

FAUNAL REMAINS FROM DOKKUM

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1. INTRODUCTION

In 1973 and 1974 faunal remains, consisting of bones and a few mollusc shells, were collected from two sites in the town centre of Dokkum, in the province of Friesland in the northern part of the Netherlands. The faunal remains collected in 1973 came from a rubbish pit in the Koningstraat, and date from the 14th-16th centuries AD. The remains collected in 1974 came from three separate rubbish pits on the building site for the extension of a department store (the "Hema"): these three rubbish pits, designated pit I, pit II and pit III, date from the 13th century, ± 1600 and the 14th century AD, respectively. The faunal material collected from both sites thus dates from late mediaeval times, or possibly from the beginning of the early modern period. The faunal remains from both sites were collected by Mr. G. Elzinga of the Frisian Museum in Leeuwarden, and were subsequently sent to the Biologisch-Archaeologisch Instituut (B.A.I.), University of Groningen for further study.

2. METHOD

The faunal remains were identified as far as possible with reference to the comparative collection of skeletal material at the B.A.I. Data were recorded for each separate bone (or mollusc shell) according to the "Knocod" system for processing data on faunal remains from archaeological sites, as developed by Uerpmann (1978). Measurements of bones were taken wherever possible, using conventional hand-operated callipers and according to the manual of Von den Driesch (1976).

3. RESULTS

Most of the faunal remains appear to be butchery refuse or kitchen waste. Table 1 lists the species identified, and gives the number of remains of each species represented in each of the four assemblages. Table 2 gives the numbers of the various skeletal elements of each species of mammal, bird and fish identified (for all four assemblages taken together). The bone measurements taken are given in the Appendix to this article.

In the following descriptions of the remains of each species the faunal remains from all four assemblages are treated jointly as a general rule, in view of the relatively small size of the samples and the partial overlap as regards chronology.

3.1. The mammal remains

Among the mammal remains, all of which come from domesticated species, those of cattle (*Bos taurus*) are most abundant, accounting for 43% of the total number of identified bones. No hornless cattle are present. Most of the horn-cores are of short to medium length and appear to come from adult female animals according to the classification of Armitage and Clutton-Brock (1976). One very large horn-core fragment is most probably from an ox. Most of the cattle bones are from subadult or adult animals: out of a total of 28 jaw fragments (maxillae and mandibulae) with teeth present there were 15 adult specimens, 7 subadult, 4 juvenile and 2 infantile. The post-cranial skeletal elements reflect a similar pattern of age distribution. The withers height of the cattle was calculated from the length measurements of metapodial bones (6 metacarpals and 5 metatarsals) according to the method of Matolcsi (1970), as recommended by Von den Driesch and Boessneck (1974): the average withers height was found to be 122 cm. (The average withers height for the present-day Frisian cattle breed is 130 cm according to Clausen and Ipsen, 1970.) Most of the cattle bones from Dokkum show traces of butchery: almost all of the larger bones have been hacked through, and only a few foot-bones have remained intact. There are traces of burning on several cattle bones, and on two bones the gnaw marks of dogs are visible.

Among the cattle remains one centrotarsal bone and five metatarsal bones show signs of spavin, a degenerative joint disease involving exostosis and eventually ankylosis of the tarsus or more rarely of the carpus. Fig. 1 shows various stages in the development of this condition as illustrated by metatarsal bones of cattle from Dokkum. Von den Driesch (1975) discusses the occurrence of spavin with reference to prehistoric faunal remains. Nieberle and Cohrs (1970) mention spavin as a disease of cattle (as well as of horses), and especially of draught oxen. Cattle bones showing spavin have

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TABLE 1

Dokkum: the animal species identified and the numbers of remains of these species found at each site.

	Hema pit I	Hema pit II	Hema pit III	Koningsstr. site	Total
Mammals					
Cattle	63	183	32	215	493
Sheep	6	25	5	29	65
Sheep/Goat	63	78	22	192	355
Pig	18	45	6	80	149
Dog	-	-	-	8	8
Cat	-	-	-	4	4
Birds					
Domestic fowl	6	4	2	2	14
Duck, wild or tame	3	10	-	9	22
Goose, wild or tame	-	5	-	3	8
Mute swan	-	1	-	-	1
Mute or Whooper swan	-	7	-	-	7
Sea eagle	-	-	-	1	1
Fish					
Cod	1	-	-	10	11
Flatfish	-	-	-	2	2
Molluscs					
Cockle	-	-	-	3	3
Venus shell	-	-	-	2	2
Periwinkle	-	-	-	1	1
Total identified remains	160	358	67	561	1146
Unidentified	9	13	9	42	73
Totals	169	371	76	603	1219

been found elsewhere at archaeological sites in the Netherlands including 16th-17th century Groningen (Van Gelder-Ottway, 1976-77) and early mediaeval Dorestad (Prummel, personal communication).

