*1066*	*4.4*	*8.6*	*6.6*	*1,306*	*232*	*1,638*	*1*	*3.4*	*1.2*
sea mammals													
common seal	*Phoca vitulina*	4	–	4	0.1	–	–	8	–	8	–	–	–
grey seal	*Halichoerus grypus*	4	–	4	0.1	–	–	53	–	53	0.1	–	–
bottle-nosed dolphin	*Tursiops truncatus*	7	–	7	0.1	–	–	134	–	134	0.1	–	0.1
whale sp.	Cetaceae	1	–	1	–	–	–	148	–	148	0.1	–	0.1
	Subtotal	*16*	–	*16*	*0.3*	–	*0.1*	*343*	–	*343*	*0*	–	*0.2*
	Totals	*7750*	*8388*	*16138*				*132,525*	*6,844*	*139,368*			
red deer, antler		1104	492	1596	–	–		7,429	286	7,714	–	–	–

Table 22.7 Mammal remains, total number of remains >4 mm calculated by adding volume-corrected data of the 4-mm fraction to the remains collected by hand.

are conspicuously absent from the pit assemblages (mice and the like are not considered here). Remains of European wildcat constitute approximately 2.5% of the overall assemblage from the units, whereas the remains from the features comprise only two wildcat remains, corresponding to 0.4%. Amounting to around 68%, the proportion of cattle bones among the remains from the features is moreover substantially higher than that among the remains from the units, which amounts to 40%. The proportion of cattle bones from the features is higher in terms of weight, too: approx. 78% as opposed to 62%; all percentages are excluding antler. There is also a difference between the remains from the units and those from the features as regards the ratios of the cattle skeletal elements. This will be discussed further in section 22.3.7.

Within the features, five assemblages with more than 25 identified bones were distinguished. In most of those assemblages, cattle is the dominant species in terms of both numbers and weight, for example in the deposition pit that will be discussed below (feature 12-48). Exceptions are feature 10-140 (a well), which yielded exclusively remains of dog, and feature 21-477 (disturbed by plant growth), in which remains of red deer predominated in quantitative terms. The remains in question are however mainly parts of antler; here, too, cattle is the dominant species in terms of weight. The concentration of dog bones found in feature 10-140 will be discussed further in section 22.5.

22.3.7 Deposition pit 12-48

A remarkable context is a small, deep, low-lying pit dating from phases 1-2a, which is on the basis of a number of exceptional characteristics assumed to have been used for deliberate deposition (feature 12-48, see section 3.5.3). It

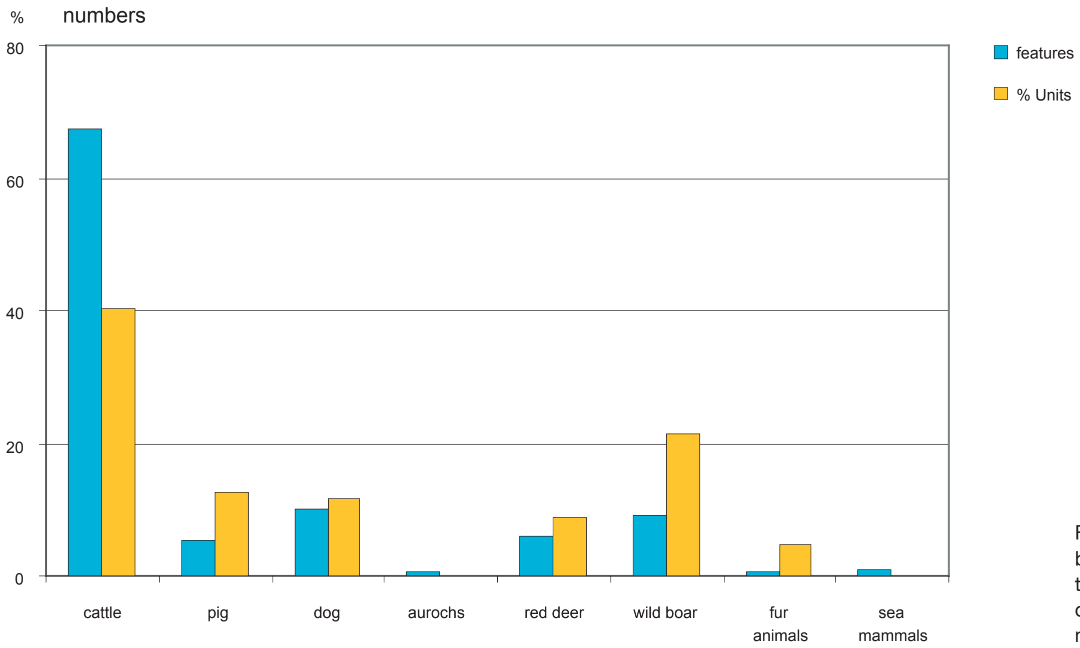


Figure 22.3 Compositions of bone assemblages from features compared with those of assemblages from units; manually collected remains.

may even be associated with the nearby cemetery. It is certainly an unusual archaeological feature that contained a high density of artefacts plus – at a lower level – a large quantity of sloes (section 19.5.1). It would seem that the fruits were the first objects to have been deliberately deposited in the pit, followed shortly after by the bones described here. The contents of the pit seem to reflect a special activity, whose nature is not yet clear.

Besides some remains of flatfish (section 25.5.3), the pit yielded 60 mammal remains. The bones lay so close together as to suggest that they were all simultaneously deposited here. The majority of the remains are cattle bones. The other bones are two pig or wild boar sesamoid bones, one red deer tarsal bone and – interestingly – the skull of a dog. If we assume that the boar and red deer bones ended up in the pit through chance, we are left with a conspicuous combination of exclusively cattle bones and one dog skull, and there is something unusual about both.

In the first place it is evident from the dog skull that the animal concerned was deliberately killed by a hard blow to the left eye socket (fig. 22.9). A dog skull showing similar evidence was found among the remains from Unit 18 on the southeastern side of the dune (see section 22.5).

Equally remarkable is the composition of the 56 cattle skeletal elements (table 22.8). They derive from all parts of the body – the head (including three isolated molars),

	N =			%		
	feature 12-48	other features	total	feature 12-48	other features	total
cranial elements	24	62	86	45.3	32.6	35.4
vertebrae and sacrum	19	8	27	35.8	4.2	11.1
ribs	–	6	6	–	3.2	2.5
scapulae	–	5	5	–	2.6	2
forelegs (humerus, radius, ulna)	2	34	36	3.8	17.9	14.8
pelvis	3	5	8	5.7	2.6	3.3
hind legs (femur, tibia)	1	25	26	1.9	13.2	10.7
lower legs (metapodia, carpalia, tarsalia, phalanges)	4	45	49	7.5	23.7	20.2
Totals	*53*	*190*	*243*	*100.0*	*100.0*	*100.0*

Table 22.8 Skeletal parts of cattle (excluding three isolated teeth) from 'deposition pit' feature 12-48 compared with those from all features.

spine, long bones, pelvis and phalanges – and from at least three individuals, two of which were more than two years old and one younger than 15-18 months (as determined on the basis of the teeth). A pelvis fragment of an animal aged less than 7-10 months may derive from the latter individual. The composition of the remains differs from the general composition of the assemblage from the features in several respects. The proportion of cranial elements may be more or less the same in both cases, but spinal elements were represented in much greater numbers in the deposition pit. Elements from the legs, also the lower legs (butchering remains), are on the contrary conspicuously scarce; the great majority of the bones are to be classed as consumption waste. The assemblage appears to represent the remains of an event during which three heads of cattle were slaughtered, after which most of the parts not containing meat were deposited elsewhere and the bones that did originally contain meat were deliberately deposited in this small pit, along with the skull of a killed dog. This suggests some (extensive) special meal and – in view of the association with the killing of a dog – a certain ritual significance. So the archaeozoological evidence supports the assumption of special deposition inferred from archaeological evidence.

22.3.8 *Taphonomy* (fig. 22.4)

Between the time of an animal's death and the time of the excavation of its remains, various taphonomic processes take places, which all leave specific signs on the bones. The first of those processes are slaughtering (including skinning), consumption and carving of the meat from the bones, which will be visible as cut marks and other traces of butchering. The (discarded) remains will subsequently have been subject to gnawing by animals such as dogs, trampling, burning and weathering. In some cases traces of burning may be associated with consumption, but on the whole, burning will be a secondary process.

Generally speaking, the identified remains are in a reasonable to good state of preservation, in spite of their fairly fragmented condition. In many cases the surface of the bones was found to have suffered no or only very little weathering, and the majority of the dental elements are intact. The percentage of bones showing traces of burning is lowest among the manually collected remains and highest among the remains from the finest sieve fractions. Burning has a strong fragmenting effect, and precisely the smallest fragments are better represented in the finest sieve fractions. On the whole, the percentage of burnt bone is however low, implying that burning played only a modest role in the taphonomic processes. Gnawing marks were found only on manually collected bones; the same holds for traces of butchering, with one exception (table 22.9).

The percentage of bones showing traces of butchering is higher in the case of the bones from the features than in the case of the bones from the units. A possible explanation for this could be that the bones contained in those sealed contexts were less affected by taphonomic processes and hence survived in better condition. Traces of butchering, in particular cut marks, can be more easily identified on bones

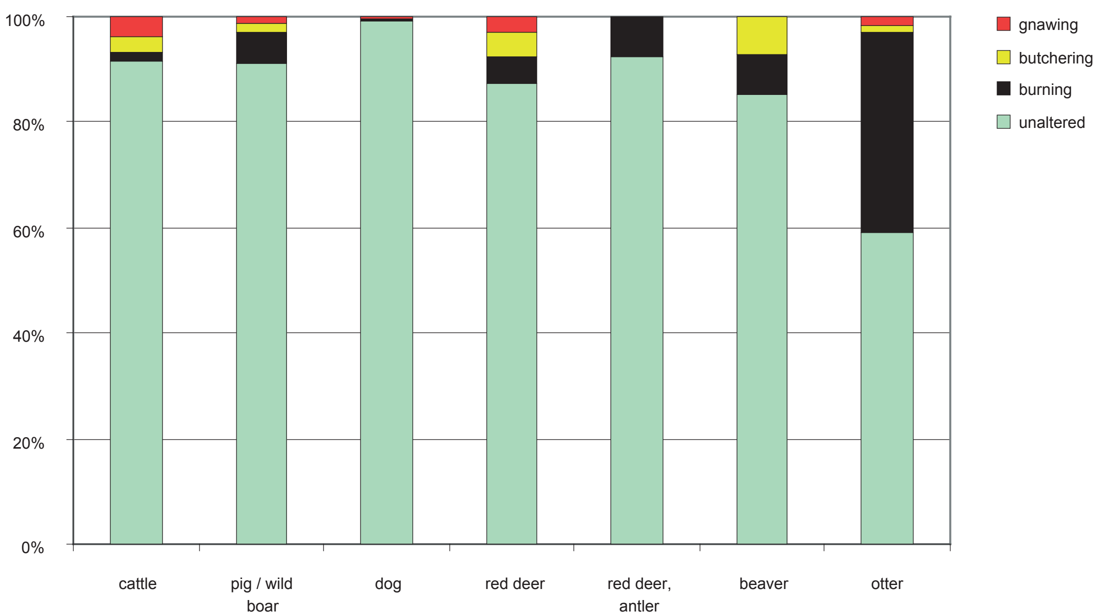


Figure 22.4 Proportions of traces of gnawing, butchering and burning on remains of various mammal species.

	N%		
	burning	butchering	gnawing
hand-collected	4.4	2.1	2.1
4 mm sieve	9	–	–
1 and 2 mm sieve	15.4	0.8	–

	N%		
	burning	butchering	gnawing
Units	4.5	1.9	2.0
features	3.1	4.8	3.6

Table 22.9 Percentages of mammal bones showing traces of burning, butchering or gnawing, presented according to recovery technique and context.

with less weathered surfaces. Secondly, gnawing marks were observed both on the bones from the features and on those from the units; the percentage is even slightly higher in the case of the bones from the features. This means that part, at least, of the butchering and consumption waste did not become buried immediately, but remained within reach of dogs for some length of time.

There are also differences – sometimes quite substantial – between the various animal species (table 22.10). They are partly attributable to the small number of identified remains of some species (aurochs, fox, brown bear, European wildcat and common seal).

Interestingly, hardly any of the dog remains show traces of burning, butchering or gnawing. This means that the carcasses of dogs were treated differently from those of the other species. This will be discussed further in section 22.5. The proportions of bones with traces of burning are in the same order of magnitude in the case of pig/wild boar, red deer and beaver, but the proportion is lower in the case of cattle and remarkably higher in the case of otter. Evidently, the different species were differently processed, and their remains were discarded in different ways. With the exception of that of dog, the percentages of remains showing gnawing marks are in the same order of magnitude.

The traces of burning, butchering and gnawing will be discussed in greater detail in the sections on the individual species (sections 22.4-6).

22.3.9 *Pathologies*

Pathologies are rare. For a proper understanding, they will be presented together here. Pathologies were observed almost exclusively on bones of domestic animals (cattle and dog). One of the exceptions concerns a thoracic vertebra of a wolf with uncontrolled bone growth along the edges. This phenomenon, which is known as 'lipping', is associated with strain or age. In this case it can be interpreted as an affliction of old age. In addition, a cattle or aurochs phalanx II shows uncontrolled bone growth just under the proximal epiphysis. This may likewise be an affliction of old age, but if the bone concerned derives from a domestic animal, it may also be attributable to strain.

Seven skeletal fragments of cattle (all mature individuals) show pathologies. Three lumbar vertebrae from the same animal show abnormal growth along the edges of the articular facets. The same phenomenon is also observable on a fourth lumbar vertebra. All four vertebrae were found in the same trench (27), but in different layers (16 and 11, respectively), so it is not certain whether they all derive from the same animal. In both cases the cause may have been

	N=				%		
	total	burning	butchering	gnawing	burning	butchering	gnawing
cattle	3279	57	96	123	1.7	2.9	3.7
pig / wild boar	2521	145	38	36	5.8	1.5	1.4
dog	897	1	3	3	0.1	0.3	0.3
aurochs	14	–	1	4	–	–	–
red deer	676	34	32	20	5	4.7	3
red deer, antler	1104	74	–	–	7.4	–	–
beaver	129	10	9	–	7.8	7	–
otter	163	62	2	3	38	1.2	1.8
fox	2	1	2	–	–	–	–
brown bear	10	–	–	1	–	–	–
wildcat	22	1	–	–	–	–	–
common seal	4	3	–	–	–	–	–
Totals	*8821*	*388*	*183*	*190*	*4.4*	*2.1*	*2.2*

Table 22.10 Mammal bones showing traces of burning, butchering or gnawing, presented according to animal species.

Figure 22.5 Pathology on a bovine pelvis. The socket of the femur joint (acetabulum) is badly worn; its surface shows a pronounced gloss; excessive bone growth is visible especially along its rim (scale 1:1).

strain and/or old age. Another abnormality is observable in two lower jaws, from which P1 and P2 are respectively absent. In both cases the associated sockets are absent, too. Whether the animals concerned lost the molars prematurely, after which the cavities became obliterated, or whether they never had the elements in question is not clear. Part of a cattle pelvis, finally, shows a remarkable abnormality. The cavity is very badly worn; part of the surface shows a high gloss and substantial abnormal growth is observable along the edges in particular (fig. 22.5). This animal may have fractured its left hind leg and have borne too much weight on its right leg for quite some time. Such a strain may have caused the aforementioned traumatic phenomena in the cavity of the right half of the pelvis.

None of the observed abnormalities can incidentally be interpreted as a direct cause of death. The pathologies on the vertebrae will have caused some inconvenience, in particular stiffness. The animal with the deformed pelvis must have suffered quite badly and was undoubtedly lame. It is indeed remarkable that the animal evidently continued to live with this defect for a fairly long time.

Pathologies were observed on four skeletal elements of dog. Two lumbar vertebrae had fused and showed abnormal growth along the edges of the articular facets. This will be due to old age. Two lower jaws also show a deformity. In the case of one, P1 is absent and the associated socket is not/no longer visible. The animal may never have had the tooth in question or it may have lost it prematurely after which the cavity became obliterated. A tooth is missing from the other lower jaw, too – in this case M1. The fact that the associated socket is still open and moreover shows some abnormal growth makes it most likely that the animal lost the molar prematurely. In none of the cases will the pathologies have been a direct cause of death, but they will definitely have caused inconvenience or pain.

22.4 Domestic animals: livestock

22.4.1 Introduction

Two livestock species are represented among the Schipluiden mammal remains: cattle and pig. Their remains date from all the occupation phases. Remains of sheep and goat are absent.

Domesticated animals are usually distinguished from their wild relatives on the basis of metric data. That's not always simple when dealing with Neolithic remains due to a certain amount of overlap. This does incidentally not imply a continuous development of measurements without interruptions. In the case of domestic cattle and aurochs, for example, the data published by Degerbøl/Fredskild (1970) show that only the measurements of the largest domesticated bulls and those of the smallest aurochs cows overlap.

