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Fishing in the Southern North Sea Region from the 1st to the 16th Century AD: Evidence from Fish Bones

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ABSTRACT: Evidence from archaeological fish bone assemblages from the southern North Sea region of Europe is used to illuminate fishing, fish consumption and fish trade from the 1st to the 16th century AD. The fish species represented in the material indicate a very strong influence from the local fish fauna at almost all sites. The species and size of the fish indicate that several fishing methods have been employed throughout the period studied, including nets, hooks and weirs. A chronological development in fishing, for example, a tendency towards more sea-going fishing, is reflected in the fish bone assemblages in some countries. Evidence from fishing in the Baltic region from the 5th century BC to the 16th century AD is included in the discussion. Indications of fish trade include bones of exotic species (for instance, marine species at inland sites) and an unbalanced representation of skeletal elements (trade with decapitated stockfish or gillless herring). Of particular interest are assemblages which indicate a fish industry, for instance, large-scale processing (removal of gills) of herring in 13th century Denmark.

KEYWORDS: FISH, FISH BONE ASSEMBLAGES, NORTH SEA, IRON AGE, VIKING AGE, MIDDLE AGES, PREHISTORIC FISHING

RESUMEN: Datos procedentes de asociaciones ictioarqueológicas de la región meridional del Mar del Norte en Europa son utilizados para evidenciar la práctica de la pesca así como el consumo y comercio de pescado desde los siglos I al XVI d.C. Las especies de peces representadas en los materiales evidencian una muy fuerte influencia de las faunas locales en prácticamente todos los yacimientos. Tanto la relación de especies como el tamaño de los ejemplares indican que, a lo largo de todo el periodo estudiado, una serie de diferentes métodos de captura, que incluyen redes, garfios y nasas, fué utilizada. Un hito cronológico en las prácticas pesqueras como, por ejemplo, la aparición de la pesca de altura, queda reflejado en las asociaciones ictioarqueológicas recuperadas en diferentes países. En la discusión se incluyen las evidencias en torno a la pesca en la región del Báltico desde el siglo V a.C. al siglo XVI d.C. Las evidencias de comercio de pescado incluyen la presencia de especies exóticas (como suelen ser, por ejemplo, las especies marinas en yacimientos del interior) así como espectros esqueléticos sesgados que implican el transporte de animales decapitados o desprovistos de agallas. De particular interés resultan ser aquellos yacimientos en donde se detecta la existencia de industrias derivadas de la pesca caso de las extracciones a gran escala de agallas de arenque en Dinamarca a lo largo de todo el siglo XIII d.C.

PALABRAS CLAVE: PECES, ASOCIACIONES DE HUESOS DE PESCADO, MAR DEL NORTE, EDAD DEL HIERRO, EDAD VIKINGA, EDAD MEDIA, PESCA PREHISTÓRICA

INTRODUCTION

During archaeological excavations, fish bones are frequently recovered in large quantities. In the present paper evidence from fish bones is used to elucidate fishing, fish consumption and fish trade in the southern North Sea region of Europe during the period from the 1st to the 16th century AD. Fis-

hing in the Baltic region from the 5th century BC to the 16th century AD has been treated in the same way in a previous paper (Enghoff, 1999). During this period, significant developments in fishing tools and techniques took place, including the development of seagoing ships which made fishing on the open sea and long-distance trade possible. This is clearly reflected in the fish bone evidence and in the present review the discussion is based solely on results from fish bone analyses. This is but one approach to the topic. Written sources may add further information, but these are often biased, mostly dealing with special situations, whereas fish bones may be found in any context.

MATERIAL AND METHODS

For the purpose of this review, the southern North Sea region has been defined as comprising the North Sea coast of Denmark and Germany, the Netherlands, Belgium and Eastern England.

The review is based mainly on published studies of large or otherwise significant fish bone assemblages. Many studies based on only a few fish bones have thus been left out of consideration. Others have been left out due to insufficient information about dating.

An original analysis of material from a Danish site (Ribe: Posthuset) is included.

The locations of the reviewed sites are shown in Figure 1. Records from Denmark, Germany, The Netherlands, Belgium and Eastern England are given in Tables 2-6. The entries in Tables 2-6 express numbers of fish bones for each species where such numbers were available. Where absolute numbers were not given, or frequency was indicated as a percentage or by a letter code, entries in the tables are given as presence/absence. This method of presentation was chosen for the sake of uniformity, at the expense of loss of information in some cases. Scales have not been included in the bone counts, instead their presence is recorded in footnotes to Tables 2-6. In the tables, as well as in the sections on individual sites from each country, sites are arranged chronologically, according to the age of their oldest phase. The fish species are divided into marine, migratory and freshwater species in Tables 2-6, within each of these ecological groupings the species are listed systematically (i.e. by taxonomic group).

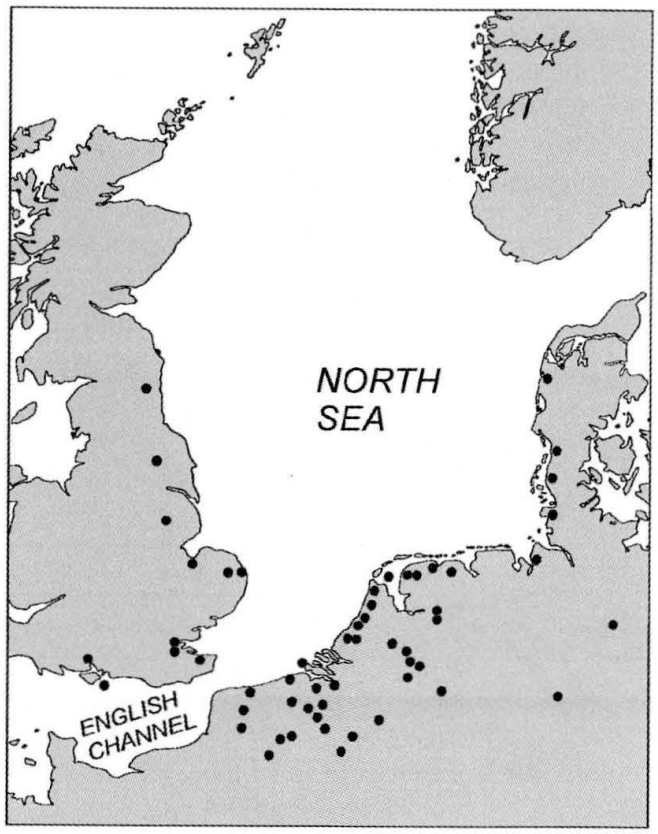

FIGURE 1

Map of the North Sea region of Europe, showing the location of the reviewed sites. See also the more detailed maps for each country (Figures 2, 5-7).

Table 1 summarizes the occurences of fish species in material from the five countries, with English and Latin names according to Whitehead *et al.* (1984-86) for marine species and Blanc *et al.* (1971) for freshwater ones. Since the English names of fish species may be unfamiliar to many readers, the species are arranged alphabetically in Table 1 which thus has the additional function of an English-Latin dictionary.

The fish bone evidence included in the review is obviously of very variable quality, having been influenced by several taphonomic factors, see Enghoff (1999). It is very important to keep in mind taphonomy, including recovery methods, when evidence from different sites is compared and general conclusions are drawn. Often, it is possible to evaluate smaller, less meticulously excavated samples against the background of large, sieved ones.

Since the cultural periods may be differently defined and delimited in the different countries, evidence is as a rule only referred to by century.

Some of the papers dealing with fish bones refer to finds of fishing tools. This information has

	DK	D	NL	B	GB
Allis shad, *Alosa alosa*	.	+	+	.	.
Anglerfish, *Lophius piscatorius*	.	.	.	.	+
Atlantic horsemackerel, *Trachurus trachurus*	+	.	+	.	+
Atlantic mackerel, *Scomber scombrus*	.	.	+	+	+
Ballan wrasse, *Labrus bergylta*	.	.	.	.	+
Barbel, *Barbus barbus*	.	.	+	+	+
Black sea bream, *Spondyliosoma cantharus*	.	.	.	+	.
Bleak, *Alburnus alburnus*	.	.	.	+	.
Blue ling, *Molva dipterygia*	.	.	.	.	.
Brill, *Scophthalmus rhombeus*	.	.	.	.	.
Bullhead, *Cottus gobio*	.	.	.	+	.
Bullrout, *Myoxocephalus scorpius*	.	.	.	+	.
Burbot, *Lota lota*	.	.	+	+	+
Butterfish, *Pholis gunnellus*	.	.	.	.	+
Cartilaginous fishes, Chondrichthyes	.	+	.	+	+
Chub, *Leuciscus cephalus*	.	.	.	+	+
Chub mackerel, *Scomber japonicus*	.	.	+	+	.
Clupeids, Clupeidae	.	.	+	+	+
Cod, *Gadus morhua*	+	+	+	+	+
Common bream, *Abramis brama*	+	.	+	+	+
Common carp, *Cyprinus carpio*	.	.	+	+	+
Common sole, *Solea vulgaris*	+	.	+	+	+
Common stingray, *Dasyatis pastinaca*	.	.	+	.	.
Conger eel, *Conger conger*	.	.	.	.	+
Cyprinids, Cyprinidae	+	+	+	+	+
Dab, *Limanda limanda*	+	.	+	+	+
Dace *Leuciscus leuciscus*	.	.	.	+	+
Dogfish, *Scyliorhinus* sp.	.	.	+	.	+
Eel, *Anguilla anguilla*	+	.	+	+	+
European anchovy, *Engraulis encrasicholus*	.	.	+	+	.
European seabass, *Dicentrarchus labrax*	.	+	+	+	+
Five-bearded rockling, *Ciliata mustela*	.	.	.	.	+
Flatfish, Heterosomata	+	+	+	+	+
Flounder, *Platichthys flesus*	+	+	+	+	+
Gadids, Gadidae	+	+	+	+	+
Garpike, *Belone belone*	.	.	+	+	+
Gobiids, Gobiidae	.	.	.	+	+
Golden grey mullet, *Liza aurata*	.	.	.	.	.
Grayling, *Thymallus thymallus*	.	.	.	.	+
Grey gurnard, *Eutrigla gurnardus*	.	.	.	.	+
Grey mullets, Mugilidae	+	+	+	+	.
Gudgeon, *Gobio gobio*	.	.	.	+	+
Gurnards, Triglidae	.	.	+	+	+
Haddock, *Melanogrammus aeglefinus*	+	+	+	+	+
Hake, *Merluccius merluccius*	.	.	.	.	+
Halibut, *Hippoglossus hippoglossus*	.	.	+	+	+
Herring, *Clupea harengus*	.	.	+	+	+
John Dory, *Zeus faber*	.	.	.	.	+
Lemon sole, *Microstomus kitt*	.	.	.	.	+

TABLE 1

List of the fish taxa (species and a few genera and higher categories) of fish mentioned in the text, and indication of the countries from which they have been recorded in Iron Age to Medieval fish bone assemblages. The list is arranged alphabetically according to the English names, with corresponding Latin names added. The nomenclature follows Whitehead *et al.* (1984-86) for marine species and Blanc *et al.* (1971) for freshwater ones. B = Belgium, D = Germany, DK = Denmark, GB = eastern England, NL = The Netherlands. Species which are not indicated as occurring in any of the countries are included because they occur in the national lists as unconfirmed possibilities (e.g., brill which has been recorded only as "turbot/brill").

	DK	D	NL	B	GB
Ling, *Molva molva*	.	+	+	+	+
Meagre, *Argyrosomus regius*	.	+	+	+	.
Minnow, *Phoxinus phoxinus*	.	.	.	+	.
Nursehound, *Scyliorhinus stellaris*	.	.	.	+	.
Orfe, *Leuciscus idus*	.	+	+	+	.
Perch, *Perca fluviatilis*	+	.	+	+	+
Percids, Percidae	+	.	+	+	+
Pike, *Esox lucius*	+	+	+	+	+
Plaice, *Pleuronectes platessa*	.	+	+	+	+
Pollack, *Pollachius pollachius*	.	.	.	.	+
Ray, *Raja* sp.	.	+	+	+	+
Roach, *Rutilus rutilus*	.	.	+	+	+
Rudd, *Scardinius erythrophthalmus*	.	.	+	+	+
Ruffe, *Gymnocephalus cernua*	.	.	+	+	.
Saithe, *Pollachius virens*	.	+	.	+	+
Salmon, *Salmo salar*	.	+	+	.	+
Salmonids, Salmonidae	+	+	+	+	+
Sandeels, Ammodytidae[1]	.	.	.	+	+
Schneider, *Alburnoides bipunctatus*	.	.	.	+	.
Sea breams, Sparidae	.	.	.	+	+
Shad, *Alosa* sp.	.	+	+	+	+
Sharks, Pleurotremata	.	.	+	+	+
Smallspotted catshark, *Scyliorhinus canicula*	.	.	+	.	.
Smelt, *Osmerus eperlanus*	.	.	+	+	+
Smoothhound, *Mustelus* sp.[2]	.	.	+	.	.
Sole, *Solea* sp.	+	.	+	+	+
Spined loach, *Cobitis taenia*	.	.	.	+	.
Sprat, *Sprattus sprattus*	.	.	.	+	+
Spurdog, *Squalus acanthias*	.	.	.	.	+
Stone loach, *Nomacheilus barbatulus*	.	.	.	+	.
Striped red mullet, *Mullus surmuletus*	.	.	+	.	.
Sturgeon, *Acipenser sturio*	+	+	+	+	+
Tench, *Tinca tinca*	.	.	+	+	+
Thicklip Grey Mullet, *Chelon labrosus*	.	+	+	.	.
Thinlip Grey Mullet, *Liza ramada*	+	.	.	.	.
Thornback Ray, *Raja clavata*	.	+	+	+	+
Three-spined Stickleback, *Gasterosteus aculeatus*	+	.	+	+	+
Topeshark, *Galeorhinus galeus*	.	.	.	+	.
Torsk, *Brosme brosme*	.	.	+	.	.
Trout, *Salmo trutta*	.	.	+	+	+
Tub gurnard, *Trigla lucerna*	.	.	+	+	+
Turbot, *Psetta maxima*	.	+	+	+	+
Twaite shad, *Alosa fallax*	.	.	+	.	.
Wels, *Siluris glanis*	.	+	+	+	.
White bream, *Blicca bjoerkna*	.	.	+	+	.
Whitefish, *Coregonus* sp.	+	.	+	+	+
Whiting, *Merlangius merlangus*	.	.	+	+	+
Wrasses, Labridae	.	.	.	.	+

TABLE 1 (cont.)

List of the fish taxa (species and a few genera and higher categories) of fish mentioned in the text, and indication of the countries from which they have been recorded in Iron Age to Medieval fish bone assemblages. The list is arranged alphabetically according to the English names, with corresponding Latin names added. The nomenclature follows Whitehead *et al.* (1984-86) for marine species and Blanc *et al.* (1971) for freshwater ones. B = Belgium, D = Germany, DK = Denmark, GB = eastern England, NL = The Netherlands. Species which are not indicated as occurring in any of the countries are included because they occur in the national lists as unconfirmed possibilities (e.g., brill which has been recorded only as "turbot/brill").

[1] The Belgian record identified as *Ammodytes tobianus*.

[2] The Dutch records identified as *Mustelus mustelus*.

been taken into account but a systematic search for literature on this subject has not been made. Written sources have in general not been taken into account. The present work is based on fish bone analyses.

DENMARK, INDIVIDUAL SITES

The review is based on already published evidence and on material from one hitherto unpublished site which has been analyzed by the author within the framework of the present project (Ribe: Posthuset).

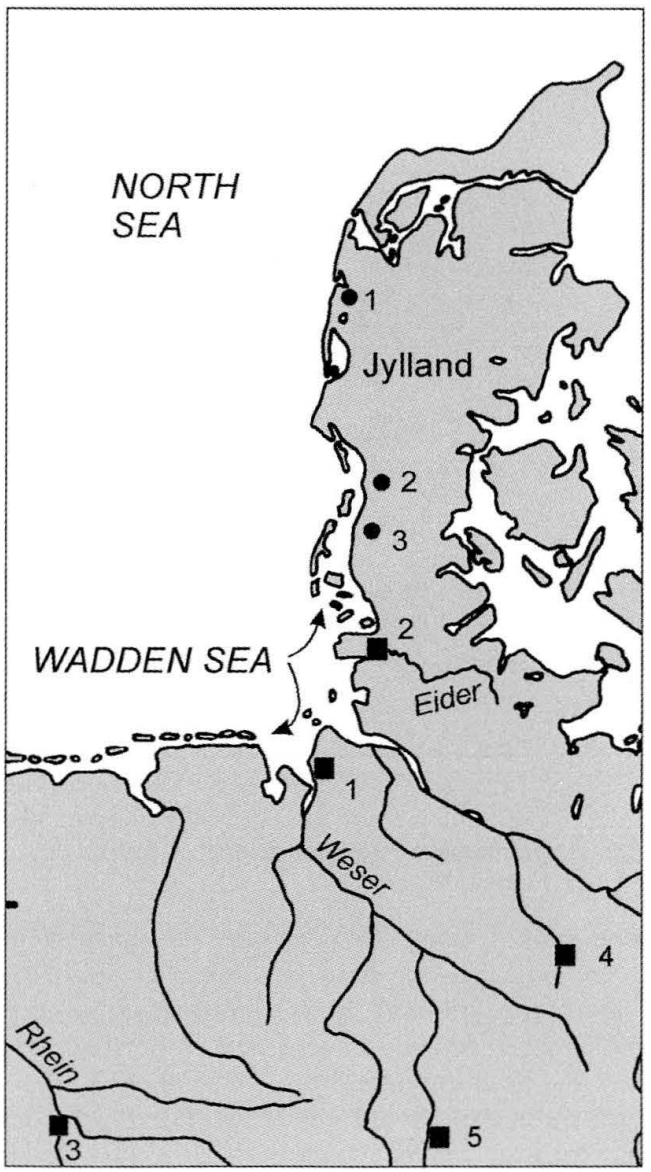

FIGURE 2

Map of the North Sea coast of Denmark and Germany, showing the location of the reviewed sites. Site numbers refer to the section "Denmark, individual sites" (dots) and "Germany, individual sites" (squares).

The site numbers refer to the map, Figure 2. See Table 2 for detailed species lists.

Nørre Fjand (1)

An Iron Age village site at Nissum Fjord, close to the North Sea. The site dates from the 2nd century BC to the 2nd century AD (Pre-Roman to Roman Iron Age) (Hatt, 1957; Rosenlund, 1976). Sieving has not been employed.

A few (25) fish bones of the fresh/brackish water species pike and perch were found. This very small assemblage, which may not be representative, indicates fishing in Nissum Fjord rather than in the North Sea.

Ribe (2)

A marketplace situated on the banks of the river Ribe Å ca. 15 km from the coast of the Wadden sea. The market was founded about AD 705 (dendrochronologically dated). Jensen (1991) assumed that the site was of a seasonal nature, remaining unused during winter, but with a small permanent neighbouring settlement. During the Viking Age, Ribe was an important centre for trade between western Europe and the rest of Scandinavia. The Iron-Viking Age fish bone material covers the period from ca. AD 700-850. In addition there is a smaller Medieval sample, dated to the 12th-13th centuries AD, deriving from two pits. The fish bones were recovered by wet sieving through a 3-4 mm mesh, a few samples through a 2 mm mesh.

The fish bones have been analyzed by Enghoff ("Posthuset", present work, 3163 identified bones). A species list, based on a much smaller amount of material, was produced by Hatting (1991) ("Kunstmuseet etc").

The Iron-Viking Age fish bone material can be subdivided into phases within the interval AD 700-850, but as there are no indications of differences between the phases the entire Iron-Viking Age material is discussed here as one unit. Bones of plaice/flounder/dab dominate the material (66% of the identified bones). Both flounder and dab are represented with certainty (dab is new to the Danish subfossil fauna). Gadids, represented by cod, haddock and ling, constitute 14%. The cod were 37-62 cm long. Gadids are followed in frequency by salmon/trout (7%) and thinlip grey mullet (5%). The find of 144 bones of thinlip grey mullet is remarkable (Figure 3).

Site	Nørre Fjand	Ribe, Kunst-museet etc.	Ribe, Post-huset	Ribe, Post-huset	Trøjborg
Site no. (Fig. 2)	1	2	2	2	3
Age (centuries)	2 BC-2 AD	8 AD	8-9 AD	12-13 AD	14-16 AD
Recovery technique	h	h	s	s	h
MARINE SPECIES					
Smallspotted catshark	-	-	-	1	-
Gadids, total	-	1	419	175	277
Cod	-	-	188	48	4
Haddock	-	1	122	90	273
Ling	-	-	14	1	
Gadids, unspecified	-	-	95	36	-
Atlantic horsemackerel	-	-	5	-	-
Thinlip grey mullet	-	-	144	-	-
Three-spined stickleback	-	-	-	-	-
Flatfishes, total	-	9	1983	5	-
Turbot/Brill	-	-	1	-	-
Flounder	-	-	2	-	-
Dab	-	-	1	-	-
Plaice/Flounder/Dab	-	9	1979	5	-
Common sole	-	-	1	-	-
MIGRATORY SPECIES					
Sturgeon	-	1	-	-	-
Trout/Salmon	-	-	199	-	-
Whitefish	-	-	19	-	-
Eel	-	-	51	-	-
FRESHWATER SPECIES					
Pike	7	-	50	-	-
Cyprinids, total	-	3	90	-	-
Common bream	-	2	1	-	-
Cyprinids, unspecified	-	1	89	-	-
Perch	18	-	21	-	1
TOTAL	25	14	2982	181	278

TABLE 2

Numbers of identified fish bones from Danish North Sea sites. Recovery technique: h = hand-collected, s = sieved.

Thinlip grey mullet is known from only four other Danish sites, all dating from the Mesolithic and the Neolithic, and in each case represented by only a few specimens (Richter, 1987). The Ribe material seems to represent quite a number of individuals representing six phases from AD 700-800. A comparison with recent material indicates that the mullet from Ribe were more than 40 cm long, the majority being more than 50 cm, and one about 70 cm. Today, this species has a southern distribution in Europe and is most frequent south of the English Channel. Only a few individuals have been caught along the coasts of Scandinavia in recent times. In the light of the earlier subfossil finds it appears more likely that the thinlip grey mullet were actually caught near Ribe than that they had been imported from the south. (The thinlip grey mullet should not be confused with the thicklip grey mullet which during the last 20-30 years has become relatively common along Scandinavian coasts).

The relatively large number of bones from salmon/trout is worth noting, since these are normally considered to preserve badly in the soil. Small

FIGURE 3

Bones from thinlip grey mullet found at Ribe, $1^{1/2} \times$ natural size: one opercular (lower left), one parasphenoid, one urohyal and one ceratohyal (upper left) and five vertebrae.

(less than 50 cm), medium-sized and large (much longer than 70 cm) individuals are represented in the material (Figure 4).

Whitefish is also represented. Today, whitefish migrate into all the watercourses running out into the North Sea south of the Limfjord, including Ribe Å.

Summer occupancy of the Iron-Viking Age trading place at Ribe is indicated by the finding of horse mackerel. It is also most likely that the thinlip grey mullet were summer visitors to Denmark.

Sea fishing dominate strongly which is not surprising, considering Ribe's location close to the North Sea.

FIGURE 4

Vertebrae from salmon/trout found at Ribe, $2 \times$ natural size.

The composition of the Iron-Viking Age Ribe material is consistent with the town's geographical location: Flatfish are abundant in the Wadden Sea, thinlip grey mullet migrate into the rivers, and the North Sea has provided an element of gadids. All the species found could have been caught from Ribe. There are almost no bones with cutmarks and there are no instances of conspicuous lack of bones from particular body regions which might suggest the presence of imported fish which had been processed elsewhere.

In contrast to the Iron-Viking Age material, the Medieval bone assemblages from Ribe are very strongly dominated by big gadids including cod, haddock and ling. The size difference in comparison with the Iron-Viking Age gadids is striking, the Medieval cod were very large: 98-122 cm long.

The varied local fishing from Ribe, including fishing in Ribe Å and the Wadden Sea, which was indicated in the Iron-Viking Age material, is not at all evident in the Medieval samples. These rather suggest fishing in the North Sea.

Trøjborg (3)

A Medieval castle in southern Jylland, dated to about AD 1300-1580 (Rosenlund, 1976). The fish bones were hand-collected and almost exclusively represent haddock.

DENMARK, OVERVIEW

In the context of the present paper, Denmark is represented by three sites. A general discussion of fishing in Denmark during the Iron Age, Viking Age and the Middle Ages has been presented in a previous paper (Enghoff, 1999) which also includes fishing and fish consumption at the three Danish North Sea sites.

GERMANY, INDIVIDUAL SITES

The review of the German North Sea sites is based on published results.

The site numbers refer to the map, Figure 2. See Table 3 for detailed species lists.

Feddersen Wierde (1)

A settlement at the mouth of the River Weser where it enters the Wadden Sea/North Sea. The fish

SITE	Feddersen Wierde	Elisenhof	Duisburg	Bodenteich Castle	Plesse Castle	Plesse Castle
Site n° (Figure 2)	1	2	3	4	5	5
Age (centuries)	3 AD	8-13 AD	10-13 AD	13-17 AD	15-16 AD	16-17 AD
Recovery technique	h	h	h	s	h+s	h+s
MARINE SPECIES						
Thornback ray	-	1	-	-	-	-
Ray, unspecified	-	-	-	-	1	-
Herring	-	-	-	4	137	11
Gadids, total	4	230	60	22	61	5
Cod	4	168	41	6	4	1
Haddock	-	45	14	9	-	-
Saithe	-	16	-	2	1?	-
Ling	-	1	3	-	-	-
Torsk	-	-	-	-	5	-
Gadids, unspecified	-	-	2	5	51	4
European seabass	-	1	-	-	-	-
Meagre	3	-	-	-	-	-
Thicklip grey mullet	-	1	-	-	-	-
Flatfishes, total	62	133[1]	1	12	3	4
Turbot	-	1	-	1	-	-
Plaice	7	[2]	-	-	-	2
Flounder	47	51	-	-	-	-
Plaice/Flounder/Dab	8	81	1	-	-	-
Flatfishes, unspecified	-	-	-	11	3	2
MIGRATORY SPECIES						
Sturgeon	215	120	-	-	-	-
Allis shad	5	-	-	-	-	-
Shad	[3]	-	4	-	-	-
Salmon	-	-	1	-	-	-
Trout/Salmon	3[4]	-	1	5	12	-
Whitefish	-	-	-	1	-	-
Eel	-	-	-	2	24	1
FRESHWATER SPECIES						
Pike	-	1	-	12	71	10
Cyprinids, total	-	-	19	37	420	49
Common carp	-	-	-	3	64	14
Gudgeon	-	-	-	-	3	-
Tench	-	-	-	-	1	-
Dace	-	-	-	-	1?	-
Chub	-	-	-	-	5	1
Orfe	-	-	7	-	-	-
Roach	-	-	-	9	11	1
Common bream	-	-	-	4	9	1
[HE1] Cyprinids unspecified	-	-	12	21	326	32
Wels	-	8	-	-	-	-
Burbot	-	-	-	1	-	-
Perch	-	-	-	16	56	2
Ruffe	-	-	-	-	3	1
TOTAL	292	495	86	112	788	83

TABLE 3

Numbers of identified fishbones from German sites. Recovery technique: h = hand collected, s = sieved, ? = unknown.