One bovine phalanx bone has been fashioned into an artefact (fig. 2). The bone has remained intact, but two small holes have been drilled in it, one in the middle of the proximal articular surface and

the other towards the distal end of the ventral surface; both of these holes connect with the inner cavity of the bone. The protruding parts of the ventral surface of the bone have become flat and smooth due to friction of some sort, while on the dorsal surface a quadrangular figure has been crudely carved in the surface of the bone. This bone artefact came from pit II on the Hema site, and thus dates from approximately 1600. This artefact

appears to be a gaming piece known in Dutch as a *koot* (literally: phalanx bone). In the Netherlands such *koten* were used in former times to play a game rather like a miniature form of skittles: several *koten* are set up vertically against a wall, while the players take it in turn to knock them over by throwing at them another *koot*, the *werpkoot*, specially weighted for the purpose with a filling of lead. The specimen from Dokkum may well be such a *werpkoot* in view of the worn ventral surface and the holes drilled

into the bone cavity, which may once have been filled with lead. The crudely carved figure on the dorsal surface probably indicates some kind of value used in counting the score. In Baart et al. (1977) a description is given of *koten*, dating from the 14th century onwards, from Amsterdam: on each of the *koten* illustrated a different motif has been carved, fairly crudely as a rule, while one *koot* from Amsterdam resembles that from Dokkum in that a hole has been drilled near the distal end of

TABLE 2A

The numbers of skeletal elements representing each mammal species identified (Hema site, pits I-II-III, and Koningsstraat site combined).

	Cattle	Sheep	Sheep/Goat	Pig	Dog	Cat
Horncore	28	-	-	-	-	-
Skull	47	10	18	13	-	-
Hyoid	2	-	-	-	-	-
Mandibula	25	-	73	15	1	-
Dentes	5	-	4	3	-	-
Atlas	3	-	2	2	-	-
Epistropheus	1	-	-	1	-	-
Other vertebrae	76	-	15	13	-	-
Ribs	109	-	89	31	-	1
Scapula	20	18	20	4	-	-
Humerus	12	12	1	7	1	-
Radius	11	10	2	4	-	-
Ulna	5	4	3	2	-	1
Radius + ulna	2	2	-	-	-	-
Metacarpus	21	6	21	5	2	-
Pelvis	17	2	15	14	-	-
Femur	20	1	20	10	1	-
Tibia	9	-	31	12	2	2
Fibula	-	-	-	3	-	-
Astragalus	8	-	4	1	-	-
Calcaneus	4	-	1	1	-	-
Other tarsals	2	-	-	-	-	-
Metatarsus	16	-	30	7	1	-
Phalanx I	33	-	6	1	-	-
Phalanx II	16	-	-	-	-	-
Phalanx III	1	-	-	-	-	-
	} fore- or hindlimb					
Totals	493	65	355	149	8	4

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the ventral surface of the bone. Perhaps the inhabitants of Dokkum played *koten* in a way more akin to the Frisian variation of this game known as *keatsjitten*, that was often played on the ice, as described by Roes (1963).

The bones of small ruminants (sheep and possibly goat) account for 37% of the total number of faunal remains identified. The bones of sheep (*Ovis aries*) and of goat (*Capra hircus*) are very similar morphologically and only some skeletal elements

TABLE 2B

The numbers of skeletal elements representing each bird species identified (Hema site, pits I-II-III, and Koningsstraat site combined).

	Domestic fowl	Duck	Goose	Mute swan	Mute or Whooperswan	Sea eagle
Sternum	2	10	2	1	-	-
Coracoid	-	-	-	-	1	-
Furcula	-	1	-	-	-	-
Rib	-	-	-	-	4	-
Humerus	2	2	-	-	2	-
Radius	1	4	1	-	-	1
Ulna	-	2	1	-	-	-
Carpometacarpus	-	2	-	-	-	-
Pelvis	1	-	1	-	-	-
Femur	4	-	-	-	-	-
Tibiotarsus	3	1	3	-	-	-
Tarsometatarsus	1	-	-	-	-	-
Totals	14	22	8	1	7	1

TABLE 2C

The numbers of skeletal elements representing each fish species identified (Koningsstraat, site).

	Cod	Flatfish
Praeoperculare	1	-
Suboperculare	1	-
Ceratohyale	1	-
Branchiostegale	1	-
Pinnae pectoralis	6	-
Vertebrae caudales	1	-
Os anale	-	2
Totals	11	2