The overlap in measurements, which is also observable in (Neolithic) pigs and wild boars, may imply a certain degree of interbreeding between the domesticated and the wild species. Although this is known from the (recent) past in the Netherlands and is still known elsewhere today (Albarella *et al.* in press 1) it cannot be proved for the Neolithic. What seems to have been far more influential – certainly as far as pig and wild boar are concerned – is that in the Neolithic the domestic form was not yet all that different from the wild one. This is further supported by the results of recent research into mitochondrial DNA, which show that wild boars were domesticated in different parts of Europe and at different times (Larson *et al.* 2005).

The amount of overlap between pig and wild boar tends to differ, but it can make it difficult to distinguish between the two. This holds for both Early and Middle Neolithic sites in different parts of Europe (Albarella *et al.* in press 2). It should incidentally be added that the amount of (metric) overlap between the wild and the domestic forms in the various publications is partly dependent on the criteria employed by the researchers concerned (see also Prummel 1987). This is in part associated with the variation in size between the domestic and wild populations in different areas, but also with more subjective aspects. Prummel (1987), for example, employed a much narrower overlap range in distinguishing between domestic and wild pigs at Hekelingen III than, say, Clason (1967) did at Hekelingen I and Vlaardingen.

In the case of Schipluiden the overlap seems to be small, though it should be borne in mind that the measurements relate to only a small number of skeletal elements. As already mentioned in section 22.2, the remains that were initially categorised under the heading of 'pig/wild boar' were divided into domestic and wild boar bones in a ratio of 1:1.7 on the basis of the measurements of 38 bones of adult animals. The same division cannot be applied – excluding the bones that can be identified as deriving from a domestic or a wild animal on the basis of measurements – where the ages at which the animals were slaughtered are concerned or noteworthy characteristics observed on the bones. We are after all not dealing with 'neutral' values such as numbers and weights, but with individual bones, each with their own specific characteristics. For this reason the specific character-istics and data relating to the ages at which the animals were slaughtered will in section 22.4.3 be discussed in relation to the undivided category of pig/wild boar, with all the limitations this implies.

The majority of the cattle and aurochs bones could be easily distinguished. In only a few cases did this prove impossible.

22.4.2 Cattle

With a total of 3279 manually collected bones, cattle is the most prominently represented mammal in the faunal spectrum. This species' remains are not only dominant in terms of number, but above all also in terms of weight. Of nine of the bones it is not certain whether they derive from cattle or from aurochs (Appendix 22.2). The measurements of two skeletal elements (a humerus and a metacarpus) fall in the overlap range between domestic bulls and aurochs cows. The other fragments do differ in size relative to the remains of domestic cattle, but it is not clear whether they derive from aurochs or domestic cattle.

More than half of the total weight of the remains recovered from the 4-mm sieve fraction can be assigned to cattle.

Remains from all the phases derive from all parts of the body (Appendices 22.1a-c), implying that they represent both butchering and consumption remains. There is in this respect however a conspicuous difference between the (manually collected) remains of cattle from the units and those from the pits. The proportion of consumption remains among the bones from the latter context is around 20% higher, the difference concerning mainly skeletal parts containing little meat, and the percentage of butchering remains (horn sheaths and lower legs) is half of that obtained for the bones from the Units (table 22.11; fig. 22.6).

There are ten associations (skeletal parts fitting or belonging together grouped under the same find number) of cattle bones. Seven concern fitting fragments deriving from the same skeletal parts (radius, metacarpus, skull, two mandibulae and two horn sheaths) that were fractured in antiquity. The fracturing will have been postdepositional. The other three associations concern a number of skeletal parts that belong together, indicating that the remains concerned were discarded there immediately after butchering or consumption ('primary deposition'), and did not end up there via secondary processes

%	Units N = 1430	features N = 244
category A, rich in meat	23.2	27.0
category B, poor in meat	36.6	52.5
consumption waste	*59.8*	*79.5*
category C, poor in meat	40.1	20.5
butchery waste	*40.1*	*20.5*

Table 22.11 Remains of cattle (excluding stray teeth N=1605), divided into main processing categories (after Uerpmann 1973).
category A: vertebrae, scapula, humerus, pelvis, femur
category B: head (excl. horn core), ribs, radius, ulna, tibia
category C: horn core, metapodia, carpalia, tarsalia, phalanges

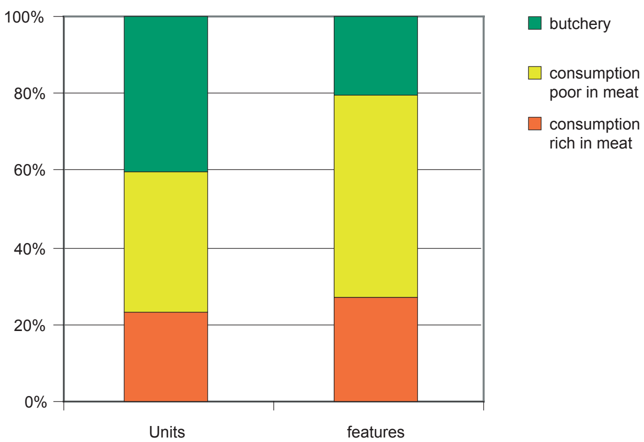


Figure 22.6 Ratios of consumption and butchering waste from units and features.

such as colluviation. Two of these associations come from Unit 18 (phase 2a) on the southeastern side of the dune. They comprise part of the left and right lower legs (metacarpus, metatarsus and carpal) and a fitting radius and ulna. The other association, likewise comprising a radius and an ulna, comes from a well dating from phase 2a (feature 18-8). The most important association is however that from the deposition pit, 12-48.

Withers height and body size
73 postcranial skeletal elements were measured (Appendix 22.2). The measurements are in the same order of magnitude as those obtained for Vlaardingen (Clason 1967), site P14 (Gehasse 1995), Swifterbant S3, Hazendonk and Kolhorn (Zeiler 1997). In two cases the withers height could be inferred from the greatest length of the metatarsus: 117.8 and 129.4 cm. The latter individual was of the same size as an animal at Kolhorn and one at Vlaardingen (129.0 and 130.0 cm, respectively); the other animal was distinctly smaller.

Traces of butchering, burning and gnawing
Traces of butchering, burning and gnawing were observed only on manually collected bones. Just under 60 skeletal remains were carbonised or calcined. All but one (a skull fragment) of the remains concerned are front or hind leg elements. The number of bones showing gnawing marks by dogs is more than twice as high (127); the bones in question are likewise mostly elements from front and hind legs (including the scapula and pelvis). Exceptions are four lower jaw parts and a piece of skull showing a dog’s teeth impressions. The number of leg parts (including the scapula and pelvis) may be around 2.5 times higher (Appendix 22.1a), but that does not explain the substantial differences in bones showing signs of burning and gnawing. It would seem that the skull bones – unlike the postcranial elements – were generally discarded out of reach of fire or dogs immediately after butchering, whereas the leg bones were left around on the farmyard for some time.

96 skeletal fragments show different types of butchering marks, from which different activities can be inferred. About half of the marks are cut marks produced in carving the meat from the bones. They were observed for example in the central parts of long bones (humerus, radius, ulna, femur and tibia), but also on some jaws and fragments of shoulder blades. A quarter of the butchering marks are cut marks on elements from the lower legs: metacarpus, metatarsus, astragalus and calcaneus. Like the cut marks observed on a skull fragment – around the base of a horn sheath – they will have been produced in skinning the animals. The other quarter are marks formed in cutting and chopping at and near articular facets of long bones, mandibulae, scapulae, pelvis and vertebrae. These marks were formed in dividing the carcasses into smaller parts. A case apart are the butchering marks observed on a scapula (find number 4546) from phase 2a. The bone shows not only cut marks around the neck (collum), which will have been formed in dividing the carcass into parts, but also an artificially produced hole near the top of the flat part. The latter could imply that the shoulder blade was suspended from a hook, for the purpose of for example smoking the meat over a fire or keeping it out of reach of dogs.

Ages at the time of death
The age determinations were based primarily on the fact that the growth zones of different leg bones of an animal fuse at different ages. Each type of bone hence yields a ‘reference age’: if the bone has fused, the animal lived beyond that age and if the bone has not yet fused, it was killed before it reached that age. This information provides an impression

of the ages at which the animals were killed, and how the livestock was exploited (table 22.12). Thanks to the large size of the Schipluiden bone assemblage, these calculations could be carried out on such a large scale for the first time for the Dutch Neolithic.

The information on the ages at which the animals were killed shows that animals of all possible maturity classes were slaughtered, from a foetus, represented by part of a lower jaw, to adult individuals of more than 3½-4 years old (Habermehl 1975). Being so numerous, the remains from phase 2a in particular, and to a lesser extent also those from phase 2b, provide a lot of useful information for a reconstruction of the kill-off patterns (table 22.13). Less information is available for phases 1, 1-2a and 3, and all that can be concluded from it is that it supports the general conclusion that animals of all maturity classes were slaughtered. This conclusion is incidentally strongly influenced by the fact that 70% of the data on which it is based concern phase 2a. Interestingly, the assemblage includes not a single unfused bone datable to phase 3. This could mean that in this phase only (relatively) old animals were slaughtered, but the limited amount of information may also play a role here.

In phase 2a a quarter of the cattle were slaughtered in their first year and another quarter in their third year. Only a small proportion (5%) of the animals belonging to the age class from one to two years were slaughtered. A substantial proportion of the cattle population (40%) lived beyond 3-4 years of age. So although animals of all age classes were slaughtered, the proportions of the various categories vary.

Clear differences are observable between phase 2b and phase 2a, but they are probably all attributable to the fact that only little information is available for phase 2b. The absence of evidence of the killing of animals of less than one year of age in phase 2b is insignificant as it is based on only 4 cases. In phase 2b, 15% and 35% of the animals were killed when they were two and three years old, respectively. The proportion of the cattle population that lived beyond the age of 3-4 (43%) is on the contrary comparable with that in phase 2a.

Information on the ages at which the animals were killed based on the eruption patterns of teeth and molars is more limited and less detailed (table 22.14). According to the dental data, the proportion of animals that were slaughtered before the end of their second year in phase 2a was not 42%, as based on bone fusion, but approximately 60%. This discrepancy illustrates the margin that should be considered in such calculations and the method's restrictions. The data available for the other phases are too limited to allow any conclusions to be drawn from them.

The kill-off patterns indicate that the cattle were kept both for their meat and for other purposes. The most obvious interpretation is that some older animals were kept for breeding (IJzereef 1981). Older animals may also have been kept for traction. Although recent research in France and England has shown that milk was being produced already at various (Early) Neolithic sites (Balasse/Tresset. 2002; Copley *et al*. 2003), there is no evidence to prove it at Schipluiden.

The aforementioned part of a lower jaw of a foetus (from phase 2a) has not been included in the tables showing the ages at the time of death. It is unlikely that a down-calving heifer was slaughtered. The bone may derive from a calf that was born prematurely and died shortly after birth. This would mean that pregnant cows, and hence probably also cows with young calves, were kept on or near the dune.

A remarkable example of an older animal concerns part of a pelvis that had fused to the sacrum; this occurs only in (fairly) old animals. It is unfortunately not possible to quote an exact age for the animal in question as this phenomenon is not described in the literature.

fused at age:	phase 1		phase 1-2a		phase 2a		phase 2b		phase 3	
(in months)	fused	unfused	fused	unfused	fused	unfused	fused	unfused	fused	unfused
7-10	4	1	2	–	19	6	4	–	3	–
12-15	2	–	2	–	14	2	1	–	–	–
15-20	2	1	7	1	26	10	10	1	2	–
20-24	3	–	1	3	15	11	6	2	1	–
24-30	3	1	1	1	33	39	4	4	5	–
36	–	–	–	1	3	8	–	4	–	–
42	–	–	–	1	5	7	1	–	–	–
42-48	2	3	1	2	12	15	2	–	1	–
Totals	*16*	*6*	*14*	*9*	*127*	*98*	*28*	*11*	*12*	–

Table 22.12 Age class determinations of cattle based on the stages of fusion of postcranial bones.
(epiphysis) fused = younger than indicated age
(epiphysis) unfused = older than indicated age

22.4.3 Pig

In the category of (agricultural) domestic animals pig comes second, with proportions of 12% of the number of manually collected remains and 6.5% of the overall weight. The proportion in terms of numbers varies from around 10 to 14% for the different occupation phases while the proportion in terms of the total weight varies from around 4 to 10% (tables 22.3, 22.5). Once again, it should be added that the distinctions between domestic pig and wild boar are based largely on extrapolation (section 22.2). The remains that can on the basis of measurements be said to indisputably derive from domestic pig show that the species was kept at the site in all the phases. The remains concerned derive both from the head and from the postcranial skeleton, implying that the animals were killed at the site.

	N=		%		
age in months	fused	unfused	% killed after age	% killed before age	% killed between two ages
phase 2a					
7-10	33	8	81	20	–
12-20	26	10	72	28	8
20-24	15	11	58	42	14
24-30	33	39	46	54	12
36-48	20	30	40	60	6
phase 2b					
7-10	4	–	100	0	–
12-20	11	1	92	8	7
20-24	6	2	75	25	17
24-30	4	4	50	50	25
36-42	3	4	43	57	7

Table 22.13 Age classes and culling rates of cattle in phases 2a and 2b based on the fusion of postcranial long bones.
(epiphysis) fused = younger than indicated age
(epiphysis) unfused = older than indicated age

age in months	phase					
	1	1-2a	2a	2b	3	totals
5-6	–	–	1	1	–	2
< 15-18	–	1	1	–	–	2
15-18	1	1	1	–	–	3
> 15-18	–	–	–	1	–	1
18-24	–	–	5	–	–	5
< 24	1	3	17	4	–	25
c. 24	–	–	–	–	1	1
> 24	–	4	15	1	1	21
Totals	*2*	*9*	*40*	*7*	*2*	*60*

Table 22.14 Age class determinations of cattle based on dental elements, excluding foetal elements.

Withers height and body size

In five cases the size of the pigs could be assessed by calculating the withers height on the basis of the greatest lateral length (GLL) of the astragalus. The remains in question were all identified as domestic pig bones on the basis of dimensional data. The smallest pig had a withers height of 66 cm; the largest two were both 72.3 cm high. The other measurements are 71.1 and 71.7 cm.

Traces of butchering, burning and gnawing

The only domestic pig remains showing marks of any kind are two astragali on which traces of gnawing by a dog were observed. The other bones showing traces of butchering, burning and gnawing all belong to the pig/wild boar category. Around 200 remains show traces of burning; about a quarter of those bones were recovered from the sieve fractions. The number of remains showing butchering marks is even smaller (less than 40); with the exception of one bone from the 1- and 2-mm sieve fraction the remains in question are all manually collected bones. Almost all the traces of butchering are cut marks that were formed in dividing the carcass into portions and/or cutting the meat from the bones. They were observed on parts of long bones, scapula, pelvis, atlas and mandibula. Cut marks on two tarsalia show that the animals were skinned. Traces of gnawing by a dog were observed on 34 bones.

As in the case of cattle, the proportion of cranial remains showing traces of burning and gnawing is very small, although the proportion of cranial elements deriving from pig/wild boar is greater than in the case of cattle (39% as opposed to 26%). This must again be attributable to a difference in deposition between cranial and postcranial bones rather than to a numerical difference between the two categories.

Ages at the time of death

The distribution of the ages shows that animals of all maturity classes were slaughtered, from foetal or newborn piglets, represented by five skeletal remains, to adult individuals aged more than 3-3½ years (Habermehl 1975). The data relating to the ages at which the animals were killed are summarised in tables 22.15-17. The remains of the foetal or newborn piglets (three from phase 2a and two from phase 2b) have not been included in the tables. Unlike the foetal cattle remains, they are difficult to explain. If they are domestic pig remains, they may derive from stillborn piglets or piglets that died shortly after birth. If so, they imply that pregnant sows and sows with piglets were kept on or near the dune. But it is also possible that young piglets were occasionally slaughtered or – in the case of wild boar – shot. This will be discussed further in section 22.7.

It should be borne in mind that the data relating to the ages at which the animals were killed concern a mixture of domestic and wild pigs – except for a small number of data that relate to remains of adult individuals that may on the basis of their dimensions be positively identified as deriving from either domestic pig or wild boar (table 22.15).

The numerous remains from phases 2a and 2b offer the best possibilities for a reconstruction of the kill-off patterns in the case of pig, too (table 22.16). In both phases high, more or less equal proportions of the pig population were killed in the animals' first year (35-37%). The same holds for animals that were killed when they were more than three years old (21-22%). The proportion of animals of the intermediate age groups that were killed in phase 2b however differs remarkably from that of phase 2a. On the whole, animals of all age groups were slaughtered. As in the case of cattle, the data available for phases 1, 1-2a and 3 are limited, and provide little more than a confirmation of the aforementioned conclusions.