[1] excluding one complete skeleton.

[2] one complete skeleton.

[3] 12,000 scales.

[4] excluding 1200 scales.

bone material is dated to the 3rd century AD and was recovered by hand-collection (Heinrich, 1991).

The most frequently represented species is the sturgeon. On the basis of the spectrum of fish species, which includes shad, Heinrich (1991) concluded that most of the fishing took place close to the settlement, for example, in the mouth of the Weser. A small number of vertebrae from very large cod (total length 107 cm and 125 cm) indicates, however, fishing in the North Sea. The presence of meagre is notable, this species being nowadays a rare visitor to the area.

Elisenhof (2)

A North Sea village situated on the estuary of the River Eider. The excavated material covers the 8th-13th centuries AD and was recovered by hand-collection (Heinrich, 1985, 1994a).

Most of the fish bones are from cod, sturgeon and plaice/flounder/dab. Considering the recovery technique small fish must, however, be regarded as under-represented. Freshwater fishing seems not to have played a major role, except for sturgeon which is thought to have been caught in connection with its spawning in the Eider. The presence of wels, nowadays extinct in the area, is also worth noting. Apart from this local fishing in the Eider estuary and the Wadden Sea, the inhabitants appear also to have fished in the North Sea. This is indicated by the presence of haddock, saithe, ling and large cod (95-130 cm). Heinrich (1985, 1994a) believed that the inhabitants of Elisenhof fished for their own sustenance, and that fishing was of great importance.

Duisburg (3)

A Medieval town, situated on the River Rhein, ca. 180 km from the sea. The fish bone material is dated to the 10th-13th centuries AD; 78 of the 86 bones are, however, from the 13th century. The bones were hand-collected and are therefore not regarded as representative (Heinrich, 1992). Most of the bones are from gadids, especially cod, but also haddock and ling. Heinrich (1992) thought that all the gadids were imported to Duisburg in the form of stockfish, because head bones are largely absent. The sizes of the fish also agree with this interpretation: cod 85-120 cm, haddock 40-70 cm and ling 130-140 cm. All haddock bones are from the 13th century. Shad, trout/salmon and cyprinids, including chub, also indicate local fishing.

Bodenteich (4)

A castle situated ca. 150 km from the North Sea coast. Fish bones were obtained by sieving and were studied by Heinrich (1994b, 1999a). The material is referable to five periods of which three (13th-17th centuries AD) are considered here. A few fish bones from the 9th-12th centuries AD and a sample from the 17th-18th centuries AD are omitted. In the light of the small numbers of bones and the lack of any difference between the three included periods, these are combined in Table 3.

Despite the long distance to the sea, the material contains both freshwater, migratory and marine fish. Whereas the former may have been caught locally, the marine species indicate long-distance transport. The gadids are almost exclusively represented by skeleton elements indicating stockfish.

Plesse (5)

A castle situated ca. 250 km from the North Sea coast. Fish bones were obtained by hand-collection and sieving of material from the courtyard and are referable to two periods, 15th-16th and 16th-17th centuries AD. They were studied by Heinrich (1994b).

The composition of the Plesse material is similar to that at Bodentiech (see above). Also in Plesse, the gadids seems to have been stockfish. The presence of torsk in particular indicates long-distance transport, torsk being an Arcto-Atlantic species.

GERMANY, OVERVIEW

The dates for the German assemblages lie within the interval from the 3rd to the 17th centuries AD.

Local influences on North Sea fishing in Germany

The Germanic village Feddersen Wierde is situated close to the North Sea and is considerably older (3rd century AD) than the other German sites reviewed here and previously (Enghoff, 1999). In spite of this, the fishing was very varied. It apparently took place mostly in the Weser estuary, but also in the Wadden Sea and possibly (as indicated by very large cod) in the open North Sea as well. Sturgeon was so common at Feddersen Wierde that its bones were used for toolmaking. A very

local element is constituted by meagre which is common in southern Europe and is often encountered in estuaries (Curry-Lindahl, 1985); at Feddersen Wierde it was probably caught in the Weser estuary.

The material from the coastal village of Elisenhof is dominated by marine species including haddock, saithe, ling and large cod which could only have been caught in the North Sea. A number (>16) of large gorges have been found, these may have been used for catching large gadids. Heinrich (1985, 1994a) regarded Elisenhof as a fishing village. In addition to the North Sea, Elisenhof's fishermen seem to have worked in the Wadden Sea and the Eider estuary. The local character of the Elisenhof fishing is underlined by the element of southern marine species like European seabass and thicklip grey mullet.

The typically marine character of the fishing from Elisenhof resembles that seen in the much older site of Feddersen Wierde.

Remains of fishing tools from German sites

More than 16 large gorges (see above) and a net floater were found at Elisenhof.

Indications of fish trade in Germany

Most of the fish bones from the North Sea site of Elisenhof are from the oldest phase and are thus contemporaneous with the nearby town of Haithabu which faces the Baltic coast (Enghoff, 1999). Material from the two sites is, however, very different, and Heinrich (1985, 1994a) believed that there was no export of fish from the fishing village, Elisenhof to the trading centre Haithabu.

Large gadids and other marine fish were imported to Duisburg, Bodenteich and Plesse 150-250 kilometres inland from the North Sea.

THE NETHERLANDS, INDIVIDUAL SITES

The review is based on published evidence.

The site numbers refer to the map, Figure 5. See Table 4 for detailed species lists.

Groenman-van Waateringe & van Wijngaarden-Bakker (1990) gave a summary of common fish species found at (pre-) urban and rural Medieval Dutch sites.

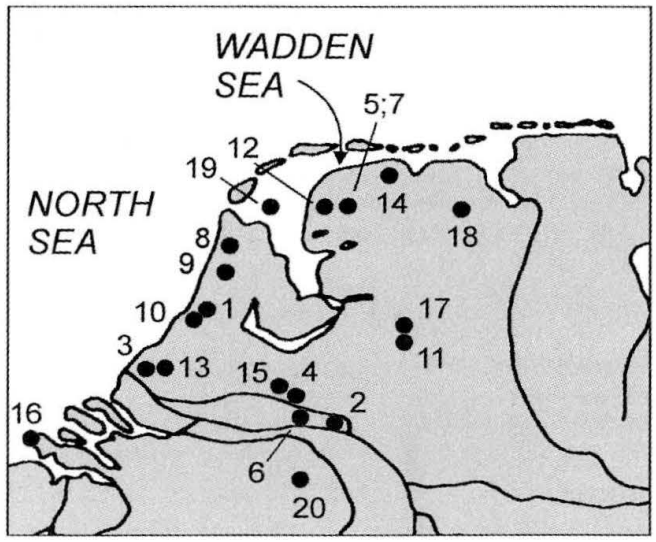

FIGURE 5

Map of the Netherlands, showing the location of the reviewed sites. Site numbers refer to the section "The Netherlands, individual sites".

Velsen 1 and Velsen 2 (1)

Two Roman military settlements situated near the coast, on the bank of the River Oer IJ, a former tributary of the Rhein. The fish bones excavated at Velsen are dated to the first half of the 1st century AD. Conditions for the preservation of fish bones at the site are good. The fish remains from Velsen 1 are from a harbour basin and two wells and were excavated partly by hand, partly with the aid of 5 mm mesh sieves. The fish remains from Velsen 2 were hand-collected, they were studied by Brinkhuizen (1989a).

The list of species in the Velsen material is very long and includes marine, migratory and freshwater fish. Among the marine species, plaice/flounder/dab, grey mullet and cod were the most important, whereas the most important freshwater species were perch, cyprinids and pike. An exotic element consisting of meagre and chub mackerel is noteworthy. The cod were large (about 1 m) and are represented by bones from both head and trunk.

Nijmegen, Canisiuscollege (2)

Hoek & Brinkhuizen (1990) presented a preliminary analysis of fish bones from a pit found during excavations of a Roman site in the area of the former Canisiuscollege in Nijmegen, ca. 110 km from the North Sea coast. The sample was sieved and is dated to ca. 100 AD. At least twelve

Site	Velsen 1	Velsen 2	Nijmegen, Canisius-college	Valken-burg 1	Valken-burg 2	Dorestad	Nijehove
Site no. (Fig. 6)	1	1	2	3	3	4	5
Age (centuries)	1 AD	1 AD	1 AD	1-3 AD	1-3 AD	8-9 AD	9 AD
Recovery technique	h+s	h	s	?	?	h+s	h
MARINE SPECIES							
Smallspotted catshark	1	-	-	-	-	-	-
Smoothhound	1	-	-	-	15[1]	-	-
Common stingray	1	-	-	-	-	-	-
Thornback ray	4	-	-	-	2	-	-
Ray, unspecified	-	-	-	-	-	-	-
Herring	-	-	-	-	-	72	-
Herring/Sprat	-	-	-	-	-	-	-
European anchovy	-	-	-	-	-	-	-
Garfish	-	-	-	-	1	-	-
Gadids, total	63	1	-	+	+	5	+
Cod	55	-	-	+	-	-	+
Haddock	3	1	-	-	-	1	-
Whiting	5	-	-	-	+	-	+
Ling	-	-	-	-	-	-	-
Ling/Blue ling	-	-	-	-	-	-	-
Torsk	-	-	-	-	-	-	-
Gadids, unspecified	-	-	-	-	-	4	-
European sea bass	3	-	-	-	-	-	-
Atlantic horse-mackerel	1	-	-	-	-	-	-
Meagre	1	-	-	-	-	-	-
Striped red mullet	1	-	-	-	-	-	-
Thicklip grey mullet	38	-	-	-	+	-	-
Thinlip/Golden grey mullet	45	3	-	+	-	-	-
Grey mullets, unspecified	107	1	-	-	-	-	-
Atlantic mackerel	-	-	-	-	-	-	-
Chub mackerel	1	-	+	-	-	-	-
Tub gurnard	10	-	-	-	-	-	-
Three-spined stickleback	-	-	-	-	+	-	-
Flatfishes, total	344	2	-	+	>1000	57	+
Turbot	5	-	-	-	-	1	-
Halibut	-	-	-	-	-	-	-
Dab	2	-	-	-	-	-	-
Plaice	1	-	-	-	-	24	-
Flounder	30	-	-	-	+	17	-
Plaice/Flounder/Dab	306	2	-	+	-	15	+
Common sole	-	-	-	-	-	-	-
Flatfishes, unspecified	-	-	-	-	-	-	-

TABLE 4

Numbers of identified fish bones from Dutch sites. Recovery technique: h = hand-collected, s = sieved, ? = unknown.

[1] recorded as spurdog by Laarman (1986), see text.

Site	Velsen 1	Velsen 2	Nijmegen, Canisius-college	Valken-burg 1	Valken-burg 2	Dorestad	Nijehove
Site no.	1	1	2	3	3	4	5
Age (centuries)	1 AD	1 AD	1 AD	1-3 AD	1-3 AD	8-9 AD	9 AD
Recovery technique	h+s	h	s	?	?	h+s	h
MIGRATORY SPECIES							
Sturgeon	5	-	+	+	+	22	-
Allis shad	-	-	+	-	-	21	-
Twaite shad	4	-	-	-	>1000	-	-
Shad	1	-	-	-	-	-	-
Salmon	-	-	+	-	-	34	-
Trout	-	-	-	-	-	-	-
Salmon/Trout	5	7	-	-	+	-	-
Whitefish	6	-	-	-	-	1	-
Smelt	-	-	-	-	-	-	+
Eel	98	2	+	-	+	265	+
FRESHWATER SPECIES							
Pike	411	13	+	+	+	105	-
Cyprinids, total	743	8	+	-	+	471	-
Common carp	-	-	-	-	-	-	-
Barbel	-	-	+	-	-	1	-
Tench	7	-	+	-	-	1	-
Orfe	-	-	+	-	-	2	-
Roach	8	-	+	-	-	8	-
Rudd	4	-	-	-	-	-	-
Common Bream	258	5	+	-	+	42	-
White bream	11	-	-	-	-	1	-
Cyprinids, unspecified	455[2]	3	-	-	-	416	-
Wels	172	27	+	+	1	1	-
Burbot	-	-	-	-	-	2	-
Perch	663[3]	3	+	-	-	272	+
Ruffe	19	-	-	-	-	-	-
TOTAL	2746	67	+	+	>10,000	1328	+

TABLE 4 (cont.)

Numbers of identified fish bones from Dutch sites. Recovery technique: h = hand-collected, s = sieved, ? = unknown.

[2] excluding 9 scales.

[3] excluding 78 scales.

Site	Nijehove	Tiel	Leeuwarden I	Leeuwarden II	Schagen	Alkmaar	Haarlem, Jansstraat 46
Site no. (Fig. 6)	5	6	7	7	8	9	10
Age (centuries)	10-11 AD	9-12 AD	11-14 AD	11-14 AD	12-13 AD	12-14 AD	12-18 AD
Recovery technique	s	h+s	h	h	h+s	?	?
MARINE SPECIES							
Smallspotted catshark	-	-	-	-	-	-	-
Smoothhound	-	-	-	-	-	-	-
Common stingray	-	-	-	-	-	-	-
Thornback ray	-	-	-	-	-	-	-
Ray, unspecified	-	-	-	-	-	-	-
Herring	-	-	-	-	-	-	77
Herring/Sprat	+	-	-	-	-	-	-
European anchovy	+	-	-	-	-	-	-
Garfish	-	-	-	3	-	-	-
Gadids, total	+	-	73	71	-	10	138
Cod	+	-	42	35	-	8	17
Haddock	-	-	7	11	-	2	10
Whiting	+	-	-	4	-	-	-
Ling	-	-	1	-	-	-	-
Ling/Blue ling	-	-	-	-	-	-	-
Torsk	-	-	-	-	-	-	-
Gadids, unspecified	-	-	23	21	-	-	-
European sea bass	-	-	-	1	-	-	-
Atlantic horse-mackerel	-	-	-	-	-	-	-
Meagre	-	-	-	-	-	-	-
Striped red mullet	-	-	-	-	-	-	-
Thicklip grey mullet	-	-	-	-	-	-	-
Thinlip/Golden grey mullet	-	-	-	-	-	-	-
Grey mullets, unspecified	-	-	-	1	-	-	-
Atlantic mackerel	-	-	-	-	-	-	-
Chub mackerel	-	-	-	-	-	-	-
Tub gurnard	-	-	-	-	-	5	-
Three-spined stickleback	-	-	-	-	5	-	-
Flatfishes, total	+	1	18	52	52	4	16
Turbot	-	-	-	-	1	-	-
Halibut	-	-	-	-	-	-	-
Dab	-	-	-	-	-	-	-
Plaice	-	1	1	2	-	-	3
Flounder	-	-	-	-	-	-	3
Plaice/Flounder/Dab	+	-	16	46	51	-	-
Common sole	-	-	1	4	-	-	-
Flatfishes, unspecified	-	-	-	-	-	4	10

TABLE 4 (cont.)

Numbers of identified fish bones from Dutch sites. Recovery technique: h = hand-collected, s = sieved, ? = unknown.

Site	Nijehove	Tiel	Leeuwarden I	Leeuwarden II	Schagen	Alkmaar	Haarlem, Jansstraat 46
Site no.	5	6	7	7	8	9	10
Age (centuries)	10-11 AD	9-12 AD	11-14 AD	11-14 AD	12-13 AD	12-14 AD	12-18 AD
Recovery technique	s	h+s	h	h	h+s	?	?
MIGRATORY SPECIES							
Sturgeon	-	12	-	-	-	-	-
Allis shad	-	-	-	-	-	-	-
Twaite shad	-	-	-	-	-	-	-
Shad	-	-	-	-	-	-	-
Salmon	-	-	-	-	-	-	-
Trout	-	-	-	-	-	-	-
Salmon/Trout	-	-	-	-	-	-	-
Whitefish	-	-	-	-	-	-	-
Smelt	+	-	-	-	-	-	-
Eel	+	-	-	-	7	-	37
FRESHWATER SPECIES							
Pike	-	-	-	-	-	-	-
Cyprinids, total	-	1	4	2	-	-	104
Common carp	-	-	2	-	-	-	-
Barbel	-	-	-	-	-	-	-
Tench	-	-	-	-	-	-	-
Orfe	-	-	-	-	-	-	-
Roach	-	-	-	-	-	-	-
Rudd	-	-	-	-	-	-	-
Common Bream	-	-	-	1	-	-	-
White bream	-	-	-	-	-	-	-
Cyprinids, unspecified	-	1	2	1	-	-	104
Wels	-	1	-	-	-	1	-
Burbot	-	-	-	-	-	-	-
Perch	-	1	1	1	-	-	100[4]
Ruffe	-	-	-	-	-	-	-
TOTAL	+	16	96	131	64	20	472

TABLE 4 (cont.)

Numbers of identified fish bones from Dutch sites. Recovery technique: h = hand collected, s = sieved, ? = unknown.

[4] mostly scales.

Site	Haarlem, Brink-mann-Complex	Voorst	Zweins	Leiden	Dokkum	Utrecht	Valkenisse
Site no. (Fig. 6)	10	11	12	13	14	15	16
Age (centuries)	13-15 AD	13-14 AD	13-14 AD	14	14-16 AD	15 AD	15 AD
Recovery technique	s	?	h	h+s	?	?	s
MARINE SPECIES							
Smallspotted catshark	-	-	-	-	-	-	-
Smoothhound	-	-	-	-	-	-	-
Common stingray	-	-	-	-	-	-	-
Thornback ray	-	-	-	-	-	-	-
Ray, unspecified	+	-	-	9	-	-	-
Herring	+	4	-	7	-	+	13
Herring/Sprat	-	-	-	-	-	-	-
European anchovy	-	-	-	-	-	-	-
Garfish	-	-	-	-	-	-	-
Gadids, total	+	6	-	145	+	+	1
Cod	+	6	-	77	+	+	-
Haddock	+	-	-	49	-	-	-
Whiting	+	-	-	19	-	-	1
Ling	-	-	-	-	-	-	-
Ling/Blue ling	-	-	-	-	-	-	-
Torsk	-	-	-	-	-	-	-
Gadids, unspecified	-	-	-	-	-	-	-
European sea bass	-	-	-	-	-	-	-
Atlantic horse-mackerel	+	-	-	-	-	-	-
Meagre	-	-	-	-	-	-	-
Striped red mullet	-	-	-	-	-	-	-
Thicklip grey mullet	-	-	-	-	-	-	-
Thinlip/Golden grey mullet	-	-	-	-	-	-	-
Grey mullets, unspecified	-	-	-	-	-	-	-
Atlantic mackerel	-	-	-	-	-	-	-
Chub mackerel	-	-	-	-	-	-	-
Tub gurnard	-	-	-	2	-	-	-
Three-spined stickleback	+	7	-	-	-	-	-
Flatfishes, total	+	-	-	138	+	+	1
Turbot	-	-	-	-	-	-	-
Halibut	-	-	-	-	-	-	-
Dab	-	-	-	-	-	-	-
Plaice	+	-	-	-	-	+	-
Flounder	-	-	-	-	-	-	-
Plaice/Flounder/Dab	-	-	-	-	-	-	-
Common sole	-	-	-	-	-	-	-
Flatfishes, unspecified	+	-	-	138	+	-	1

TABLE 4 (cont.)

Numbers of identified fish bones from Dutch sites. Recovery technique: h = hand-collected, s = sieved, ? = unknown.

Site	Haarlem, Brink-mann-Complex	Voorst	Zweins	Leiden	Dokkum	Utrecht	Valkenisse
Site no.	10	11	12	13	14	15	16
Age (centuries)	13-15 AD	13-14 AD	13-14 AD	14	14-16 AD	15 AD	15 AD
Recovery technique	s	?	h	h+s	?	?	s
MIGRATORY SPECIES							
Sturgeon	-	-	-	-	-	-	-
Allis shad	-	-	-	-	-	-	-
Twaite shad	-	-	-	-	-	-	-
Shad	-	-	-	-	-	-	-
Salmon	-	4	-	[5] -	-	-	-
Trout	-	-	-	-	-	-	-
Salmon/Trout	-	-	-	-	-	-	-
Whitefish	-	-	-	-	-	-	-
Smelt	-	-	-	1	-	-	-
Eel	+	12	-	14	-	+	8
FRESHWATER SPECIES							
Pike	-	5	1	4	-	-	-
Cyprinids, total	-	38	71	68	-	+	5
Common carp	-	3	1	+	-	-	-
Barbel	-	-	-	-	-	-	-
Tench	-	-	-	-	-	-	-
Orfe	-	-	-	-	-	-	-
Roach	-	6	70	-	-	+	-
Rudd	-	-	-	-	-	-	-
Common Bream	+	1	-	+	-	-	-
White bream	-	-	-	-	-	-	-
Cyprinids, unspecified	+	28	-	+	-	-	5
Wels	-	-	-	-	-	-	-
Burbot	-	-	-	-	-	-	-
Perch	+	[6] 6	-	49	-	+	-
Ruffe	-	1	-	-	-	+	-
TOTAL	+	83	72	437	+	+	28

TABLE 4 (cont.)

Numbers of identified fish bones from Dutch sites. Recovery technique: h = hand-collected, s = sieved, ? = unknown.

[5] 3 scales.

[6] excluding scales.

Site	Deventer	Groningen Raamstadt	Groningen Katten-diep	Scheurrak SO1 Barrel 1	Scheurrak SO1 Barrel 2	Eindhoven
Site no. (Fig. 6)	17	18	18	19	19	20
Age (centuries)	15 AD	16 AD	16 AD	16 AD	16 AD	16-17 AD
Recovery technique	s	?	s	-	-	h+s
MARINE SPECIES						
Smallspotted catshark	-	-	-	-	-	-
Smoothhound	-	-	-	-	-	-
Common stingray	-	-	-	-	-	-
Thornback ray	-	-	4	-	-	54
Ray, unspecified	-	-	2	-	-	-
Herring	-	-	53	-	-	-
Herring/Sprat	-	-	-	-	-	-
European anchovy	-	-	-	-	-	-
Garfish	-	-	-	-	-	-
Gadids, total	21	+	543	4068	2052	417
Cod	16	+	12	4068	142	344
Haddock	-	+	64	-	-	38
Whiting	5	-	22	-	-	35
Ling	-	-	-	-	-	-
Ling/Blue ling	-	-	-	-	6	-
Torsk	-	-	-	-	27	-
Gadids, unspecified	-	-	445	-	1877	-
European sea bass	-	-	-	-	-	-
Atlantic horse-mackerel	-	-	-	-	-	-
Meagre	-	-	-	-	-	-
Striped red mullet	-	-	-	-	-	-
Thicklip grey mullet	-	-	-	-	-	-
Thinlip/Golden grey mullet	-	-	-	-	-	-
Grey mullets, unspecified	-	-	-	-	-	-
Atlantic mackerel	-	-	-	-	-	-
Chub mackerel	-	-	-	-	-	-
Tub gurnard	-	-	-	-	-	-
Three-spined stickleback	-	-	-	-	-	-
Flatfishes, total	1	+	497	-	-	277
Turbot	-	-	4	-	-	5
Halibut	-	-	-	-	-	-
Dab	-	-	1	-	-	-
Plaice	-	-	10	-	-	3
Flounder	-	-	-	-	-	7
Plaice/Flounder/Dab	-	-	482	-	-	-
Common sole	-	-	-	-	-	-
Flatfishes, unspecified	1	+	-	-	-	262

TABLE 4 (cont.)

Numbers of identified fish bones from Dutch sites. Recovery technique: h = hand-collected, s = sieved, ? = unknown.

Site	Deventer	Groningen Raamstadt	Groningen Katten-diep	Scheurrak SO1 Barrel 1	Scheurrak SO1 Barrel 2	Eindhoven
Site no.	17	18	18	19	19	20
Age (centuries)	15 AD	16 AD	16 AD	16 AD	16 AD	16-17 AD
Recovery technique	s	?	s	-	-	h+s
MIGRATORY SPECIES						
Sturgeon	-	-	-	-	-	2
Allis shad	-	-	-	-	-	-
Twaite shad	-	-	-	-	-	-
Shad	-	-	2	-	-	-
Salmon	-	-	-	-	-	-
Trout	-	-	-	-	-	-
Salmon/Trout	-	-	5	-	-	8
Whitefish	-	-	-	-	-	-
Smelt	-	-	4	-	-	-
Eel	205	-	214	-	-	90
FRESHWATER SPECIES						
Pike	-	-	11	-	-	54
Cyprinids, total	1403	-	53	-	-	295
Common carp	-	-	-	-	-	16
Barbel	-	-	-	-	-	-
Tench	-	-	-	-	-	1
Orfe	-	-	-	-	-	-
Roach	-	-	11	-	-	1
Rudd	-	-	1	-	-	-
Common Bream	-	-	3	-	-	1
White bream	-	-	1	-	-	-
Cyprinids, unspecified	1403	-	37	-	-	276
Wels	-	-	-	-	-	-
Burbot	-	-	-	-	-	-
Perch	-	-	2	-	-	43
Ruffe	-	-	-	-	-	-
TOTAL	1630	+	1386	4068	2052	1240

TABLE 4 (cont.)

Numbers of identified fish bones from Dutch sites. Recovery technique: h = hand-collected, s = sieved, ? = unknown.

species of migratory and freshwater fish are present, including sturgeon and wels. Some vertebrae of salmon were cleft, and of the allis shad only remains of the head were found. Therefore, Hoek & Brinkhuizen (1990) interpreted the fish remains as refuse from processing of fish.

Vanderhoeven *et al.* (1994) mentioned a find of chub mackerel in a new, as yet unpublished sample from the same site. Lauwerier (1993) reported on further finds of chub mackerel in another Roman site, Kopse Hof, in Nijmegen: a concentration of bones interpreted as remains of imported fish sauce, as well as remains of three complete specimens which were regarded as having been imported in a salted condition. A sample from fourth century AD Nijmegen revealed another exotic species, namely barracuda, which is also regarded as having been imported (Lauwerier, 1988).