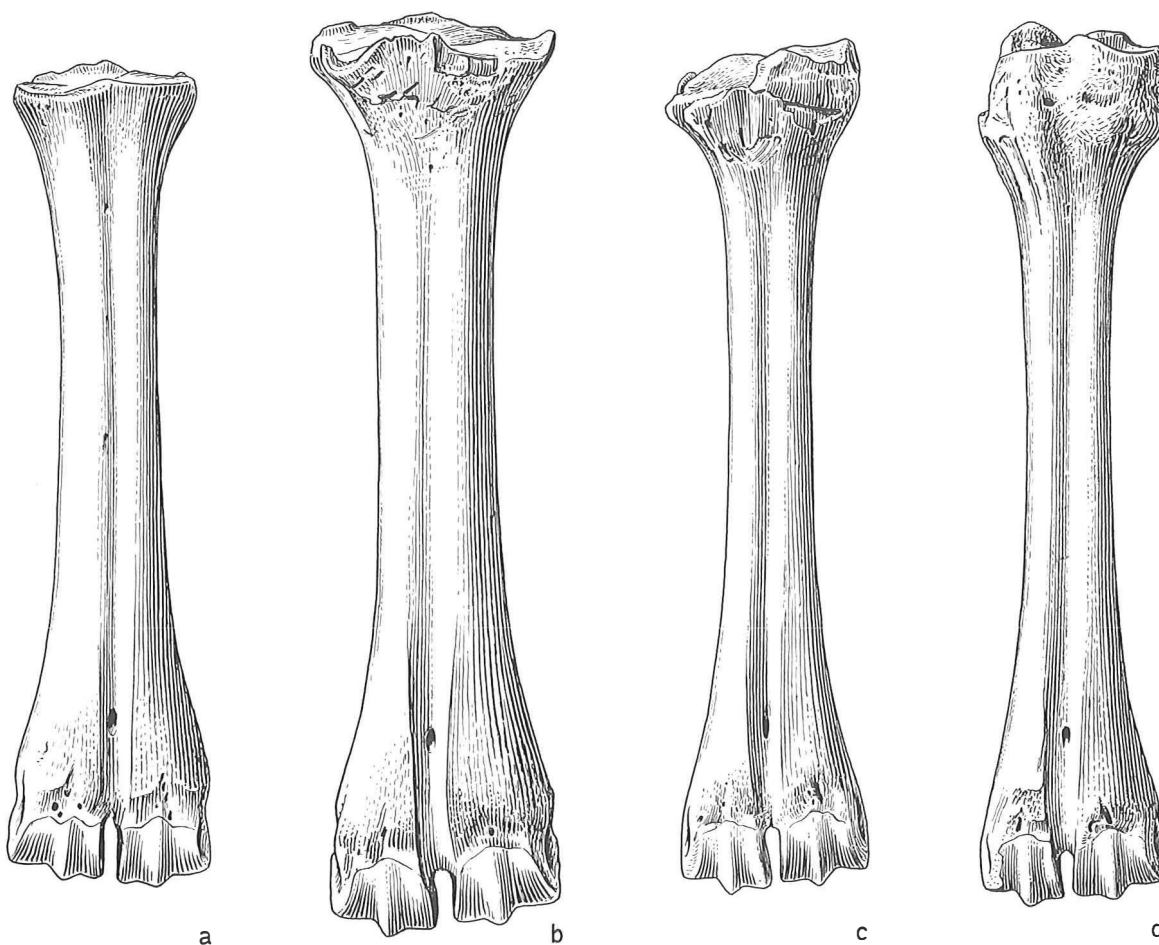


Fig. 1. Cattle metatarsal bones from Dokkum showing different stages in the development of spavin. a) normal metatarsal; b) metatarsal showing exostosis at the proximal end; c) metatarsal showing exostosis and partial fusion with the centrotarsal bone (N.B. only part of the centrotarsal bone is present); d) metatarsal with centrotarsal almost completely fused.

can be ascribed to either species with certainty. On the basis of distinguishing features described by Boessneck (1969) it was possible to identify 15% of the bones of small ruminants as sheep, while no bones at all could be identified positively as goat. It is probable that most, if not all of the bones of small ruminants are of sheep, especially in view of the importance of wool as a commodity for which the Frisians were famous in mediaeval times. Many of the sheep/goat bones from Dokkum show traces of butchery. Out of a total number of 62 sheep/goat

jaw bones (maxillae and mandibulae) with teeth present, 24 were adult specimens, 6 were subadult, 26 were juvenile and 6 infantile. Among the bones that could be positively identified as sheep no horn-cores or horned skulls were present; six skull fragments were from hornless animals although one of these fragments has a slight bump at the spot where a horn-core would be expected to be present. The average withers height of the sheep was found to be 65 cm, calculated from the length measurements of long bones (two radii and five metacarpal bones) according to the method of Teichert (1975).

The bones of pig (*Sus domesticus*) account for 13% of the total number of identified remains. As these pig bones come from an urban site with little or no woodland in the neighbourhood, it is assumed that they are all from domesticated animals, especially in view of their moderate size range.

Traces of butchery are present on many of the pig bones. Out of a total of 16 jaw bones of pig (maxillae and mandibulae) in which teeth are present 5 are of adult age, 3 subadult, 7 juvenile and one infantile. The other bones of pig reflect a similar pattern of age distribution. No suitable intact bones of pig were available for the calculation of withers height.

Bones of dog and cat represent a small proportion of the animal remains. Using the method of Harcourt (1974), the withers heights of three dogs were calculated from the length measurements of long bones (one humerus and two tibiae) and found to be 64 cm, 66 cm and 33 cm respectively. The two higher values are indicative of rather large dogs, seeing that these withers heights exceed the range of 58.4-61.4 cm given for large dogs by Van Wijngaarden-Bakker and IJzereef in their study of dog remains from mediaeval urban sites in the Netherlands (1977).