The data relating to the ages at which the animals were killed based on the eruption patterns of teeth and molars likewise show a high proportion of young animals in phase 2a: 42% of the remains derive from individuals of at most 16 months old (table 22.17). The percentage obtained for phase 2b is lower (26%). This reveals a shift towards the slaughtering or hunting of older animals, though this may to some extent be influenced by the fact that we have fewer data for phase 2b than for phase 2a.

As already mentioned, our understanding of the slaughter patterns is not clear as they relate to a mixture of domestic and wild pigs. The difference in slaughter patterns between domestic cattle (a relatively high proportion of young animals) and wild animals (almost exclusively adult individuals) makes it likely that the young(er) animals are mainly domestic pigs while the category of old(er) animals also includes wild boars. The occupants of for example Hardinxveld on the contrary randomly hunted wild boars, whereas – like the Schipluiden occupants – they did spare young individuals in hunting red deer (Van Wijngaarden-Bakker *et al*. 2001, 231).

22.5 Other domestic animals: dog

In total, 970 dog remains were identified, mainly among the bones collected by hand from the units bordering the dune. The bones derive from all parts of the body. Their spatial distribution largely coincides with that of all the other mammal remains. The total number is rather high because in the case of fractured skulls the number of fragments was counted (insofar as those fragments couldn't be refitted) and in a few places skeletal parts of a single individual were found together.

22.5.1 Deposition of dogs – heads and other body parts

In the field, compact concentrations of dog bones were found in three places, and also a relatively large number of skulls and complete lower jaws. This suggested a special treatment and deviating deposition of dogs, possibly the disposal of entire bodies and heads. To check this hypothesis we needed more information on the spatial distribution of the dog remains and on any clustering of those remains. The dog remains were therefore all recorded in detail and differentiated according to location, phase, skeletal part and degree of fragmentation, with special attention to associations and clusters. The majority of the dog bones were found to be in accordance with the general bone distribution patterns. In the end, four depositions of incomplete carcasses were identified (fig. 22.7). They were found to comprise secondarily buried dog remains or discarded body parts – both entire bones and fragments. In addition, seven more or less complete heads (skull-lower jaw combinations) were discarded, plus various individual body parts.

The dog depositions are documented in Appendix 22.3 and figure 22.8, and will be described below.

fused at age:	phase 1		phase 1-2a		phase 2a		phase 2b		phase 3	
(in months)	fused	unfused	fused	unfused	fused	unfused	fused	unfused	fused	unfused
12	4	2	1	1	44	26	13	7	14	3
24	1	–	3	1	21	27	17	11	3	5
24-30	–	–	–	–	4	6	–	2	–	2
36	–	1	–	–	–	2	–	1	–	1
36-42	–	–	–	–	–	7	–	–	–	–
42	–	2	1	–	6	14	2	6	–	1
Totals	*5*	*5*	*5*	*2*	*75*	*82*	*32*	*27*	*17*	*12*

Table 22.15 Age class determinations of pig/wild boar based on the stages of fusion of postcranial bones, excluding foetal and neonate bones.
(epiphysis) fused = younger than indicated age
(epiphysis) unfused = older than indicated age

Dog 1 (d1)
Well 10-140 contained the incomplete and partly fractured remains of a dog (d1). The bones lay fairly close together in the highest part of the secondary fill, suggesting that they were deliberately buried there. They certainly didn't end up there via natural processes, as we would then expect to find a scattered pattern. This well was initially dated to an early part of the occupation period on the basis of its position – fairly low down the dune and in line with fence stretch 1 that must have intersected its fill. On the other hand, the soil of the fill was anthropogenic in nature, indicating that the well was by this time no longer surrounded by sterile soil. The well therefore most probably dates from phase 2a or 2b and the dog remains from phase 2b.

The following remains were found in the well: the entire lower jaw, the atlas and axis and a few other vertebrae, a few ribs, a shoulder blade and parts of the forelegs, in particular the lower legs, and of both hind legs. Large parts were absent, including the skull, the pelvis and most of the long leg bones. The lower leg bones are intact, but all the other bones are fractured and have survived in part only. Some bones found in Unit 18 next to the well need not necessarily derive from the same dog, as suggested by a second lower right jaw.

The find context is more indicative of the deliberate burial of (some) remains of a dog than of natural fragmentation and disintegration.

	N=		%		
age in months	fused	unfused	% killed after age	% killed before age	% killed between two ages
phase 2a					
12	44	26	63	37	–
24-30	25	33	43	57	20
36-42	6	23	21	79	24
phase 2b					
12	13	7	65	35	–
24-30	17	13	57	43	8
36-42	2	7	22	78	39

Table 22.16 Age classes and culling rates of pig/wild boar in phases 2a and 2b based on the fusion of postcranial long bones, excluding foetal and neonate bones.
(epiphysis) fused = younger than indicated age
(epiphysis) unfused = older than indicated age

age in months	phase					
	1	1-2a	2a	2b	3	totals
c. 8	–	–	–	2	–	2
> 8	–	1	9	2	1	13
8-13	–	–	10	2	–	12
8-16	–	–	13	–	1	14
12-13	–	1	5	2	–	8
12-16	–	1	3	–	–	4
> 12	1	2	10	3	2	18
< 16	–	3	22	3	3	31
> 16	1	1	11	16	2	31
13-20	–	–	1	–	–	1
> 18	–	–	5	–	–	5
18-20	–	1	12	–	–	13
> 20	2	3	25	5	3	38
Totals	*4*	*13*	*126*	*35*	*12*	*190*

Table 22.17 Age class determinations of pig/wild boar based on dental elements, excluding foetal elements.

Dog 2 (d2)
Remains of a second dog (d2) were found in Unit 18, in the middle of the southeastern side of the dune (trench 19). The remains were clustered within an area of one m^2 and are more complete than those of dog 1. All body parts are represented, including the complete skull, but many of the long bones have survived in part only and some smaller leg bones are missing. The find context suggests that the remains were buried in a shallow pit, which the excavators failed to identify as such. If the bones had been discarded on the ground they would have ended up scattered further apart. In the immediate surroundings of these remains the excavators did incidentally find some skeletal elements that were absent from the concentration and could derive from the same dog, but also the remains of three (other) dog skulls, including a complete head (h4). The find context closely resembles that of the remains of dog 1, the main difference being that the entire head of dog 2 was found. The combination of a sharply defined concentration with the degree of fragmentation and missing body parts makes it more likely that these remains were discarded (buried) than that they represent a complete cadaver. This could also explain why the vulnerable skull has survived almost intact. The remains must hence have been buried after phase 2a.

Dog 3 (d3)
Remains of a third dog were found on the northwestern side, in Unit 10 (phase 3), within an area of 2 m^2. The findspot lies relatively far (around 15 m) from the former periphery of the dune, in what was then peatland, outside the general distribution of settlement refuse and probably also outside the area covered in daily expeditions. This could explain why parts of this deposition have survived. The stratigraphic position places the remains in phase 3.

This skeleton is also very incomplete, comprising, besides large parts of the left hind leg, fragments of the right hind leg, the pelvis, vertebrae and both humeri. Some of the long

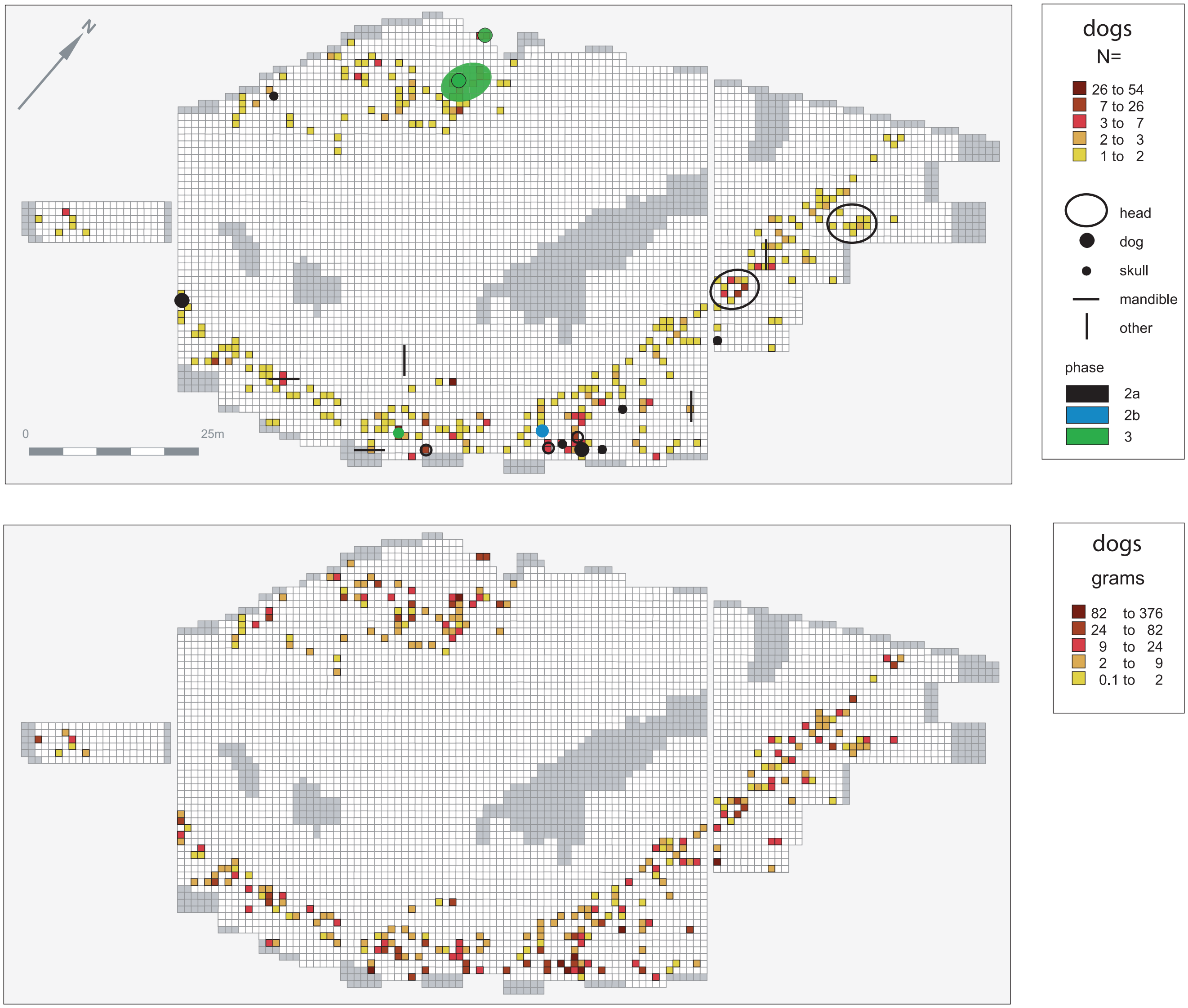


Figure 22.7 Distribution patterns of all dog bones per square metre.
a number of bones with the findspots of the depositions
b bone weight

bones are not fractured and (almost) intact. No other dog remains were found within a radius of 4 m. This find likewise more probably represents discarded remains than a carcass.

Dog 4 (d4)

Remains of a fourth dog were identified in a cluster of skeletal parts covering an area of around 4 m^2, also on the northwestern side, in Units 10/11, only 7 m away from those of dog 3 at the edge of the dump zone. These remains comprise exclusively bones from the head (skull, lower jaw, atlas) and the two forelegs, some of the long bones of which were intact. The presence of (corresponding parts of) two humeri among the remains of dogs 3 and 4 implies that the bones represent two different individuals. A fairly large number of skeletal parts of several dogs were found in older deposits (19N, 15) in the immediate vicinity of this concentration, but the

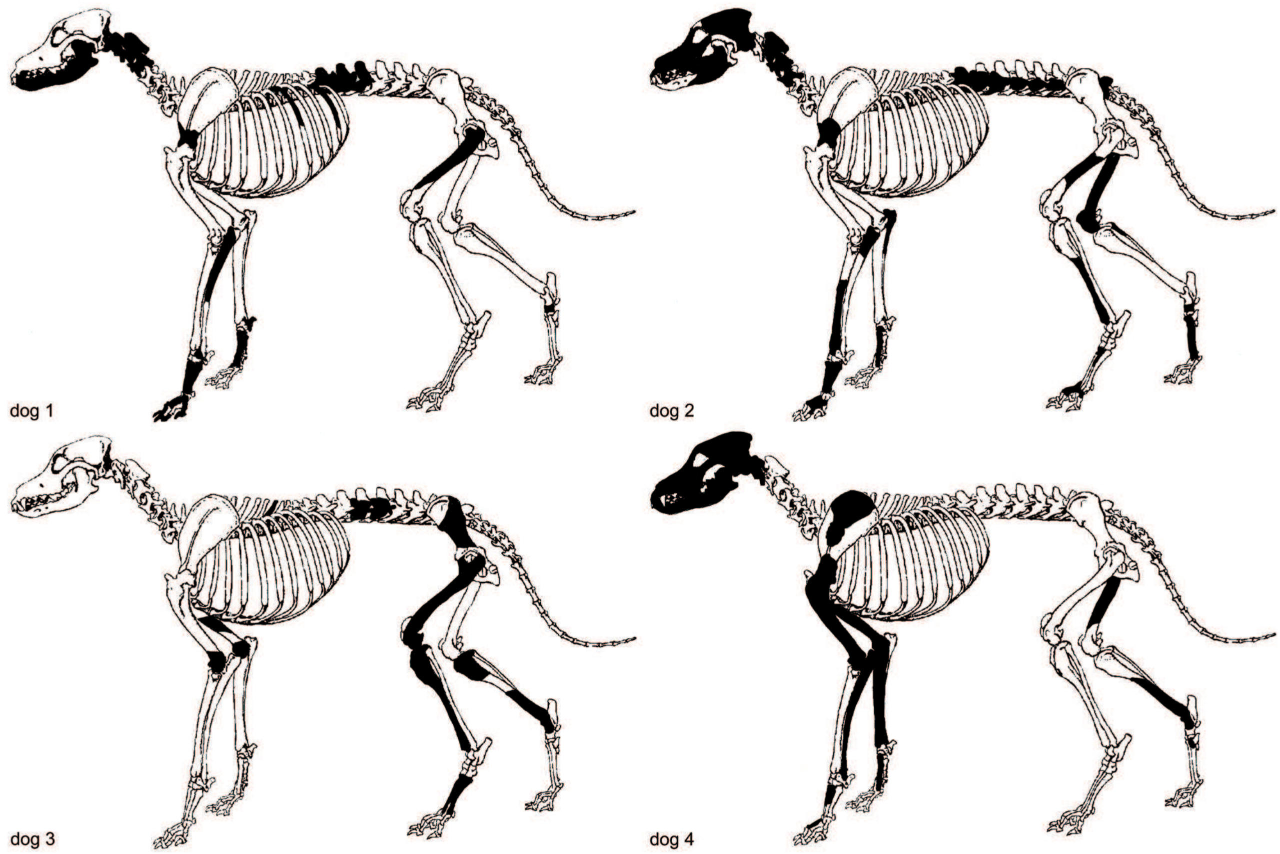


Figure 22.8 Preserved skeletal parts in dog depositions 1-4.

majority can't derive from dog 4. This does not hold for remains of a right hind leg and a right scapula that were found 3 to 4 m further east in the same unit (10/11): the shoulder blade fragment could be fitted to the humerus of dog 4. The leg partly duplicated that of dog 3, showing that it derived from a different animal. This is the only find involving remains that were distributed further than a few m^2 apart, but – as with dog 3 – intact leg bones contrast with the absence of other bones, and again the deposition of certain body parts – as opposed to an entire carcass – seems the most likely explanation.

Heads

On top of this there were also seven isolated finds comprising remains of entire dog heads, including the lower jaws and – in four cases – the atlas and/or axis. They were all found on the southeastern side of the dune (trenches 15-29, western end); five date from phase 2a, one from phase 2b and one from phase 3. Most of these remains lay concentrated within an area of 1 to 2 m^2. In one case the lower jaw lay 4 m from the other skull parts, making their association uncertain. In two cases, both in the northern part of the dump zone, the head remains were scattered across an area with a diameter of several metres. The bones in question were clearly post-depositionally disturbed. The skulls are all incomplete, having fractured in the past and/or during excavation. The robust lower jaws have survived largely intact, or even in their entirety, including the atlas and axis. One assemblage of small fragments of the skull and lower jaw (h2) for example includes an almost intact atlas and axis. No concentrations of other (connected) body parts were found around these heads from phases 2a, 2b and 3 within the long band of (fragments of) dog bones on the southeastern side, so the conclusion must be that these bones indeed represent the deposited remains of individual (chopped-off) heads.