Valkenburg (3)

A Roman castellum situated near the coast. Well-preserved fish bone material dated to the 1st-3rd centuries AD has been recovered from this site. Neither the recovery technique, nor the number of identified bones, was given by Brinkhuizen (1979a) who considered that the recovery technique was responsible for the shorter list of species from Valkenburg ("Valkenburg 1" in Table 4), compared with contemporaneous and similarly situated Velsen.

Laarman (1986) gave a preliminary report on a very big, partly very well-preserved fish bone assemblage from Valkenburg, also from the Roman castellum (Valkenburg 2" in Table 4). The material includes several sieved samples, e.g., a barrel (*dolium*) with more than ten thousand fish bones. The barrel mostly contained remains of flatfishes, but sturgeon and pike were also identified. Flatfishes are in general the commonest type of fish in the material. Of the remaining species on Laarman's list, twaite shad is one of the most frequent (more than a thousand bones). Laarman (1986) reported spurdog from this material; however, his fig. 3 which is said to show spurdog vertebra, rather suggests smoothhound. Migratory species constitute a very large fraction of the material.

Dorestad (4)

A town about 70 km from the North Sea coast situated at a fork from which the Rivers Rhein and Lek continue their flow westwards. Dorestad dates approximately from AD 700-850, at which time it was a major shipping port, trading for example with Germany, England and Scandinavia. Fish bone material was recovered at Dorestad, partly by hand-collecting, partly by sieving through three sieves with meshes of 10 mm, 4 mm and 1.5 mm respectively. The fish bones are from settlements partly at the harbour, partly in the farming area (Prummel, 1978, 1982, 1983). Prummel (1983) analyzed the material in great detail but could demonstrate no differences in fish consumption between the harbour and the agrarian areas. In Table 4, only the total numbers of identified fish bones from excavations post-1967 are therefore given. Older excavations (before 1967, not shown in the table) yielded unrecorded numbers of bones of sturgeon, pike and wels. As can be seen from the species list, most of the fish bones are from freshwater fish, but many are also from migratory species. All these species could have been caught in rivers in the vicinity, probably even in Dorestad itself. In addition, bones of marine species: herring, haddock, unspecified gadids and flatfish were found.

Nijehove (5)

One of the three small settlements which later fused and became Leeuwarden on the Wadden Sea (see below). There are two fish bone assemblages from Nijehove, one was hand-collected and dated to the 9th century AD, the other was sieved through a 0.5 mm mesh and dated to the 10th-11th centuries AD. All the species present, except perch, are common in the Wadden Sea (Brinkhuizen, 1988a).

Tiel (6)

A small sample of fish bones were hand-collected and sieved from kitchen refuse, dated to the 9th-12th centuries AD, from Tiel, ca. 80 km from the North Sea coast. Most of the fish bones are from migratory (sturgeon) and freshwater species (including wels) but plaice is also represented (Lauwerier & Villari, 1995).

Leeuwarden (7)

A town situated about 15 km from the Wadden Sea. Fish bones were hand-collected at two sites in Medieval Leeuwarden, I: Sct. Jacobsstraat, II: Speelmanstraat. Both are from occupation layers

dating from the 11th-14th centuries AD, but may be contaminated with material from the 15th-16th centuries. The majority of the fish bones are from marine species, especially gadids and flatfish. The former are represented by cod, haddock, ling and whiting. Five parasphenoid bones are from ca. 1 m long cod. Several of these have been split longitudinally or carry longitudinal cutmarks. Brinkhuizen (1983) interpreted this as an indication that remains of stockfish are involved. The presence of common carp is also noteworthy.

Schagen (8)

A site which during the 12th-13th centuries was situated close to a flat tidal landscape. A small amount of fish bone material, dated to the 12th-13th centuries AD, was excavated at Schagen in 1980. Bones were both hand-collected and recovered by sieving. Most of the fish bones are from small flounder or plaice which must have been very common locally (Prummel, 1989).

Alkmaar (9)

A town ca. 7 km from the North Sea coast. A small amount of fish bone material from 12th-14th century AD occupation layers has been excavated from Medieval Alkmaar. The recovery technique is unknown. All fish bones are from marine species, except one bone of wels. The cod bones are from individuals about 90 cm long and only represent the head. Haddock is represented by two shoulder girdle bones (cleithrum) (Clason & Brinkhuizen, 1978).

Haarlem, Jansstraat 46 (10)

Haarlem is situated ca. 10 km from the sea coast. Fishbones were recovered during excavations in Jansstraat 46. The material dates from the 12th-18th (mostly 14th-17th) centuries AD. Most of the fish bones derive from a soil sample taken in a pit. They were studied by Seeman (1984).

Marine and freshwater species are about equally represented in the material, cf. the following site.

Haarlem, Brinkmann-Complex (10)

During excavations in the Brinkmann-Complex in Haarlem, several soil samples dated to the 13th-15th century were sieved and yielded a material of fishbones. The bones were identified by P. Kelk and published by van Wijngaarden-Bakker (1980a).

The fish bones represent marine, migratory and freshwater species. The marine species may have been imported from the nearby coast; the freshwater ones may have been caught in the vicinity of Haarlem.

Voorst (11)

Fish bones were obtained from a sample taken in a well in the castle of Voorst, ca. 110 from the North Sea coast. The technique of recovery is not indicated. Freshwater fish, especially cyprinids, dominate the rather small material which dates from the 13th-14th centuries AD (Ijzereef, 1983).

Zweins (12)

Well-preserved faunal remains including fish bones were hand-collected in material dated from 1250-1400 AD excavated from the moat surrounding a "stinswier" (a small mound of about 3 metres height, with a square towerlike castle on top, K. Bosma pers. comm.) near Zweins in Friesland, ca. 6 km from the Waddensea coast. Fish bones were identified by D. Brinkhuizen and published by van Maanen & Vaandrager (1988).

Few fish bones were found, most of them are from roach and may represent one individual only. The find of carp is among the earliest known from the Netherlands.

Leiden (13)

Leiden lies less than 10 km from the North Sea coast. Fish bones were hand-collected and sieved from a soil sample taken under the modern fish market. The sample was dated to the 14th century AD. Fish bones were studied by P. Vos-Kelk and publihed by van Wijngaarden-Bakker (1980b).

Most of the fish bones are from marine fishes, especially gadids and flatfishes, but there is a considerable element of freshwater fishes and a few migratory ones as well.

Dokkum (14), Utrecht (15) and Groningen, Raamstadt (18)

Information on fish remains from these three sites was taken from table 1 in Brinkhuizen

(1979a). The fish remains from Dokkum (ca. 10 km from the Wadden Sea) came from a 14th-16th century AD refuse pit, those from Utrecht (ca. 50 km from the North Sea) from the Catharijne Convent (15th century and later), and those from Groningen (Raamstadt, ca. 25 km from the Wadden Sea) from around the foundations of a castle which was demolished in 1577. Recovery techniques and numbers of identified bones are unknown.

Valkenisse (16)

Excavations in remnants of a castle from the early 15th century situated on a peninsula at the mouth of the estuary of the river Schelde produced a small assemblage of fish bones. The fish bones were recovered by sieving of samples of a latrine pit through a 2 mm mesh. Marine, migratory and freshwater fish are represented in the sample (Lauwerier & Laarman, 1996).

Deventer (17)

A sieved sample of fish bones has been taken in a refuse pit, dated to the 15th century AD, in Deventer, ca. 110 km from the North Sea coast. Due to the huge number of fish bones in the samples, only vertebrae were identified and counted (Laarman, 1989). Eel and cyprinids constitute the vast majority of the identified fish vertebrae, but marine species are available as well.

Groningen, Kattendiep (18)

During excavations at Gedempte Kattendiep-Kleine Peperstraat in Groningen a cesspit dating from the third quarter of the 16th century was found. Fish bones were recovered from soil samples by sieving through a 5 mm mesh. They were studied by Brinkhuizen (1988b).

Marine species, especially gadids and flatfishes, dominate the sample, but eel bones are also numerous. Haddock is the best represented gadid species. Some of the cod were big, about 100 cm.

Scheurrak SO1 (19)

Scheurrak SO1 is the wreck of a merchant vessel which sank in the late 16th century in the Dutch Wadden Sea, northeast of Oudeschild. Three barrels found in the wreck contained fish remains, two of the barrels were analyzed by Brinkhuizen (1994). Barrel 1 contained exclusively cod bones. The representation of bone elements shows that the fish were headless, and that a major part of the backbone had also been removed. Barrel 2 contained bones from cod, torsk and ling/blue ling. Here too, the fish were headless and lacked a large part of the backbone. Barrel 2 also contained the trunks of cod and torsk smaller than 55 cm, where the abdominal part of the backbone had been either totally removed, partly removed, or not removed at all. The length of the cod from the barrels was 35-115 cm, that of the torsk 50-60 cm, and that of the ling/blue ling 50-160 cm. The barrel contents have been interpreted as stockfish meant for consumption on board. Torsk and ling/blue ling are thought to have been caught in the northern part of the North Sea or further north still (Brinkhuizen, 1994).

Eindhoven (20)

Excavations in the former Eindhoven Castle, ca. 100 km from the North Sea coast, yielded fish bone material dating from the 16th to the first half of the 17th century AD. Most fish bones were recovered from a sieved sample. The fish bones were studied by de Jong (1994) who compared the fish bone evidence with written sources. In spite of the considerable distance to the sea, most remains are from marine species, with cod and flatfishes dominating, but there is a significant element of cyprinids and other freswhater species as well. Most of the cod were large (80-113 cm). The high number of remains of thornback ray is noteworthy.

THE NETHERLANDS, OVERVIEW

The oldest Dutch fish bone material covered here dates from the 1st century AD; the youngest reaches marginally into the 18th century. The fish bone samples derives from a varied selection of sources such as Roman military settlements, an early Medieval trading centre, several Medieval urban settlements, castles and a shipwreck. Several of the Dutch sites reviewed above were included in a review by Clason *et al.* (1982).

Local influences on Dutch fishing

The proximity of the North Sea is reflected by the presence of gadids at all sites except Nijmegen, Tiel, Schagen and Zweins, from most of which there is only a small amount of material which is perhaps not representative. Nijmegen and Tiel

furthermore lie relatively far from the sea. Cod, haddock, whiting and ling are present, and even torsk in the rather special material from a ship's cargo. Large cod, represented by both head and trunk bones, have been found in the material from Velsen, a 1st century AD site directly on the North Sea coast from where large cod could possibly have been caught. The proximity of the sea has resulted in a large number of marine species in the Velsen material; in addition to the gadids there are several species of sharks and rays, European seabass, Atlantic horse mackerel, meagre, striped red mullet, several species of grey mullet, mackerel, chub mackerel and tub gurnard. Several of these, smoothhound, common stingray, striped red mullet, chub mackerel and tub gurnard, have a southern distribution. Tub gurnard, for instance, is common off the Dutch North Sea coast but occurs only irregularly further north (Curry-Lindahl, 1985). The presence of these species on the Dutch sites, combined with their virtual absence in material from further north, is striking. Meagre, which has been found at two Dutch sites, viz. Ezinge (4th-3th centuries BC, Brinkhuizen, 1988a) and Velsen 1, is another southern species which is nowadays only rarely caught off the Dutch coast. Velsen 1 has provided the most varied Dutch material, probably due to its ideal location with opportunities for fishing in both salt as well as fresh waters. The fact that the fish bones have been recovered by sieving, resulting in a large representative assemblage, has, however, also played a role. This becomes clear if comparison is made with the otherwise comparable material from Velsen 2.

The material from Nijehove contains, i.a., European anchovy and smelt. The former is another southern species, which is rare north of The Netherlands. Both anchovy and smelt occur, the latter very abundantly, in the Wadden Sea, which is close to Nijehove.

The large amount of material from Dorestad, where sieving was employed, contains evidence of local fishing for a great number of freshwater and migratory fishes in the nearby rivers.

As another example of the local character of Dutch fishing, the small specimens of plaice/flounder/dab from Schagen can be mentioned: these could very well have been caught in the nearby Wadden sea. Also, the large amount of bones of twaite shad found at Valkenburg agrees with the present-day abundance of this species in the nearby coastal waters and inlets.

Although the Dutch fish bone assemblages represent different kinds of sites and different periods, no correlation between the type of fish bones and the kind of site or the period is evident. Differences between the Dutch sites relate rather to whether their location is coastal as opposed to well inland.

Brinkhuizen (1989a) noted that a number of marine species in the Velsen 1 material indicate that fishing took place in the summer half of the year. As all the marine species from Velsen 1 are demersal, Brinkhuizen suggested that fishing at sea was carried out exclusively with lines. On the other hand, the small cyprinids in the material suggest use of nets and traps in fresh water.

Remains of fishing tools from Dutch sites

A rectangular oaken frame, with a wickerwork bottom and remains of the sidewalls still present, was found in the harbour of Medieval Dorestad. This is probably the remains of a livebox which was suspended under water and used for keeping fish alive until needed (Prummel, 1978, 1982; Brinkhuizen, 1986). Brinkhuizen (1986) reviewed finds of prehistoric fishing tools from The Netherlands and other northwest European countries. The Dutch finds include gorges from Dorestad, Friesland and Groningen. Remains of wickerwork fishtraps have been found in the harbour complex at Dorestad (Prummel, 1983; Brinkhuizen, 1986).

Indications of fish trade in the Netherlands

The trading centre of Dorestad was situated far inland but was accessible via rivers. Bones of several marine species have been found here, viz., herring, haddock, unspecified gadids and flatfish. These are the very fish which are suitable for drying or salting with a view to long-distance transport. Remains of gadids and flatfishes have also been found at other inland sites: Utrecht, Deventer and Eindhoven. In these cases fish imported from the North Sea coast must be involved. Groenman-van Waateringe & van Wijngaarden-Bakker (1990) noted that particularly at inland sites, trade in marine fish may be traced, mainly from the 14th century AD onwards, and that at some coastal sites in the southern Netherlands, freshwater fish are frequently found in 14th century AD deposits, whereas they are almost entirely absent from contemporaneous sites in the northern part of the country.

The cod bones from Leeuwarden have been interpreted as remains of stockfish (Brinkhuizen, 1983). The bones in question are five parasphenoid bones from ca. 1 m long cod. Several of the parasphenoids have been split longitudinally or carry longitudinal cutmarks, indicating that the fish were split for the purpose of being dried. The finds of ling in the same assemblages are also interpreted as remains of imported stockfish. Straightforward proof that gadids were actually transported is provided by the shipwreck Scheurrak SO1 in which remains of stockfish in barrels were found. This find shows that cod, ling and torsk were all used for this purpose, and the 16th century butchering technique for gadids can be deduced. Brinkhuizen (1994) speculated that torsk and ling/blue ling came from the northern North Sea or from even further north - torsk has never been caught in Dutch waters.

There is a further example of cured fish which deserves mention, although it is from a somewhat younger period, i.e., the 17th century. This is a find of fish remains from a Dutch whaling station on the island of Spitzbergen in the Arctic Sea. This find includes 3488 cod bones, which are interpreted as remains of preserved fish because the head bones are absent. The Spitzbergen material also includes 386 bones of herring, which were probably caught in the North Sea. It is characteristic that bones from the area behind the herring's head are missing. This is a result of a cut being made behind the head as part of the preservation process (Seeman, 1986). The find on Spitzbergen thus represents the product (known as "haring kaken" in Dutch) of this processing method, in which the gills are removed. In contrast, an example of the corresponding processing refuse was found at the Danish site of Selsø-Vestby, 13th century AD (Enghoff, 1996).

Bones of chub mackerel have been found only at two sites in the Netherlands, both Roman: Velsen 1 and Nijmegen. Brinkhuizen (1989b) and Lauwerier (1993) suggested that these finds indicate import of products to these sites from remote coasts. The find of barracuda at Nijmegen (Lauwerier, 1988) is another example of import of exotic species.

BELGIUM, INDIVIDUAL SITES

The review is based on previous publications, in particular on the review article by Van Neer & Ervynck (1994b) from which much of the following has been directly taken. When no particular reference is given, the archaeological information is from Van Neer & Ervynck's paper.

The site numbers refer to the map, Figure 6. See Table 5 for detailed species lists.

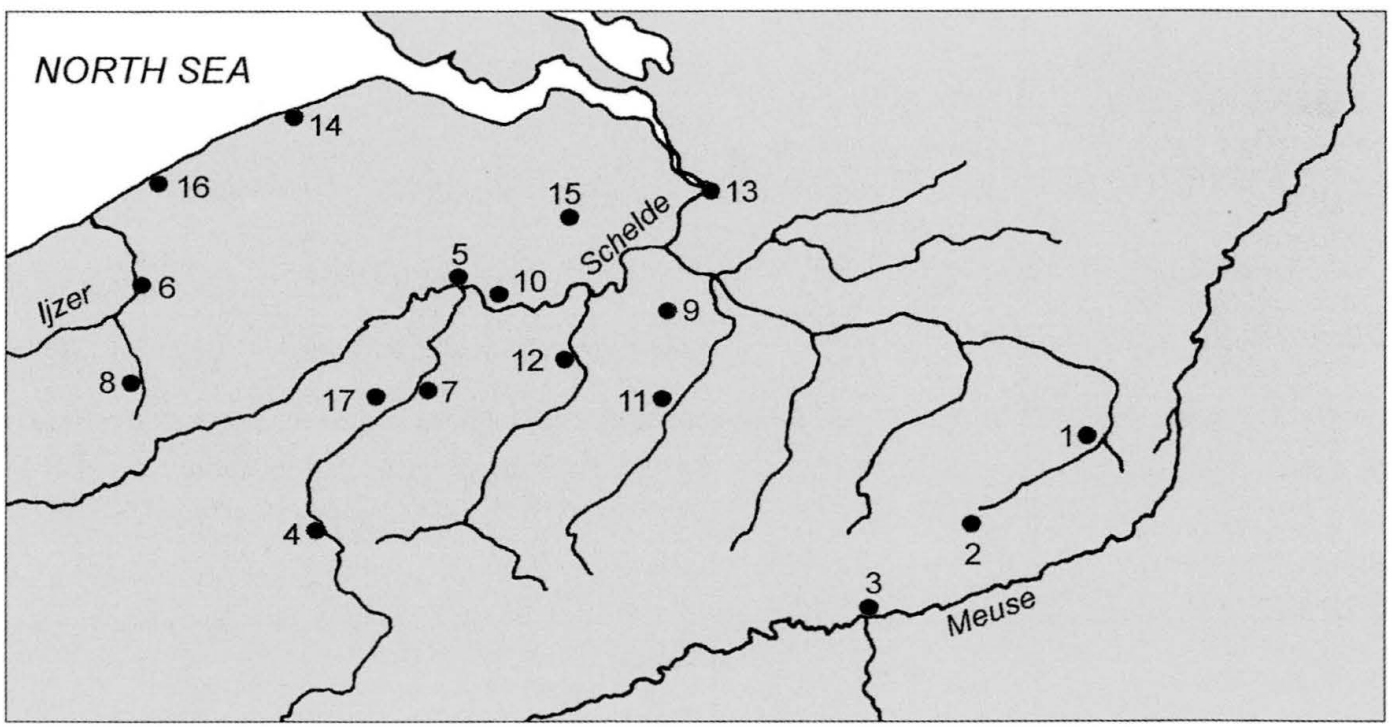

FIGURE 6

Map of Belgium, showing the location of the reviewed sites. Site numbers refer to the section "Belgium, individual sites". Modified after Van Neer & Ervynck (1994b).

Site	Tongeren, Hond-straat	Tongeren, Veemarkt	Tongeren, Minder-broeder-straat	Braives	Namur, Place Marché aux Légumes	Namur, Saint-Gilles	Namur, Saint-Gilles
Site no. (Fig. 6)	1	1	1	2	3	3	3
Age (centuries)	1-2 AD	2 AD	2-4 AD	3 AD	2-3 AD	3-5 AD	11-13 AD
Recovery technique	h	s	s	s	s	h	h
MARINE SPECIES							
Nursehound	-	-	-	-	-	-	-
Topeshark	-	-	-	-	-	-	-
Thornback ray	-	-	-	-	-	-	-
Ray, unspecified	-	-	-	-	-	-	-
Cartilaginous fishes, unspecified	-	-	-	-	-	-	-
Herring	-	-	-	-	-	-	-
Sprat	-	-	-	2	-	-	-
Herring/Sprat	-	-	-	56	-	-	-
European anchovy	-	-	-	-	-	-	-
Garfish	-	-	-	-	-	-	-
Gadids, total	-	-	-	3	-	-	-
Cod	-	-	-	-	-	-	-
Haddock	-	-	-	-	-	-	-
Whiting	-	-	-	3	-	-	-
Saithe	-	-	-	-	-	-	-
Ling	-	-	-	-	-	-	-
Gadids, unspecified	-	-	-	-	-	-	-
European sea bass	-	-	-	-	-	-	-
Black sea bream	-	-	-	-	-	-	-
Meagre	-	-	-	-	-	-	-
Grey mullets	-	-	-	-	-	-	-
Sandeel	-	-	-	1	-	-	-
Atlantic mackerel	-	-	-	-	-	-	-
Chub mackerel	-	-	1	-	-	-	-
Gobiids, unspecified	-	-	-	-	-	-	-
Bullrout	-	-	-	-	-	-	-
Tub gurnard	-	-	-	-	-	-	-
Gurnards, unspecified	-	-	-	-	-	-	-
Three-spined stickleback	-	-	-	1	-	-	-
Flatfishes, total	-	-	-	-	-	-	-
Turbot	-	-	-	-	-	-	-
Halibut	-	-	-	-	-	-	-
Dab	-	-	-	-	-	-	-
Plaice	-	-	-	-	-	-	-
Flounder	-	-	-	-	-	-	-
Plaice/Flounder/Dab	-	-	-	-	-	-	-
Common sole	-	-	-	-	-	-	-
Sole, unspecified	-	-	-	-	-	-	-

TABLE 5

Numbers of identified fish bones from Belgian sites. Recovery technique: h = hand-collected, s = sieved, ? = unknown.

Site	Tongeren, Hond-straat	Tongeren, Veemarkt	Tongeren, Minder-broeder-straat	Braives	Namur, Place Marché aux Légumes	Namur, Saint-Gilles	Namur, Saint-Gilles
Site no.	1	1	1	2	3	3	3
Age (centuries)	1-2 AD	2 AD	2-4 AD	3 AD	2-3 AD	3-5 AD	11-13 AD
Recovery technique	h	s	s	s	s	h	h
MIGRATORY SPECIES							
Sturgeon	-	-	-	-	-	-	1
Shad	-	-	-	-	-	-	-
Trout	-	6	-	-	-	-	-
Whitefish	-	-	1	-	-	-	-
Salmonids, unspecified	6	-	-	-	-	5	-
Smelt	-	-	-	1	-	-	-
Eel	-	12	-	-	+	-	-
FRESHWATER SPECIES							
Pike	-	3	-	-	-	-	-
Cyprinids, total	21	88	4	-	+	19	-
Common carp	-	-	-	-	-	-	-
Gudgeon	-	-	-	-	+	-	-
Barbel	1	-	-	-	-	2	-
Bleak	-	-	-	-	-	-	-
Schneider	-	-	-	-	-	-	-
Tench	-	-	-	-	-	-	-
Minnow	-	10	-	-	-	-	-
Dace	-	9	-	-	-	-	-
Chub	1	4	-	-	-	-	-
Orfe	-	-	-	-	-	3	-
Dace/Chub/Orfe	-	-	-	-	-	1	-
Roach	-	-	-	-	+	-	-
Rudd	-	-	-	-	-	-	-
Common Bream	-	-	-	-	-	-	-
White Bream	-	-	-	-	-	-	-
Spined loach	-	-	-	-	-	-	-
Stone loach	-	-	-	-	-	-	-
Cyprinids, unspecified	19	65	4	-	+	13	-
Wels	-	-	-	-	-	3	-
Burbot	-	-	-	-	-	-	-
Perch	10	4	+[1]	-	-	-	-
Ruffe	-	-	-	-	-	-	-
Percids, unspecified	-	-	-	-	-	-	-
Bullhead	-	1?	-	-	-	-	-
TOTAL	37	116	6	64	+	27	1

TABLE 5 (cont.)

Numbers of identified fish bones from Belgian sites. Recovery technique: h = hand-collected, s = sieved, ? = unknown.

[1] 6 scales.

Site	Namur, Grognon	Namur, Grognon	Namur, Saint-Gilles	Tournai	Gent, Veemarkt	Gent, Kammer-straat	Gent, Belfort-straat
Site no. (Fig. 6)	3	3	3	4	5	5	5
Age (centuries)	12 AD	15-16 AD	14-15 AD	4-5 AD	7-8 AD	12 AD	13 AD
Recovery technique	s	s	s	h	h	h	h+s
MARINE SPECIES							
Nursehound	-	-	-	-	-	-	-
Topeshark	-	-	-	-	-	-	-
Thornback ray	-	-	-	-	-	-	-
Ray, unspecified	-	-	-	-	-	-	1
Cartilaginous fishes, unspecified	-	-	-	-	-	-	-
Herring	5	148	21	-	-	-	71
Sprat	-	-	-	-	-	-	-
Herring/Sprat	-	-	-	-	-	-	-
European anchovy	-	-	-	-	-	-	-
Garfish	-	-	-	-	-	-	-
Gadids, total	-	1	2	-	-	9	82
Cod	-	1	1	-	-	5	7
Haddock	-	-	1	-	-	2	41
Whiting	-	-	-	-	-	-	14
Saithe	-	-	-	-	-	-	-
Ling	-	-	-	-	-	-	-
Gadids, unspecified	-	-	-	-	-	2	20
European sea bass	-	-	-	-	-	-	-
Black sea bream	-	-	-	-	-	-	-
Meagre	-	-	-	-	-	-	-
Grey mullets	-	-	-	-	-	-	-
Sandeel	-	-	-	-	-	-	-
Atlantic mackerel	-	-	-	-	-	-	-
Chub mackerel	-	-	-	-	-	-	-
Gobiids, unspecified	-	-	-	-	-	-	-
Bullrout	-	-	-	-	-	-	-
Tub gurnard	-	-	-	-	-	-	-
Gurnards, unspecified	-	-	-	-	-	-	-
Three-spined stickleback	19	-	6	-	-	-	-
Flatfishes, total	-	-	-	-	-	3	98
Turbot	-	-	-	-	-	-	-
Halibut	-	-	-	-	-	-	-
Dab	-	-	-	-	-	-	-
Plaice	-	-	-	-	-	-	-
Flounder	-	-	-	-	-	-	-
Plaice/Flounder/Dab	-	-	-	-	-	3	98
Common sole	-	-	-	-	-	-	-
Sole, unspecified	-	-	-	-	-	-	-

TABLE 5 (cont.)