3.2. The bird remains

Remains of the domestic fowl (*Gallus gallus domesticus*) are present in each of the four assemblages. Cut remarks are present on one humerus (fig. 3). The domestic fowl has been present in the Netherlands since Pre-Roman Iron Age times (Clason, 1977) and remains of this species are commonly found at Dutch mediaeval sites.

The most abundant bird species represented in Dokkum is the duck, *Anas platyrhynchos*. It is not known whether these remains are of domesticated or wild duck: tame duck have probably been present in the Netherlands since early mediaeval times. In present-day Friesland the wild duck is a common breeding species both in rural and urban areas, and interbreeding between wild and domesticated forms occurs frequently (W. de Jong, 1976). The earliest treatise on hunting and fowling in the Netherlands is the so-called *Jacht-Bedryff* manuscript of c. 1635 (published by Swaen, 1948), in which a description is given of how to catch wild duck using a duck decoy. Van der Ploeg (1977) mentions the use of duck decoys as a very old method of fowling in Friesland. Remains of wild duck (or its tame derivative) are frequently found at archaeological sites in the Netherlands: elsewhere in Friesland remains have been identified for example from the Iron Age *terp* of Tritsum and from

a late mediaeval urban site in Leeuwarden (Clason and Prummel, 1978).

Similarly the remains of goose from Dokkum cannot be ascribed with any certainty to the domesticated goose or to its wild precursor, the greylag goose (*Anser anser*). The tame goose has probably been present in the Netherlands since early mediaeval times. At the present time the greylag goose is mainly a migrant species in Friesland, passing through in the autumn and in the spring, and only very occasionally breeding in this region (Smit, 1976). The *Jacht-Bedryff* manuscript describes both tame and wild geese, and mentions a prohibition on shooting wild geese. Remains of the greylag goose or its domesticated counterpart have been found at various archaeological sites in the Netherlands, including the Frisian sites of Tritsum and Leeuwarden. Among the goose remains from Dokkum cut marks were present on two sterna (breast bones), both of which had been cut through more or less longitudinally (fig. 3).

A total of eight swan bones were found in Dokkum of which one, a sternum, could be identified as *Cygnus olor*, the mute swan. On this sternum cut marks were present (fig. 3). The other seven bones are either *Cygnus olor* or *Cygnus cygnus*, the whooper swan, as these two species are very similar osteologically. The whooper swan is a wild species which at the present time is only an occasional winter visitor in Friesland (W. de Jong, 1976). Remains of the whooper swan have been found only infrequently at Dutch archaeological sites. It is more

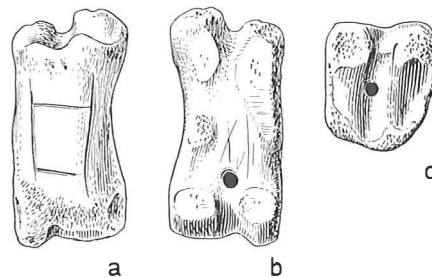


Fig. 2. Bone gaming piece (a *keel*) made out of a bovine phalanx I. a) dorsal view: note quadrangular figure carved in surface; b) ventral view: note surfaces worn smooth and hole drilled distally; c) upper view of proximal articular surface: note hole drilled in central groove.

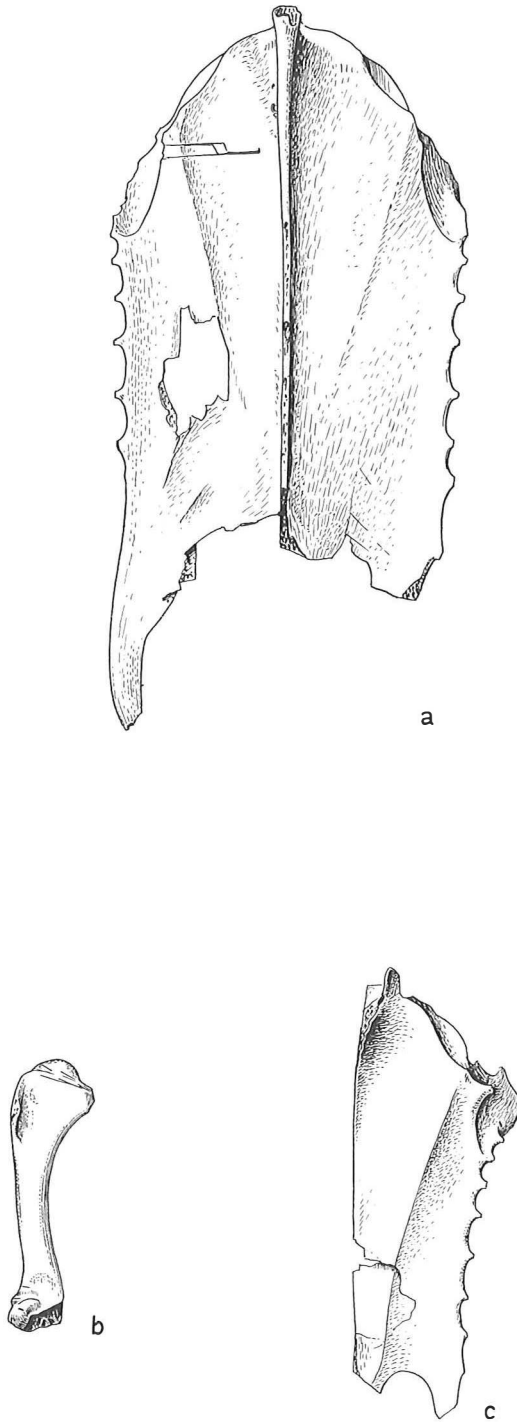


Fig. 3. Bird bones with cut marks. a) sternum of mute swan (*Cygus olor*): cut marks on ventral surface near anterior end (top left of picture); b) humerus of domestic fowl (*Gallus gallus domesticus*): cut marks at proximal end (top of picture); c) fragment of sternum of goose (*Anser anser*), cut through longitudinally.