Other body parts

The dog remains also include a relatively large number of lower jaw halves. In two cases the two halves were found lying together. Other noteworthy finds are five skulls with the associated upper jaws and dental elements, but without the lower jaws, one of these from the fill of deposition pit no. 12-48 (fig. 22.9). These finds we however don't consider exceptional; we regard them as part of the general refuse, though they may of course be the last remaining relics of head depositions. Two complete lower jaws – found without any skull remains in their vicinity –, an almost complete pelvis and remains of a right foreleg (from the ulna and radius) can also be regarded as 'normal' waste, and need not necessarily be associated with any significant deposition. The scapula and right hind leg of dog no. 4 are more in line with the deposition pattern.

Conclusion
This unusual form of deposition is not randomly distributed in spatial and chronological terms. Its focus is in phase 2a, with depositions along the entire central and northern parts of the southeastern periphery of the dune, and a concentration in the middle. There, we also found remains of a head deposited in phase 2b and another in phase 3. In those phases dog remains were dumped in two places on the other side of the dune, too (fig. 22.7). In two cases we found evidence showing that the dog was killed by a blow to the side of its head. One of the skulls concerned was found in the deposition pit 12-48 as one of the few non-cattle remains (fig. 22.9). The other skulls were too fragmented to allow such a conclusion. Dogs evidently had a special meaning for the dune occupants and played some role in rituals whose purpose eludes us. Dogs were killed, their heads were chopped off and discarded separately. Other remains were collected and secondarily buried (2× in phase 2a) or dumped, partly still in an articulated condition (2× in phase 3). No evidence of such an unusual treatment and meaning of dogs has so far been found for the Swifterbant culture. Such a treatment and meaning are in line with the special role of dogs in general in late hunter-gatherer societies, in particular in the Mesolithic, but contrast with the careful burial known from for example Hardinxveld-Polderweg.

Withers height and body size
26 cranial and postcranial skeletal elements were measured (Appendix 22.2). The measurements are in the same order of magnitude as those obtained for other Neolithic sites in the western Netherlands, in particular Ypenburg (De Vries 2004), Vlaardingen (Clason 1967), site P14 (layer D; Gehasse 1995), Hazendonk (Hazendonk-3 phase; Zeiler 1997) and Kolhorn (Zeiler 1997). In two cases the withers height could be determined: 42.4 and 47.8 cm. The former is an average of three measurements obtained for bones deriving from the same individual (greatest length of the left and right humerus and right radius), the latter is based on the greatest length of a (left) tibia. The withers height of the smallest individual is comparable with the heights of dogs whose remains were found at Ypenburg, Vlaardingen, Hazendonk and Kolhorn, which range from 43.0 to 44.9 cm. Both dogs were however a lot smaller than the Mesolithic dogs of Hardinxveld-Giessendam Polderweg (Van Wijngaarden-Bakker 2001 *et al.*), which had withers heights ranging from 49 to 59 cm (average of 54.5 cm). A dog at site P14 was also bigger than the Schipluiden dogs, having a withers height of 50.6 cm.

Traces of butchering, burning and gnawing
Only a few of the dog remains showed marks of any kind. Six parts of dog skeletons showed evidence of burning while three bones showed traces of gnawing by other dogs. Intriguing are the two skulls, mentioned before, showing that the dogs in question were deliberately killed, by a hard blow to the head close to the left eye socket (fig. 22.9).

Also intriguing is part of the shaft of a tibia showing fairly deep, short transverse cut marks. Cut marks in this particular part of the bone may have been produced in cutting away meat, but the marks formed in such an action are usually shallower and longer. Precisely what happened to this bone will have to remain a mystery for the time being. All that can so far be said with certainty is that, as in the case of the two battered skulls, there is no (clear) connection with consumption.

Ages at the time of death
Almost all the dog skeletal elements that can be used to determine the ages at which the animals died derive from adult (fully-grown) animals. The jaws all contain permanent teeth and molars, indicating an age of at least 6-7 months. The information provided by the postcranial bones agrees with this (Habermehl 1975). The only exceptions are a tibia of a not yet fully grown animal (younger than 1½ years) and two parts of the pelvises of young dogs in which the individual bones had not yet fused. In the latter case the exact age cannot be determined due to the absence of literature data.

22.6 WILD MAMMALS
The wild mammals can be divided into three categories: ungulates, fur animals and marine mammals. The ungulates comprise aurochs, red deer, roe deer and wild boar. The fur animals are beaver, fox, wolf, marten, polecat, weasel, otter, brown bear, European wildcat and lynx and the marine mammals are common and grey seal, bottle-nosed dolphin and a cetacean.

22.6.1 Ungulates
Aurochs
Fourteen of the manually collected bones were identified as deriving from aurochs, three on the basis of dimensional data (Appendix 22.2). Comparison with the data published by

Figure 22.9 Skull of a dog from deposition pit 12-48 (no. 6441) showing evidence of a blow (scale approx. 1:1).

Degerbøl and Fredskild (1970) shows that the greatest length (GL) of a phalanx I (GL = 75.5 mm) and a phalanx II (GL = 51.3 mm) fall within the range of aurochs bulls (fig. 22.10). A phalanx I with a distal width (BD) of 34.4 mm can be assigned to an aurochs cow. The other identifications are based on (immeasurable) remarkable differences in size relative to the remains of domestic cattle. All the remains derive from adult individuals. With the exception of two cervical vertebrae and a fragment of ulna and pelvis, the bones are parts of the lower legs: phalanges and carpal and tarsal bones. This implies that some of the animals were not butchered on site. The lower leg elements may have been brought to the site incorporated in skins. The aurochs bones seem to date from phases 1 and 2a only. There are remains from both these phases and phase 2b that cannot be unambiguously identified as deriving from domestic cattle or aurochs.

Red deer

Red deer is one of the two dominant wild mammals, represented by 676 remains (excluding antler). Remains have survived from all the phases, amounting to approx. 6-15% of the total number of manually collected remains and approx. 7-16% of the total weight (tables 22.3, 22.5). The remains derive from the head, front and hind legs (including scapula and pelvis) and the body (vertebral spine) and therefore comprise both butchering and consumption waste (Appendices 22.1a-c). The remains show that entire animals were brought to the site and processed there.

Nine associations were distinguished, four of which comprise fitting fragments of a single skeletal part (scapula, tibia and two fragments of mandibula). The fragmentation of these skeletal elements will be postdepositional. The other associations are the result of the direct deposition of elements belonging together – parts of the right hind leg (tibia and astragalus, and calcaneus and astragalus) and twice a fitting radius and ulna.

Antler

Constituting 62% of the total number of manually collected red deer remains, antler fragments are remarkably numerous. The weight proportion of the antler is much smaller at around 27%, but still quite substantial. The main cause of this overrepresentation will be that even small

Figure 22.10 Phalanx II of an aurochs bull (1299) compared with a phalanx II of domestic cattle (6441) (scale 1:1).

antler fragments can be easily identified. The difference between numbers and weights is due to the facts that antler is lighter than bone and the fragments are on average fairly small. The occupants of the dune also collected shed antler. Of the thirteen antler bases (not counting artefacts), nine derive from shed beams. The other four include attached parts of the skull, implying that they come from hunted animals. The shed antler is unequally distributed among the occupation phases (fig. 22.17), but in view of the small numbers concerned no great significance should be attached to this. Nevertheless remarkable is that antler with attached parts of the skull is completely absent from phases 2b and 3.

The large proportion of antler is also observable in the percentages of burnt red deer remains. 6% of the manually collected remains is burnt and the majority of those burnt remains (approx. 68%) are antler fragments. The percentage of burnt red deer remains in the 4-mm sieve fraction is even higher: approx. 77%. An even greater proportion than in the case of the manually collected remains consists of antler, constituting 95% of the number of burnt remains. These high percentages are again due to the fact that antler can be fairly easily identified, even in small, burnt fragments – much more easily than, say, fragments of long bones.

Traces of butchering, burning and gnawing
Excluding antler fragments, traces of burning were observed exclusively on postcranial elements. The same holds for gnawing marks, excluding one mandibula fragment. More so than in the case of cattle and pig/wild boar, this seems to be attributable to the relatively small proportion of cranial elements (approx. 8%). A difference in deposition may however have played a role, too.

The manually collected remains include 34 bones with traces of burning, 20 skeletal parts with gnawing marks and 32 remains showing marks produced in butchering (table 22.10). The butchering marks can be divided into four types, each representing a different activity. The saw marks observed on two skull parts, for example, point to the removal of the antler beams. Cut marks on seven lower leg elements (astragalus, metacarpus and metatarsus) indicate that the animals were skinned. Cut marks on or near articular facets (long bones, mandibula, scapula and pelvis) constitute the largest category (63%) and represent the division of the carcasses. The butchering marks of the fourth and last type, observed on the central part of three radius fragments, were in all probability produced in cutting the meat from the bones.

Ages at the time of death
The animals killed in hunting were almost exclusively (fairly) old. The great majority of the postcranial bones from which the age at the time of death can be inferred derive from individuals of more than 20 months old (Mariezkurrena 1983; Habermehl 1985; table 22.18). This is confirmed by the eruption and wear patterns of the molars. Only two of the 25 lower jaw fragments derive from animals that had not yet reached maturity: the presence of milk premolars indicates an age of less than 32 months. The other jaw fragments come from individuals in which M3 had erupted and/or the milk premolars had been replaced by permanent ones, implying that they were more than 32 months old. In the case of eleven of these individuals the age at the time of death could be more precisely determined on the basis of the wear patterns of the molars (table 22.19). The youngest animal was killed when it was around 3 years old, the oldest at an age of 12-13 years.

Roe deer
Only one bone fragment of roe deer was found, among the manually collected remains (phase 2a). It is part of a metapodium from an adult animal aged more than 1½ year (Habermehl 1985). The fragment shows no noteworthy characteristics.

Wild boar
Wild boar is the second most important wild species after red deer (tables 22.2-3; fig. 22.15). The (extrapolated) number percentages of the manually collected remains vary from around 16% to 23% for the various phases; the weight percentages vary from 7.5% to 15.5%.

From the remains that can on the basis of measurements be positively identified as wild boar it can be concluded that the species was hunted in all phases. The remains concerned derive both from the head and from the postcranial skeleton.

Two bones show traces of butchering. Cut marks on a mandibula imply that the meat was cut from the bones; cut marks just above the distal epiphysis of humerus are evidence of the division of the carcass.

In four cases the animals' withers height could be inferred from the greatest lateral length (GLL) of the astragalus: 88.9, 88.4, 86.0 and 80.9 cm. These values are in the same order of magnitude as those obtained for Hardinxveld-De Bruin (87.0 and 99.0 cm) and Polderweg (79.6, 80.4, 82.6, 86.9 and 87.0 cm). For present-day (European) wild boars Lange *et al.* (1994) quote a range of 60-110 cm; Van den Brink (1978) cites heights of 70-115 cm.

2.6.2 Fur animals

A great variety of fur animals was found at Schipluiden, including as the most spectacular species the lynx. This we owe primarily to the exceptionally large number of identifications because, except for beaver and otter, the various species are each represented by only a very small number of remains. Correction for the 4-mm sieve fraction (table 22.7) enhances the evidence very little.

Besides for their skins, some fur animals (beaver, otter and fox) were also hunted for their meat. The hunt for fur animals, which was incidentally of minor economic importance, was selective, focusing almost exclusively on adult individuals.

The proportion of fur animals shows an increase from phase 2a to phase 2b, followed by a drop in phase 3 (tables 22.2-3, fig. 22.15). The increase most probably reflects a change in environmental conditions. The continuing shift towards freshwater conditions will have been favourable for beavers and otters, although the latter are also to be found in brackish environments and even along seacoasts. The drop in phase 3 is more difficult to explain. Environmental changes (decrease in the area of open water) may have played a role, but another possibility is that the site's function changed slightly.

age in months	fused	unfused
8-20	41	–
20	58	2
20-32	28	2
32	50	2
Totals	*177*	*6*

Table 22.18 Age class determinations of red deer based on the fusion of postcranial long bones.
(epiphysis) fused = younger than indicated age
(epiphysis) unfused = older than indicated age

age in years	N =
3	1
5	1
7	1
8	1
9	1
9-10	1
10	1
11	3
12-13	1
Totals	*11*

Table 22.19 Age class determinations of red deer based on wear patterns of teeth in mandibles.

Beaver

The assemblage includes beaver remains from all phases, if in low frequencies. The numerical proportion is at most approx. 3%, the maximum weight proportion approx. 1.5%. Correction on the basis of the 4-mm sieve fraction (table 22.7) leads to a substantial decrease in these percentages as virtually no beaver remains were found during the sieving. So hunting for beavers was of minor importance.

Just over 40% of the skeletal remains are cranial elements; the other bones are parts of the front and hind legs (including clavicula, scapula and pelvis; approx. 48%) and the vertebral spine (11.5%). Particularly well represented in the latter category are caudal vertebrae.

Cut marks were observed on nine skeletal remains. In most cases (clavicula, pelvis, femur, tibia and lumbar vertebra) they indicate the division of the carcass and/or the cutting of meat from the bones. Cut marks on the bottom side of a lower jaw fragment show that the animal concerned was skinned. Ten remains were burnt – six of the ten were calcined, the other four carbonised.

Ages at the time of death were determined only on the basis of postcranial bones (Iregren/Stenflo 1982). The age distribution shows a pronounced dominance of adult individuals. Of the 34 bones for which the age at the time of slaughtering could be determined, 30 derive from animals that were more than two years old, 16 of which were more than 3 years old. Only four remains come from individuals that were less than three years old at the time of their death (table 22.20).

Unlike at sites in other ecozones of the delta, the beaver was at Schipluiden evidently of only complementary importance. In all the phases the occupants selectively hunted almost exclusively adult animals, for both their skin and their meat. This means that if the animals were hunted with traps, the occupants set free young animals. The same form of exploitation was observed at Swifterbant and Hazendonk (Zeiler 1997). At Hardinxveld-Giessendam De Bruin on the contrary, a much larger proportion of young animals were killed (Oversteegen *et al.* 2001).

Otter

Represented by 163 skeletal fragments (2.1%), the otter was the most commonly hunted fur animal. Due to the relatively large number of identifications in the 4-mm sieve residue, correction causes the proportion of otter to increase to on average 3.5% (table 22.7). There are no otter remains from phase 1 and the proportion increases to 4.7 % for phase 2b, followed by a decrease. The weight percentage never exceeds 1%.

Besides elements from the head (approx. 32%) and the front and hind legs (including scapula and pelvis; approx. 66%), two caudal vertebrae and a penis bone were found. Three fragments show traces of gnawing by dogs. Two remains show cut marks: a proximal part of a femur and part of the shaft of a humerus. The positions of the cut marks in both cases point to consumption: the division of the carcass (femur) and cutting of meat from the bones (humerus). This means that the otters were consumed, but they will certainly also have been hunted for their fur.

A remarkably high percentage of the otter bones show evidence of burning: 31% of the remains from the 4-mm sieve fraction and 38% of the manually collected remains are carbonised or calcined (fig. 22.4). The otter remains evidently came into contact with fire more often than the bones of other species, implying that they were processed in a different way.

In the case of 64 postcranial bones the age at the time of death could be roughly estimated on the basis of the fusion of the epiphyses (table 22.21; see Zeiler 1988). In 11 cases this could be done on the basis of the wear patterns of molars (table 22.22). The results show that the occupants hunted otters in a very selective manner, focusing almost exclusively on adult individuals, as was also observed at the much older site of Hardinxveld, and for example also for all the occupation phases of the Hazendonk site.

Fox

Fox is represented by two remains dating from phase 3. The remains in question are part of a lower jaw and a fragment of a humerus. The lower jaw is burnt (calcined) and shows cut marks that were produced in skinning the animal. The humerus shows cut marks implying consumption.

Wolf

Four bones were identified as deriving from wolves: a thoracic vertebra, two skull fragments and an ulna (fig. 22.11). The first three were identified on the basis of their remarkable size in comparison with the dog remains. The ulna – deriving from an adult individual of more than 2½ years old – was likewise identified on the basis of measurements (Appendix 22.2). The Schipluiden bone is larger than an ulna of a (male) wolf in the reference collection of the GIA.[5]

Marten, polecat and weasel

The manually collected remains include a few remains of small predators – 13 in total, representing less than 0.1% of the overall bone assemblage. More remains were recovered from the 4-mm sieve residue, bringing the percentage of marten species to 0.7% after correction (table 22.7).