Numbers of identified fish bones from Belgian sites. Recovery technique: h = hand-collected, s = sieved, ? = unknown.

Site	Namur, Grognon	Namur, Grognon	Namur, Saint-Gilles	Tournai	Gent, Veemarkt	Gent, Kammer-straat	Gent, Belfort-straat
Site no.	3	3	3	4	5	5	5
Age (centuries)	12 AD	15-16 AD	14-15 AD	4-5 AD	7-8 AD	12 AD	13 AD
Recovery technique	s	s	s	h	h	h	h+s
MIGRATORY SPECIES							
Sturgeon	-	-	-	-	1	-	4
Shad	-	-	-	-	1	-	-
Trout	-	-	-	-	-	-	-
Whitefish	-	-	-	-	-	-	-
Salmonids, unspecified	-	-	-	-	-	-	-
Smelt	-	-	-	-	-	-	3
Eel	14	20	6	-	-	-	42
FRESHWATER SPECIES							
Pike	4	1	-	3	-	-	6
Cyprinids, total	148	323	69	4	2	-	11
Common carp	-	2	-	-	-	-	-
Gudgeon	5	5	-	-	-	-	-
Barbel	3	8	3	-	-	-	-
Bleak	2	1	-	-	-	-	-
Schneider	29	4	-	-	-	-	-
Tench	-	-	-	-	-	-	-
Minnow	-	-	-	-	-	-	-
Dace	5	8	-	-	-	-	-
Chub	-	3	3	-	-	-	-
Orfe	3	-	-	-	-	-	-
Dace/Chub/Orfe	1	1	-	1	-	-	-
Roach	7	10	-	-	-	-	-
Rudd	-	-	-	-	-	-	-
Common Bream	-	-	-	-	2	-	-
White Bream	-	-	-	-	-	-	-
Spined loach	13	-	3	-	-	-	-
Stone loach	-	-	8	-	-	-	-
Cyprinids, unspecified	80[2]	281	52	3	-	-	11
Wels	-	1	-	-	-	-	-
Burbot	-	-	-	-	-	-	-
Perch	2	2	-	-	-	-	5
Ruffe	-	-	-	-	-	-	-
Percids, unspecified	-	1[3]	-	-	-	-	-
Bullhead	8	-	20	-	-	-	-
TOTAL	200	493	124	7	4	12	323

TABLE 5 (cont.)

Numbers of identified fish bones from Belgian sites. Recovery technique: h = hand-collected, s = sieved, ? = unknown.

[2] excluding 31 scales.

[3] excluding 3 scales.

Site	Diksmuide	Ename	Ename	Ename	Ieper	Londer-zeel	Laarne
Site no. (Fig. 6)	6	7	7	7	8	9	10
Age (centuries)	12-13 AD	12-13 AD	14-15 AD	15-16 AD	13 AD	13-14 AD	13-14 AD
Recovery technique	s	h+s	s	s	s	h+s	s
MARINE SPECIES							
Nursehound	-	-	-	-	-	-	-
Topeshark	-	-	-	-	-	-	-
Thornback ray	+	-	1	13	-	-	-
Ray, unspecified	-	-	-	-	-	-	-
Cartilaginous fishes, unspecified	-	-	-	-	-	-	-
Herring	+	4	59	234	-	272	+
Sprat	-	-	-	-	-	-	-
Herring/Sprat	-	-	-	-	-	-	-
European anchovy	-	-	-	-	-	-	-
Garfish	-	-	-	-	-	-	-
Gadids, total	+	4	11	91	16	249	+
Cod	+	2	-	8	5	4	-
Haddock	+	-	4	14	3	75	+
Whiting	+	-	-	10	-	116	-
Saithe	-	-	-	-	-	-	-
Ling	-	-	-	-	-	-	-
Gadids, unspecified	-	2	7	59	8	54	+
European sea bass	-	-	-	-	1	-	-
Black sea bream	-	-	-	-	2	-	-
Meagre	-	-	-	-	-	-	-
Grey mullets	-	-	-	-	-	11	-
Sandeel	-	-	-	-	-	-	-
Atlantic mackerel	+	-	-	-	-	-	+
Chub mackerel	-	-	-	-	-	-	-
Gobiids, unspecified	-	-	-	-	-	-	-
Bullrout	-	-	-	-	-	-	-
Tub gurnard	+	-	-	-	4	-	-
Gurnards, unspecified	-	-	2	-	-	-	-
Three-spined stickleback	-	-	-	-	-	-	-
Flatfishes, total	+	-	24	176	1	93	+
Turbot	-	-	-	1	-	-	-
Halibut	-	-	-	-	-	-	-
Dab	-	-	-	-	-	-	-
Plaice	-	-	-	8	-	-	-
Flounder	-	-	-	1	-	-	-
Plaice/Flounder/Dab	+	-	9	149	1	93	+
Common sole	-	-	-	17	-	-	-
Sole, unspecified	-	-	15	-	-	-	-

TABLE 5 (cont.)

Numbers of identified fish bones from Belgian sites. Recovery technique: h = hand-collected, s = sieved, ? = unknown.

Site	Diksmuide	Ename	Ename	Ename	Ieper	Londer-zeel	Laarne
Site no.	6	7	7	7	8	9	10
Age (centuries)	12-13 AD	12-13 AD	14-15 AD	15-16 AD	13 AD	13-14 AD	13-14 AD
Recovery technique	s	h+s	s	s	s	h+s	s
MIGRATORY SPECIES							
Sturgeon	-	-	-	1	-	39	-
Shad	-	-	-	-	-	-	-
Trout	-	-	-	-	-	-	-
Whitefish	-	-	-	1	-	22	-
Salmonids, unspecified	-	-	-	2	-	-	-
Smelt	-	-	-	-	-	-	-
Eel	+	5	39	175	-	90	+
FRESHWATER SPECIES							
Pike	-	-	4	20	-	42	+
Cyprinids, total	-	7	67	659	-	218	+
Common carp	-	-	35	116	-	1	2
Gudgeon	-	-	-	-	-	-	-
Barbel	-	-	-	-	-	-	-
Bleak	-	-	-	-	-	-	-
Schneider	-	-	-	-	-	-	-
Tench	-	-	-	-	-	4	-
Minnow	-	-	-	-	-	-	-
Dace	-	-	-	-	-	-	-
Chub	-	-	-	-	-	-	-
Orfe	-	-	-	-	-	1	-
Dace/Chub/Orfe	-	-	-	-	-	-	-
Roach	-	-	2	11	-	9	-
Rudd	-	-	1	2	-	2	-
Common Bream	-	-	1	-	-	-	-
White Bream	-	-	1	-	-	1	-
Spined loach	-	-	-	-	-	-	-
Stone loach	-	-	-	-	-	-	-
Cyprinids, unspecified	-	7	27	530	-	200	+
Wels	-	-	-	-	-	-	-
Burbot	-	-	1	2	-	-	-
Perch	-	3[4]	2	9	-	57	-
Ruffe	-	-	-	5	-	-	+
Percids, unspecified	-	-	-	-	-	-	-
Bullhead	-	-	-	-	-	-	-
TOTAL	+	23	210	1388	24	1093	+

TABLE 5 (cont.)

Numbers of identified fish bones from Belgian sites. Recovery technique: h = hand-collected, s = sieved, ? = unknown.

[4] excluding 12 scales.

Site	Brussels, St. Clara	Brussels, St. Clara	Brussels, Sarma	Brussels, Sarma	Aalst	Ant-werpen, Burcht-gracht	Ant-werpen, St. Ont-commer
Site no. (Fig. 6)	11	11	11	11	12	13	13
Age (centuries)	13-14 AD	15-16 AD	14-15 AD	16-17 AD	14 AD	14 AD	16 AD
Recovery technique	h	h	h	h	s	h+s	h
MARINE SPECIES							
Nursehound	-	-	-	-	-	-	-
Topeshark	-	-	-	-	-	-	-
Thornback ray	-	1	-	-	-	-	-
Ray, unspecified	-	-	-	-	-	-	-
Cartilaginous fishes, unspecified	-	-	-	-	-	-	-
Herring	-	-	-	-	77	41	-
Sprat	-	-	-	-	-	-	-
Herring/Sprat	-	-	-	-	-	-	-
European anchovy	-	-	-	-	-	-	-
Garfish	-	-	-	-	-	-	-
Gadids, total	9	128	23	16	16	38	12
Cod	7	59	7	7	-	9	10
Haddock	2	34	8	1	9	15	2
Whiting	-	-	-	-	-	5	-
Saithe	-	-	-	-	-	-	-
Ling	-	-	-	-	-	-	-
Gadids, unspecified	-	35	8	8	7	9	-
European sea bass	-	-	-	-	-	-	-
Black sea bream	-	-	-	-	-	-	-
Meagre	-	1	-	-	-	-	-
Grey mullets	-	-	-	-	-	-	1
Sandeel	-	-	-	-	-	-	-
Atlantic mackerel	-	-	-	-	-	-	-
Chub mackerel	-	-	-	-	-	-	-
Gobiids, unspecified	-	-	-	-	-	-	-
Bullrout	-	-	-	-	-	-	-
Tub gurnard	-	1	-	-	-	-	-
Gurnards, unspecified	-	-	-	-	-	-	-
Three-spined stickleback	-	-	-	-	-	-	-
Flatfishes, total	3	22	6	3	130	60	1
Turbot	-	-	-	-	-	-	-
Halibut	-	-	-	-	-	-	-
Dab	-	-	-	-	-	-	-
Plaice	-	-	-	-	3	-	-
Flounder	-	-	-	-	1	-	-
Plaice/Flounder/Dab	3	22	6	3	126	60	1
Common sole	-	-	-	-	-	-	-
Sole, unspecified	-	-	-	-	-	-	-

TABLE 5 (cont.)

Numbers of identified fish bones from Belgian sites. Recovery technique: h = hand collected, s = sieved, ? = unknown.

Site	Brussels, St. Clara	Brussels, St. Clara	Brussels, Sarma	Brussels, Sarma	Aalst	Ant-werpen, Burcht-gracht	Ant-werpen, St. Ont-commer
Site no.	11	11	11	11	12	13	13
Age (centuries)	13-14 AD	15-16 AD	14-15 AD	16-17 AD	14 AD	14 AD	16 AD
Recovery technique	h	h	h	h	s	h+s	h
MIGRATORY SPECIES							
Sturgeon	-	-	-	1	-	-	1
Shad	-	-	-	-	-	1	-
Trout	-	-	-	-	-	-	-
Whitefish	-	-	-	-	-	-	-
Salmonids, unspecified	-	-	-	-	-	-	-
Smelt	-	-	-	-	-	-	-
Eel	-	-	-	-	47	30	-
FRESHWATER SPECIES							
Pike	-	1	-	-	-	1	-
Cyprinids, total	-	6	3	6	97	10	-
Common carp	-	1	1	1	1		-
Gudgeon	-	-	-	-	-	-	-
Barbel	-	-	-	-	-	-	-
Bleak	-	-	-	-	-	-	-
Schneider	-	-	-	-	-	-	-
Tench	-	-	-	1	-	-	-
Minnow	-	-	-	-	-	-	-
Dace	-	-	-	-	-	-	-
Chub	-	-	-	-	-	-	-
Orfe	-	-	-	-	-	-	-
Dace/Chub/Orfe	-	-	-	-	-	-	-
Roach	-	-	-	-	5	-	-
Rudd	-	-	-	-	1	-	-
Common Bream	-	-	-	-	-	-	-
White Bream	-	-	-	-	-	-	-
Spined loach	-	-	-	-	-	-	-
Stone loach	-	-	-	-	-	-	-
Cyprinids, unspecified	-	5	2	4	90[5]	10	-
Wels	-	-	-	-	-	-	-
Burbot	-	-	-	-	-	-	-
Perch	-	-	-	-	19[6]	2	-
Ruffe	-	-	-	-	-	-	-
Percids, unspecified	-	-	-	-	-	-	-
Bullhead	-	-	-	-	-	-	-
TOTAL	12	160	32	26	386	183	15

TABLE 5 (cont.)

Numbers of identified fish bones from Belgian sites. Recovery technique: h = hand-collected, s = sieved, ? = unknown.

[5] excluding 549 scales.

[6] excluding 51 scales.

Site	Antwerpen, Episcopal Palace	Antwerpen, Gulden-berg	Antwerpen, Zwart-zuster-straat	Heist	Sinaai	Raversijde I	Raversijde II "pit"
Site no. (Fig. 6)	13	13	13	14	15	16	16
Age (centuries)	16-17 AD	16-17 AD	16-17 AD	14-16 AD	14-16 AD	15 AD	15 AD
Recovery technique	s	s	h+s	s	h	s	h
MARINE SPECIES							
Nursehound	-	-	-	-	-	1	-
Topeshark	-	-	-	-	-	1	-
Thornback ray	-	-	-	1	-	+	-
Ray, unspecified	-	-	-	-	-	-	-
Cartilaginous fishes, unspecified	-	-	-	-	-	-	-
Herring	+	3	2	268	-	+	5
Sprat	-	-	-	-	-	-	-
Herring/Sprat	-	-	-	-	-	-	-
European anchovy	-	-	2	-	-	-	-
Garfish	-	-	1	-	-	-	-
Gadids, total	+	37	32	616	82	+	32
Cod	+	14	20	1	34	+	12
Haddock	+	13	4	43	17	+	4
Whiting	+	-	-	220	-	+	-
Saithe	-	-	-	10	-	-	-
Ling	+	-	-	56	-	-	-
Gadids, unspecified	+	10	8	286	31	-	16
European sea bass	-	-	-	-	-	-	-
Black sea bream	-	-	-	-	-	-	-
Meagre	-	-	-	-	-	-	-
Grey mullets	-	-	-	-	-	-	-
Sandeel	-	-	-	-	-	-	-
Atlantic mackerel	-	-	-	-	-	-	-
Chub mackerel	-	-	-	-	-	-	-
Gobiids, unspecified	-	-	-	-	-	-	-
Bullrout	-	-	-	4	-	-	-
Tub gurnard	-	-	-	1	-	-	-
Gurnards, unspecified	-	-	-	-	-	-	-
Three-spined stickleback	-	-	-	-	-	-	-
Flatfishes, total	+	43	24	169	26	+	111
Turbot	-	-	-	-	-	-	-
Halibut	-	-	-	-	-	-	-
Dab	-	-	-	1	-	-	-
Plaice	-	-	2	5	-	-	-
Flounder	-	-	-	-	-	-	1
Plaice/Flounder/Dab	+	43	21	163	26	+	110
Common sole	-	-	1	-	-	-	-
Sole, unspecified	-	-	-	-	-	-	-

TABLE 5 (cont.)

Numbers of identified fish bones from Belgian sites. Recovery technique: h = hand collected, s = sieved, ? = unknown.

Site	Antwerpen, Episcopal Palace	Antwerpen, Gulden-berg	Antwerpen, Zwart-zuster-straat	Heist	Sinaai	Raversijde I	Raversijde II "pit"
Site no.	13	13	13	14	15	16	16
Age (centuries)	16-17 AD	16-17 AD	16-17 AD	14-16 AD	14-16 AD	15 AD	15 AD
Recovery technique	s	s	h+s	s	h	s	h
MIGRATORY SPECIES							
Sturgeon	-	-	2	-	1	-	-
Shad	+	-	-	-	-	-	-
Trout	-	-	-	-	-	-	-
Whitefish	-	-	-	-	-	-	-
Salmonids, unspecified	+	-	2	-	-	-	-
Smelt	+	-	-	-	-	-	-
Eel	+	2	-	6	-	+	6
FRESHWATER SPECIES							
Pike	+	-	1	-	3	-	-
Cyprinids, total	+	1	8	1	1	+	1
Common carp	+	-	4	-	-	-	1
Gudgeon	-	-	-	-	-	-	-
Barbel	-	-	-	-	-	-	-
Bleak	-	-	-	-	-	-	-
Schneider	-	-	-	-	-	-	-
Tench	-	-	-	-	-	-	-
Minnow	-	-	-	-	-	-	-
Dace	-	-	-	-	-	-	-
Chub	-	-	-	-	-	-	-
Orfe	-	-	-	-	-	-	-
Dace/Chub/Orfe	-	-	-	-	-	-	-
Roach	+	-	-	1	-	-	-
Rudd	+	-	-	-	-	-	-
Common Bream	-	-	-	-	-	-	-
White Bream	-	-	-	-	-	-	-
Spined loach	-	-	-	-	-	-	-
Stone loach	-	-	-	-	-	-	-
Cyprinids, unspecified	+	1	4	-	1	+	-
Wels	-	-	-	-	-	-	-
Burbot	-	-	-	-	-	-	-
Perch	-	-	-	-	1	-	-
Ruffe	-	-	-	-	-	-	-
Percids, unspecified	-	-	-	-	-	-	-
Bullhead	-	-	-	-	-	-	-
TOTAL	+	86	74	1066	114	+	155

TABLE 5 (cont.)

Numbers of identified fish bones from Belgian sites. Recovery technique: h = hand-collected, s = sieved, ? = unknown.

Site	Raversijde II "lens"	Petegem
Site no. (Fig. 6)	16	17
Age (centuries)	15 AD	16 AD
Recovery technique	s	h+s
MARINE SPECIES		
Nursehound	-	-
Topeshark	-	-
Thornback ray	1	6
Ray, unspecified	1	-
Cartilaginous fishes, unspecified	-	-
Herring	44	-
Sprat	-	-
Herring/Sprat	-	-
European anchovy	-	-
Garfish	-	-
Gadids, total	5	147
Cod	-	50
Haddock	1	4
Whiting	3	-
Saithe	-	-
Ling	-	-
Gadids, unspecified	1	93
European sea bass	-	-
Black sea bream	-	-
Meagre	-	-
Grey mullets	-	-
Sandeel	-	-
Atlantic mackerel	-	-
Chub mackerel	-	-
Gobiids, unspecified	4	-
Bullrout	-	-
Tub gurnard	-	-
Gurnards, unspecified	-	-
Three-spined stickleback	-	-
Flatfishes, total	9807	36
Turbot	-	-
Halibut	-	-
Dab	-	-
Plaice	183	-
Flounder	-	-
Plaice/Flounder/Dab	9624	35
Common sole	-	1
Sole, unspecified	-	-

TABLE 5 (cont.)

Numbers of identified fish bones from Belgian sites. Recovery technique: h = hand-collected, s = sieved, ? = unknown.

Site	Raversijde II "lens"	Petegem
Site no.	16	17
Age (centuries)	15 AD	16 AD
Recovery technique	s	h+s
MIGRATORY SPECIES		
Sturgeon	-	-
Shad	-	-
Trout	-	-
Whitefish	-	-
Salmonids, unspecified	-	-
Smelt	-	-
Eel	9	-
FRESHWATER SPECIES		
Pike	-	-
Cyprinids, total	-	23
Common carp	-	-
Gudgeon	-	-
Barbel	-	-
Bleak	-	-
Schneider	-	-
Tench	-	1
Minnow	-	-
Dace	-	-
Chub	-	-
Orfe	-	-
Dace/Chub/Orfe	-	-
Roach	-	-
Rudd	-	-
Common Bream	-	-
White Bream	-	-
Spined loach	-	-
Stone loach	-	-
Cyprinids, unspecified	-	22
Wels	-	-
Burbot	-	-
Perch	-	-
Ruffe	-	-
Percids, unspecified	-	-
Bullhead	-	-
TOTAL	9871	212

TABLE 5 (cont.)

Numbers of identified fish bones from Belgian sites. Recovery technique: h = hand-collected, s – sieved, ? – unknown.

Tongeren: Hondstraat and Veemarkt (1)

A former Roman inland *civitas* capital. During rescue excavations, fish bones were hand-collected from a cesspit found at Hondstraat in the backyard of a rich Roman urban residence dated to the 1st-2nd centuries AD. From another cesspit (at Veemarkt), which once belonged to a rich household from the 2nd century AD, fish bones were recovered by sieving.

The fish represented in these cesspits are exclusively freshwater and migratory species.

Tongeren, Minderbroederstraat (1)

Vanderhoeven *et al.* (1994) reported on fish bones from a third pit in Tongeren. They were recovered by sieving and dated to the 2nd century AD.

In addition to freshwater fish (cyprinids and perch) this sample contains a bone of the marine chub mackerel. This species is very rare off the Belgian coast today and the find is interpreted as the remains of imported salted fish or fish sauce from the South, the first Belgian find of its kind. At the same site, a small number of fish remains were found in the fill of a fourth century oven. These include a vertebra of the whitefish family which does not occur in Belgian inland waters today.

Braives (2)

A late Roman inland settlement. Fish remains were recovered by sieving through a 0.5 mm mesh from the 3rd century AD fill of a well.

In spite of the inland location of Braives, the material is dominated by marine species, mostly herring/sprat. Whiting, smelt, sandeel and three-spined stickleback are also present. The specimens were all very small (4-5 cm). Van Neer & Lentacker (1994) reached the conclusion that the fish must have been caught in inshore waters along the northeastern Atlantic coast, during spring or early summer, using small-meshed fishing gear. Due to the poor durability of such small fish, Van Neer & Lentacker (1994) assumed that they were preserved in the form of fish sauce before being transported to Braives.

Namur, Place Marché aux Légumes and Saint-Gilles (3)

Namur is an inland site, ca. 125 from the coast, from where several fish bone assemblages have been studied. Excavations of the central part of a Roman settlement at the Place Marché aux Légumes yielded fish bone material. This was recovered by sieving the fill of a well from the 2nd-3rd centuries AD. Excavation at Saint-Gilles yielded faunal remains corresponding to a peripheral part of the settlement near the ancient harbour. There is material from three periods at the Saint-Gilles site: hand-collected material from the 3rd-5th and the 11th-13th centuries AD, and a sieved sample from a pot found in the well and dated to the 14th-15th centuries AD.

The fish found at the Place Marché aux Légumes are migratory and freshwater species, especially cyprinids. The same is true of the two oldest samples from Saint-Gilles. In contrast, the late Medieval material (14th-15th centuries) also contains marine species: herring, cod and haddock.

Namur, Grognon (3)

Fish remains were recovered from this site at Namur by sieving the contents of a cesspit excavated in 1995 through 5 mm, 4 mm and 2 mm meshes. The fish bones are dated partly to the 12th, and partly to the 15th-16th centuries AD. They were studied by Van Neer & Lentacker (1996).

Naturally enough, most of the fish bones are from freshwater species but two marine species are present, viz., herring and cod. Among the freshwater fish, the presence of wels and common carp in the 15th-16th century material should be noted. The latter indicates pisciculture (carp production). All the specimens of freshwater fish are very small, for example pike (10-25 cm) and eel (20-30 cm). This suggests intense exploitation of the fish fauna.

Tournai (4)

A fortress in the central part of a Roman settlement on the River Scheldt. Faunal remains were hand-collected and dated to the 4th-5th centuries AD.

The few fish bones from Tournai are from freshwater species: cyprinids and pike.

Gent, Veemarkt, Kammerstraat and Belfortstraat (5)

Gent is situated more than 40 km from the coast, on the River Schelde. The few fish bones

from Veemarkt are from the 7th-8th centuries AD and were hand-collected from a Merovingian well. The small amount of hand-collected material from Kammerstraat represents 12th century AD household refuse. A somewhat larger body of material was partly hand-collected, partly sieved from slightly younger deposits (an urban refuse heap from the 13th century AD) at Belfortstraat.

The Veemarkt and Kammerstraat fish bone samples are too small to be considered representative. The Belfortstraat assemblage is dominated by marine fish: ray, herring, cod, whiting, haddock and plaice/flounder/dab. In addition there are bones of freshwater and migratory species, for example, sturgeon, smelt and eel. The 12th century (Kammerstraat) sample also contains marine fish, whereas that from the 7th-8th centuries (Veemarkt) does not.

Diksmuide (6)

A site lying about 20 km from the coast, on the River Ijzer. The material was recovered by sieving of a refuse layer dated to the 12th-13th centuries.

The material has only been preliminarily analyzed but seems to be dominated by marine species, in particular herring, cod, haddock and plaice/flounder/dab. Other notable species are ray, whiting, tub gurnard and Atlantic mackerel.

Ename, Abbey of St. Salvator (7)

An inland abbey in East Flanders, ca 60 km from the sea.

One assemblage, dated to the 12th-13th centuries AD, is from a cesspit at the abbot's lodgings. It represents a mixture of household refuse and human excrement. The fish bones, which were recovered by hand-collecting and sieving, represent freshwater as well as marine species (Ervynck *et al.*, 1994).

Further material from this site derives from a cess- and refuse pit (14-15th centuries AD) from the guest quarters of the abbey. The fish bones are from a sample of 25 litres sieved through a 0.5 mm mesh. Marine and freshwater species are roughly equally represented. Herring, eel and common carp are the most frequent species (Ervynck *et al.*, 1996).

A third source of material from the Ename abbey is constituted by food debris which had gradually accumulated under a kitchen floor in the abbey. This material is from the 15th-16th centuries AD and was sieved. The fish bones represent no less than 20 different species (Van Neer & Ervynck, 1994b; Ervynck & Van Neer, 1992a).

Even though Ename lies far from the sea, there are bones from several marine fish species, i.e., thornback ray, herring, haddock, cod, whiting, common sole, plaice, flounder and turbot. The herring from the 15-16th centuries kitchen debris appear to have had their gills removed, bones from the shoulder girdle being consistently absent. The most frequent freshwater species is the common carp.

Van Neer & Ervynck (1996) reviewed all the fish bone assemblages from Ename.

Ieper, Lakenhalle (8)

A site ca. 35 km from the coast, lying on a tributary of the River Ijzer. A small number of fish bones were hand-collected from a 13th century refuse layer, excavated in the inner court of the Cloth Hall of Ieper. All bones are from marine species: cod, haddock and plaice/flounder/dab, plus an element of southern species: tub gurnard, European seabass and black sea bream (Ervynck *et al.*, 1990).

Londerzeel (9)

A castle situated about 80 km from the sea. A late Medieval refuse layer was excavated from the slope of the castle moat. The material, which was recovered using both hand-sampling and sieving, is presumed to reflect the general food consumption of the castle household.

The large and varied assemblage includes marine, migratory and freshwater species. Bones from herring, cod, whiting, haddock and plaice/flounder/dab are very frequent, as are bones from eel and cyprinids, the latter being represented by no less than six species.

Laarne (10)

Another castle, more than 60 km from the sea. A refuse deposit, dated to the 13th-14th centuries AD, was found in a cellar. The refuse probably comes from the servants' quarters and does not illustrate the consumption habits of the castle owners. The entire material was sieved.