likely that the swan remains from Dokkum are all of the mute swan, as this species has been semidomesticated in Northwestern Europe since mediaeval times. The mute swan is a common species in present-day Friesland, in its wild form as an occasional breeding species, an irregular migrant or a winter visitor. Van der Meulen (1976) mentions the importance of the mute swan in Friesland since mediaeval times: there was strict control of fowling activities with regard to swans, and the right to shoot the swans was in fact a privilege in Burgundian times. Mute swans were semidomesticated and kept in swanneries where they were protected during the breeding season. The mute swan was valued not only for its flesh but also for its quills, as well as being an ornamental bird in semicaptivity. Remains of the mute swan have been found at various sites in the Netherlands including urban sites in the north of the country such as mediaeval Leeuwarden (Clason and Prummel, 1978) and 16th-17th century Groningen (Van Gelder-Ottway, 1976-77).

One fragment of the radius of a sea eagle (*Haliaeetus albicilla*) was found in Dokkum. This species is an irregular visitor in present-day Friesland (M. de Jong, 1976), although formerly it must have been a breeding species in this region. Remains of the sea eagle have been found at various archaeological sites in the Netherlands, although mainly from sites dating from prehistoric or Roman times (Clason and Prummel, 1978); in the *terpen* area of the Northern Netherlands bones of the sea eagle have been found at Iron Age *terp* sites such as Oosterwiltwerd (Van Giffen, 1913), Tritsum and Britsum (Clason, in press), as well as Middelstum (Van Gelder-Ottway, in preparation).

3.3. The fish remains

The fish remains from Dokkum are all of sea fish, and include bones of cod (*Gadus callarias*) and of flatfish. The two flatfish bones may be either of plaice (*Pleuronectes platessa*) or of flounder (*Platichthys flesus*). At the present time Dokkum lies less than 10 km inland from the coast of the Wadden Sea: in the late middle ages there was a direct connection with the Wadden Sea via the estuary known as the Lauwerszee. Fishery must always have been important in this coastal region. Remains of cod and flatfish have been found at other urban sites in

this northern coastal area including late mediaeval Leeuwarden (Brinkhuizen, 1979, this volume) and 16th-17th century Groningen (Van Gelder-Ottway, 1976-77).

3.4. The mollusc remains

Molluscs are represented by six shells or shell fragments in the Dokkum remains. The species identified include the cockle (*Cardium edule*), a Venus shell (*Venus* sp.) and the periwinkle (*Littorina littorea*), all of which are common littoral species in this region. Both the cockle and the periwinkle are edible species. In former times molluscs were not only a source of food in the Netherlands, but also a source of shells which were used in considerable quantities for various building purposes; the mudflats and shallows of the Wadden Sea must always have been a rich source of mollusc shells for such purposes.

3.5. Other bones

The unidentified bone remains consist for the most part of fragments of ribs and of long bones of animals in the sheep-cattle size range. One unidentified fragment was of a bird, possibly a duck.

Among the remains from the Koningsstraat site there was one human bone, an intact collar bone (not included in the tables). Occasional human bones often turn up among faunal remains from archaeological sites, although the reason for this is not always clear. In view of the fact that Dokkum was an important place of pilgrimage in the middle ages (St. Boniface had been martyred here in A.D. 754), it is tempting to look for a possible interpretation of such a find as this collar-bone in the mediaeval passion for "relics", although of course there is a wide range of other possibilities. (In fact animal bones must have served equally well as "relics", bearing in mind the disreputable activities of the Pardoner in Chaucer's "Canterbury Tales".)

4. DISCUSSION

The predominance of cattle and small ruminants (probably mostly sheep, though possibly also goats) among the faunal remains from Dokkum is hardly

surprising in view of the nature of the local environment. The town of Dokkum is situated in the northern coastal region of the Netherlands where there is abundant rich pasture, especially in those areas where marine clay has been deposited. It is these rich pastures that have made Friesland famous as a centre of dairy-farming. It is unlikely that the cattle represented by the Dokkum remains were the direct ancestors of the present-day Frisian breed. The main basis of the modern Dutch Frisian breed was formed by black-and-white cattle from Jutland which were imported into Friesland after the local cattle population had suffered serious losses following flooding and outbreaks of cattle plague, especially in the 18th century (Alderson, 1976). The cattle from Dokkum were probably multi-purpose animals, providing primarily milk, but also meat and traction power (in view of the prevalence of spavin), as well as hides. Hengeveld (1865), in his classic work on cattle, cites the 17th-century historian Schotanus as saying that in the 14th century the Frisians exported ox and cow hides in considerable quantities to Sweden. According to Hengeveld, cattle were being sent from Friesland to the cattle markets of North-Holland, including Amsterdam, already in the 15th century. Hengeveld also refers to the importance of Friesland in historical times as a centre of dairy produce from which quantities of butter and cheese were exported; moreover he mentions that in the late 18th and early 19th century there was a cheese market at Dokkum, as the adjacent area (the Dongeradeel) had the best land for cheese production.