	N=		%		
age in months	fused	unfused	% killed before age	% killed after age	% killed between two ages
24	14	–	100	0	–
36	16	4	80	20	20

Table 22.20 Age class determinations of beavers based on the fusion of postcranial long bones.
(epiphysis) fused = younger than indicated age
(epiphysis) unfused = older than indicated age

	N=		%		
age in months	fused	unfused	% killed after age	% killed before age	% killed between two ages
12	29	–	0	100	–
24	34	1	3	97	3

Table 22.21 Age class determinations of otters based on the fusion of postcranial long bones.
(epiphysis) fused = younger than indicated age
(epiphysis) unfused = older than indicated age

	N=	C	P2	P3	P4	M1	estimated age in years
mandible							
	1	+	+	–	+	+	> 1
	1	–	+	+	–	+	> 1
	1	–	+	•	•	•	> 1
	1	–	+	+	–	–	> 1
	1	–	–	+	+	+	> 1
	1	–	–	–	+	+	> 1
	2	–	–	•	•	•	< 1
	1	–	–	–	•	•	< 1
maxilla							
	1	–	+	•	–	–	> 1
	1	–	–	–	+	+	> 2

• no dentine visible
\+ dentine visible
– no data

Table 22.22 Age class determinations of otters based on wear patterns of teeth.

Marten
The four marten remains are two molars, a phalanx I and a tibia. The remains cannot be identified to species (pine or stone marten) level.

Polecat
With 11 manually collected remains, polecat is the best represented of the marten species. The remains date from all the phases except phase 1. The 4-mm sieve fraction yielded only a few extra remains. The remains are predominantly cranial elements plus three postcranial bones (pelvis, femur, tibia) of adult individuals.

Weasel
A single weasel bone was identified thanks to the sieving programme: a right lower jaw of an adult individual that was at least 3-4 months old (fig. 22.12).

Brown bear
Of the 11 skeletal fragments of brown bear nine derive from the skull (fig. 22.12), the other two are phalanges. Most of the remains date from phase 2b and were found in two small associations lying far apart: no. 1302/2345, trench 14: parts of a left and a right upper jaw and a left incisor; no. 10,387/10,507, trench 27: two fragments of a right lower jaw and a left M2 from the lower jaw.

The jaw fragments can on the basis of the surviving permanent molars be assigned to one or more adult animals. According to Dittrich (1960, quoted in Iregren *et al.* 2001) the replacement of dental elements is in brown bears complete by the age of 1-2 years. The phalanges also derive from at least one adult individual.

The fact that the brown bear remains comprise only cranial remains and phalanges implies that the killed animals were not brought back to the site in their entirety; only their skins, with attached phalanges and skull (with lower jaw), were brought home from the hunt. It is not certain, but very likely that this bear (or bears) was shot in the occupants' own territory. From both archaeozoological and historical data it is known that brown bear was a native species in the Low Countries. Brown bear remains have also been identified at various sites of the Vlaardingen group (Vlaardingen, Hekelingen 1 and 3, Voorschoten, Hazendonk). More than half of the remains found at prehistoric sites are cranial elements (including isolated teeth and molars). Any postcranial bones encountered are usually parts of the lower legs, such as phalanges and metapodia. In only a few cases have other bones been found (lumbar vertebra, humerus, tibia, femur and patella). This suggests that most of the remains, including those of Schipluiden, are remnants of skins with attached heads and lower legs (Zeiler, in press). With a few exceptions, bears were evidently skinned at the spot where they were shot and their meat was not consumed.

Figure 22.11 Left ulna of a wolf (7173) compared with a left ulna of a dog (843) (scale 1:1). The withers height of the dog was calculated to be 42.4 cm.

European wildcat
Represented by 22 skeletal parts in the manually collected remains and 15 in the 4-mm sieve residues, the European wildcat is the most frequently encountered predator after

Figure 22.12 Skeletal remains of fur animals.
1302 right maxilla of a brown bear with M2 (scale 1:1)
9262 lower right canine tooth of a brown bear (scale 1:1)
9185 right half of a wildcat mandible (magnification 2×)
4437 right half of a weasel mandible (magnification 5×)

the otter. This is supported by the results obtained after correction of the 4-mm sieve sample (table 22.10).
Both elements from the head (fig. 22.12) and from the postcranial skeleton (front and hind legs) are represented. In all 15 cases in which the age at the time of death could be determined the remains were found to derive from adult individuals (older than 8½-11½ months; Habermehl 1975). No wildcat remains dating from the earliest phases (1 and 1-2a) were found. This could be due to the open salt-marsh landscape that surrounded the dune in those days – by no means an ideal biotope for this species. The relatively small number of identifications may however also play a role here.

Lynx
The lynx is definitely the most spectacular species in the represented faunal range. Along with a skull found at the Roman *castellum* of Valkenburg (Van Bree/Clason 1971) and an as yet undated (and unpublished) lower jaw from the IJsselmeer polders, this is the third archaeological find of this species in the Netherlands, and officially the first dating from Dutch prehistory. The species is represented by three molars, one right one and two left ones from the lower jaw, all M1. Two date from phase 2a. The third was found in Unit 20 (fig. 22.13). That means that they derive from at least two individuals. As in the case of brown bear, the nature of the remains suggests that they are remnants of skins with attached

skulls, including the lower jaws. The same interpretation was suggested for the skull that was found at the Roman Valkenburg site. It is impossible to say whether the animals were killed in the site's own territory or whether their skins were imported from elsewhere. The latter option is the most likely in view of the fact that – unlike in the case of brown bear – we have no archaeological and/or historical sources indicating that the lynx was indigenous in the Low Countries.

22.6.3 Marine mammals

Considering its location close to the coast and the environment of the Schipluiden site, remains of marine mammals are remarkably scarce. A few remains have survived from all phases except phase 1. They derive from common seal, grey seal, bottle-nosed dolphin and a cetacean.

Common seal is represented by four skeletal remains: three cervical vertebrae and a phalanx I from the front leg. The vertebrae – which have the same find number and hence most probably derive from the same individual – were all three burnt (calcined).

In addition, four grey seal remains were identified: two tarsals, one phalanx I from the front leg and a thoracic vertebra (fig. 22.14).

The seven fragments that were identified as deriving from bottle-nosed dolphin are all caudal vertebrae (fig. 22.14). Four of them were found in one of the wells (feature 12-314), the others come from (different) deposits.

One vertebra is too large for a bottle-nosed dolphin, so it must come from a (fairly) large, indeterminate cetacean.

22.7 SUBSISTENCE

Most of the identified species will have been consumed. This is in the first place evident from cut marks on the bones of frequently encountered species, in particular cattle, pig,

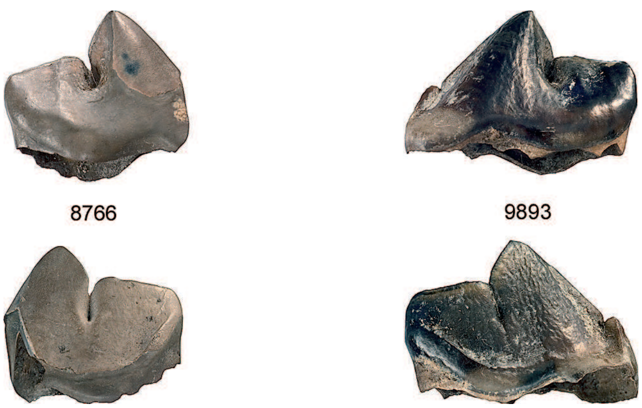


Figure 22.13 molars of a lynx (magnification 2×).
8766 M1 from a right mandible
9893 M1 from a left mandible

wild boar, red deer, otter and beaver, plus the bones of fox. In combination with the distribution of the skeletal elements (Appendices 22.1a-c), the traces of butchering indicate that the domestic animals were slaughtered and consumed at the site, and that – in some cases at least – the hunted animals were in their entirety (or in parts) brought back to the site to be processed there. This holds for both small species such as otter and beaver and for the larger ungulates (red deer, wild boar).

Stock farming was more important for the meat supply than hunting (fig. 22.15). Cattle was the principal stock, followed by pigs. Hunting large wild animals (red deer, wild boar) was however also very important. Insofar as they were (also) hunted for their meat, fur animals were in this respect of less importance, as were marine mammals. Considering the local landscape and the site's location it is surprising that so few marine mammal remains were found. This was however also the case at all Mesolithic and Neolithic sites in the Rhine/Meuse delta, but most of those sites lay further inland, in the freshwater zone. The same was indeed also observed at most of the Late Neolithic sites in the former tidal area of West-Friesland. The only exception in that area is the Mienakker site (Schnitger 1991). Hunting for seals and other marine mammals was evidently in all periods and almost everywhere in the western Netherlands of minor importance. This is not easy to explain. Perhaps hunting at sea was more cumbersome than hunting on land.

Although the picture outlined above in broad lines applies to the entire period of occupation, some changes did take place in the course of time (fig. 22.15). After phase 1 cattle gradually became less important; this is particularly evident from the weights of the bones, more so than from their numbers. Cattle farming nevertheless remained the main source of animal protein throughout the entire period of occupation.

No trends are observable in pig and wild boar, but they do show fluctuations, of around 6 weight percent in the case of pig and 13 weight percent in the case of wild boar. The values obtained for red deer (excluding antler) are for all phases around 10% in numbers of identifications and around 15% in terms of weight. In phase 3 the weight percentage however rises to more than 30%, at an only slightly rising number percentage, implying that (relatively) large bones were deposited.

The latter is an intriguing observation that calls for an explanation. This effect was observed only among red deer remains, and not among the cattle bones. The fact that the average weights of the cattle bones from phases 2b and 3 are more or less the same tells us that the bones from the two phases underwent the same formation processes. The bones of both red deer and cattle from phase 2a are larger (heavier) than those from phases 2b and 3, but this is attributable to

Figure 22.14 Skeletal remains of sea mammals (scale 1:1). 10,185 thoracic vertebra of grey seal
8032 caudal vertebra of bottle-nosed dolphin

a difference in taphonomy: the layer containing the remains from phase 2b is a colluvium, whereas that containing those from phase 2a consists of trampled clay.

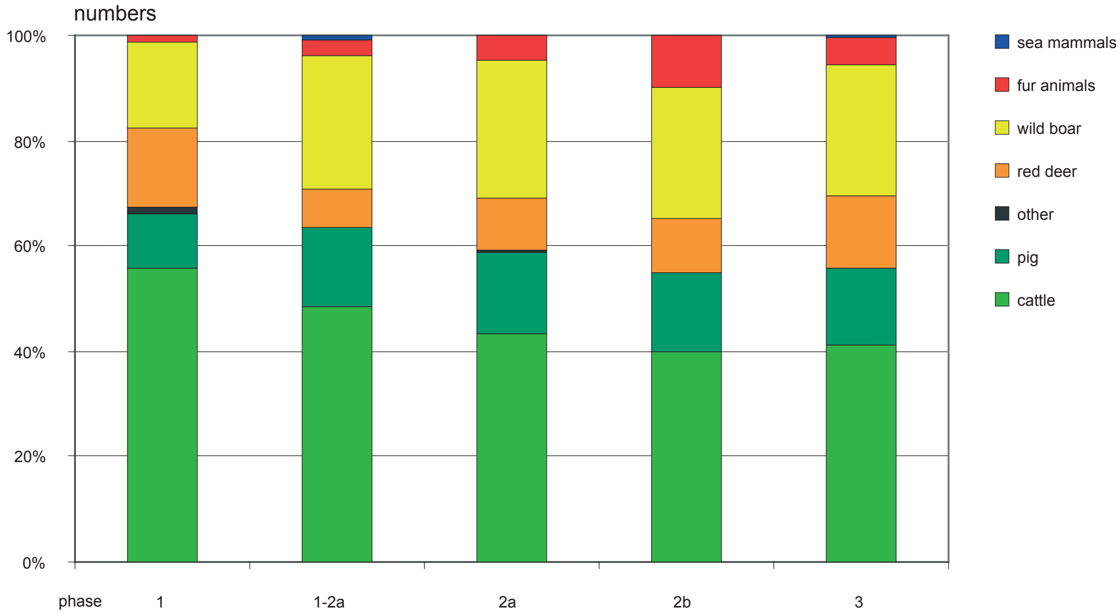
So the greater weight of the red deer bones from phase 3 relative to that of the bones from phase 2b can't be attributed to differences in postdepositional processes, because such processes are not species-specific. Are all the bones larger or is the difference caused by a limited number of large bones, and, if so, were they deposited in a special way? In an attempt to find an answer to this question the frequencies, numbers, weights and average weights of red deer bones from phases 2b and 3 on the different sides of the dune were compared. The bones from both phases were found to be substantially larger on the northwestern side than on the other sides, which can be explained by better preservation conditions. The weight proportions of the bones from the two phases are almost the same on that side (34 and 36%), so this factor does not explain the differences in the general average values.

The difference lies in the bones on the southeastern side, those from phase 3 being larger (heavier) than those from phase 2b – notably 25 grams on average as opposed to 11 grams. This difference is largely caused by eleven large parts of long bones – five humeri, four radii, one ulna and one metacarpus – found in the southern part of this side, in trenches 10-16. Without these large bones the average weight on this side would decrease from 25 to 14 grams. Interestingly, the bones in question all derive from forelegs, and in the overall identifications long bones from forelegs are also strongly dominant among the remains from phase 3, in terms of both number and dimensions. This is not the case with the bones from phase 2b.

So the greater weight of red deer bones from phase 3 is entirely due to the deposition of the long bones of forelegs, which underwent only little fragmentation, along a restricted stretch of the periphery of the dune. Such a deviating, localised deposition suggests some special activity whose remains cannot be stratigraphically distinguished from those of phase 3. One possibility is that the abandoned settlement site was later used as a hunting base. The large size of the bones could then be attributed to the absence of trampling by cattle. Evidently a red deer foreleg was from time to time consumed at the hunting base and the rest of the animal (hind legs, body, skin) was taken along to the new settlement.

22.8 Other purposes for which parts of mammals were used

Besides meat, the various species also yielded other products. The occupants of the dune used red deer antler and cattle and pig bones to make tools (chapter 10). They also used skins of both domestic and wild animals. Although only a (small) number of skeletal remains of cattle, pig, red deer, beaver and fox show cut marks indicating that the animals were skinned, it may be assumed that the skins of other (fur) species were used, too. A different indication of skinning is the exclusive or dominant occurrence of bones of the lower legs and/or the head of an



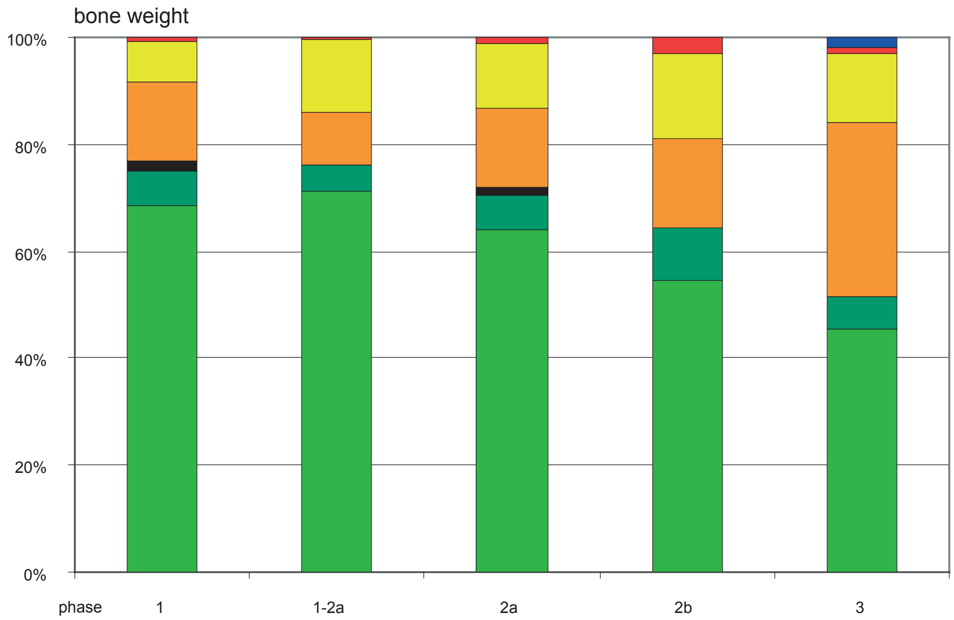


Figure 22.15 Ratios of the most important species and groups of mammals; all manually collected remains, excluding dog bones and antler, expressed as numbers of identifications and as bone weight and presented according to phase. Note that an increase in red deer remains is observable exclusively in the weight data. This is due to a restricted number of large bones, which were found mainly in the western part of the southeastern margin of the dune (see section 22.7).

animal, which implies that the animal was killed off-site and its fresh skin was brought back to the settlement for further processing. This holds for aurochs, brown bear and lynx. In the use-wear analysis of the flint tools evidence of the scraping of fresh and dried skins was frequently observed (chapter 7).

22.9 Seasonal evidence

Information on human activities in specific seasons was inferred from evidence provided by shed red deer antler and antler with parts of the skull attached, fur animals and marine mammals and the ages at which pig/wild boar and cattle were killed (figs. 22.16-17).