The material includes both marine and freshwater species. Most frequent are herring, haddock and plaice/flounder/dab.

Brussels: St. Clara and Sarma (11)

Brussels is situated just less than 100 km from the sea, on a tributary to the River Schelde. Several urban refuse deposits were found at St. Clara Abbey in central Brussels and were dated to the 13th-14th centuries AD, i.e. prior to the abbey being built. A few fish bones were hand-collected. Somewhat younger (15th-16th centuries) hand-collected material from the same place represents household refuse, most probably brought in from the urban neighbourhood.

Several hand-collected late Medieval assemblages representing refuse were collected at the site Sarma. They are dated to either the 14th-15th or the 16th-17th centuries AD.

In the finds from Brussels, which are all of small or modest size, cod, haddock and plaice/flounder/dab dominate. A few bones of the southern species, tub gurnard and meagre, from the 15th-16th centuries at St. Clara are of note, as is the presence of common carp both at St. Clara (15th-16th centuries) and at Sarma (both periods).

Aalst: Holy Ghost Chapel (12)

Aalst is an inland town in eastern Flanders from where a small amount of fish bone material from the 14th century has been recovered by sieving. Both freshwater and marine species are present. The latter are represented by herring, haddock, plaice and flounder, species which are all well suited for preservation and transport. The presence of common carp is noteworthy, being among the oldest Belgian finds of this fish. Pieters *et al.* (1993) thought that the material represents a poor household since expensive fish such as cod, pike and common sole are absent.

Antwerpen: Burchtgracht, St. Ontcommer, Episcopal Palace, Guldenberg I, Zwartzusterstraat (13)

The city of Antwerpen is situated at the base of the Schelde estuary. Several fish bone assemblages, dating from the 14th-17th centuries AD, have been excavated here, the oldest being hand-collected and sieved material from the 14th century fill of the artificial ditch Burchtgracht. The others are: hand-collected material from the fill of an urban cesspit at St. Ontcommer (16th century); the sieved contents of refuse pits and cesspits at the Episcopal Palace (16th-17th centuries); hand-collected and sieved material from a refuse pit at Guldenberg I (16th-17th centuries); partly-sieved material from two pits in Medieval and post-Medieval houses in Zwartzusterstraat (16th-17th centuries).

Most of the fish bones in the Antwerpen material are from marine fish; in particular herring, cod, whiting, haddock and plaice/flounder/dab. Ling is present in the sample from the Episcopal Palace. The material from Zwartzusterstraat is slightly more varied than the others and contains, i.a., bones of European anchovy and garfish.

Heist (14)

A former fishing village on the coast. Sieved samples from 14th-16th century AD refuse pits and well fills have yielded one of Belgium's largest fish bone assemblages.

With the exception of seven examples, all the fish bones are from marine species, viz., thornback ray, herring, cod, whiting, haddock, saithe, ling, tub gurnard, bullrout, plaice and dab.

Sinaai, Boudelo Abbey (15)

Sinaai is situated ca. 50 km from the coast. Fish bone material was recovered by hand-collection during excavations at the abbey. The dating (14th-16th centuries AD) is rather tentative.

Most of the fish bones are from marine fish, viz., cod, haddock and plaice/flounder/dab. The representation of different skeletal elements indicates that entire gadids were imported to the abbey. The cod were 60-120 long, the haddock 30-60 cm (Gautier & Van Neer, 1991).

Raversijde (16)

An abandoned Medieval fishing village on a former island off the Belgian coast.

Van Neer & Ervynck (1994b) reviewed finds of fish bones from one of many excavated contexts at Raversijde (I). This find, dating from the 15th century AD, consists almost exclusively of marine fish: several species of cartilaginous fish and gadids, in addition to herring and many flatfish. There are only a few bones of eel and common carp.

Pieters *et al.* (1994) and Van Neer & Pieters (1997) reported on another find from 15th century Raverside (II) which turned out to be of a very special character. The material derives from a rubbish pit. Within the pit there was a lens (volume approximately 21 l) with a concentration of fish remains. The lens was sieved (series of meshes ranging from 2 to 0.25 mm), bones from the rest of the pit were hand-collected. The fish bones from the lens belong almost exclusively to plaice and represent a minimum of 130 individuals. The most interesting aspect of this find is that it comprises almost only bones from the head and tail. In addition, there are the shells of the bivalve *Donax vittatus* which are interpreted as fish stomach contents. Cutmarks behind the head and near the caudal fin are frequent. Apparently this find represents waste products from the processing of plaice. The narrow size range of the plaice indicate that they may have been intended for export. The material from the rest of the pit is interpreted as kitchen or table refuse. The single bone of common carp may be interpreted as evidence of import from the inland (Van Neer & Pieters, 1997).

Petegem, Beaulieu Abbey (17)

A site ca. 60 km from the coast, on the River Schelde.

A large refuse pit, probably dating back to the beginning of the 16th century, was excavated during a rescue excavation at the site of the former Beaulieu Abbey. Fish remains were hand-collected from among the household refuse. Most of the fish bones are from marine species, including thornback ray, cod, haddock, plaice/flounder/dab and sole (Van Neer & Ervynck, 1994b). Ervynck & Van Neer (1992b) interpreted the Beaulieu Abbey bones as refuse from a not very wealthy kitchen because expensive fish species are absent. Fish consumption seems to have depended entirely upon import of marine fish.

BELGIUM, OVERVIEW

Van Neer & Ervynck (1994b) have presented a detailed review of fish remains from Belgian archaeological sites. The interpretation of Belgian fishing in the present paper is very much based on their paper. Some newer publications have, however, also been incorporated. Another review paper on Belgian fishing is that of Van Neer & Ervynck (1994a). Ervynck & Van Neer (1995) discussed fish remains from Medieval castles, abbeys and towns in Flanders.

The Belgian fish bone material reviewed here covers the period from the 1st to the 17th centuries AD and represents many different types of sites. The Roman sites form a category of their own, as opposed to the Medieval sites, which include fishing villages on the coast, inland towns, abbeys, monasteries and castles.

Local influences on Belgian fishing

Belgian sites are generally dominated by marine species, except the Roman sites which are also the oldest. Among the marine species, gadids, plaice/flounder/dab, and herring in particular were important. The gadids are primarily represented by cod and haddock, but there are also more whiting than seen in other countries (an explanation for this is not obvious). It is characteristic that bones of herring are present in the sieved samples but absent from those which have merely been hand-collected.

There are a number of species on the Belgian species list which show that the country lies further south than those reviewed so far. Nursehound, which occurs in the material from the fishing village of Raversijde, has a southern distribution in Europe, occurring only irregularly north of the English Channel. Nursehound is a species of shark which frequents coastal waters to a depth of 60 m (Curry-Lindahl, 1985): it was thus within the reach of coastal fishermen. Other marine species with southern distributions are European anchovy, tub gurnard, European seabass, black sea bream, meagre and grey mullet. Several of these, for example, black sea bream, are common in the English Channel and further south. Black sea bream, European seabass and tub gurnard were found at Ieper, the latter also occurred at Diksmuide. These towns are located on the River Ijzer, the estuary of which lies close to the English Channel and is therefore more likely to receive the southern warm-water species than the more northerly River Schelde (Ervynck & Van Neer, 1995). European anchovy and tub gurnard also occur in some of the finds from the Netherlands, just north of Belgium. Meagre has also been found at some Dutch sites and is represented at one German site (Feddersen Wierde on the North Sea coast). The occurrence of thornback ray at no less than six Belgian sites is also noteworthy.

Quite a large number of freshwater species are represented, as a result of the inland location of most of the Belgian sites. The commonest of these are perch, cyprinids and pike. Barbel can be regarded as representing a more local element. The species of fish represented at the Belgian sites indicate both net and line fishing.

Remains of fishing tools from Belgian sites

Van Neer & Ervynck (1994a) mentioned a find of an eel trap from the Abbey of St. Salvator in Ename, as well as several net sinkers and a line sinker from Raversijde.

Fishing from Roman sites in Belgium

The samples from Tongeren, Braives and Namur (Place Marché aux Légumes, Saint-Gilles 3rd-5th centuries AD) are all from Roman settlements. At the same time, they represent the oldest Belgian assemblages in the considered period, being from the 1st-5th centuries AD, and will therefore be commented on separately.

All the Roman sites lie inland. Apart from Braives, from where freshwater fish are absent, and Tongeren where a single bone of a marine species was found, the Roman sites have yielded bones exclusively of freshwater fish, with a few remains of migratory species. The samples from Tongeren (Veemarkt) and Namur (Place Marché aux Légumes) are characterized by being composed of bones from very small individuals; more than 70% of the fish bones from Tongeren (Veemarkt) are from fish below 15 cm in standard length (Van Neer & Ervynck, 1994b). Regular exploitation of small freshwater fish seems to have taken place at the Roman sites. The material from Braives consists of even smaller fish: 4-5 cm in standard length, in this case exclusively marine species, especially clupeids, smelt and three-spined stickleback. Considering the size of these fish, and the difficulties it would have given to tranport them in a fresh state, Van Neer & Ervynck (1994b) interpreted this find as the remains of fish sauce, see also Van Neer & Lentacker (1994). In the material from Tongeren (Minderbroederstraat), a single bone of chub mackerel was found which was interpreted as the remains of fish sauce or salted fish imported from the south (Vanderhoeven *et al.* 1994).

Towns, fishing villages, monasteries and castles

The material from the non-Roman sites in Belgium covers the 7th-17th centuries AD, the more recent part of the period being best represented.

A striking characteristic of these sites is the great importance of marine fish, which strongly dominate almost all the assemblages.

Naturally enough, the marine dominance is most pronounced in material from the coastal fishing villages of Heist and Raversijde. Not only do almost all fish remains from these sites represent marine species, but the range of marine species is also the most diverse. For instance, Raversijde is the only Belgian site where shark remains have been found. Heist has provided the only Belgian record of saithe, and ling is known only from Heist and one other site.

Even in the inland towns, the marine dominance is very obvious. This is true, for example, of Antwerpen and Gent on the River Schelde, and Ieper and Dijksmuide on the River Ijzer. The number of marine species is particularly high at the two latter sites (which are also closer to the sea than the others) and includes, for example, thornback ray, tub gurnard, European seabass and black sea bream. Further inland, the town of Namur is situated on the River Meuse and here freshwater fish appear to have been more important than marine species.

Although most of the material from monastery and castle sites is dominated by marine species, Van Neer & Ervynck (1994b) believed that freshwater fish were exploited to a greater degree in the castles and abbeys than in contemporaneous urban settlements. Freshwater (and migratory) fish, especially eel and common carp, actually dominate in the material from St. Salvator's Abbey at Ename. There were often special rules for food consumption in abbeys, giving particular importance to fish. The find of common carp from Ename is the largest find of its kind from Belgium and indicates carp rearing at this site. Bones of common carp occur regularly in material from Belgian urban, monastery, abbey and castle sites (Antwerpen, Brussels, Laarne, Londerzeel and Ename). Carp seem to have served the purpose of providing a stable supply of fish. The material from the castle at Laarne is supposed to derive from the servants' quarters, but that from Londerzeel is thought to give an impression of the general food consumption at the castle. Marine fish dominate here, but freshwater species also played an important role.

Indications of fish trade in Belgium

Marine fish could of course be caught by the inhabitants of the coastal sites but their occurrence inland must be the result of trade. All the Belgian inland sites lie near rivers, by which fish could have been transported from the coast. According to Van Neer & Ervynck (1994b), the fish bone evidence offers no possibility of dating the onset of the trade in marine fish because of the lack of early Medieval material. There are no marine species among the four fish bones from 7th-8th century Gent, whereas in 12th century Gent, marine fish seem to have been imported, because cod, haddock and plaice/flounder/dab are present. There are no remains of herring but then, sieving was not carried out. Similar indications of the import of marine fish are generally seen in all the material from the 12th century AD onwards, and imported fish appears to have been of great importance. Van Neer & Ervynck (1994b) believed that this large-scale importing of seafish inland should not be regarded as result of a culinary demand but rather as having been necessitated by the pollution of inland running waters, tax regulations, over-exploitation etc. At many of the sites it has also been noted that the freshwater fish which were exploited were extremely small. For instance, 10-25 cm long pike and 20-30 long eels were caught in Namur (Grognon), indicating intense exploitation, bordering on over-exploitation of the fish fauna (Van Neer & Lentacker, 1996; see also Ervynck *et al.*, 1999). Several of the freshwater species which are present in the Belgian material are now extinct in Belgium, viz., burbot, whitefish, wels and sturgeon. It should be noted that from the 12th century onwards, haddock is included in the seafish imported to Belgian inland sites.

St. Salvator's Abbey in Ename, far from the coast, could be mentioned as an example of the import of seafish, although freshwater fish dominate the bone material. A wide range of marine fish was imported to Ename: thornback ray, herring, cod, whiting, haddock, turbot, plaice, flounder and common sole.

Namur is another example, situated still further inland. The material from Namur, Grognon, includes fish bones from different chronological phases. The 12th century material includes a mere five herring bones, no gadids or flatfish. In the 15th-16th century material, by contrast, there are many herring bones plus a single cod bone. This trend continues into the 17th century which presents many bones of herring, cod and plaice/flounder/dab (Van Neer & Lentacker, 1996; this assemblage is not included in Table 5 as it falls outside the scope of the present paper). The cod from Grognon seem to represent remains of stockfish. A similar tendency is seen at nearby sites in the Meuse bassin, whereas in Flanders, the import of seafish started earlier. The reason for this discrepancy could be the long distance from Namur to the coast (Van Neer & Lentacker, 1996), but might also be due to a smaller need for marine fish in the Meuse bassin where the pressure on freshwater fish would have been less than in more densely populated Flanders (Ervynck *et al.*, 1999).

Transport of fish from the inland to the coast may be indicated by the find of a single bone of common carp at Raversijde (Van Neer & Pieters, 1997).

Evidence of the processing of fish constitutes, in turn, further evidence of trade. The Belgian material offers several examples of processing. The oldest of these is the Roman material from Tongeren, Minderbroederstraat, from where a bone of chub mackerel has been interpreted as being the remains of imported fish sauce or salted fish from southern countries (Vanderhoeven *et al.*, 1994), cf. the chapter "Indications of fish trade in the Netherlands" above. Van Neer & Ervynck (1994b) mentioned that from the second century AD onwards, the original Mediterranean fish sauce was replaced by a local product produced along the Atlantic coast of Gallia. The 3rd century material from Braives, another Roman site, supports this conclusion. It consists of bones of very small marine fish, 4.5 cm long, and is interpreted as the remains of fish sauce prepared from fish caught in the northeastern Atlantic (Van Neer & Ervynck, 1994b; Van Neer & Lentacker, 1994). Remains of herring, which appear to have had their gills removed, were found under the kitchen floor in St. Salvator's Abbey in Ename: bones from the shoulder region were consistently missing (Van Neer & Lentacker, 1994). A mass of remains of processed plaice has been found in the fishing village of Raversijde: thousands of bones from the head and tail, together with presumed stomach contents represented by bivalve shells. Pieters *et al.* (1994) and Van Neer & Pieters (1997) suggested that the plaice were processed for future consumption and export inland.

EASTERN ENGLAND, INDIVIDUAL SITES

The review is based on already published results plus one unpublished report from the part of England facing east to the North Sea (from the Scottish border in the north to the Straits of Dover in the south). For a few sites, the only dating available is a reference to the "Roman" period which corresponds to ca. 55 BC - ca. 440 AD (Morgan, 1984).

The site numbers refer to the map, Figure 7. See Table 6 for detailed species lists.

York, 46-54 Fishergate (1)

York is situated ca. 60 km from the coast, at the confluence of the Rivers Ouse and Foss in northeastern England. Fish bones were recovered during the period 1985-86 by sieving of bulk samples through a 2 mm mesh sieve. The bone material derives, i.a., from 8th-9th century AD deposits associated with a presumed Anglian trading settlement. The archaeological evidence suggests that it is improbable that the settlement was occupied long after the Viking capture of York in AD 866. The larger fish bones from these deposits showed evidence of having been gnawed by dogs and other scavengers and many of the samples derive from cess pits. Fish bones from some of the latter were found to be crushed or flattened and were interpreted as having been eaten by people. Fish bones were also found in deposits connected with a church and cemetery dated to the 11th-12th centuries AD, and in deposits from a Medieval priory of the Gilbertine order dated to the 12th-16th centuries. Finally, fish bone material dated to the 16th century AD is connected with the demolition of the priory. In addition, some fish bones were found together with traces of Roman agricultural activity (1st-2nd centuries AD); it has, however, been suggested that these were all or mostly contamination from overlying Medieval deposits. Fish bones from Fishergate were identified and recorded by A.K.G. Jones, *in* O'Connor (1991).

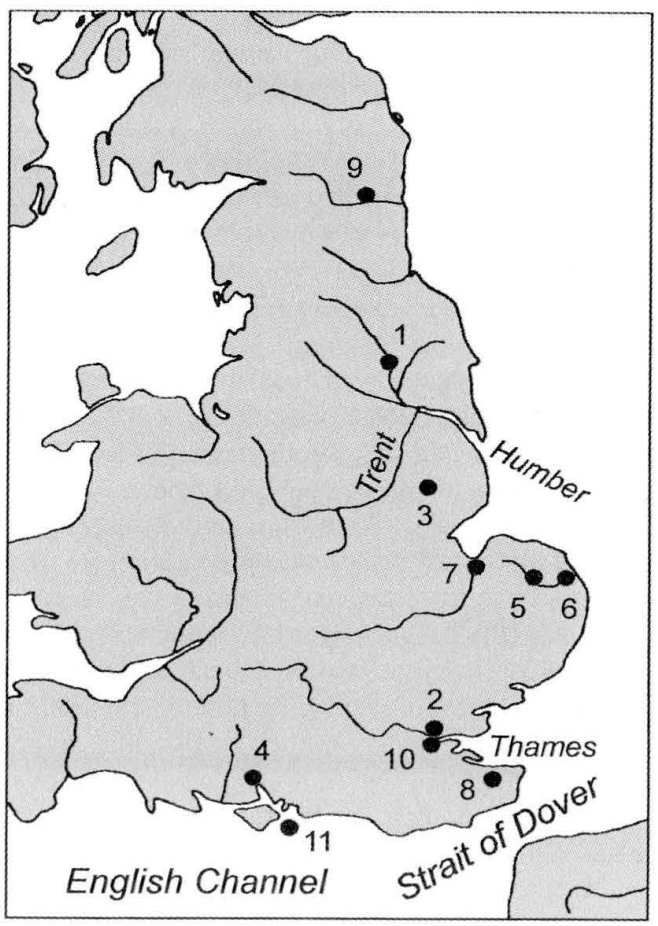

FIGURE 7

Map of eastern England, showing the location of the reviewed sites. Site numbers refer to the section "England, individual sites".

A wide range of fish species is present, from the site as a whole, including marine, migratory and freshwater species. Herring, eel and cyprinids seem to have been important during all periods.

The Anglian settlement (8th-9th centuries) relied heavily on eels. Cyprinids and herring were also of importance. Eel and herring were of equal importance in the 11th-12th century material. The abundance of cyprinids is less than in the previous period but then, gadids had achieved a certain importance. When the priory was in use herring was the most abundant species, whereas gadids were still of only moderate importance. In the youngest material (16th century) the importance of cod is greater, herring is still important but the cyprinids are far less significant. The general tendency thus seems to be a development from primarily eels and secondarily cyprinids during the 8th-9th centuries, to a more intense exploitation of herring during the 11th-12th centuries and an increase in the importance of gadids during the 12th-16th centuries, when the priory was in use and subsequently demolished.

The older phases in the material include species characteristic of rivers and estuaries, such as shad, grayling, barbel and burbot, whereas the younger phases include offshore marine species like thornback ray, conger eel, turbot and halibut.

Site	York, Fishergate	York, Fishergate	York, Fishergate	York, Fishergate	York, Fishergate	York, Church Street	York, Skelder-gate
Site no. (Fig. 7)	1	1	1	1	1	1	1
Age (centuries)	1-2 AD	8-9 AD	11-12 AD	12-16 AD	16 AD	"Roman"	"Roman"
Recovery technique	s	s	s	s	s	s	s
MARINE SPECIES							
Dogfish	-	-	2	-	-	-	-
Spurdog	-	-	-	-	-	-	-
Common stingray	-	-	-	-	-	-	-
Thornback ray	-	-	-	6	19	-	-
Ray, unspecified	-	-	1	-	9	-	-
Cartilaginous fishes, unspecified	1	-	2	1	14	-	-
Herring	50	714	716	685	1273	-	-
Herring/Sprat	-	-	-	-	-	-	
Sprat	-	-	-	-	-	-	-
Clupeids, unspecified	-	-	-	-	-	-	+
Conger eel,	-	-	-	1	2	-	-
Garfish	-	-	-	-	-	-	-
Hake	-	-	-	-	-	-	-
Gadids, total	2	31	79	181	781	-	-
Cod	-	17	50	51	111	-	-
Haddock	1	3	7	62	432	-	-
Whiting	1	1	-	47	176	-	-
Pollack	-	-	-	-	-	-	-
Saithe	-	-	-	-	-	-	-
Ling	-	-	-	4	13	-	-
Five-bearded rockling	-	-	-	-	-	-	-
Gadids, unspecified	-	10	22	17	49	-	-
John Dory	-	-	-	-	-	-	-
European sea bass	-	-	-	-	-	-	-
Atlantic horse-mackerel	-	1	2	-	-	-	-
Black sea bream	-	-	-	-	-	-	-
Common sea bream	-	-	-	-	-	-	-
Common pandora	-	-	-	-	-	-	-
Read Sea bream	-	-	-	-	-	-	-
Black sea bream	-	-	-	-	-	-	-
Common sea bream	-	-	-	-	-	-	-
Common pandora	-	-	-	-	-	-	-
Read Sea bream	-	-	-	-	-	-	-
Gilt-head sea bream	-	-	-	-	-	-	-
Seabreams, unspecified	-	-	-	-	-	-	-
Ballan wrasse	-	-	-	-	-	-	-
Wrasses, unspecified	-	-	-	-	-	-	-
Sandeel	-	-	-	-	-	-	-
Grey mullets, unspecified	-	-	-	-	-	-	-
Atlantic mackerel	-	-	-	-	46	-	-
Butterfish	-	-	-	-	-	-	-
Gobiids, unspecified	-	-	-	-	-	-	-
Tub gurnard	-	-	-	-	-	-	-
Grey gurnard	-	-	-	-	-	-	-
Red gurnard	-	-	-	-	-	-	-
Gurnards, unspecified	-	-	-	-	2	-	-
Three-spined stickleback	-	-	-	-	2	1	-

TABLE 6

Numbers of identified fish bones from eastern English sites. Recovery technique: h = hand-collected, s = sieved, ? = unknown.

Site	York, Fishergate	York, Fishergate	York, Fishergate	York, Fishergate	York, Fishergate	York, Church Street	York, Skelder-gate
Site no.	1	1	1	1	1	1	1
Age (centuries)	1-2 AD	8-9 AD	11-12 AD	12-16 AD	16 AD	"Roman"	"Roman"
Recovery technique	s	s	s	s	s	s	s
Flatfishes, total	-	91	11	40	85	-	+
Turbot	-	-	-	-	1	-	-
Halibut	-	-	-	1	2	-	-
Dab	-	-	-	-	-	-	-
Plaice	-	-	-	6	4	-	-
Flounder	-	9	1	1	2	-	-
Plaice/Flounder/Dab	-	82	10	32	76	-	-
Witch	-	-	-	-	-	-	-
Lemon sole	-	-	-	-	-	-	-
Common sole	-	-	-	-	-	-	-
Flatfishes, unspecified	-	-	-	-	-	-	+
Anglerfish	-	-	-	-	-	-	-
MIGRATORY SPECIES							
Sturgeon	-	-	-	1	1	-	-
Shad	-	52	4	7	-	-	-
Salmon	-	28	4	5	15	-	-
Trout	-	15	2	4	2	-	-
Salmon/Trout	-	-	-	-	-	-	-
Whitefish	-	1	-	-	-	-	-
Salmonids, unspecified	-	15	4	4	1	-	-
Smelt	-	16	11	11	19	82	-
Eel	10	3582	729	371	361	29	+
FRESHWATER SPECIES							
Grayling	-	12	-	5	-	-	-
Pike	1	72	23	27	12	-	-
Cyprinids, total	-	918	73	105	164	6+	-
Common carp	-	-	-	-	-	-	-
Gudgeon	-	2	-	-	-	-	-
Barbel	-	4	1	2	-	-	-
Bleak	-	-	-	-	-	1	-
Tench	-	-	-	-	-	-	-
Dace	-	-	-	-	-	-	-
Chub	-	1	1	1	3	-	-
Dace/Chub	-	2	-	1	-	-	-
Roach	-	1	-	1	9	2	-
Rudd	-	-	-	-	-	-	-
Common Bream	-	-	-	-	-	-	-
White bream	-	-	-	-	-	-	-
Stone loach	-	-	-	-	-	-	-
Bitterling	-	-	-	-	-	-	-
Cyprinids, unspecified	-	908	71	100	152	3+	-
Burbot	-	5	1	2	1	-	-
Perch	-	2	7	1	1	5	+
Ruffe	-	-	-	-	-	-	-
Percids, unspecified	1	1	3	8	7	-	-
Bullhead	-	-	-	-	-	-	-
TOTAL	65	5555	1674	1465	2817	126+	+

TABLE 6 (cont.)

Numbers of identified fish bones from eastern English sites. Recovery technique: h = hand-collected, s = sieved, ? = unknown.