The sheep remains from Dokkum may well represent the polder sheep that were kept in previous centuries along the fertile North-Sea coastlands from Northern France to Denmark; it was from these polder sheep that the *Fries Melkschaap* or Frisian milk-sheep breed was eventually developed (Van Helden and Minkema, 1978). The *Fries melkschaap*, a hornless breed of sheep, is famous for its high milk yield, for which it is the top-ranking sheep in the world, and also for its high fertility and abundant yield of wool (Alderson, 1978). On the other hand, the Dokkum sheep remains may be more closely related to another sheep breed, namely the *Drentse beideschaap*. This is a horned breed of sheep, formerly kept in large numbers on the heathlands of the Northern Netherlands, notably in the

province of Drente. Although it yields only a moderate quantity of wool and meat, this breed was formerly important in providing dung and for maintaining the heath vegetation. Reitsma (1932) made a study of sheep remains from *terpen* in the Northern Netherlands, i.e. raised dwelling mounds that were occupied between c. 600 B.C. and c. A.D. 1000, after which the systematic construction of dykes began in this region. On the basis of skull morphology, Reitsma found that the sheep remains from the *terpen* more closely resembled the *Drentse beideschaap* than the *Fries melkschaap*. The sheep remains from Dokkum cannot be ascribed with certainty to any breed or type, however, as they are too fragmentary and too few in number. In view of the importance of the wool trade in Friesland in mediaeval times, it is more probable that a type of sheep with a high yield of wool would have been kept in this region.

The relatively low proportion of pig bones from Dokkum compared to remains of ruminant species is probably a reflection of the local type of environment, i.e. predominantly open pasture-land with relatively little or no woodland. Remains of pig are usually more abundant at sites in the vicinity of forest where pigs can be turned out to feed. A broader discussion of this subject with reference to mediaeval sites in the Netherlands is given by Prummel (1979, this volume).

Some general similarities are apparent between the faunal remains from Dokkum and those from other urban sites in the Netherlands, with regard to species composition and relative abundance of the different species. Other late mediaeval Dutch urban sites from which faunal remains have been studied include Amsterdam (Clason, 1967) and Alkmaar (Clason and Brinkhuizen, 1978); urban sites in the northern coastal region of the Netherlands which have yielded faunal remains include late mediaeval Leeuwarden (incompletely published so far) and 16th-17th century Groningen (Van Gelder-Ottway, 1976-77). All these sites have certain features in common with Dokkum, including the predominance of remains of cattle, sheep/goat and pig, cattle being

the most abundant species, and the frequent occurrence of other common species such as dog, cat, domestic fowl, duck and goose. Remains of wild mammals, wild birds, fish and molluscs occur frequently and are relatively few in number at most of these sites, although they may well be under-represented in the faunal samples due to selective methods of collection. In the same region as Dokkum, faunal remains have also been collected from the *terpen*. (In fact the town of Dokkum itself developed from such a *terp* settlement.) At these earlier *terp* sites, as in mediaeval Dokkum, too, cattle and sheep were the two most abundant species and clearly the most important economically (Clason, 1972), while remains of pig occur less frequently. Within this region there is thus a pattern of continuity in stock-breeding activities over a long period of time.

5. GEOGRAPHICAL NOTE

The present-day province of Friesland in the Netherlands is only part of the region known as Friesland in previous centuries. Formerly the region occupied by the Frisians extended further west (into the area of North Holland known as West Friesland) and further east (into the present-day province of Groningen and that part of Germany known as East Friesland).

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APPENDIX

Measurements of bones

Measurements were taken according to Von den Driesch (1976). All measurements are expressed in mm.

m = mean

n = number of specimens measured

Bos taurus - cattle

	m	min.	max.	n
Horncores				
Max. diameter of base	48.0	38.5	82.5	18
Min. diameter of base	36.0	30.5	60.0	18
Circumference of base	127.5	115.0	230.0	17
Length of outer curve	130.5	105.0	210.0	15
Mandibula				
Length of cheektooth row	140.0	140.0	140.0	2
Length of molar row	85.2	82.5	90.0	3
Length of premolar row	52.6	49.5	58.3	4
Height in front of M ₁	47.4	42.2	51.5	5
Height behind M ₃	70.3	67.0	75.5	3
Length of M ₃	35.2	32.4	39.2	7
Width of M ₃	13.8	12.0	15.2	7
Scapula				
Min. length of neck	46.7	35.8	57.5	6
Max. length proc. articularis	65.5	59.8	78.3	6
Length of articular surface	53.5	48.5	60.5	6
Width of articular surface	44.4	39.8	54.8	6
Greatest dorsal length	158.5			1
Humerus				
Max. dist. width	77.9	75.1	80.6	3
Width of trochlea	68.6	66.0	72.3	3
Min. width of diaphysis	28.2			1
Radius				
Max. prox. width	73.4	69.0	83.5	5
Width of prox. articular surface	66.5	59.5	74.5	5
Ulna				
Width across coronoid process	43.8	39.5	46.2	4
Min. depth across process anconaeus	48.2	42.0	55.6	4