Red deer males shed their antler in late winter and early spring; the new antler is fully grown in the summer (July). As antler decomposes fairly quickly, shed antler will have been collected in February-April, too. Antlers with parts of the skull attached on the contrary point to active hunting in the period of August-January. Of the twenty collected antler bases 12 are from collected antlers and eight from shot animals. Both stages are fairly unequally distributed among the occupation phases – 14 antler bases from phase 2a are equally divided over both categories, the five bases from phases 2b and 3 are all from shed antlers.[6]

As far as fur animals are concerned, the quality of the fur is best in (late) winter. An exception is the fur of the otter; this animal sheds its hair gradually throughout the year, so its fur is of a constant quality. Although the occupants of Schipluiden also consumed the meat of some species (beaver, otter, fox), an important objective of their hunting strategies will generally have been to obtain fur. So we may safely assume that fur animals – excluding the otter – will have been most intensively hunted from late autumn until early spring (November-March).

As for the seals – the common seal may have been hunted in the dune's surroundings at any time of the year. This species tends to move around fairly little, unlike the grey seal, which leaves the coast in winter, going in search of deeper water. So the incidental occurrence of remains of this species indicates hunting in the period from spring until (late) autumn (April-October).

On the basis of the eruption of molars in lower and upper jaws of pig/wild boar and cattle, the ages at the time of death can in some cases be coupled to the month or season in which the animal must have been killed (table 22.23). In these calculations the average dates of birth of calves and piglets were set at 1 and 15 April, respectively. Both cattle and pig/wild boar were slaughtered in both the summer and the winter half of the year (fig. 22.16). The data relating to phase 2a in particular show that the greatest proportion of animals were killed between autumn and (early) spring (October-May). Extra information is provided by six foetal and/or neonatal skeletal remains – five of pig and one of a bovine animal. These animals must all have died in early spring.

The above data are summarised in fig. 22.17. Although the number of data varies substantially from one phase to another, there is evidence for human activities in all seasons in all the occupation phases. This is not to say that these data imply that the site was occupied on a year-round basis. Along with the results of the other studies they do however constitute a supportive argument in favour of permanent human presence and occupation of the dune.

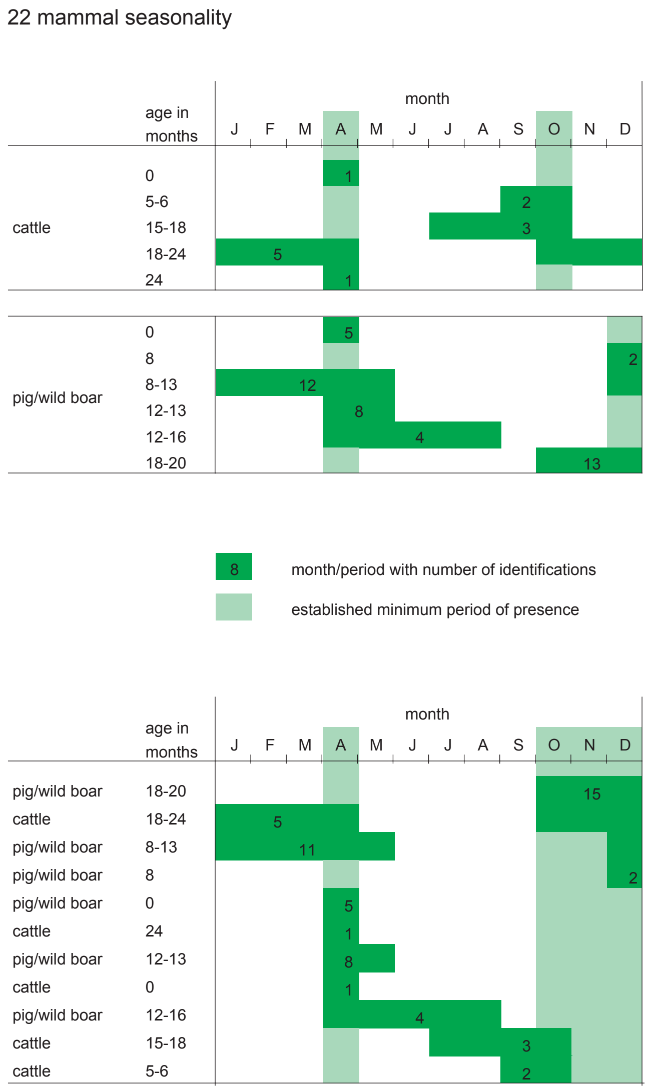


Figure 22.16 Seasonal indications based on culling ages of cattle and pig inferred from dental evidence.

22.10 Exploited ecozones

The results of the physical-geographical and palaeobotanical studies reveal an open landscape initially characterised by a salt-marsh vegetation that later gave way to a swamp vegetation. The brackish conditions of phase 1 were in the course of the occupation period replaced by freshwater conditions, which development was associated with the growth of reed and sedge peat. So we know what the landscape was like in general terms. Our understanding of small-scale landscape elements is however much poorer, and precisely these elements may have been important for the macrofauna.

The landscape reconstructions constitute the context for the assessment of the faunal data. Thanks to their preference for specific biotopes, the wild mammals provide supplementary information on the landscape. The species show us

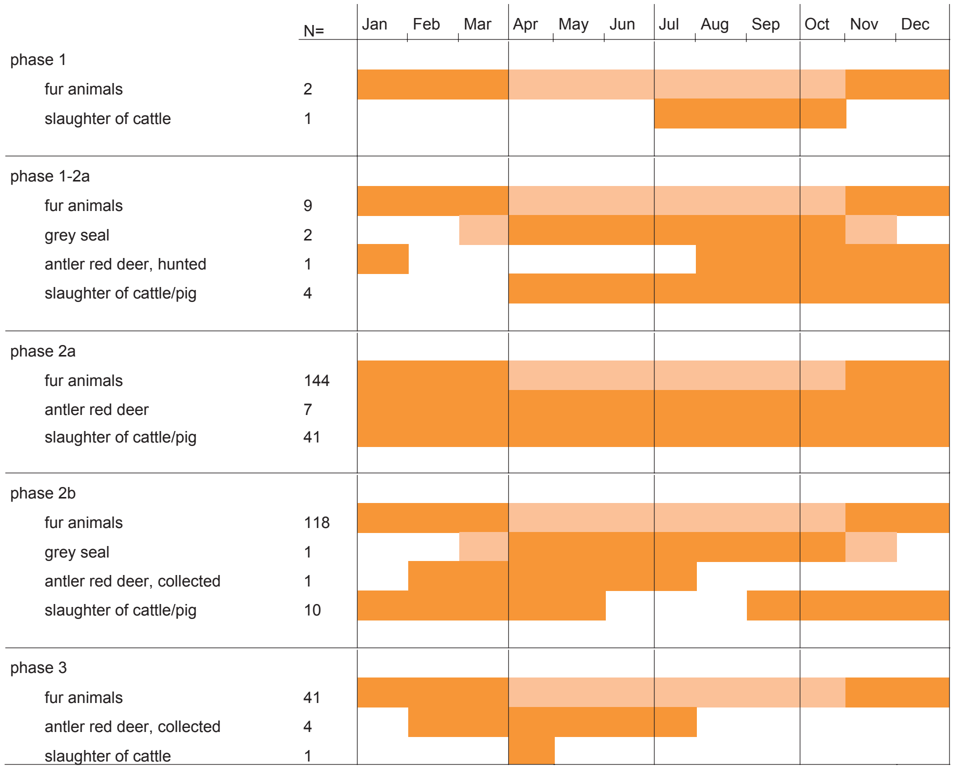


Figure 22.17 Seasonal indicators among the mammal bone remains, presented according to phase.

which ecozones were exploited within the occupants' daily action radius, which we may assume extended no further than 5 to 10 km from the dune.

The landscape must initially have been very suitable for cattle farming; this will indeed have been an important factor in the site's selection. The cattle will have been pastured in the dune's immediate surroundings, in particular on the (former) salt marshes and the beach plain. The presence of alder pollen in cattle coprolites (chapter 17) however indicates that cattle were also pastured in the swampy areas

Table 22.23 Seasonal indications based on culling ages of cattle and pig as inferred from dental evidence, presented according to phase.

age in months	month/period	phase					
		1	1-2a	2a	2b	3	totals
cattle							
0	April	–	–	1	–	–	1
5-6	September - October	–	–	1	1	–	2
15-18	July - October	1	1	1	–	–	3
18-24	October - April	–	–	5	–	–	5
24	April	–	–	–	–	1	1
	Totals	*1*	*1*	*8*	*1*	*1*	*12*
pig/wild boar							
0	April	–	–	3	2	–	5
8	December	–	–	–	2	–	2
8-13	December - May	–	–	10	2	–	12
12-13	April - May	–	1	5	2	–	8
12-16	April - August	–	1	3	–	–	4
18-20	October - December	–	1	12	–	–	13
	Totals	–	*3*	*33*	*8*	–	*44*

to the east of the dune. The decreasing proportion of cattle in the species spectrum after phase 1 may be associated with the changes that took place in the landscape, in particular the increasing growth of peat in the course of the occupation period, which will have led to a decrease in the area of pastureland.

The (open) landscape of the earliest phases was probably far less suitable for pigs and wild boars. There were for example no forests with an abundance of acorns (although they are of course available for only a limited part of the year). Wild boars moreover prefer semi-open areas in which they can find sufficient shelter. Nowadays the highest wild boar densities are found in flat areas abounding in water with deciduous forests and farmland. The landscape was probably not particularly suitable for red deer either. This species likewise prefers a semi-open landscape with mixed forests alternating with open plains. The landscape nevertheless afforded sufficient nutrients and shelter for red deer throughout the entire period of occupation. They were probably to be found in the brushwood behind the coastline, small woods on the scattered dunes and the carrs in the eastern part of the surrounding area. Red deer (fig. 22.18) may have been attracted by the lush pastures, too. Rather surprising in this context is that roe deer, which show a comparable biotope preference, were very scarce, or were perhaps not hunted. All in all, red deer and wild boar may have been hunted anywhere in the dune's surroundings, in different places and different biotopes.

Sheep and goat remains are conspicuously absent. Remains of sheep, and sometimes goats too, have been found at most Neolithic sites (if always in small quantities), even in environments, which at first sight seem to have been entirely unsuitable for these species. An example is Swifterbant, which also yielded evidence of liver fluke, which is lethal for sheep and goats (De Roever-Bonnet *et al.* 1979). Conditions at Schipluiden will certainly have been more favourable, comparatively speaking.

The bones of beavers are evidence of hunting in the swampy area to the east of the dune (fig.22.19). The beaver biotope must contain flowing or stagnant water with a depth of at least 50 cm and nutrients in the form of herbs, water plants and woody shrubs such as willows. Beavers show a strong preference for freshwater conditions, unlike otters, which are to be found in both freshwater and brackish environments and even along seacoasts. So otters may have been hunted in the swamp, but also in the brackish and saline ecozones, such as the estuary. Remarkable in this context is the absence of otter remains from phase 1, whereas beaver remains have survived from all the occupation phases in almost the same frequencies, and the numbers of beaver and otter remains surviving from the other phases don't differ that much.

The other wild mammal species were represented by (far) fewer remains. From those remains we can at least conclude that the species concerned were to be found in the dune's surroundings, but were for example less intensively hunted. This may hold for example for the polecat. Polecats are not restricted to a specific biotope, but they do like the proximity of water (Broekhuizen *et al.* 1992).

In some cases the absence of a suitable biotope for a specific species however plays an important part in interpretation. A case in point concerns the lynx, a species typical of large uninterrupted forested areas (Lange *et al.* 1994). It is highly unlikely that the lynx roamed the dune's surroundings; the represented remains most probably derive from skins that were imported via the occupants' far-reaching contacts with areas further south. The brown bear remains and some of the aurochs bones are also remnants of skins. Contrary to the lynx, these two species may however have been hunted in the dune's surroundings. From archaeological finds we know that both species were indigenous in these parts. So, although the brown bear, being a typical mixed forest occupant, is not really a species we would immediately associate with this landscape, it is quite possible that (roaming) individuals were from time to time to be found in the area.

Much less is known about the aurochs' biotope. Van Vuure (2003) writes: "Finds of bones and ancient sources suggest that there was a close affinity between the aurochs and swamps and swamp forests … for example river valleys, river deltas, salt marshes and other types of swamps". He (quite rightly) adds that the favourable preservation conditions in wet soils may have led to a strong bias in the species' distribution. In his opinion the many finds from wet areas nevertheless suggest that: "… such biotopes constituted at least an important part of the aurochs' local distribution". So whether this was indeed the case is questionable. Two thousand years earlier there were no aurochs to be found in the swamps surrounding Hardinxveld-Giessendam. The aurochs bones that were found there are imported tools.

Another species that we would not immediately expect to find in such a landscape is the European wildcat. It is nevertheless represented by a few dozen remains. Nowadays, the European wildcat is found only in higher parts, but in the past it roamed in lowlands, too (Lange *et al.* 1994). Remains of this animal have been found at most Mesolithic and Neolithic lowland sites. The landscape of the Schipluiden area evidently afforded sufficient shelter for this species in the form of brushwood and shrubs.

The other wild mammal species – wolf, fox and weasel – may have lived in the landscape, but they are not typical of it. No conclusions concerning the landscape can be drawn from the marten remains as those remains cannot be identified to species level (pine or stone marten).

Figure 22.18 Red deer in the lowlands in the present-day Oostvaardersplassen nature reserve in the IJsselmeerpolders. The animals were deliberately introduced there and are doing very well in this environment. Red deer disappeared from the lowlands in late prehistoric/early historical times due to reclamation and agrarian use of the land.

The remains of marine mammals from almost all the occupation phases indicate that the marine ecozone (coast and estuary) constantly formed part of the occupants' action radius, but was exploited to a limited extent only. Seals and bottle-nosed dolphins may have been actively hunted if they happened to come close to the coast or in the adjacent estuary. Bottle-nosed dolphins occur mainly in shallow coastal waters and sometimes swim up (large) rivers. Common and grey seals usually live close to or at the coast and in deltas (fig. 22.20); sometimes seals, especially common seals, swim up rivers (Lange *et al.* 1994). It is not certain whether the Schipluiden occupants actively hunted bottle-nosed dolphins and seals at the beach or on the water, or whether the represented remains derive from animals that got caught in nets or fish weirs. The cetacean vertebra most probably derives from an animal that was washed up on the shore.

22.11 Conclusions

Stock keeping and hunting game were important in the subsistence of the occupants of the dune. Cattle were by far the most important stock, followed by pigs. Sheep and goats were absent. The two main hunted species in terms of meat yield were red deer and wild boar. Throughout the entire period of occupation the occupants also – often incidentally – hunted a broad range of mammal species, including around ten fur animals and a few marine mammals. In a few cases they will have benefited from the availability of dead animals, such as a cetacean washed up on the beach. In all phases the occupants exploited several ecozones: the swamps to the east of the dune, the beach plain, other nearby dunes and the coastal zone with the estuaries it contained. The species spectrum is comparable with that of sites such as Ypenburg (De Vries 2004) and Hardinxveld-Giessendam De Bruin (Oversteegen *et al.* 2001). The results of the study of

Figure 22.19 Beavers were originally to be found in the Dutch wetlands in large numbers but they became extinct in the early 19th century. Reintroduction of beavers in nature reserves such as this one in the Oostvaardersplassen region has had varying results.

the mammal remains, along with those of the analyses of bird (chapter 23) and fish (chapter 25) remains, point to a highly diverse subsistence system.

In the course of time the importance of hunting increased at the expense of that of stock (cattle) keeping, possibly due to changes in the landscape: the growth of reed and sedge peat will have led to a decrease in the area of pastureland. Even so, cattle farming remained the most important source of animal protein throughout the entire period of occupation. Interesting is the substantial increase in the weight proportion of red deer remains from phase 3. This increase is entirely attributable to a deviating deposition of long bones of the forelegs along a limited stretch of the periphery of the dune. This could mean that the abandoned settlement site was later used as a hunting base.

As far as the exploitation of different types of mammals is concerned, there is a remarkable difference between the kill-off patterns of the cattle and those of hunted wild animals. The latter focused specifically on relatively old, adult individuals. Younger animals were killed only incidentally. This holds for both fur animals (otter and beaver) and red deer. Judging from the available data, a fairly large proportion of the cattle population was on the contrary slaughtered already before the end of the animals' second year. The exploitation patterns of domestic pigs and wild boars are much less clear because their remains could not be distinguished, as a result of which the ages at the time of death relate to a mixture of a domestic and a wild population. What can be inferred from the remains is that, as with the cattle, a large proportion derive from young animals. If the wild boars were hunted in the same manner as the other wild mammals, this would mean that the remains of young individuals derive mainly from domestic pigs and those of older animals partly from wild boars.