Site	York, St. Mary Bishophill Junior	York, Coppergate	York, Coppergate	York, Coppergate	York, Coppergate	York, Coppergate	York, Coppergate
Site no. (Fig. 7)	1	1	1	1	1	1	1
Age (centuries)	3-10 AD	9-10 AD	10 AD	10-11 AD	11 AD (early-mid)	11 AD (late)	12 AD
Recovery technique	?	h+s	h+s	h+s	h+s	h+s	h+s
MARINE SPECIES							
Dogfish	-	-	-	-	-	-	-
Spurdog	-	-	-	-	-	-	-
Çommon stingray	-	-	-	-	-	-	-
Thornback ray	-	-	-	+	+	-	+
Ray, unspecified	-	-	-	-	-	-	+
Cartilaginous fishes, unspecified	-	-	-	-	-	-	-
Herring	41	+	+	+	+	-	+
Sprat	13	+?	-	-	-	-	-
Herring/Sprat	5702	-	-	-	-	-	-
Clupeids, unspecified	-	+	+	-	-	-	-
Conger eel,	-	-	-	-	-	-	-
Garfish	-	-	-	-	-	-	-
Hake	-	-	-	-	-	-	-
Gadids, total	1	+	+	+	+	+	+
Cod	-	+	+	+	+	+	+
Haddock	-	-	-	-	+	+	+
Whiting	1	-	+	-	-	-	-
Pollack	-	-	-	-	-	-	-
Saithe	-	-	-	-	-	-	-
Ling	-	-	-	-	-	+	+
Fivebearded rockling	-	-	-	-	-	-	-
Gadids, unspecified	-	-	+	+	+	-	+
John Dory	-	-	-	-	-	-	-
European sea bass	-	-	-	-	-	-	-
Atlantic horsemackerel	-	+	-	-	+	-	-
Black sea bream	-	-	-	-	-	-	-
Common sea bream	-	-	-	-	-	-	-
Common pandora	-	-	-	-	-	-	-
Read Sea bream	-	-	-	-	-	-	-
Gilt-head sea bream	-	-	-	-	-	-	-
Seabreams, unspecified	-	-	-	-	-	-	-
fBallan wrasse	-	-	-	-	-	-	-
Wrasses, unspecified	-	-	-	-	-	-	-
Sandeel	-	-	-	-	-	-	-
Grey mullets, unspecified	-	-	-	-	-	-	-
Atlantic mackerel	-	+	-	-	+	-	-
Butterfish	-	-	-	-	-	-	-
Gobiids, unspecified	-	-	-	-	-	-	-
Tub gurnard	-	-	-	-	-	-	-
Grey gurnard	-	-	-	-	-	-	-
Red gurnard	-	-	-	-	-	-	-
Red gurnard	-	-	-	-	-	-	-
Gurnards, unspecified	-	-	-	-	-	-	-
Threespined stickleback	-	+	+	-	-	-	-

TABLE 6 (cont.)

Numbers of identified fish bones from eastern English sites. Recovery technique: h = hand-collected, s = sieved, ? = unknown.

Site	York, St. Mary Bishophill Junior	York, Coppergate	York, Coppergate	York, Coppergate	York, Coppergate	York, Coppergate	York, Coppergate
Site no.	1	1	1	1	1	1	1
Age (centuries)	3-10 AD	9-10 AD	10 AD	10-11 AD	11 AD (early-mid)	11 AD (late)	12 AD
Recovery technique	?	h+s	h+s	h+s	h+s	h+s	h+s
Flatfishes, total	-	+	+	+	-	-	+
Turbot	-	-	-	-	-	-	-
Halibut	-	-	-	-	-	-	-
Dab	-	-	-	-	-	-	-
Plaice	-	-	-	-	-	-	+
Flounder	-	+	+	+?	-	-	-
Plaice/Flounder/Dab	-	-	-	-	-	-	-
Witch	-	-	-	-	-	-	-
Lemon sole	-	-	-	-	-	-	-
Common sole	-	-	-	-	-	-	-
Flatfishes, unspecified	-	+	+	+	-	-	+
Anglerfish	-	-	-	-	-	-	-
MIGRATORY SPECIES							
Sturgeon	-	-	+	-	-	-	-
Shad	-	+	+	-	-	-	-
Salmon	-	+	+	+	+	-	-
Trout	-	+	+	+	+	-	-
Salmon/Trout	-	-	-	-	-	-	-
Whitefish	-	-	-	-	-	-	-
Salmonids, unspecified	-	+	+	+	+	+	-
Smelt	-	+	+	+	+	-	-
Eel	-	+	+	+	+	-	+
FRESHWATER SPECIES							
Grayling	-	+	+	-	-	-	-
Pike	-	+	+	+	+	-	+
Cyprinids, total	-	+	+	+	+	-	+
Common carp	-	-	-	-	-	-	-
Gudgeon	-	-	+?	-	+?	-	-
Barbel	-	-	+	-	-	-	-
Bleak	-	-	-	-	-	-	-
Tench	-	+	+?	-	-	-	-
Dace	-	+	+?	+?	-	-	-
Chub	-	+	+	+?	-	-	-
Dace/Chub	-	-	-	-	-	-	-
Roach	-	+	+	+	+?	-	+
Rudd	-	-	+?	-	-	-	-
Common Bream	-	-	+?	-	-	-	-
White bream	-	-	-	-	-	-	-
Stone loach	-	-	-	-	-	-	-
Bitterling	-	-	-	-	-	-	-
Cyprinids, unspecified	-	+	+	+	+	-	+
Burbot	-	+	+	+	-	-	-
Perch	-	+	+	+	+	-	+
Ruffe	-	-	-	-	-	-	-
Percids, unspecified	-	+	+	-	-	-	-
Bullhead	-	-	-	-	-	-	-
TOTAL	5757	+	+	+	+	+	+

TABLE 6 (cont.)

Numbers of identified fish bones from eastern English sites. Recovery technique. h = hand-collected, s = sieved, ? = unknown.

Site	York, Copper-gate	York, Tanner Row	York, The Bedern	York, 1-5 Aldwark	London, Peninsular House	London, Westmin-ster Abbey	London, Westmin-ster Abbey
Site no. (Fig. 7)	1	1	1	1	2	2	2
Age (centuries)	13 AD	12-13 AD	13- AD	15-16 AD	2-4 AD	11-13 AD	15-16 AD
Recovery technique	h+s	h+s	h(+s)	?	s	h+s	h+s
MARINE SPECIES							
Dogfish	-	-	-	-	-	-	-
Spurdog	-	-	-	-	-	-	-
Common stingray	-	-	-	-	-	-	-
Thornback ray	+	-	+	-	-	2	-
Ray, unspecified	-	-	-	-	-	-	-
Cartilaginous fishes, unspecified	-	-	-	-	-	1	-
Herring	+	+	+	-	+	91	-
Sprat	-	-	-	-	+	-	-
Herring/Sprat	-	-	-	-	-	-	-
Clupeids, unspecified	-	-	-	-	-	-	-
Conger eel,	-	+	+	+	-	14	1
Garfish	-	-	-	-	-	-	-
Hake	-	-	-	-	-	-	-
Gadids, total	+	+	+	+	-	107	6
Cod	+	+	+	+	-	21	4
Haddock	+	+	+	+	-	17	1
Whiting	+	+	+	-	-	69	-
Pollack	-	-	-	-	-	-	-
Saithe	-	-	+	-	-	-	-
Ling	+	+	+	+	-	-	1
Fivebearded rockling	-	-	-	-	-	-	-
Gadids, unspecified	+	+	+	+	-	-	-
John Dory	-	-	-	-	-	1	-
European sea bass	-	-	-	-	+	5	-
Atlantic horsemackerel	-	-	-	-	-	-	-
Black sea bream	-	-	-	-	-	-	-
Common sea bream	-	-	-	-	-	-	-
Common pandora	-	-	-	-	-	-	-
Read Sea bream	-	-	-	-	-	-	-
Gilt-head sea bream	-	-	-	-	-	-	-
Seabreams, unspecified	-	+	-	-	-	-	-
Ballan wrasse	-	-	-	-	-	-	-
Wrasses, unspecified	-	-	-	-	-	-	-
Sandeel	-	-	-	-	+	-	-
Grey mullets, unspecified	-	-	-	-	-	-	-
Atlantic mackerel	-	-	-	-	-	1	-
Butterfish	-	-	-	-	-	-	-
Gobiids, unspecified	-	-	-	-	-	-	-
Tub gurnard	-	-	-	-	-	-	-
Grey gurnard	-	-	-	-	-	-	-
Red gurnard	-	-	-	-	-	-	-
Gurnards, unspecified	-	-	+	-	-	2	-
Threespined stickleback	-	-	-	-	-	-	-

TABLE 6 (cont.)

Numbers of identified fish bones from eastern English sites. Recovery technique: h = hand-collected, s = sieved, ? = unknown.

Site	York, Copper-gate	York, Tanner Row	York, The Bedern	York, 1-5 Aldwark	London, Peninsular House	London, Westmin-ster Abbey	London, Westmin-ster Abbey
Site no.	1	1	1	1	2	2	2
Age (centuries)	12 AD	12-13 AD	13- AD	15-16 AD	2-4 AD	11-13 AD	15-16 AD
Recovery technique	h+s	h+s	h(+s)	?	s	h+s	h+s
Flatfishes, total	+	+	+	+	+	101	4
Turbot	-	-	-	+	-	3	-
Halibut	-	-	+	-	-	-	-
Dab	-	-	-	-	-	-	-
Plaice	+	-	+	-	-	8	-
Flounder	-	+	-	-	-	4	-
Plaice/Flounder/Dab	-	-	-	-	+	-	-
Witch	-	-	+	-	-	-	-
Lemon sole	-	-	-	-	-	-	-
Common sole	-	-	+	-	-	13	-
Flatfishes, unspecified	+	+	+	-	-	73	4
Anglerfish	-	-		-	-	-	-
MIGRATORY SPECIES							
Sturgeon	-	-	-	-	-	3	-
Shad	-	+	-	-	-	1	-
Salmon	+	+	-	-	-	-	-
Trout	-	+	-	-	-	-	-
Salmon/Trout	-	-	-	-	-	-	-
Whitefish	-	-	-	-	-	-	-
Salmonids, unspecified	+	+	-	-	-	-	-
Smelt	-	+	-	-	-	3	-
Eel	+	+	-	-	-	28	1
FRESHWATER SPECIES							
Grayling	-	+	-	-	-	-	-
Pike	+	+	+	-	-	4	-
Cyprinids, total	+	+	+	-	-	12	-
Common carp	-	-	+	-	-	-	-
Gudgeon	-	-	-	-	-	-	-
Barbel	-	-	-	-	-	-	-
Bleak	-	-	-	-	-	-	-
Tench	-	-	-	-	-	-	-
Dace	+	-	-	-	-	-	-
Chub	-	-	-	-	-	-	-
Dace/Chub	-	-	-	-	-	-	-
Roach	+	+	+	-	-	-	-
Rudd	-	+	-	-	-	-	-
Common Bream	-	-	-	-	-	-	-
White bream	-	-	-	-	-	-	-
Stone loach	-	-	-	-	-	-	-
Bitterling	-	-	-	-	-	-	-
Cyprinids, unspecified	+	+	+	-	-	12	-
Burbot	-	+	-	-	-	-	-
Perch	+	+	+	-	-	-	-
Ruffe	-	-	-	-	-	-	-
Percids, unspecified	+	+	-	-	-	-	-
Bullhead	-	-	-	-	-	-	-
TOTAL	+	+	+	+	+	376	12

TABLE 6 (cont.)

Numbers of identified fish bones from eastern English sites. Recovery technique: h = hand-collected, s = sieved, ? = unknown.

Site	Lincoln, waterfront	Lincoln, waterfront	Lincoln, waterfront	Lincoln, waterfront	South-ampton, Mel-bourne St.	Norwich, Alms Lane	Norwich, Alms Lane
Site no. (Fig. 7)	3	3	3	3	4	5	5
Age (centuries)	3 AD	4 AD	9-11 AD	11-16 AD	7-8 AD	11-13 AD	13-16 AD
Recovery technique	s	s	s	s	s	s	s
MARINE SPECIES							
Dogfish	-	-	-	-	-	-	-
Spurdog	-	-	-	-	-	-	3
Common stingray	-	-	-	-	+	-	-
Thornback ray	-	-	-	1	+	9	25
Ray, unspecified	-	-	-	-	-	-	-
Cartilaginous fishes, unspecified	-	-	-	-	+	4	21
Herring	-	-	-	-	-	224	1124
Sprat	-	-	-	-	-	-	5?
Herring/Sprat	-	-	-	-	-	-	-
Clupeids, unspecified	-	-	-	2	-	-	115
Conger eel,	-	-	-	-	-	-	-
Garfish	-	-	-	-	-	-	-
Hake	-	-	-	-	-	-	-
Gadids, total	-	-	2	11	+	54	322
Cod	-	-	-	-	+	37	105
Haddock	-	-	2	-	-	-	6
Whiting	-	-	-	-	+	15	184
Pollack	-	-	-	-	+	-	-
Saithe	-	-	-	-	-	-	-
Ling	-	-	-	-	-	-	4
Fivebearded rockling	-	-	-	-	-	-	-
Gadids, unspecified	-	-	-	11	-	2	23
John Dory	-	-	-	-	-	-	-
European sea bass	-	-	-		+	-	-
Atlantic horsemackerel	-	-	-		+	-	1
Black sea bream	-	-	-	-	-	-	-
Common sea bream	-	-	-	-	-	-	-
Common pandora	-	-	-	-	-	-	-
Read Sea bream	-	-	-	-	-	-	-
Gilt-head sea bream	-	-	-	-	+	-	-
Seabreams, unspecified	-	-	-	-	-	-	-
Ballan wrasse	-	-	-	-	-	-	-
Wrasses, unspecified	-	-	-	-	-	-	-
Sandeel	11	29	-	-	-	-	-
Grey mullets, unspecified	-	-	-	-	+	-	-
Atlantic mackerel	-	-	-	-	+	8	16
Butterfish	-	-	-	-	-	-	-
Gobiids, unspecified	-	-	-	-	-	-	-
Tub gurnard	-	-	-	-	-	-	-
Grey gurnard	-	-	-	-	-	-	-
Red gurnard	-	-	-	-	-	-	-
Gurnards, unspecified	-	-	1	-	-	1	-
Threespined stickleback	-	-	3	-	-	-	-

TABLE 6 (cont.)

Numbers of identified fish bones from eastern English sites. Recovery technique: h = hand-collected, s = sieved, ? = unknown.

Site	Lincoln, waterfront	Lincoln, waterfront	Lincoln, waterfront	Lincoln, waterfront	South-ampton, Mel-bourne St.	Norwich, Alms Lane	Norwich, Alms Lane
Site no.	3	3	3	3	5	5	5
Age (centuries)	3 AD	4 AD	9-11 AD	11-16 AD	7-8 AD	11-13 AD	13-16 AD
Recovery technique	s	s	s	s	s	s	s
Flatfishes, total	3	10	-	3	+	6	72
Turbot	-	-	-	-	-	-	-
Halibut	-	-	-	-	-	–	-
Dab	-	-	-	-	-	-	-
Plaice	-	-	-	-	+	-	3
Flounder	-	-	-	-	+	-	-
Plaice/Flounder/Dab	-	-	-	-	-	6	64
Witch	-	-	-	-	-	-	-
Lemon sole	-	-	-	-	-	-	-
Common sole	-	-	-	-	-	-	5
Flatfishes, unspecified	3	10	-	3	-	-	-
Anglerfish	-	-	-	-	-	-	-
MIGRATORY SPECIES							
Sturgeon	-	-	-	-	-	-	-
Shad	-	-	-	-	-	-	-
Salmon	-	2	-	-	+	-	-
Trout	-	-	-	-	-	-	-
Salmon/Trout	-	1	3	8	-	-	-
Whitefish	-	-	-	-	-	-	-
Salmonids, unspecified	1	-	-	-	-	1	-
Smelt	-	-	2	-	-	-	-
Eel	22	42	99	66	+	13	111
FRESHWATER SPECIES							
Grayling	-	-	1	-	-	-	-
Pike	4	4	18	4	-	-	3
Cyprinids, total	96	60	317	115	-	-	22
Common carp	1	-	-	1	-	-	-
Gudgeon	-	-	-	-	-	-	-
Barbel	-	-	-	-	-	-	-
Bleak	-	-	-	-	-	-	-
Tench	1	-	-	-	-	-	-
Dace	-	-	-	-	-	-	-
Chub	-	-	1	-	-	-	-
Dace/Chub	-	2	-	2	-	-	-
Roach	-	2	14	10	-	-	3
Rudd	-	-	3	-	-	-	-
Common Bream	1	-	3	2	-	-	-
White bream	-	-	1	-	-	-	-
Stone loach	6	-	-	-	-	-	-
Bitterling	-	1	-	-	-	-	-
Cyprinids, unspecified	87	55	295	100	-	-	19
Burbot	-	-	1	1	-	-	-
Perch	16	23	79	1	-	-	1
Ruffe	-	1	9	-	-	-	-
Percids, unspecified	1	-	5	-	-	-	-
Bullhead	-	1	-	-	-	-	-
TOTAL	154	173	541	212	+	320	1841

TABLE 6 (cont.)

Numbers of identified fish bones from eastern English sites. Recovery technique: h = hand-collected, s = sieved, ? = unknown.

Site	Norwich, White-friars St. Car Park	Great Yarmouth	King's Lynn	King's Lynn	Canter-bury, St. Gregory's Priory	Canter-bury, St. Gregory's Priory	Canter-bury, St. Gregory's Priory
Site no. (Fig. 7)	5	6	7	7	8	8	8
Age (centuries)	10-13 AD	11-13 AD	11-13 AD	13-14 AD	12-15 AD	14-15 AD	15-16 AD
Recovery technique	s	h+s	h	h	h	s	h
MARINE SPECIES							
Dogfish	-	-	-	-	-	-	-
Spurdog	-	+	-	-	-	-	-
Common stingray	-	-	-	-	-	-	-
Thornback ray	+	+	-	-	-	-	-
Ray, unspecified	-	-	-	+	2	-	3
Cartilaginous fishes, unspecified	+	+	-	-	-	-	-
Herring	287	+	-	-	94	1215	84
Sprat	-	-	-	-	-	-	-
Herring/Sprat	-	-	-	-	-	-	-
Clupeids, unspecified	-	-	-	-	-	-	-
Conger eel,	-	+	-	+	3	11	15
Garfish	-	+	-	-	-	-	-
Hake	-	-	-	+	-	-	-
Gadids, total	+	+	+	+	28	576	76
Cod	+	+	+	+	15	39	22
Haddock	-	+	+	+	3	9	4
Whiting	+	+	-	-	1	494	36
Pollack	-	-	-	-	-	-	-
Saithe	-	-	-	-	-	-	-
Ling	-	+	-	+	-	-	-
Fivebearded rockling	-	-	-	-	-	-	-
Gadids, unspecified	-	-	+	+	9	34	14
John Dory	-	-	-	-	-	-	-
European sea bass	+	+	-	-	-	9	-
Atlantic horsemackerel	+	+	-	-	-	-	-
Black sea bream	-	-	-	-	-	4	-
Common sea bream	-	-	-	-	-	3	-
Common pandora	-	-	-	-	-	1	-
Read Sea bream	-	-	-	-	-	2	-
Gilt-head sea bream	-	-	-	-	-	-	-
Seabreams, unspecified	-	-	-	-	-	-	-
Ballan wrasse	-	-	-	-	-	-	-
Wrasses, unspecified	-	-	-	-	-	-	-
Sandeel	-	-	-	-	-	-	-
Grey mullets, unspecified	-	-	-	-	1	88	2
Atlantic mackerel	+	+	-	-	-	-	-
Butterfish	-	-	-	-	-	-	-
Gobiids, unspecified	-	-	-	-	-	-	-
Tub gurnard	-	+	-	-	-	-	-
Grey gurnard	-	-	-	-	-	-	-
Red gurnard	-	-	-	-	-	1	-
Gurnards, unspecified	-	-	-	-	4	44	-
Threespined stickleback	-	-	-	-	-	-	-

TABLE 6 (cont.)

Numbers of identified fish bones from eastern English sites. Recovery technique: h = hand-collected, s = sieved, ? = unknown.

Site	Norwich, White-friars St. Car Park	Great Yarmouth	King's Lynn	King's Lynn	Canter-bury, St. Gregory's Priory	Canter-bury, St. Gregory's Priory	Canter-bury, St. Gregory's Priory
Site no.	5	6	7	7	8	8	8
Age (centuries)	10-13 AD	11-13 AD	11-13 AD	13-14 AD	12-15 AD	14-15 AD	15-16 AD
Recovery technique	s	h+s	h	h	h	s	h
Flatfishes, total	+	+	+	+	26	487	45
Turbot	-	+	-	-	-	-	1
Halibut	-	+	-	+	-	-	-
Dab	-	-	-	-	-	-	-
Plaice	+	+	+	+	3	10	41
Flounder	+	+	-	-	-	9	3
Plaice/Flounder/Dab	44	-	-	-	-	-	-
Witch	-	-	-	-	-	-	-
Lemon sole	-	-	-	-	-	4	-
Common sole	-	+	-	-	-	-	-
Flatfishes, unspecified	-	+	-	+	23	464	-
Anglerfish	-	-	-	-	-	-	-
MIGRATORY SPECIES							
Sturgeon	-	-	-	-	-	-	-
Shad	-	-	-	-	-	-	-
Salmon	-	-	-	-	-	-	-
Trout	1?	-	-	-	-	-	-
Salmon/Trout	-	-	-	-	-	-	-
Whitefish	-	-	-	-	-	-	-
Salmonids, unspecified	+	-	-	-	-	-	-
Smelt	-	-	-	-	-	-	-
Eel	26	+	-	-	-	171	11
FRESHWATER SPECIES							
Grayling	-	-	-	-	-	-	-
Pike	+	-	-	-	-	-	-
Cyprinids, total	+	-	-	-	1	140	-
Common carp	-	-	-	-	-	-	-
Gudgeon	-	-	-	-	-	-	-
Barbel	-	-	-	-	-	-	-
Bleak	-	-	-	-	-	-	-
Tench	-	-	-	-	-	-	-
Dace	-	-	-	-	-	7	-
Chub	+	-	-	-	-	-	-
Dace/Chub	-	-	-	-	-	-	-
Roach	+	-	-	-	-	-	-
Rudd	+	-	-	-	-	-	-
Common Bream	+	-	-	-	-	-	-
White bream	-	-	-	-	-	-	-
Stone loach	-	-	-	-	-	-	-
Bitterling	-	-	-	-	-	-	-
Cyprinids, unspecified	+	-	-	-	1	133	-
Burbot	-	-	-	-	-	-	-
Perch	-	-	-	-	-	-	-
Ruffe	-	-	-	-	-	-	-
Percids, unspecified	-	-	-	-	-	-	-
Bullhead	-	-	-	-	-	-	-
TOTAL	+	+	+	+	159	2752	236

TABLE 6 (cont.)

Numbers of identified fish bones from eastern English sites. Recovery technique: h = hand-collected, s = sieved, ? = unknown.

Site	Canterbury, St. Gregory's Priory	Newcastle, Quayside, Queen St.	Newcastle, Quayside, Queen St.	Newcastle, Quayside, The Crown Court Site	Newcastle, Quayside, The Crown Court Site	Newcastle, Quayside, The Crown Court Site	Little Pickle
Site no. (Fig. 7)	8	9	9	9	9	9	10
Age (centuries)	15-16 AD	13 AD	14-16 AD	13 AD	14-15 AD	15-16 AD	16 AD
Recovery technique	s	h+s	h+s	h+s	h+s	h+s	h+s
MARINE SPECIES							
Dogfish	-	-	-	-	-	-	-
Spurdog	-	-	-	-	-	-	-
Common stingray	-	-	-	-	-	-	-
Thornback ray	-	2	2	-	46	8	-
Ray, unspecified	3	1	2	-	28	2	3
Cartilaginous fishes, unspecified	-	-	-	-	2	-	-
Herring	1743	66	411	82	533	169	54
Sprat	-	-	-	-	-	-	-
Herring/Sprat	-	-	-	-	-	-	-
Clupeids, unspecified	-	2	30	-	22	1	-
Conger eel,	12	-	-	-	1	-	10
Garfish	-	-	1	-	-	-	-
Hake	-	-	-	-	1	-	-
Gadids, total	396	445	1338	124	883	661	833
Cod	30	150	180	25	85	70	+
Haddock	15	23	199	14	143	145	+
Whiting	300	3	272	4	172	102	+
Pollack	-	-	1	-	-	-	+
Saithe	-	32	17	23	14	21	+
Ling	-	67	88	12	40	20	+
Fivebearded rockling	-	-	-	-	5	-	-
Gadids, unspecified	51	170	581	46	424	303	-
John Dory	-	-	-	-	-	-	-
European sea bass	3	-	-	-	-	-	-
Atlantic horsemackerel	-	1	1	-	-	-	-
Black sea bream	-	-	-		-	-	-
Common sea bream	-	-	-	-	-	-	-
Common pandora	-	-	-	-	-	-	-
Read Sea bream	-	-	-	-	-	-	-
Gilt-head sea bream	-	-	-	-	-	-	-
Seabreams, unspecified	-	-	1	-	-	-	-
Ballan wrasse	-	-	1	-	-	-	-
Wrasses, unspecified	-	-	1	-	-	-	-
Sandeel	-	-	17	2	120	4	-
Grey mullets, unspecified	22	-	-	-	-	-	-
Atlantic mackerel	4	-	-	-	-	-	-
Butterfish	-	-	-	-	14	-	-
Gobiids, unspecified	-	-	-	-	4	-	-
Tub gurnard	-	-	-	-	-	1	-
Grey gurnard	-	1	17	2	5	41	-
Red gurnard	–	-	-	-	-	-	-
Gurnards, unspecified	78	2	13	2	9	16	60
Threespined stickleback	-	-	-	-	-	-	-

TABLE 6 (cont.)

Numbers of identified fish bones from eastern English sites. Recovery technique: h = hand-collected, s = sieved, ? = unknown.