Faunal remains from Dokkum

Metacarpus				
Max. prox. width	56.1	52.8	66.0	9
Min. width of diaphysis	30.3	26.2	34.8	7
Max. dist. width	54.0	47.3	62.0	12
Max. dist. thickness	32.4	29.4	35.4	9
Max. length	196.3	188.0	214.5	6
Pelvis				
Length of acetabulum	65.7	61.1	69.6	4
Femur				
Depth of caput	45.6	45.5	45.7	2
Max. dist. width	91.2			1
Tibia				
Max. dist. width	57.8	57.3	58.2	2
Astragalus				
Lateral length	67.7	65.8	69.5	3
Medial length	62.2	60.0	64.2	4
Lateral thickness	37.4	35.0	38.8	3
Medial thickness	37.6	35.0	40.0	4
Max. dist. width	41.4	36.5	45.0	3
Calcaneus				
Max. length	131.5			1
Metatarsus				
Max. prox. width	48.3	45.0	52.3	6
Min. width of diaphysis	25.7	22.0	30.5	5
Max. dist. width	48.7	44.4	56.2	9
Max. dist. thickness	31.3	29.0	35.2	8
Max. length	228.2	210.5	242.5	5
Phalanx I (fore- or hindlimb)				
Max. prox. width	27.9	25.0	33.2	23
Min. width of diaphysis	22.7	19.6	27.2	28
Max. dist. width	26.3	22.0	31.5	30
Length of peripheral half	58.3	51.8	67.0	25
Phalanx II (fore- or hindlimb)				
Max. prox. width	28.2	24.8	31.0	16
Min. width of diaphysis	21.8	19.7	24.6	16
Max. dist. width	23.5	20.3	27.3	16
Length of peripheral half	39.4	35.8	42.8	16
Phalanx III				
Max. diagonal length of sole	53.1			1
Length of dorsal surface	43.3			1

Ovis aries - sheep

	m	min.	max.	n
Scapula				
Min. length of neck	18.0	15.0	21.7	13
Max. length of proc. articularis	33.3	31.8	36.1	10
Length of articular surface	25.1	23.4	26.5	10
Width of articular surface	21.6	19.0	22.7	10
Height along the spine	136.8	125.5	150.0	3
Max. dorsal length	90.4	82.5	107.5	4
Humerus				
Max. length from caput	125.5			1
Max. dist. width	30.6	30.0	32.6	10
Width of trochlea	28.2	26.6	29.6	10
Min. width of diaphysis	14.2	13.0	15.5	3
Radius				
Max. prox. width	31.7	29.2	33.6	8
Min. width of diaphysis	16.5	15.5	17.7	6
Max. dist. width	29.4	29.2	30.2	5
Max. length	154.4	150.2	158.5	2
Width of prox. articular surface	28.0	23.7	30.0	8
Width of dist. articular surface	24.1	23.3	25.4	6
Ulna				
Width across coronoid process	18.2	17.4	19.2	4
Min. depth across proc. anconaeus	22.2	20.7	23.2	2
Metacarpus				
Max. prox. width	24.2	22.5	26.5	4
Min. width of diaphysis	14.0	12.6	15.5	4
Max. dist. width	26.6	24.8	29.3	5
Max. length	137.9	131.5	149.4	5
Pelvis*				
Max. length one half	214.5			1
Length of acetabulum	29.5			1
Femur				
Max. prox. width	54.1			1
Diameter of caput	23.6			1