A question that arises in this context is whether the pigs were herded and kept largely separate from their wild relatives or whether they were allowed to roam unsupervised by humans (and dogs) – perhaps more often than the cattle. Albarella *et al*. (in press 2) have recently discussed a scenario involving extensive exploitation of a semi-wild population of pigs. In an ethnographic study they describe traditional pig-farming methods in Sardinia and Corsica. In spite of a substantial degree of variation, one of the most important characteristics of the farming system concerned is that the pigs roam either entirely freely within a range of at most 50 ha or in enclosed areas measuring 1 to 30 ha. The herds are relatively small (at most 50 animals). Interbreeding with wild boars occurs, but has no influence on the animals' body size as both the wild and the domestic species are dwarf types. The animals are caught by luring them with food or by driving them into an enclosure; sometimes they are shot. Very few animals are lost, both in the free-range herds and in the herds kept in the enclosures.

Sardinia and Corsica of course have specific climatic, natural and cultural conditions. So their extensive form of pig farming cannot simply be used as a model anywhere else, as the authors themselves indeed emphasise. At Schipluiden there were for example no forests where pigs could have foraged for acorns on a large scale. And the small number of animals lost in Corsica and Sardinia is without doubt (partly) attributable to the absence of large predators such as the wolf and the brown bear. The ethnographic study is however of value in that it warns us not to concentrate too much on distinguishing between the management of domestic and wild sources of food. The authors incidentally add that in cases in which the wild and domestic forms cannot be readily distinguished on metric grounds, the problem is not solved "...by introducing the possible existence of a third biological status placed somewhere between the wild boar and the domestic pig ...". They add that "...the emphasis in our explanations must be on *management* rather than *biological status*, as the second is by and large a product of the first."

It would seem that the pig-farming system described by Albarella *et al*. cannot be applied to Schipluiden. As already mentioned above, the conditions at Schipluiden differed substantially from those on the two islands in some respects. In the first place there were clear metric differences between the wild and the domestic pig populations. Secondly, the remains include bones of foetal or neonatal piglets. If we assume that they derive from domestic individuals, this means that pregnant sows and sows with piglets were kept on or near the dune itself. That is not in agreement with the above scenario based on extensive exploitation of

Figure 22.20 Grey seal and common seal on a shoal near the isle of Ameland in the Waddenzee. Both species occurred in the Meuse estuary and along the North Sea coast in prehistoric times but were hunted only incidentally throughout the Neolithic by the Schipluiden community.

a free-range semi-wild population. The problem, however, is that it is not possible to say whether the remains of such young animals derive from domestic or wild individuals. What we can ask ourselves is whether pregnant animals will at all have been hunted.

What should also be borne in mind in this context is that the remains include isolated milk premolars and teeth. They need not necessarily derive from slaughtered animals, but may also have been lost following natural replacement by permanent elements. Interestingly, the remains include far fewer of such elements from pig/wild boar than from cattle. In the case of both the manually collected remains and the remains recovered from the 4-mm sieve fraction, more than 40% of the total number of isolated cattle dental elements are milk premolars and teeth. The percentage for pig/wild boar is 2.5 to 3 times lower (13-17%). This difference cannot be attributed to a difference in kill-off patterns: in the case of both cattle and pig/wild boar a large proportion of young animals were slaughtered. A possible explanation could be that piglets, unlike calves, were only incidentally kept on the dune itself. This would mean that the pigs – including the sows with piglets – usually roamed freely, which would agree with the scenario based on extensive exploitation of a semi-wild population. A more obvious explanation however lies in the fact that, as with most of the other remains, it is not possible to say whether the milk molars and teeth of pig/wild boar derive from domestic or wild animals. The teeth of young wild boars were replaced off-site. So some of these elements are not represented in the overall assemblage of domestic and/or wild mammal remains, and their proportion is consequently much lower than that of cattle.

So, on the basis of the currently available evidence, there is no reason to assume extensive free-range pig farming at Schipluiden. The data clearly point to a domestic and a wild population, which will have been exploited in different ways: the former herded, the latter hunted. This does incidentally not necessarily mean that the two populations were kept strictly apart. Certainly if the pigs were allowed to forage unsupervised in the dune's surroundings they will have been in contact with their wild relatives, and that may well have involved some interbreeding.

notes

1 No literature data are available for age determinations of polecat, marten, European wildcat and common and grey seal. The data available for domestic cats were used – as a guideline – for the European wildcat (Habermehl 1975).

2 No wild/domestic distinction has been made in the measurements of the other skeletal elements; they are for this reason given under "pig/wild boar" in Appendix 22.2.

3 This number includes the fragments that were stuck together and fitting or associated fragments that were counted as a single fragment in the database. If they were to be counted individually, the total number of identified mammal remains would be around 14,000.

4 Of the 17 human remains, 14 were found among the manually collected remains and three in the 4-mm sieve fraction. These figures are 37 and two, respectively, for the 39 pieces of carved bone and antler.

5 The DPA and SDO of the ulna in the GIA reference collection are 34.2 and 28.2 mm; the measurements of the specimen from Schipluiden are 36.5 and 32.5 mm, respectively.

6 In these numbers are six worked antlers bases (chapter 10) included.

Acknowledgements

I would like to thank Umberto Albarella (Dept. of Archaeology, University of Sheffield, UK) for making available various publications on pigs and wild boars and unpublished metric data relating to prehistoric wild boars.

References

Albarella, U./K. Dobney/P. Rowley-Conwy forthcoming. Size and shape of the Eurasian wild boar (*Sus scrofa*), with a view to the reconstruction of its Holocene history.

Albarella, U./F. Manconi/J.-D. Vigne/P. Rowley-Conwy, in press 1. Traditional pig husbandry in Sardinia and Corsica. In: U. Albarella/K. Dobney/A. Ervynck/P. Rowley-Conwy (eds), Pigs and Humans: 10,000 years of interactions, Oxford

Albarella, U./K. Dobney/P. Rowley-Conwy, in press 2. The domestication of the pig (*Sus scrofa*): new challenges and approaches. In: M. Zeder/ D. Bradley/B. Smith/E. Emswhiller (eds), *Documenting domestication: new genetic and archaeological paradigms*.

Balasse, M./A. Tresset 2002. Early weaning of Neolithic domestic cattle (Bercy, France) revealed by intra-tooth variation in nitrogen isotope ratios, *Journal of Archaeological Science* 29 (8), 853-859.

Bree, P.J.H. van/A.T. Clason 1971. On the skull of a lynx, *Lynx lynx* (Linnaeus, 1758), found in the Roman castellum at Valkenburg, province of Zuid-Holland, The Netherlands. *Bijdragen tot de Dierkunde* 41 (2), 130-35.

Brink, F.H. van den 1978. Zoogdierengids van alle in ons land en overig Europa voorkomende zoogdieren, Amsterdam/ Brussel.

Broekhuizen, S./B. Hoekstra/V. van Laar/C. Smeenk/ J.B.M. Thissen (eds). *Atlas van de Nederlandse zoogdieren*, Utrecht/Arnhem.

Clason, A.T. 1967. *Animal and man in Holland's past*, PhD thesis, Groningen.

Copley, M. S./R. Berstan/S.N. Dudd/G. Docherty/A.J. Mukherjee/V. Straker/S. Payne/R.P. Evershed 2003. Direct chemical evidence for widespread dairying in prehistoric Britain, *Proceedings of the National Academy of Sciences of the United States of America* 100, 1524-1529.

Degerbøl, M./B. Fredskild 1970. *The urus (Bos primigenius Bojanus) and neolithic cattle (Bos taurus domesticus Linné) in Denmark,* Kopenhagen (Biologiske Skrifter 17/1).

Driesch, A. von den 1976. *A guide to the measurement of animal bones from archaeological sites*, Cambridge (USA).

Gehasse, E.F. 1995. *Ecologisch-archeologisch onderzoek van het Neolithicum en de Vroege Bronstijd in de Noordoostpolder met de nadruk op vindplaats P14*, PhD thesis, Amsterdam.

Habermehl, K.-H. 1975. *Die Alterbestimmung bei Haus- und Labortieren*, Berlijn/Hamburg.

Habermehl, K.-H. 1985. *Die Alterbestimmung bei Wild- und Pelztieren*, Berlijn/Hamburg.

Harcourt, R.A. 1974. The dog in prehistoric and early historic Britain, *Journal of Archaeological Science* 1, 151-175.

IJzereef, G.F. 1981. *Bronze Age animal bones from Bovenkarspel. The excavations at Het Valkje,* PhD thesis Amsterdam, also: Amersfoort (Nederlandse Oudheden 10).

Iregren, E./G. Stenflo 1982. An osteological and statistical attempt to interpret seasonal occupation of dwelling sites, *Pact* 7, 225-234.

Iregren, E/M.-R. Bergström/P.E. Isberg 2001. The influence of age on metric values in the brown bear cranium (*Ursus* *arctos* L.). In: H. Buitenhuis/W. Prummel (eds), *Animals and man in the past. Essays in honour of Dr. A.T. Clason,* Groningen *(ARC-publicatie* 41), 21-27.

Lange, R./P. Twisk/A. van Winden/A. van Diepenbeek 1994. *Zoogdieren van West-Europa*, Utrecht.

Larson, G./K. Dobney/U. Albarella/M. Fang/E. Matisoo-Smith/ J. Robins/S. Lowden//H. Finlayson/T. Brand/E. Willerslev/ P. Rowley-Conwy/L. Anderson/A. Cooper 2005. Worldwide phylogeography of wild boar reveals multiple centers of pig domestication, *Science* vol. 307, 1618-1621.

Mariezkurrena, K. 1983. Contribución al conocimiento del desarrollo de la dentición y el esqueleto postcraneal de *Cervus elaphus, Munibe* 35 (3-4), San Sebastián, 149-202.

Matolcsi, J. 1970. Historische Erforschung der Körpergrösse des Rindes auf Grund von ungarischen Knochenmaterial, *Zeitschrift für Tierzüchtung und Züchtungsbiologie* 87, 89-137.

Oversteegen, J.F.S./L.H. van Wijngaarden-Bakker/ R. Maliepaard/Th. van Kolfschoten 2001. Zoogdieren, vogels, reptielen. In: L.P. Louwe Kooijmans (ed.), *Hardinxveld-Giessendam De Bruin. Een kampplaats uit het Laat-Mesolithicum en het begin van de Swifterbant-cultuur (5500-4450 v.Chr.)*, Amersfoort (Rapportage Archeologische Monumentenzorg 88), 209-97.

Prummel, W. 1987. The faunal remains from the neolithic site of Hekelingen III, *Helinium* 27, 190-258.

Raemaekers, D.C.M./C.C. Bakels/B. Beerenhout/A.L. van Gijn/K. Hänninen/S. Molenaar/D. Paalman/M. Verbruggen/ C. Vermeeren 1997. Wateringen 4: a settlement of the Middle Neolithic Hazendonk 3 group in the Dutch coastal area, *Analecta Praehistorica Leidensia* 29, 143-191.

Roever-Bonnet, H. de/A.C. Rijpstra/M.A. van Renesse/ C.H. Peen 1979. Helminth eggs and gregarines from coprolites from the excavations at Swifterbant (Swifterbant contribution 10), *Helinium* 19, 7-12.

Schnitger, F.W. 1991. *Mienakker 1990. De botten van vogels en zoogdieren,* Amersfoort (internal report Rijksdienst voor het Oudheidkundig Bodemonderzoek).

Teichert, M. 1969. Osteometrische Untersuchungen zur Berechnung der Widerristhöhe bei vor- und frühgeschichtlichen Schweinen, *Kühn-Archiv* 83, 237-292.

Uerpmann, H.-P. 1973. Animal bone finds and economic archaeology: a critical study of "osteo-archaeological" method, *World Archaeology* 4, 307-322.

Vuure, C. van 2003. *De oeros. Het spoor terug*, Wageningen.

Vries, L.S. de 2004. *Luilekkerland aan de kust. De fauna-resten van de neolithische nederzetting bij Rijswijk-Ypenburg*, Amersfoort (Rapportage Archeologische Monumentenzorg 106).

Wijngaarden-Bakker, L.H./C. Cavallo/Th. van Kolfschoten/ C.H. Maliepaard/J.F.S. Oversteegen 2001. Zoogdieren, vogels, reptielen. In: L.P. Louwe Kooijmans (ed.), *Hardinxveld-Giessendam Polderweg. Een mesolithisch jachtkamp in het rivierengebied (5500-5000 v.Chr.)*, Amersfoort (Rapportage Archeologische Monumentenzorg 83), 181-242.

Zeiler, J.T. 1988. Age determination based on epiphyseal fusion in postcranial bones and tooth wear in otters (*Lutra lutra*), *Journal of Archaeological Science* 15, 555-561.

Zeiler, J.T. 1997. *Hunting, fowling and stock-breeding at Neolithic sites in the western and central Netherlands,* PhD thesis Groningen.

Zeiler, J.T. in press. The bear, the wolf, the otter and the weasel: carnivore mammals in the Dutch Neolithic. In: D. Serjeantson/D. Field (eds), *Animals in the Neolithic of Britain and Europe*.

J.T. Zeiler
ArcheoBone
Aggemastate 135
8926 PC Leeuwarden
The Netherlands
abone@planet.nl

Appendices

22.1a Mammal remains collected by hand: species versus skeletal element, numbers of identifications.

	cattle	pig	dog	cattle/ aurochs	aurochs	red deer	roe deer	wild boar	pig/ wild boar	beaver	otter	marten	polecat	fox	wolf	brown bear	wildcat	lynx	common seal	grey seal	bottle–nosed dolphin	whale
antler	–	–	–	–	–	1104	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
horn core	60	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
cranium	135	–	241	–	–	15	–	–	63	5	1	–	–	–	2	–	–	–	–	–	–	–
mandibula	220	8	58	2	–	35	–	17	424	7	40	–	7	1	–	3	5	–	–	–	–	–
maxilla	26	–	51	–	–	3	–	–	118	–	3	–	1	–	–	2	1	–	–	–	–	–
teeth	670	–	–	–	–	9	–	–	267	10	–	–	–	–	–	–	–	–	–	–	–	–
upper teeth	589	–	91	–	–	78	–	–	214	19	7	–	2	–	–	2	1	–	–	–	–	–
lower teeth	346	–	56	–	–	25	–	–	493	10	2	–	–	–	–	2	1	3	–	–	–	–
hyoid	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
vertebra	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
atlas	9	–	3	1	1	5	–	–	13	–	–	–	–	–	–	–	–	–	–	–	–	–
axis	3	–	19	–	–	4	–	–	1	–	–	–	–	–	–	–	–	–	1	–	–	–
cervical vertebra	10	–	75	1	1	–	–	–	3	3	–	–	–	–	–	–	–	–	2	–	–	–
thoracic vertebra	20	–	6	1	–	1	–	–	14	–	–	–	–	–	1	–	–	–	–	1	–	–
lumbar vertebra	10	–	28	–	–	3	–	–	7	2	–	–	–	–	–	–	–	–	–	–	–	–
caudal vertebra	–	–	1	–	–	–	–	–	–	10	2	–	–	–	–	–	–	–	–	–	7	–
sacrum	8	–	1	–	–	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
rib	14	–	4	–	–	–	–	–	11	–	–	–	–	–	–	–	–	–	–	–	–	–
clavicula	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–
scapula	77	–	6	–	–	24	–	–	55	4	2	–	–	–	–	–	1	–	–	–	–	–
humerus	120	2	17	1	–	34	–	5	97	4	26	–	–	1	–	–	3	–	–	–	–	–
radius	99	–	18	–	–	45	–	–	40	2	10	–	–	–	–	–	1	–	–	–	–	–
ulna	43	–	20	1	1	14	–	–	57	6	6	–	–	–	1	–	2	–	–	–	–	–
carpalia	45	–	16	–	3	49	–	–	47	–	–	–	–	–	–	–	–	–	–	–	–	–
metacarpus	143	–	–	1	–	11	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
metacarpus1	–	–	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
metacarpus2	–	–	8	–	–	–	–	–	3	–	1	–	–	–	–	–	–	–	–	–	–	–
metacarpus3	–	–	7	–	–	–	–	–	8	–	–	–	–	–	–	–	–	–	–	–	–	–
metacarpus4	–	–	2	–	–	–	–	–	14	–	1	–	–	–	–	–	–	–	–	–	–	–
metacarpus5	–	–	5	–	–	–	–	–	4	–	–	–	–	–	–	–	–	–	–	–	–	–
pelvis	40	–	23	–	1	15	–	–	25	10	3	–	–	–	–	–	–	–	–	–	–	–
femur	94	–	28	–	–	23	–	–	58	10	18	–	1	–	–	–	–	–	–	–	–	–
patella	3	–	–	–	–	2	–	–	10	–	–	–	–	–	–	–	–	–	–	–	–	–
tibia	112	–	24	–	–	57	–	–	78	10	15	1	–	–	–	–	4	–	–	–	–	–
fibula	–	–	2	–	–	–	–	–	13	–	1	–	–	–	–	–	–	–	–	–	–	–
astragalus	25	5	6	–	–	33	–	3	26	6	9	–	–	–	–	–	–	–	–	–	–	–
calcaneus	35	–	4	–	–	26	–	1	38	–	10	–	–	–	–	–	2	–	–	–	–	–
tarsalia	43	–	5	–	2	27	–	–	31	–	1	–	–	–	–	–	–	–	–	2	–	–
carpalia/tarsalia	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
metatarsus	119	–	–	–	–	34	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–
metatarsus1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
metatarsus2	–	–	3	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–
metatarsus3	–	–	3	–	–	–	–	–	5	1	2	–	–	–	–	–	–	–	–	–	–	–
metatarsus4	–	–	5	–	–	–	–	–	14	2	1	–	–	–	–	–	–	–	–	–	–	–

	cattle	pig	dog	cattle/ aurochs	aurochs	red deer	roe deer	wild boar	pig/ wild boar	beaver	otter	marten	polecat	fox	wolf	brown bear	wildcat	lynx	common seal	grey seal	bottle–nosed dolphin	whale
metatarsus5	–	–	3	–	–	–	–	–	2	1	–	–	–	–	–	–	1	–	–	–	–	–
metapodia	34	–	5	–	–	5	1	–	38	–	–	–	–	–	–	–	–	–	–	–	–	–
phalanx I	53	–	20	–	3	51	–	–	69	3	1	1	–	–	–	1	–	–	1	1	–	–
phalanx II	38	–	7	1	2	30	–	–	53	2	–	–	–	–	–	–	–	–	–	–	–	–
phalanx III	10	–	5	–	–	6	–	–	31	–	–	–	–	–	–	–	–	–	–	–	–	–
sesamoid	16	–	1	–	–	10	–	–	36	–	–	–	–	–	–	–	–	–	–	–	–	–
Totals	*3270*	*15*	*879*	*9*	*14*	*1780*	*1*	*26*	*2480*	*129*	*163*	*2*	*11*	*2*	*4*	*10*	*22*	*3*	*4*	*4*	*7*	*1*