Site	Canterbury, St. Gregory's Priory	Newcastle, Quayside, Queen St.	Newcastle, Quayside, Queen St.	Newcastle, Quayside, The Crown Court Site	Newcastle, Quayside, The Crown Court Site	Newcastle, Quayside, The Crown Court Site	Little Pickle
Site no.	8	9	9	9	9	9	10
Age (centuries)	15-16 AD	13 AD	14-16 AD	13 AD	14-15 AD	15-16 AD	16 AD
Recovery technique	s	h+s	h+s	h+s	h+s	h+s	h+s
Flatfishes, total	214	6	93	16	58	69	+
Turbot	-	-	2	-	-	-	-
Halibut	-	-	-	1	-	-	-
Dab	-	-	4	-	1	1	-
Plaice	9	-	31	3	6	8	+
Flounder	3	2	1	2	9	7	+
Plaice/Flounder/Dab	-	1	3	3	-	6	116
Witch	-	-	-	-	-	-	-
Lemon sole	5	1	10	-	-	-	-
Common sole	39	-	-	-	-	-	-
Flatfishes, unspecified	158	2	42	7	42	47	-
Anglerfish	-	-	-	-	1		-
MIGRATORY SPECIES							
Sturgeon	-	-	-	-	-	-	5
Shad	-	-	-	-	-	1	-
Salmon	-	-	-	-	-	-	-
Trout	-	-	-	-	-	-	-
Salmon/Trout	-	-	1	-	-	-	-
Whitefish	-	-	-	-	-	-	-
Salmonids, unspecified	-	-	-	-	1	-	6
Smelt	-	-	1?	-	3	-	-
Eel	48	3	20	2	16	5	5
FRESHWATER SPECIES							
Grayling	-	-	-	-	-	-	-
Pike	4	-	-	-	-	-	67
	89	-	-	-	-	-	61
Cyprinids, total							
Common carp	-	-	-	-	-	-	+
Gudgeon	-	-	-	-	-	-	-
Barbel	-	-	-	-	-	-	-
Bleak	-	-	-	-	-	-	-
Tench	1	-	-	-	-	-	+
Dace	-	-	-	-	-	-	-
Chub	-	-	-	-	-	-	-
Dace/Chub	-	-	-	-	-	-	-
Roach	-	-	-	-	-	-	-
Rudd	-	-	-	-	-	-	-
Common Bream	-	-	-	-	-	-	+
White bream	-	-	-	-	-	-	-
Stone loach	-	-	-	-	-	-	-
Bitterling	-	-	-	-	-	-	-
Cyprinids, unspecified	88	-	-	-	-	-	-
Burbot	-	-	-	-	-	-	-
Perch	-	-	-	-	-	-	-
Ruffe	-	-	-	-	-	-	-
Percids, unspecified	-	-	-	-	-	-	-
Bullhead	-	-	-	-	-	-	-
TOTAL	2616	529	1949	230	1747	979	1220

TABLE 6 (cont.)

Numbers of identified fish bones from eastern English sites. Recovery technique: h = hand-collected, s = sieved, ? = unknown.

Site	Mary Rose
Site no. (Fig. 7)	11
Age (centuries)	16 AD
Recovery technique	?
MARINE SPECIES	
Dogfish	-
Spurdog	-
Common stingray	-
Thornback ray	-
Ray, unspecified	-
Cartilaginous fishes, unspecified	-
Herring	-
Sprat	-
Herring/Sprat	-
Clupeids, unspecified	-
Conger eel,	170
Garfish	-
Hake	+
Gadids, total	+
Cod	3804
Haddock	+
Whiting	-
Pollack	+
Saithe	-
Ling	-
Fivebearded rockling	-
Gadids, unspecified	182
John Dory	-
European sea bass	-
Atlantic horsemackerel	-
Black sea bream	-
Common sea bream	-
Common pandora	-
Read Sea bream	-
Gilt-head sea bream	-
Seabreams, unspecified	-
Ballan wrasse	-
Wrasses, unspecified	-
Sandeel	-
Grey mullets, unspecified	-
Atlantic mackerel	-
Butterfish	-
Gobiids, unspecified	-
Tub gurnard	-
Grey gurnard	-
Red gurnard	-
Gurnards, unspecified	-
Threespined stickleback	-

Site	Mary Rose
Site no.	11
Age (centuries)	16 AD
Recovery technique	?
Flatfishes, total	-
Turbot	-
Halibut	-
Dab	-
Plaice	-
Flounder	-
Plaice/Flounder/Dab	-
Witch	-
Lemon sole	-
Common sole	-
Flatfishes, unspecified	-
Anglerfish	-
MIGRATORY SPECIES	
Sturgeon	-
Shad	-
Salmon	-
Trout	-
Salmon/Trout	-
Whitefish	-
Salmonids, unspecified	-
Smelt	-
Eel	-
FRESHWATER SPECIES	
Grayling	-
Pike	-
	-
Cyprinids, total	
Common carp	-
Gudgeon	-
Barbel	-
Bleak	-
Tench	-
Dace	-
Chub	-
Dace/Chub	-
Roach	-
Rudd	-
Common Bream	-
White bream	-
Stone loach	-
Bitterling	-
Cyprinids, unspecified	-
Burbot	-
Perch	-
Ruffe	-
Percids, unspecified	-
Bullhead	-
TOTAL	4193

TABLE 6 (cont.)

Numbers of identified fish bones from eastern English sites. Recovery technique: h = hand-collected, s = sieved, ? = unknown.

York, Church Street (1)

A modest number of fish bones were recovered from sediment sieved through a 0.6 mm mesh during a rescue excavation of a Roman sewer system. They were identified by A. Wheeler and published *in* Buckland (1976). With one exception, the fish bones are from small individuals of freshwater and migratory fishes, smelt being the best represented species. Wheeler (*in* Buckland, 1976) notices that such young fish often stay near the mouth of drainage ditches from where they may have penetrated upstream during flooding and may have stranded as the water receded. This find may thus represent a natural deposit with no connection to fishing.

York, Skeldergate (1)

Fish bones were recovered from ten samples from a Roman well plus two further samples of Roman age, possibly by sieving. They were identified by P.J. Spencer and P.A. Veilleux and published by Hall *et al.* (1980). The very few fish bones are all from small individuals.

York, St Mary Bishophill Junior (1)

Fish bones were excavated during the period 1961-67. The site lies within the Roman *colonia*. The fish remains formed the bulk of a layer on a floor. A 100 ml subsample was analyzed by Jones (1988a). No exact dating is available; the layer may date from any time from the late Roman period to the 10th century AD. Approximately 75% of the fish bones were from young herring (7-11 cm total length), approximately 25% were from sprat of the same size. It was estimated that the excavated material included 40,000 fish bones in total. According to Jones (1988a), the remains may be interpreted as evidence of a fish processing enterprise, perhaps the manufacturing of fish sauce during the end of the Roman or the early post-Roman period.

York, 16-22 Coppergate (1)

Fish bone material from the urban Anglo-Scandinavian occupation of York, dated to the mid-9th to mid-11th centuries AD, was recovered at 16-22 Coppergate, an artisans' quarter. Small numbers of fish bones were recovered by hand-collection and very large numbers by wet-sieving. The fish bones were sorted out from the 2 mm fraction. The preservation of bone in most contexts is recorded as very good. The fish bones were identified and recorded by A.K.G. Jones *in* O'Connor (1989).

Medieval deposits from 16-22 Coppergate mainly consist of levelling/dumps which appear to have been laid down during the late 11th-13th centuries AD. Fish bones from these deposits were recovered by hand-collection and by sieving; they were identified by A.K.G. Jones and published by Bond & O'Connor (1999).

The species list from Coppergate is very varied and includes marine, migratory as well as freshwater fish. The number of samples in which each species occurred has been recorded in O'Connor (1989) for the 9th-11th centuries material. On this basis, herring, salmonids, pike, cyprinids and eel are regarded as frequent during this period. Herring and eel in particular were heavily exploited throughout the Anglo-Scandinavian period. On the other hand, Jones/O'Connor believed that the importance of cyprinids and salmonids decreased during the latter phases of the Anglo-Saxon period, while the importance of gadids increased. This is interpreted as a shift in exploitation in the early 11th century from local rivers to the open sea. The fact that thornback ray occurs only in the younger layers whereas shad and grayling, for example, occur exclusively in the oldest ones, is in agreement with this interpretation. Even though herring is a marine species, the fish are known to shoal in inshore and estuarine waters during the summer months and could have been caught in the Humber estuary. Sturgeon, shad, salmon, trout, smelt, eel and flounder could also have been caught in estuarine waters. The presence of sturgeon should be noted, this species being rare in British waters nowadays. Burbot is even regarded as extinct in England today (Wheeler, 1992).

York, 24-30 Tanner Row (1)

Fish bones were recovered mainly from various deposits dated to 12th-13th century AD, identified by A.K.G. Jones and published in Bond & O'Connor (1999).

The long list includes marine, freshwater and migratory species.

York, The Bedern (1)

Fish bones were excavated from the remains of the college of the Vicars Choral of Yorkminster.

The material dates from 13th century AD onwards. Fish bones were mainly hand-collected; they were identified by A.K.G. Jones and published by Bond & O'Connor (1999).

Marine species dominate the rather long species list.

York, 1-5 Aldwark (1)

Fish bones were recovered from 15th-16th century AD deposits, identified by A.K.G. Jones and published in Bond & O'Connor (1999).

All fish bones in the material are from marine species.

London, Peninsular House (2)

Remnants of a fish processing plant have been found at the Roman waterfront in London. The plant was active from the mid-2nd to the ?early 4th centuries AD. A compact deposit consisting of silt, small fish bones and amphora sherds were found at the site. Two and a half kilograms of the layer were sampled and sieved through a 0.25 mm mesh. The residue (650 g) was composed entirely of small fish bones representing thousands of individuals. Herring comprised 84% of the bones, sprat 16%; in addition there were a few bones of other species. The herring and sprat were very small, maximum total length 8.3 cm.

Bateman & Locker (1982) who studied this sample proposed that it might represent a relatively small-scale fishing industry. The herring and sprat could have been whole fish pickled in brine in the amphora, or they could be remains of locally produced fish sauce.

London, Westminster Abbey (2)

London lies on the River Thames in southeastern England. Fish bone material has been excavated in the sub-vault of the misericorde of the Westminster Abbey. Fish bones were picked out by hand and in addition, soil was sieved through a 0.3 mm mesh. The material is referable to several phases which are here grouped into two periods, the 11th-13th and 15th-16th centuries AD. The fish bones were studied by Jones (1976) and represent 21 marine, estuarine and freshwater species. The former, in particular herring, gadids and flatfish are, however, by far the most numerous. Eel seems also to have been of great importance. Several of the species are considered as rare and highly valued food fish, viz., sturgeon, European seabass, turbot, common sole and in particular John Dory. With the exception of ling, all the species could have been caught in the Thames and its estuary, and the southern North Sea.

Lincoln (3)

Dobney *et al.* (1996) analyzed a range of fish bone assemblages representing a range of periods (3rd century AD to Late Medieval) and areas from Lincoln, ca. 50 km from the North Sea. Systematic sieving was employed at four waterfront sites, and the discussion below refers to this material.

A dominance of freshwater species (cyprinids, perch) and eel is a general trait throughout all considered periods. The bones of eel are all from very small individuals (elvers) and may represent a natural death assemblage.

The find of common carp from a Roman deposit in Lincoln (3rd century AD) represents the earliest known occurrence in the British Isles and suggests that the Romans introduced the carp to certain areas (Dobney *et al.*, 1996).

A remarkable trait of several Late Roman samples is a high concentration of bones of small clupeids and sandeel. These are not included in Dobney *et al.*'s table but in one analyzed sample they represent an estimated 2860 individuals. Dobney *et al.* (1996) suggest that these small fish bones might be remains of locally produced fish sauce although the material does not allow a firm conclusion.

The single bone of bitterling is also of outstanding interest. Dobney *et al.* (1996) emphasize that this find suggests a natural occurrence of bitterling in the British Isles, where it has till now been regarded as introduced (Wheeler, 1969; Holčík, 1999).

In addition to the waterfront sites discussed above, Dobney *et al.* (1996) reported on a small number of hand-collected fish bones from other sites. These are all from marine species: conger eel, garfish, gadids, turbot and halibut.

Southampton, Melbourne Street (4)

Fish bones were recovered, mainly by sieving of a pit in middle Saxon (7th-8th centuries AD) deposits. They were studied by Bourdillon & Coy (1980) who presented a species list, however wit-

hout numbers of bones. According to the authors, the most abundant fishes were eel, flounder, European seabass and mullet which could all have been caught in intertidal traps or kiddles.

Norwich, Alms Lane (5)

Norwich lies on the River Wensum, ca. 30 km from the English North Sea coast. Fish bone material from Medieval Norwich was recovered by sieving soil samples through a 1 mm mesh. The material has been divided into several phases, which are here collected in two main groups. The site was first a dumping ground for iron waste (AD 1000-1275), thereafter it developed into an intensely occupied area of the town (AD 1275-1600).

The list of fish species is varied and is dominated by marine species. Herring remains are particularly frequent, but there are also many remains of gadids, eel, flatfish and cartilaginous fish. The gadids are represented by cod, whiting, haddock and ling. The Medieval whiting were 26-60 cm long, the cod 45-105 cm. The presence of bones from both head and body suggests that whole fish were imported. A special sample is constituted by a pot, dated to AD 1274-1400, the fill of which contained remains of herring and herring/sprat. Eel seems to be the only local species which was consumed in any quantity. Pike, tench, roach, perch and three-spined stickleback occur in the River Wensum today. There is no sign of a temporal change in fish consumption (Jones & Scott, 1985).

Norwich, Whitefriars Street Car Park (5)

Fish remains were recovered by sieving from deposits which had accumulated on the riverbank; these are dated to the 10th-13th centuries AD. According to Jones (1983), herring is the most frequent species, remains of cod and whiting are more abundant than remains of cartilaginous fish, eel and flatfish and Atlantic mackerel, Atlantic horse mackerel and European seabass bones are uncommon. Remains of estuarine and freshwater fish are present at lower frequencies. Since the bones were collected from the river bank the possibility exists that some of the bones of freshwater fish could be from fish which died from natural causes. The sampled deposits contain refuse from a large number of households over unspecified periods of time but Jones (1983) emphasized that in spite of all reservations the assemblages illustrate the variety of fish in the diet of Medieval occupants of Norwich.

Great Yarmouth (6)

Great Yarmouth lies on the English North Sea Coast at approximately the same latitude as the inland town of Norwich. In 1974, fish bones were recovered by hand-collection and sieving of soil through a 1 mm mesh. The material was published by Wheeler & Jones (1976) as early Medieval (10th-13th centuries AD, R. Nicholson in litt.). The authors compared this material extensively with the, at least partly contemporaneous, material from Norwich. The species list is varied but is composed exclusively of marine species, plus the migratory eel. According to the authors, cod, whiting and Atlantic mackerel dominate throughout and probably were the most important species caught. Plaice also occurs in most samples, as do haddock, Atlantic horse mackerel and conger eel. The remaining species are represented by relatively few bones. The cod bones fall into two size classes. Wheeler & Jones (1976) suggested that this may represent local fishing for small cod and the importing of large ones.

King's Lynn (7)

A town on the north coast of Norfolk, situated at the mouth of the River Gt. Ouse where it enters the North Sea. Fish bones from Medieval King's Lynn were recovered by hand and dated to two phases covering the 11th-14th centuries AD. All the fish bones are from marine species. According to Wheeler (1977), numerous bones were identified as cod, which seems to have been the most important fish used for food at King's Lynn. In addition to cod, numerous bones of haddock, ling and plaice were recorded; the other species are only represented by one or two bones each. A striking feature of the material is that all bones are from large fish. The lack of small species, such as for instance herring and eel, may be a result of the recovery technique rather than their not having been consumed at the site. The total length of the fish was estimated to 80-140 cm for ling, 45-60 cm for haddock, and 55-142 cm for cod. The cod fall largely in two size classes: 60-80 cm and 80-137 cm. This perhaps reflects local fishing for smaller cod, probably during wintertime, and the import of large cod from the North. The large cod might, however, also have been caught by local fishermen fishing further afield. Bones from both the head and trunk of the cod are present.

Canterbury, St. Gregory's Priory (8)

Canterbury lies in extreme southeastern England, ca. 10 km from the North Sea. Excavations at the Medieval St. Gregory's Priory yielded a wealth of fish bones. Smith (unpublished) has presented a detailed report and discussion of these fish assemblages. The samples date from the 12th-16th century AD. In addition to hand-collected samples from various sites in the Priory there are two large sieved samples from the refectory (14th-15th century AD) and kitchen (15th-16th century AD); these contained so many fish bones that only 1/8 and 1/4 were analyzed, respectively.

All the samples are dominated by marine fish. Herring is by far the commonest species in the hand-collected samples, and in the sieved samples, its dominance is even more striking. Whiting bones are abundant, too, especially in the sieved samples. The southern location of Canterbury is reflected by the presence of European sea bass, grey mullet, tub gurnard and several species of sea breams. Based on four lines of evidence, viz., local availability of fish, butchery evidence, element representation and size distribution, Smith concluded that a combination of fresh and preserved fish were consumed at the priory. Some of the gadid remains bear evidence of deriving from stockfish. The numerous remains of whiting from the kitchen sample derive from specimens of a very uniform size (ca. 19 cm length), an indication that these had been processed. Remains of other species show much more size variation, indicating that they were taken fresh into the Priory.

Newcastle Quayside, Queen Street (9)

Newcastle lies on the River Tyne on England's northeast coast. Medieval fish bone material was excavated in the Quayside area, partly by handpicking, partly by sieving of bulk samples. The part of the material which is relevant for the present publication has been dated to the 13th-16th centuries AD. Twenty-one species of fish were identified in the material. Nearly all bones are from marine species, in addition there are a few estuarine or migratory species. The gadids seem to have been most important and are represented by cod, haddock, whiting, pollack, saithe and ling. There are also many herring bones, and flatfish seem to have been of some importance. The cod in the material were 35-ca.130 cm long, most of them being large. All the ling were more than 1 m long. Nicholson (1988) believed that fishing certainly took place in summer and autumn as shown by the presence of herring, garfish and large cod. Some of the smaller cod, as well as haddock, whiting, ling and flatfish, could have been caught in winter.

Newcastle Quayside, the Crown Court Site (9)

The fish remains are partly from inside buildings, and partly from outside areas with general rubbish. The material is referable to several phases. For the present review, indoor and outdoor samples have been pooled, and only three periods are recognized, viz. the 13th, 14th-15th, and 15th-16th centuries AD. As no temporal change is evident in the material, this does not result in loss of information. Fish bones were recovered by handpicking and predominantly from sieving of bulk residues. The species list is particularly varied. Virtually all the fish remains recovered are from marine species, gadids being by far the dominant group, followed by herring. The gadids are represented by cod, haddock, whiting, saithe and ling. Hake is also noteworthy. Both medium sized (35-75 cm) and large (>75 cm) cod are present. The ling were more than 1 m long, and the saithe around or over 1 m. The sizes of the gadids suggest that both deep sea and inshore fishing was practised. The variety of fish suggests that a range of fishing techniques was used, for example, nets and long lines with baited hooks (Nicholson, 1989).

Little Pickle, Surrey (10)

Little Pickle is situated south of London. Fish bones were excavated from a single well-preserved pit feature of Tudor date. The material is interpreted as kitchen waste and has been dated to the 16th century AD. The fish bones were recovered partly by hand-collection, partly by sieving through a 6 mm mesh. There are many species represented, marine, migratory and freshwater. Gadids seem to have been of the greatest importance; cod, haddock, whiting, pollack, saithe and ling are present. Flatfish and herring were also important, perhaps even more so than the material shows, as small fish must be regarded as underrepresented due to the large mesh size used during bone recovery. On the basis of the representation of skeletal elements the large individuals of cod, ling, haddock and saithe are thought to have been imported as preserved stockfish. The presence of sturgeon is taken as evidence of the high status of the household (Bullock, 1995).

Mary Rose (11)

The Tudor man-of-war Mary Rose sank in 1534 off Portsmouth in the English Channel. A large amount of fish bone material was retrieved from the orlop (or lowest) deck of the wreck. The fish bones are the remains of stores and thus provide a unique insight into the character of the fish supplies carried by ships at that time. Although Portsmouth lies marginally with regard to the scope of the present review, the Mary Rose material has been included (cf. Scheurrak SO1 under The Netherlands). The recovery method used for the fish bones was not given by Hamilton-Dyer (1995) who published the material. All in all, about 30,000 fish bones were found. Most of these were fin rays. Identification of the finrays was not attempted, but they are probably from cod because nearly all other bones are from this species. It is characteristic that bones from the head region are absent, as are the first ca. six vertebrae. The cleithrum, a shoulder girdle bone, is represented, but many of the cleithra were chopped. It thus seems that fish processing had at least included decapitation. In all probability the bones are remains of dried and/or salted cod, i.e. stockfish.

In addition to the numerous cod bones, there was a total of 37 bones from conger eel, hake, haddock and pollack. Hamilton-Dyer (1995) concluded that the remains seem to indicate the organized provision of specific types and amounts of fish as part of the regular diet on board naval ships.

EASTERN ENGLAND, OVERVIEW

The material from the eastern English sites covers the period from the 1st to the 16th centuries AD.

Local influences on English fishing

The English species lists are generally dominated by gadids, herring and eel. In addition there is an element reflecting local characteristics. The presence of southern species like European seabass, tub gurnard, red gurnard, John Dory and several species of sea breams thus agrees with southern England's location near warmer seas. Some of the other species found in the English materials, viz., conger eel, Ballan wrasse and fivebearded rockling are most common on rocky shores (the conger eel, however, also occurs offshore on rough ground, Wheeler, 1969). England has long stretches of rocky coast, although not along the southern half of the east coast where many of the sites are located. Thornback ray is the commonest species of ray in inshore waters along the East Anglian coast and is also relatively frequent in the eastern English material. In material from the other countries, with the exception of Belgium, it is much less abundant. Sandeels have similarly been found much more abundantly in England than in the other countries. The find of numerous bones of sandeel, together with bones of small clupeids, in Roman deposits in Lincoln, tempted Dobney *et al.* (1996) to an interpretation as remains of locally produced, Roman-type fish sauce. According to written sources, sandeels were of great importance in Medieval England (Nicholson, 1989). Maybe sandeels could be dug out on the long sandy stretches of tidal coast (suggestion by J. G. Nielsen who has tried this method in Denmark). The English material resembles that from Belgium with its large content of whiting bones.

Among the freshwater species, bitterling and burbot are of particular interest. Bitterling has been regarded as having been introduced to the British Isles during the 20th century (Holčík, 1999), but the find in 4th century deposits in Lincoln (Dobney *et al.*, 1996) suggests that it may have occurred naturally. Burbot used to have a very limited distribution in eastern England (Wheeler, 1969) and is possibly extinct in England today (Wheeler, 1992). The presence of barbel in English fish bone assemblages is also noteworthy, this species now having a very local and scattered distribution in eastern England (Wheeler, 1969). The find of common carp from 3rd century AD Roman deposits in Lincoln is by far the oldest record of this species in the region. According to Dobney *et al.* (1996) this find strongly supports the suggestion that the Romans introduced the common carp to certain areas as a prized food item and as an ornamental pond fish.

The large quantities of herring at the English sites suggests the widespread use of drift nets. The range of seafish species, in combination with the estimated sizes of the specimens caught, indicates that both inshore and deep sea fishing was practised from the 12th century onwards. European seabass, garfish, Atlantic horsemackerel and Atlantic mackerel indicate fishing during the summer and/or autumn. On the other hand, small cod indicate winter fishing, because these are more com-

mon close inshore along the English North Sea coast during winter. All in all, there is evidence for fishing all the year round in Viking Age and Medieval eastern England.

Differences between inland and coastal sites are evident. For instance, the coastal samples from Great Yarmouth, King's Lynn and Newcastle are totally devoid of freshwater fish.

Some samples represent refuse from high-status households. These include those from the 11th-12th century church and from the 12th-16th century priory of the St. Gilbertine Order (both from York), the fish remains from Westminster Abbey in London and the kitchen refuse from Little Pickle. Most of the few English finds of sturgeon, a rare and highly esteemed fish, are from this category of site. Westminster Abbey also contains remains of other highly esteemed fish species: European seabass, turbot, common sole and John Dory.

Remains of fishing tools from English sites

Fourty-five large iron fish-hooks (54-75 mm, one 122 mm) dated to the 11th-13th centuries have been found at Great Yarmouth. Hooks of this size would have been useful for catching large fish like spurdog, conger eel, ling, cod, large haddock or halibut, (cf. also the above discussion about import or local fishing at Great Yarmouth, Steane & Foreman, 1988). The Coppergate site at York produced ten fish-hooks of smaller size: 40-55 mm (Steane & Foreman, 1988). Hooks have also been found at Norwich; Jones & Scott (1985) reported a total of eight hooks, dated to the 14th-18th centuries.

In the wreck of Mary Rose, hand frames and floaters were found as part of the sailors' equipment, they were probably intended for supplying the diet with fresh fish.

Extensive fish weir complexes have been excavated in the River Trent at Colwick. The Trent empties into the Humber, the site is thus not too far away from York. One of the complexes has a calibrated radiocarbon date of AD 810-880, the other, AD 1070-1200. The latter complex was at least 100 m long (Losco-Bradley & Salisbury, 1979; Salisbury, 1988). These weir complexes were thus both in operation at the time of the settlements in York which are documented in the Fishergate and Coppergate bone assemblages. Fish weirs such as these have generally been used to catch eels and lamprey on their downstream migrations. As is evident from the species lists, eel were of particular importance. Just like today, fish weirs were probably also placed in estuaries and on tidal coasts in order to catch estuarine and inshore fish such as eel, salmon, trout, dab and flounder.

Indications of a chronological development and fish trade in eastern England

Chronological development in the exploitation of fish can be excellently illustrated using the material from York as an example. The Roman samples from York are mostly small and/or of dubious origin. The material from St. Mary Bishophill Junior, however, includes several thousand of bones of herring/sprat and may be interpreted as remains of locally produced of fish sauce.

Fishing during the Viking Age (8th-10th centuries) is very well documented at York. The material clearly indicates exploitation of local fish resources in rivers and the estuary, with eels and cyprinids being most frequent. There are also a good many remains of herring which may also have been caught in the estuary. After the Viking period, i.e., during the 11th-16th centuries, a shift towards greater exploitation of fish from the open sea seems to have taken place. Jones (1988b) noted a marked increase in species diversity in the bone assemblages from York from the 12th century AD onwards. The most striking feature is the larger content of gadid remains, but species such as thornback ray, conger eel, Atlantic mackerel and halibut also became important (O'Connor, 1989, 1991). An element of freshwater fish, present during all periods, is consistent with York's inland location. See Jones (1988b) for a discussion of further trends.

The Viking Age is not represented at the remaining English sites but the tendency for marine species to have been most important from the 11th century onwards is generally valid. However, different marine species dominate at different sites.

At Norwich, for instance, herring bones dominate, and all the marine species found here have also been found in the contemporaneous material from coastal Great Yarmouth. Jones & Scott (1985) assumed therefore that the marine fish found at Norwich were imported from Great Yarmouth.

Two size classes of cod are represented in the Great Yarmouth material. As large cod are nowadays uncommon off Great Yarmouth, Wheeler &

Jones (1976) suggested local fishing for small cod and the import of larger ones from northern waters. Alternatively, local fishermen may have caught large cod on fishing trips far away from home. The finds of large fish-hooks at Great Yarmouth are of relevance to this discussion. The presence of bones from the head as well as the trunk of the cod in the Norwich material suggests that if cod really was imported from Great Yarmouth to Norwich, then it was not in the form of stockfish.

The King's Lynn material also contains cod in two size classes (60-80 cm and 80-137 cm) and here too, both head and trunk bones are present (Wheeler, 1977).