* One female specimen measured

Faunal remains from Dokkum

Ovis aries/Capra hircus – sheep/goat

	m	min.	max.	n
Mandibula				
Length of cheektooth row	70.8	67.2	76.0	11
Length of molar row	49.3	45.7	52.3	11
Length of premolar row	22.1	19.2	24.2	10
Length of diastema (P ₂ -I ₄)	39.8	35.6	40.9	9
Height in front of M ₁	21.2	19.5	23.5	12
Height behind M ₃	36.4	33.8	38.5	10
Length from ramus to foramen mentale	143.7	137.5	148.8	8
Dentes				
Length of M ₃	21.6	19.5	23.6	15
Width of M ₃	7.9	7.0	8.6	15
Scapula				
Min. length of neck	19.6	17.8	21.0	3
Max. length of proc. articularis	35.2	33.5	36.8	2
Length of articular surface	27.2	26.1	28.2	2
Width of articular surface	22.3	21.9	23.0	3
Ulna				
Width across coronoid process	18.4	16.1	21.0	3
Metacarpus				
Max. prox. width	23.3	21.1	25.3	14
Min. width of diaphysis	13.2	11.9	14.6	6
Pelvis				
Length of acetabulum	27.4	25.5	29.0	7
Tibia				
Min. width of diaphysis	13.2	12.0	14.3	2
Max. dist. width	26.2	25.4	27.6	5
Astragalus				
Lateral length	30.2	28.0	32.9	4
Medial length	28.5	26.9	30.2	4
Lateral thickness	16.5	15.3	18.4	4
Medial thickness	16.7	14.8	18.4	4
Max. dist. width	17.9	16.8	19.5	4
Metatarsus				
Max. prox. width	20.2	18.7	22.4	14
Min. width of diaphysis	11.2	10.1	13.3	8
Max. dist. width	23.5	21.4	25.3	8
Max. length	144.1	135.5	154.4	3
Phalanx I (fore- or hindlimb)				
Max. prox. width	12.1	11.4	12.9	4
Min. width of diaphysis	10.0	9.0	10.5	4
Max. dist. width	11.5	10.5	12.3	4
Length of peripheral half	37.1	36.8	37.7	4

Sus domesticus - pig

	m	min.	max.	n
Mandibula				
Length of cheektooth row (M ₃ -P ₂)	110.0			1
Length of molar row	74.5			1
Length of premolar row (P ₂ -P ₄)	35.5			1
Height in front of M ₁	42.2			1
Max. diameter of canine alveolus	17.5			1
Dentes				
Length of M ₃	34.8			1
Width of M ₃	15.0			1
Scapula				
Height along spine	165.5			1
Min. length of neck	44.3	18.5	25.8	2
Max. length proc. articularis	35.4	33.6	37.2	2
Length of articular surface	25.4	23.3	27.5	2
Width of articular surface	28.1	25.0	31.2	2
Humerus				
Max. dist. width	40.6	37.3	45.5	4
Width of trochlea	27.5	26.0	29.0	2
Min. width of diaphysis	15.7	15.0	16.4	2
Radius				
Max. prox. width	28.8	27.3	30.2	2
Min. width of diaphysis	16.3	15.5	17.0	3
Ulna				
Width across coronoid process	20.7			1
Min. depth across proc. anconaeus	24.8			1
Pelvis				
Length of acetabulum	31.6	30.0	33.0	5
Femur				
Max. dist. width	52.5			1
Tibia				
Max. dist. width	27.2	26.1	28.4	3
Min. width of diaphysis	15.6	15.3	16.0	3
Astragalus				
Lateral length	43.4			1
Medial length	39.8			1
Metatarsus IV				
Max. length	107.3			1
Length excepting plantar projection	104.7			1
Max. dist. width	20.3			1

Famnal remains from Dokkum

Canis familiaris - dog

	m	min.	max.	n
Humerus				
Max. length	194.5			1
Prox. depth	47.5			1
Min. width of diaphysis	14.7			1
Max. dist. width	38.0			1
Tibia				
Max. length	165.0	108.0	220.0	2
Max. prox. width	32.6	25.7	39.5	2
Min. width of diaphysis	12.0	8.9	15.0	2
Max. dist. width	21.0	16.4	25.5	2

Gallus gallus domesticus - domestic fowl

	m	min.	max.	n
Humerus				
Prox. width	20.0	18.0	21.2	2
Dist. width	14.4			1
Max. length	69.8	67.1	72.5	2
Min. width of corpus	7.3	7.0	7.5	2
Radius				
Max. length	59.1			1
Min. width of corpus	3.5			1
Dist. width	6.0			1
Femur				
Max. length	77.7			1
Prox. width	17.6			1
Dist. width	16.3			1
Medial length	72.5			1
Min. width of corpus	7.6	7.4	7.7	3
Tibiotarsus				
Max. length	113.0			1
Dist. width	11.4	10.0	12.8	2
Min. width of corpus	7.2			1
Tarsometatarsus*				
Max. length	82.5			1
Prox. width	13.0			1
Dist. width	15.2			1
Min. width of corpus	7.2			1

* One female specimen measured

Anas platyrhynchos - duck

	m	min.	max.	n
Humerus				
Max. length	95.0			1
Dist. width	15.1			1
Min. width of corpus	7.4			1
Radius				
Max. length	70.8	69.5	70.8	3
Max. dist. width	6.6	6.3	6.8	4
Min. width of corpus	3.2	3.0	3.5	3
Ulna				
Max. length	77.8	75.5	80.0	2
Max. dist. width	10.7	10.3	11.0	2
Min. width of corpus	5.3	5.3	5.3	2
Carpometacarpus				
Max. length	58.9	58.7	59.0	2
Max. prox. width	13.4	13.3	13.5	2
Tibiotarsus				
Max. dist. width	8.5			1
Dist. thickness	8.5			1
Min. width of corpus	3.6			1

Anser anser - goose

	m	min.	max.	n
Tibiotarsus				
Min. width of corpus	8.5	7.8	9.0	3
Max. dist. width	16.5	16.5	16.5	2

Haliaeetus albicilla - sea eagle

	m	min.	max.	n
Radius				
Max. dist. width	15.4			1