22.1B MAMMAL REMAINS COLLECTED FROM 4-MM SIEVE RESIDUES: SPECIES VERSUS SKELETAL ELEMENT, NUMBERS OF IDENTIFICATIONS.

	cattle	dog	red deer	pig/ wild boar	beaver	otter	marten	polecat	weasel	brown bear	wildcat
antler	–	–	41	–	–	–	–	–	–	–	–
horn core	27	–	–	–	–	–	–	–	–	–	–
cranium	1	1	–	2	–	–	–	–	–	–	–
mandibula	–	–	–	1	–	1	–	–	1	–	–
maxilla	–	–	–	1	–	1	–	1	–	–	–
teeth	197	–	3	191	2	–	–	–	–	–	–
upper teeth	17	30	–	17	–	5	2	–	–	–	2
lower teeth	18	13	1	45	–	3	–	1	–	–	4
scapula	–	–	–	–	–	–	–	–	–	–	1
humerus	1	–	–	–	–	1	–	–	–	–	–
radius	–	1	–	–	–	–	–	–	–	–	–
ulna	1	2	–	–	–	–	–	–	–	–	–
carpalia	–	4	–	2	–	–	–	–	–	–	–
metacarpus	1	–	–	–	–	1	–	–	–	–	–
metacarpus 1	–	1	–	–	–	–	–	–	–	–	2
metacarpus 2	–	–	–	–	–	1	–	–	–	–	–
metacarpus 3	–	–	–	1	–	1	–	–	–	–	1
metacarpus 5	–	–	–	1	–	1	–	–	–	–	–
pelvis	–	–	–	–	–	–	–	1	–	–	–
femur	–	–	–	–	–	1	–	–	–	–	–
patella	–	1	–	–	–	–	–	–	–	–	–
tibia	1	–	–	–	–	1	–	1	–	–	–
astragalus	–	–	–	–	–	1	–	–	–	–	–
calcaneus	–	–	–	–	–	1	–	–	–	–	–
tarsalia	–	–	–	2	–	1	–	–	–	–	–
metatarsus	–	–	1	–	–	1	–	–	–	–	–
metatarsus2	–	–	–	1	–	–	–	–	–	–	–
metatarsus5	–	–	–	–	–	1	–	–	–	–	–
metapodia	1	3	1	2	–	2	–	–	–	–	–
phalanx I	2	4	2	13	–	7	–	–	–	–	4
phalanx II	–	7	1	6	–	3	–	–	–	1	1
phalanx III	–	5	–	3	–	–	–	–	–	–	–
sesamoid	–	–	2	1	–	–	–	–	–	–	–
baculum	–	–	–	–	–	1	–	–	–	–	–
Totals	*267*	*72*	*52*	*289*	*2*	*35*	*2*	*4*	*1*	*1*	*15*

22.1c Mammal remains collected from 1- and 2-mm sieve residues: species versus skeletal element, numbers of identifications.

	cattle	dog	red deer	pig / wild boar	otter	wildcat
antler	–	–	2	–	–	–
cranium	–	–	–	2	–	–
mandibula	1	–	–	–	–	–
teeth	2	–	–	32	–	–
upper teeth	2	–	–	3	–	–
lower teeth	1	–	–	5	–	1
atlas	–	1	–	–	–	–
humerus	1	–	–	2	–	–
radius	–	–	1	–	–	–
metacarpus	–	–	1	–	–	1
femur	–	–	2	–	–	–
tibia	–	1	1	–	–	–
astragalus	–	–	1	2	–	–
calcaneus	–	–	3	–	–	–
tarsalia	–	–	–	1	1	–
metatarsus5	–	–	–	1	–	–
phalanx II	–	–	–	1	–	–
phalanx III	–	–	–	1	–	–
Totals	*7*	*2*	*11*	*50*	*1*	*2*

22.2: Abbreviations

BD	maximum width of the distal end
BG	width of the glenoid cavity (scapula)
BM3	width of the third molar
BP	maximal width of the proximal end
BT	maximum width of the trochlea (humerus)
DPA	depth across the processus anconeus (ulna)
GL	maximum length
GLL	maximum length of the lateral half (astragalus)
GLM	maximum length of the medial half (astragalus)
GLPE	maximum length of the peripheral half (phalanx I)
HVR	height of the vertical ramus (mandible)
LG	length of the glenoid cavity (scapula)
LM3	length of the third molar
M1-M3	length along the alveoles from first molar up to and including third molar
LP1-M3	length along the alveoles from first premolar up to and including third molar
LP1-M2	length along the alveoles from first premolar up to and including second molar
SD	minimum width of the diaphysis
SDO	minimum depth of the olecranon (ulna)
SL	snout length
SLC	minimum length of the collum scapulae
TL	total length (mandible)

22.2 MAMMAL REMAINS COLLECTED BY HAND: MEASUREMENTS (IN MM) OF SKELETAL ELEMENTS. In the case of pig/wild boar only the measurements of the humerus (BT), calcaneus (GL), astragalus (GLL) and mandible (LM3) were used to make a distinction between domestic pig and wild boar.

	measurements	values	range
cattle			
scapula	GLP	63.0; 61.0; 61.0; 61.7; 69.9	61.0 - 69.9
	SLC	56.5; 50.1; 47.8; 47.3; 48.8; 45.8	47.3 - 56.5
	LG	53.4; 51.8; 54.0; 52.4; 53.0; 59.4	51.8 - 59.4
	BG	49.6; 46.0; 45.7; 46.8; 42.7; 57.2	42.7 - 57.2
humerus	BT	74.4	
radius	BP	78.7	
	SD	37.1	
metacarpus	BP	54.3; 56.5; 58.0; 56.2; 53.7; 57.8; 54.8; 50.2	50.2 - 58.0
	BD	40.7; 39.6; 51.2; 53.3; 42.9; 64.9; 53.2; 41.7; 45.8; 43.7; 42.2; 55.8; 54.9; 43.4; 55.2	40.7 - 64.9
metatarsus	BP	50.5; 50.2; 45.3; 46.2; 44.7; 45.5	45.3 - 50.5
	SD	27.2; 24.9	24.9 - 27.2
	BD	54.9; 50.2; 53.9; 57.5; 52.3; 51.0; 51.0	50.2 - 57.5
	GL	237.5; 216.1	216.1 - 237..5
tibia	BD	56.1; 55.9	55.9 - 56.1
astragalus	BD	41.8; 39.6; 39.7; 40.9; 39.7; 42.6	39.6 - 42.6
	GLL	66.5; 66.1; 68.0; 67.2; 65.5; 64.8; 70.9; 66.6; 67.6; 65.6; 69.0; 64.0	64.0 - 70.9
	GLM	61.4; 61.5; 58.8; 60.3; 66.1; 59.0; 61.9; 59.9; 63.2; 57.1; 61.5; 63.0	57.1 - 63.2
calcaneus	GL	130.8	
phalanx I	BP	29.2; 26.8; 30.2	26.8 - 30.2
	SD	23.1; 22.2	22.2 - 23.1
	BD	26.7; 26.0; 25.8; 27.0	25.8 - 27.0
	GLPE	53.7; 53.3; 58.1; 65.1; 58.2	53.3 - 65.1
phalanx II	BP	26.6; 28.7; 26.2; 25.8; 26.9; 28.7; 23.6	23.6 - 28.7
	BD	22.9; 22.0; 21.4; 21.9; 22.6; 24..1	21.4 - 24.1
	GL	40.3; 42.5; 36.3; 37.5; 38.7; 39.1	36.3 - 42.5
aurochs			
phalanx I	BD	34.4	
phalanx I	BP	38	
	GLPE	75.5	
phalanx II	BP	42.6	
	BD	36.2	
	GL	51.3	
cattle/aurochs			
humerus	BD	87.1	
metacarpus	BD	70.6	
dog			
mandibula	LP1-M3	71.3; 71.1; 73.6; 64.4; 64.5; 69.3; 68.2; 67.5; 65.5; 70.4; 72.0; 75.7; 69.8; 68.4; 68.6	64.4 - 75.7
	HVR	46.5; 56.2; 51.7	46.5 - 56.2
	TL	121.6; 141.5; 127.2; 127.4	121.6 - 141.5
maxilla	LP1-M2	64.5; 64.3; 61.0	61.0 - 64.5
cranium	SL	81.5; 86.8; 85.9	81.5 - 86.8
	TL	173.9; 167.1; 169.9; 165.2	165.2 - 173.9
humerus*	SD	10.5; 10.5	
	BD	25	
	GL	132.7; 133.4	
radius*	BP	14.6	
	SD	10.9	
	BD	19.2	

	measurements	values	range
	GL	123	
femur	BP	37.4	
tibia	GL	160.5	
metacarpus 2	GL	53.8	
wolf			
ulna	DPA	36.5	
	SDO	32.5	
pig			
mandible	P2-M3	109.1	
	LM3	33.4; 33.5; 33.4; 34.1; 35.0; 33.8; 34.7	33.4 - 35.0
	BM3	15.0; 15.4; 15.1; 15.8; 16.2; 15.7; 16.9	15.0 - 16.9
humerus	BT	27.7; 29.9	27.7 - 29.9
astragalus	GLL	38.8; 41.8; 42.2; 42.5; 42.5	38.8 - 42.5
	GLM	36.5; 38.4; 38.8; 39.4	36.5 - 39.4
	BD	24.6	
pig/wild boar			
mandible	LM3	37.3; 36.7; 36.2; 36.4	36.2 - 37.3
	BM3	16.6; 16.0; 15.8; 16.1	15.8 - 16.6
maxilla	M1-M3	69.0; 70.2	69.0 - 70.2
	LM3	31.1; 33.0; 35.1; 36.4; 38.1; 38.8; 40.4; 40.6; 40.9	31.1 - 40.9
	BM3	18.4; 19.7; 21.2; 21.4; 21.9; 22.0; 22.8; 22.8; 24.0	18.4 - 24.0
scapula	GLP	36.4; 46.8	36.4 - 46.8
	SLC	24.5; 32.5	24.5 - 32.5
ulna	DPA	46.9	
phalanx I	BP	16.5	
	BD	15.3	
	GL	38	
wild boar			
mandible	M1-M3	75.7; 82.7; 79.9	75.7 - 82.7
	LM3	38.1; 38.5; 39.1; 40.2; 40.4; 40.5; 41.4; 42.6; 43.0; 43.1; 43.4; 44.3; 46.1; 40.3; 41.8	38.1 - 46.1
	BM3	17.2; 17.1; 17.6; 18.1; 18.6; 18.8; 19.0; 19.5; 19.6; 20.2; 20.9. 21.0; 22.0; 18.9; 20.4	17.1 - 22.0
humerus	BT	35.6; 31.6; 31.8; 34.1; 38.2	31.6 - 38.2
astragalus	GLL	47.6; 50.6; 52.3	47.6 - 52.3
	GLM	43.9; 46.6; 47.2	43.9 - 47.2
calcaneus	GL	94.6	

* one individual (DOG 01)

22.3 ASSOCIATIONS OF DOG REMAINS.

code	phase	no.	trench	body parts	specification of skeletal elements
dog 1	2a	1400	10	part of head, part of spine, ribs, part of left & right fore leg, part of left & right hind leg	left & right mandible; 3 cervical vertebra (incl. atlas & axis), 3 lumbar vertebra; 2 ribs
					left scapula, left ulna, left metacarpus 1-5, left carpal;
					right metacarpus 1-5, right carpal;
					left femur; right tarsal;
					4 phalanges I, 6 phalanges II, 3 phalanges III
dog 2	2a	7804	19	head, part of spine, part of left & right fore leg, part of left & right hind leg	cranium, left & right maxilla, left & right mandible; 3 cervical vertebra (incl. atlas), 6 lumbar vertebra; left scapula, left radius, left ulna, left metacarpus 2&5, left carpal
					right ulna, right metacarpus 2, right carpal;
					left femur, left tibia, left metatarsus 2&4;
					right femur, right tibia, right fibula, right metatarsus 4&5, right tarsal
	2a	8035	19	part of head, part of spine, part of (lower) fore leg	cranium; axis; left metacarpus 3
dog 3	3	6508 / 6513	17	part of spine, pelvis, part of left fore leg, part of left & right hind leg	thoracic vertebra, 2 lumbar vertebra left half of pelvis; left humerus, left femur, left tibia, left metatarsus 1-4
					right tibia, right astragalus
dog 4	3	843	16	part of left and right fore leg	left: humerus, ulna; right: humerus, radius, ulna, metacarpus 5
	3	902	16	head and part of spine	cranium, left & right maxilla, left & right mandible; atlas
	3	1455	16	part of left (lower) fore leg	metacarpus 2&3, carpale, phalanx I
	3	6386	17	part of right hind leg	femur, tibia, metatarsus 5, astragalus
	3	6297	17	scapula	parts of right scapula
head 1	3	5672	15	part of head	cranium, left & right maxilla
		5667	15	part of head	left & right mandible with associated teeth
head 2	2b	3184	18	part of head and part of spine	cranium, left maxilla, left & right mandible; atlas, axis
head 3	2a	7801	19	part of head	cranium, left & right maxilla with associated teeth
		7492	19	part of head	left & right mandible with associated teeth
head 4	2a	7803	19	part of head	cranium, left & right maxilla, left & right mandible
		7817	19	part of spine	3 cervical vertebra
head 5	2a	6348	15	part of head	cranium, right maxilla
		1698	16	part of head	cranium, left & right maxilla
		1677	16	part of head	left & right mandible with associated teeth
head 6	2a	10393	28	part of head	cranium, left & right maxilla
		10503	28	part of head	cranium, left & right maxilla
		10320	28	part of head	right mandible with associated teeth
		10270	27	part of head	teeth
		10350	27	part of head	right maxilla
		10378	27	part of head	mandibula
		10507	27	part of head	atlas
		10352	28	part of head	teeth
		10354	28	part of head	teeth
		10393	28	part of head	cranium
head 7	2a	5761	26	part of head	left mandible
		5771	26	part of head	teeth
		5765	26	part of head	right mandible
		5749	26	part of head	teeth
		5738	26	part of head	teeth
		5747	26	part of head	right maxilla, teeth
		5719	26	part of head	teeth

code	phase	no.	trench	body parts	specification of skeletal elements
skull 1	2a	7802	19	part of head	cranium, left & right maxilla
skull 2	2a	4554	20	part of head	cranium, right maxilla, teeth of left maxilla
skull 3	2a	4577	20	part of head	cranium, right maxilla with associated teeth
skull 4	2a	10125	29	part of head	cranium, left & right maxilla with associated teeth
skull 5	1/2	6441	12	part of head	cranium, left & right maxilla with associated teeth
mand. 1	2a	2323	14	mandible	left and right mandible
mand. 2	2a	3452	12	mandible	right mandible
	2b	3451	12	mandible	left mandible
varia 1	2a	10138	27	fore leg	metapodal, phalanges, carpalia
varia 2	2a	4488	22	pelvis	left & right half of pelvis