Ling is another gadid which is generally present at sites from the 13th century onwards. Ling does not normally occur off the English North Sea coast and is therefore regarded as having been imported. According to Wheeler & Jones (1976), the same is true of halibut and possibly even large individuals of haddock. Large cod may have been more common in the southern part of the North Sea during the Middle Ages. There is, however, no reason to believe that this was also the case for ling and halibut and these must therefore be regarded as having been imported (Wheeler & Jones, 1976; Wheeler, 1977).

The import of stockfish seems to be indicated in the bone assemblages from Canterbury (14th-15th centuries AD) and Little Pickle (16th century) since several gadid species, viz., cod, ling, pollack and saithe are only represented by the shoulder girdle bone, cleithrum, and vertebrae. Other gadids, viz., whiting and haddock, do not show this bias in representation of skeletal elements (Bullock, 1995).

The finds from the shipwreck, the Mary Rose, prove that fish, especially cod, but also some conger eel, hake, haddock and pollack, were brought along as supplies. The representation of skeletal elements in the Mary Rose material shows that the fish were headless; they were probably dried and/or salted (Hamilton-Dyer, 1995).

REGIONAL OVERVIEW

Archaeo-osteological evidence for fishing in the southern North Sea region in the period from the 1st to the 16th century AD has been reviewed on a national basis in the preceding chapters. Evidence from a large number of sources has revealed some regional trends concerning the influence of local conditions on fishing and fishing methods. For the remaining discussion (seasonality and trade), fish bone evidence from sites in the Baltic area reviewed previously (Enghoff, 1999) is taken into consideration in order to reveal trends in fishing within this larger area in the period from the 5th century BC to the 16th century AD. Figure 8 shows the locations of all the Baltic and North Sea sites. Topics covered include the former distributions of fish species, the decline of sturgeon and other species, fishing seasons, and the chronological development of trade in fish.

When individual sites are referred to below outside a national context, the country in question is indicated with the same letter codes as those used in Table 1.

Local fishing for local fish in the North Sea region

The fish bone assemblages included in the present review contain species which could have occurred in local waters, suggesting that fishing was conducted locally. This is shown most clearly by species with a limited distribution in Europe which is reflected in the subfossil finds. Barbel is such a species, it has been found at Dutch, Belgian, English and Polish sites. Enghoff (1999) gave several other examples of species whose occurrence in the subfossil assemblages reflect their present-day distribution.

The proximity of the North Sea is reflected in the strong representation of gadids in the material treated here. Cod and haddock have been found in all of the countries; saithe, ling and whiting in most.

Corresponding to the abundance of herring bones at sites in the Baltic area and the famous seasonal herring fishing in Øresund (Enghoff, 1999), a striking profusion of herring bones also characterizes sites on the Belgian and English North Sea coasts. The North Sea is known to harbour several large herring stocks which through time have formed the basis of important herring fisheries (Jensen & Olsen, 1991). In England, the well-known East Anglian herring fishery is thought to have commenced about the year AD 495 (Wheeler & Jones, 1976). In this area, migration of herring resulted in seasonal exploitation and market activity each autumn (September-November), for instance in Great Yarmouth (Wheeler & Jones, 1989).

The English and Belgian sites flanking the southern North Sea show additional common traits. For instance, samples from these sites contain more remains of thornback ray and whiting than those from other countries, although both species are actually common along all North Sea coasts.

Several of the fish species seen in the assemblages are only common today as far north as the English Channel, for example the sea breams, red gurnard, nursehound and chub mackerel. Others, such as tub gurnard and European seabass, reach slightly further north. Material from the southernmost of the countries studied contains elements of species with similar distributions. In English material, the southern element is represented by John Dory, European seabass, red gurnard, tub gurnard and several species of bream. Belgian material has yielded nursehound, European anchovy, chub mackerel, tub gurnard, European seabass, black sea bream, meagre and grey mullet. Southern species from Dutch sites include smoothhound, common stingray, European seabass, meagre, striped red mullet, chub mackerel, barracuda, tub gurnard and European anchovy. The finds of chub mackerel and barracuda are, however, interpreted as deriving from imported fish.

Even Germany has records of three bones of meagre. The finds of meagre from The Netherlands and Germany are all dated to 4th century BC - 3rd century AD; perhaps this species occurred further north at this time. The Belgian find of meagre is dated to 15-16th centuries AD, but Belgium lies close to the English Channel which forms the northern boundary for the common occurrence of the species today (Curry-Lindahl, 1985).

Some of the southern species have been encountered at even more northerly sites, without there being any indication that they were not caught locally. This is true of smoothhound at Smedegaard (DK) and of thinlip grey mullet at Ribe (DK) (Enghoff, 1999).

The common carp

Common carp is an indigenous species in southeastern Europe but has been kept in aquaculture over much of central and western Europe. Common carp is represented in several bone assemblages from the region and period under consideration here; its bones are particularly plentiful in two of the samples from Ename (B). The oldest finds in the respective countries are: Poland, Wrocław 10th-14th centuries AD - Germany, Hitzacker (von den Driesch, 1982) 9th-10th centuries AD - The Netherlands, Leeuwarden 11-14th centuries AD - Belgium: Londerzeel and Laarne 13th-14th century AD - England, Lincoln 3rd century AD. See Hoffman (1994, 1995) for further details regarding the culture of common carp in Medieval Europe.

Sturgeon and other declining species

Species like pikeperch (*Stizostedion lucioperca*) are examples of the constancy of the geographical distributions of fish species (Enghoff, 1999). The subfossil assemblages also provide evidence of changes of distribution with time. Thus the migratory species sturgeon has been found at sites from all the countries covered here and thus can be assumed to have been widely distributed. As recently as in the 19th century sturgeon occurred commonly along the Baltic and North Sea coasts of Europe (Curry-Lindahl, 1985). In the 3rd century AD intense fishing for sturgeon took place at Feddersen-Wierde (D) where there even was a tool industry based on sturgeon bones. In the Middle Ages sturgeon was a highly esteemed fish reserved for the upper class. Based on German and Polish fish bone assemblages, Benecke (1986) documented a decline in sturgeon populations in the southern Baltic region in the course of the Middle Ages and ascribed this to overfishing. Nowadays, the sturgeon is regarded as extinct in the Baltic-North Sea region.

Similar, albeit less spectacular, examples of extralimital finds of fish which seem not to have been imported include wels and burbot. Wels was, i.a., found at some sites in Belgium and the south-central to southeastern Netherlands but is absent from this area nowadays (Heinrich, 1999b; Ervynck *et al.*, 1999), just as the find of wels at Birka (Enghoff, 1999) is slightly to the north of the present-day distribution in Sweden. (Brinkhuizen (1979b) showed that wels is native to an area in the western Netherlands). Burbot was found at a few English and Belgian sites but is now regarded as extinct in both countries.

Fishing methods

The variety of fish species found, especially at the coastal sites, suggests that fishing was conducted using a number of different methods. Nets, hook-and-line and fish weirs seem to have been most important.

NET FISHING

Jones (1981) wrote that "a likely explanation for the sudden rise in surfaceswimming, pelagic fish [herring, Atlantic mackerel and garfish] in the late Saxon period is the development of the East Anglian herring fishery, which used floating nets". Wheeler & Jones (1976), Jones (1983) and Nicholson (1989) also assumed surface nets to be the main tools for English herring fishing. In the Baltic area the extensive catches of herring were likewise supposed to have been secured by net fishing (Enghoff, 1999).

Fishing nets were of course used for catching many species other than herring. Other pelagic species likely to have been net-caught include Atlantic horsemackerel and European seabass (Wheeler & Jones, 1976). Also the numerous whiting in the English assemblages are assumed to have been net-caught (Nicholson, 1989). The same is probably true of the abundant Belgian finds of this pelagic shoaling species. Atlantic mackerel and garfish were probably net-caught, too, as seems to have been the case in the Baltic region (Enghoff, 1999).

The large finds of plaice/flounder/dab at Ribe (DK) and several other coastal sites further south may also represent results of net fishing [net sinkers have been found in Iron-Viking Age Ribe and in Raversijde (B)].

HOOK-AND-LINE FISHING

From most of the countries large individuals of gadids (cod, haddock, ling) and/or hake are known. These fish mainly occur in not-too-shallow waters close to the seabed and would have been most efficiently caught using hooks attached to long lines.

There are several examples of fish bone assemblages from countries on the North Sea containing the remains of large gadids, which are assumed to have been caught this way. For instance, they are present at the German North Sea sites of Feddersen Wierde and Elisenhof. The former site provides a remarkably early example of fishing for these large fish (3rd century AD). Eastern English assemblages with large cod, haddock and ling include Great Yarmouth and King's Lynn (both 11th-13th centuries AD). Finds of large fish-hooks at Great Yarmouth contribute to the picture.

Large fish-hooks like those found in Great Yarmouth were probably used for catching species other than gadids, for example, spurdog and other sharks, conger eel and halibut. Thornback ray, which is particularly frequent in English and Belgian assemblages, was probably also caught on hooks (a line sinker was found at Raversijde (B)). Brinkhuizen (1989a) mentioned that all marine species represented at Velsen I (NL, 1st century AD) are demersal (bottom-living) and that sea-fishing was conducted using lines.

FISHING WITH WEIRS

Very large catches may be obtained using weirs. Several complexes are known from England, for example from Colwick on the River Trent (9th and 11th-13th centuries AD) (Losco-Bradley & Salisbury, 1979; Salisbury, 1988). Weirs placed in rivers may catch large numbers of migratory species such as eel and salmon. It seems probable that the large numbers of eels caught in York (GB, 8th-9th centuries AD) are due to weirs of a kind.

Weirs placed on tidal coasts may be used for catching inshore species such as flatfish (plaice/flounder/dab) but also eel, salmonids and many others. The most abundant fishes found at Southampton (eel, flounder, European seabass and mullet; Bourdillon & Coy, 1980) were hypothesized by the authors to have been caught in intertidal traps or kiddles.

OTHER METHODS

Brinkhuizen (1989a) thought that the small cyprinids from Velsen 1 (NL, 1st century AD) indicate freshwater fishing using traps or nets. Remains of wickerwork fishtraps are known from Dorestad (NL), and an eel-trap from Ename (B).

Fishing seasons

Knowledge of fish biology may indicate the time of year at which fishing took place. Certain species, known as seasonal fish, occur in local waters exclusively in certain seasons and therefore reveal directly the fishing season. Garfish is a typical seasonal fish which has been found at sites in all the Baltic and North Sea countries studied except Estonia and Poland; it indicates fishing

during the summer half of the year. Atlantic mackerel only occurs in coastal waters during the summer half of the year but may be caught in the North Sea all the year round. Like garfish it is represented in material from all countries except Estonia and Poland. Other species which indicate summer fishing at coastal sites include Atlantic horsemackerel and European seabass.

Herring fishing from Great Yarmouth (GB) and in the Øresund region (DK and S) took place during the autumn, in connection with the herring migration.

In general, there are several indications that fishing took place in the summer half of the year. It is much more difficult to find signs of winter fishing. In England, however, small cod and haddock are assumed to have been caught during the winter, when they come closer to the coast. Although evidence for winter fishing is sparse, there is no reason to assume that fishing did not take place at this time of the year, both in the sea and in fresh water.

Trade in the Baltic and North Sea regions: how it can be indicated by fish bone assemblages

Fish bone assemblages indicate trade if they contain species which could not have been caught locally, for example marine species at inland sites, or exotic species. Over- or under-representation of certain skeletal elements may reveal fish processing characteristic of the fish trade, for example stockfish or gill-less herrings. Also, a limited size range of individuals in a bone assemblage may be indicative of trade, locally caught fish ussually exhibit a large size variation.

Indications of fish trade before AD 800

In Sweden, the Eketorp material from 5th-8th centuries AD (Hallström, 1979) contains bones of ling and vertebrae of large cod which have possibly been imported, since these are both rare in the Baltic Sea. In the Netherlands, bones of chub mackerel were found in material from the Roman settlements at Velsen and Nijmegen, 1st century AD, and at the latter site a single vertebra of barracuda appeared as well. Some of these bones have been interpreted as deriving from salted, imported fish, but other chub mackerel bones are possibly remnants of fish sauce imported from the south. Remains of fish sauce have also been found at two Roman sites in Belgium (Tongeren and Braives). As time went by, local fish sauce industries based on local raw materials arose (Bateman & Locker, 1982; Jones, 1988a; Van Neer & Ervynck, 1994b; Van Neer & Lentacker, 1994; Dobney *et al.*, 1996).

Danish, Estonian, Polish, German, English and Norwegian fish bone assemblages from this period provide no indications of trade.

Fish trade at major Viking and contemporaneous trading centres

Ribe on the Danish Wadden sea coast is known as an important Danish Viking Age trading centre and has yielded fish bone material dated to AD 700-850. All species in the Ribe Iron-Viking Age material could have been caught in the river, Ribe Å, or in the sea off Ribe. Although Ribe seems to have been an important trading centre, trade in fish is not suggested by the bone material.

The great importance of local fishing also characterizes the other major trading centres of this epoch, such as Sebbersund (DK, 8th-10th centuries AD), Birka (S, 10th century AD, Ericson *et al.*, 1988), Haithabu (D, 9th-11th centuries AD, Lepiksaar & Heinrich, 1977), Dorestad (NL, 8th-9th centuries AD) and York (GB, 8th-11th centuries AD).

In addition to local fishing there are some indications of limited import, perhaps in the form of travellers' supplies, to some of the centres. Thus, a small number of bones of ling, saithe and halibut were found at Haithabu. These species could not have been caught locally but are thought to represent provisions carried by travellers. The marine element in the York assemblages (Fishergate, Coppergate) is insignificant and may also represent travellers' supplies or minor import for sale. In the Dorestad material, however, there are a modest number of bones from gadids, plaice/flounder/dab and herring; exactly the fish most well suited for preservation and transport.

In conclusion, the fish remains from the trading centres active at the end of the first millienium AD do not reflect fish trade, with the possible exception of Dorestad.

Subsequent to the great trading centres mentioned above, trade in fish did gain very much in importance. Within the study area, the fish most suited for trade are gadids, herring and flatfish. These three groups will therefore be discussed individually, and a few words will then be added on trade with other species.

Trade in haddock, cod and other gadids

The clearest example of a gadid species whose representation in the subfossil assemblages changes significantly with time is the haddock. The earliest finds of haddock are from sites on or near the North Sea coast. In Denmark, there is a single haddock bone from Smedegaard (4th century BC - 2nd century AD, Enghoff, 1999), and there are several haddock bones from Ribe (8th-9th centuries) and Aggersborg (8th-10th centuries, Rosenlund, 1976). Further south on the North Sea coast, haddock occurs at Elisenhof (D) (8-13th centuries, most bones from the oldest phase). In the Netherlands haddock bones occur already at the Roman sites (1st century AD) on the coast. One must assume that the appearance of haddock at those sites where it could have been caught locally is determined by the development of fishing techniques.

Haddock appears in inland assemblages with some delay and gradually gains in importance. At Selsø-Vestby (DK, Enghoff, 1996), for example, haddock is absent from the 8th-10th century phases but appears in the 10th-11th centuries. From this time onwards, haddock is present in the majority of Danish assemblages, certainly as a result of trade, and its importance increases throughout the Middle Ages. Haithabu-Schleswig (D, Heinrich, 1983, 1987) provides another example of the delay in the appearance of haddock at inland sites. Haddock is absent altogether from the Haithabu material (9th-11th centuries) but at the succeeding settlement of Schleswig, the importance of haddock increases through the 11th-12th, 13th-14th and 15th-16th century phases. It seems, however, that trade in haddock did not extend beyond Schleswig: this species has not been found at any other German Baltic sites and is absent altogether from Polish and Estonian assemblages. On the other hand, haddock was imported in the north to the sites of Eketorp (11th-14th centuries) and Uppsala (13th-17th centuries) on the Swedish Baltic coast (Jonsson, 1986).

The above-mentioned delay in the appearance of haddock inland is also obvious in the North Sea region. For instance, haddock makes its appearance at Duisburg (D), more than 200 km from the sea, in the 13th century, and at Namur (B), far inland in Belgium, in the 14th-15th centuries, although it occurs generally in other Belgian material from the 12th century onwards.

In England, the increasing importance of haddock is seen, for instance, in York, Fishergate (GB) where the proportion of haddock bones in the assemblages increases from 0.05% of the identified bones in the 8th-9th centuries to 0.4% in the 11th-12th centuries AD, 4.2% in the 12th-16th centuries and 15% in the 16th century (O'Connor, 1991). Similarly in Newcastle (GB); 6% in 13th century, 8.1% in 14-15th centuries and 14.8% in 15-16th centuries (Nicholson, 1989).

Haddock is just one among many gadids which have been subject to trade. The others are cod, ling, saithe, pollack, torsk and perhaps whiting, as well as hake, a close relative of the gadids proper. For export purposes, these species were probably dried and/or salted. There were various methods of salting and drying but usually the product, stockfish, can be traced by a biased representation of the skeletal elements. Heinrich (1986, 1992) was of the opinion that remains of gadids from Medieval sites in northern Central Europe can, to a large extent, be regarded as evidence of trade with stockfish. Especially the west coast of Norway was an important source of stockfish. Western German merchants traded with Norway, and from the 13th century AD onward the Hanseatic League was the main trading company. After the introduction of Christianity, stockfish became very important as food during the fast (Heinrich, 1986, 1987). The gadid group as a whole appears first in material from coastal sites. Cod is mostly found earlier than haddock, because cod goes closer to the coast and is therefore easier to catch.

In a country like Denmark where any place is close to the sea, trade with marine fish is difficult to document. Accordingly, there is no evidence whatsoever of fish trade in Denmark prior to the Middle Ages when the import of gadids, among others, to monasteries and castles seems to have taken place.

In Sweden, the import of large cod and ling to Eketorp may have taken place as early as the 5th-8th centuries AD. In addition, large cod seem to have been imported to Sigtuna in the 12th century (Hårding, 1990), Uppsala in the 13th-14th centuries (Jonsson, 1986), Borganäs in the 14th-15th centuries (Sten, 1988) and Skara in the 13th-17th centuries (Lepiksaar, 1976). Hårding (1990) and Jonsson (1986) thought that the large cod may have come from the Atlantic Ocean, having been imported via Norway. The gadids from Skara were probably imported from Gamla Lödose on the Swedish North Sea (Kattegat) coast where bones from the same gadid species have been found. Fishing

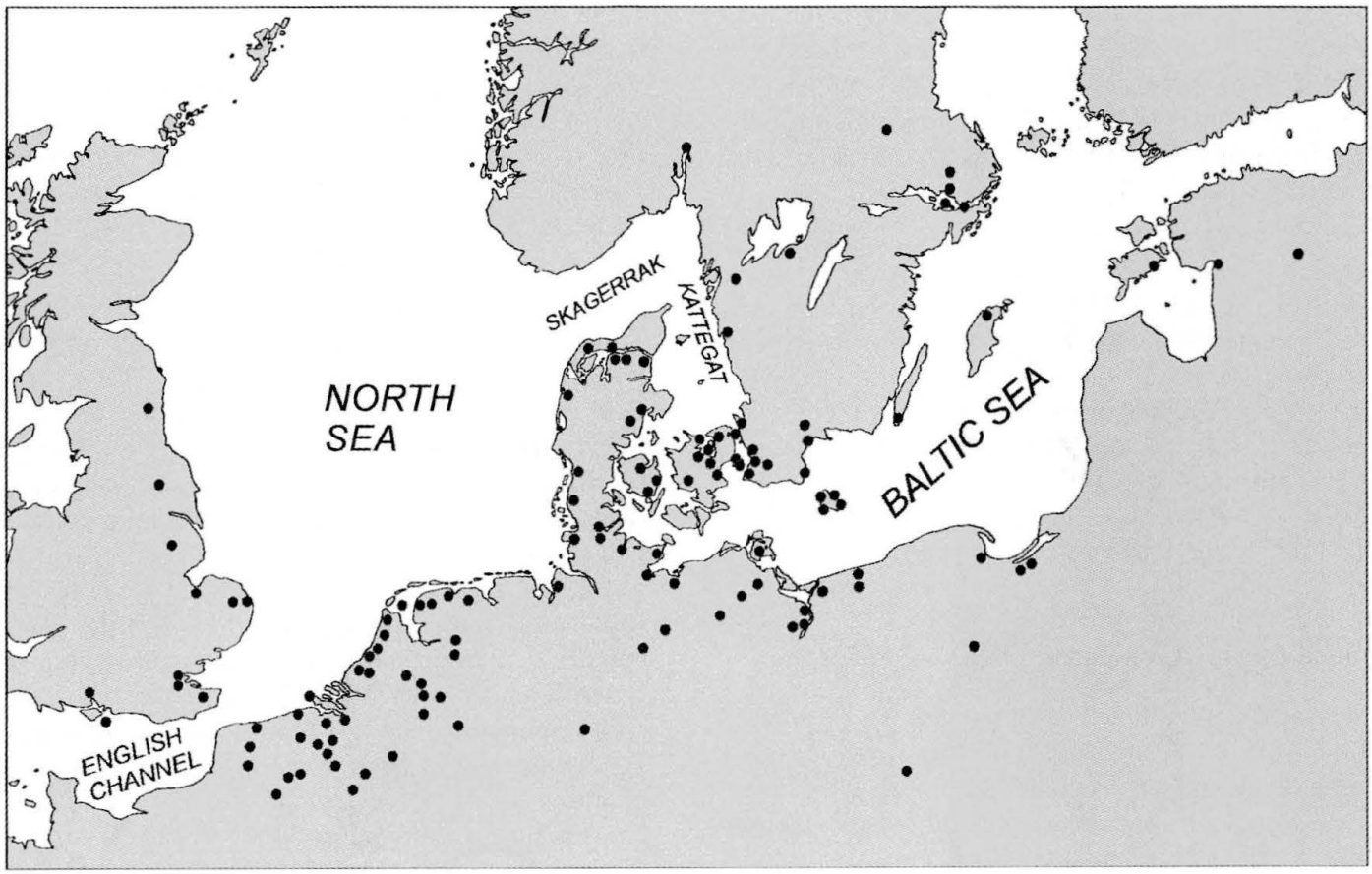

FIGURE 8

Map of the Baltic and North Sea region of Europe, showing the location of the reviewed sites in Enghoff (1999) and the present work

from Gamla Lödöse, in turn, was probably local, as hake, ling and saithe could all have been caught off the coast at this site (*contra* Lepiksaar, 1965).

Small cod could have been caught in the Baltic Sea, whereas large cod in Baltic assemblages must be regarded as having been imported. For example, large cod seem to have been imported to Schleswig (D, 11th-14th centuries, Heinrich, 1987). Cod has also been imported to Lübeck (D, 12th-16th centuries, Paul, 1980; Pudek, 1980), and even to far-inland Freyenstein (D, 13th century, Benecke, 1989). For Germany in general, cod seems not to have been popular at Slavonic sites from where its bones are almost completely absent (Benecke, 1983; Heinrich, 1986, 1987). The situation in Poland apparently also reflects this cultural difference in fish taste: Among the Polish inland sites, only the Teutonic castle in Mała seems to have imported cod. Cod were also imported to the Medieval town of Tartu in Estonia in the 14th-16th centuries.

Gadids caught off the North Sea coast reached Hitzacker (D, von den Driesch, 1982) in the 12-16th centuries, and Duisburg (D) in the 10-14th centuries. Dutch and Belgian assemblages are generally rich in marine fish, including gadids, but it is difficult to determine when the importing of gadids commenced. In the Netherlands, gadids are present already at the trading centre of Dorestad, 8th-9th centuries, and bones of cod and ling from Leeuwarden (11th-14th centuries) seem to be the remains of stockfish. In Belgium, import of cod appears to have been going on at least since the 12th century.

In England, gadids made up only a very small part of the Viking Age material from York, but later material generally contains many gadid bones. The cod could have been caught off the English coast, as was the case at sites like King's Lynn and Great Yarmouth. The latter seems to have been the source of gadids and other marine fish imported to the inland town of Norwich. Remains of ling found in English assemblages (mostly 13th century) might represent imported fish. At Little Pickle (GB) not only ling, but also cod, pollack and saithe seem to have arrived as

stockfish. On the other side of the Channel, in Heist (B), many ling bones have been found from the 14-16th centuries. Even Oslo (N), which lies close to gadid-rich waters, is reported to have received imported dried ling and large cod from the north (Lie, 1988).

The finds of fish remains in the Dutch shipwreck Scheurrak SO1 and the English Mary Rose (both 16th century) provide direct proof that barrels of dried/salted gadids were taken on board ships, probably as provisions. Cod, torsk and ling were found on board Scheurrak SO1, and there were cod in the Mary Rose. The representation of skeletal elements indicates how these stockfish had been processed and, furthermore, provides clues for the interpretation of other assemblages.

Trade in herring

As described above, the occurrence of herring bones at coastal sites within the area and period of time dealt with here, is markedly local. It includes, for example, a concentration of herring bone finds in eastern Denmark and further eastward along the Baltic Sea coast. In particular, the abundance of herring bones at sites in the Øresund region (DK and S) is overwhelming, corroborating the historical accounts of an incredible Medieval "herring adventure" in this area. Special markets (the most famous of which was in Skanör, southwesternmost Sweden) arose with the purpose of trading herring freshly caught in the Øresund and then salted in barrels (Eriksson, 1980). A most interesting find relating to the herring industry has been made at Selsø-Vestby (DK) close to the Øresund region (13th-14th century). This is the first indication whatsoever of a technique involving the removal of the gills in order to increase the quality and durability of the preserved fish for export (Enghoff, 1996). Until now, the invention of this technique has been ascribed to a 14th century Dutchman named Beukelszoon van Biervliet (Seeman, 1986).

The importing of herring to the Swedish interior is not suggested by the bone evidence; not a single herring bone has been found at Swedish inland sites. In contrast, herring appear to have been extensively imported to inland Baltic Germany and Poland. Herring bones have been found at Menzlin (D, 9th-10th centuries, Benecke, 1987), Lieps (D, 10th-13th centuries, Benecke, 1984) and Freyenstein (D, 13th century, Benecke, 1989) far from the Baltic coast. Polish inland sites with herring include Poznan (12th century, 240 km from the sea), Santok (13th century, 160 km from the sea) (Makowiecki pers. comm.), and Wrocław (10th-14th centuries, 400 km from the sea, Kozikowska, 1974). It may not be coincidental that particularly abundant herring remains have been found at Kolobrzeg-Budsistowa (8/9th-11/12th centuries) on the Polish coast. The salty springs near this site would have been very useful when salting herring for export inland (Rulewicz, 1994).

Even the North Sea stocks of herring seem to have formed the basis for trade. In Belgium, herring is generally present in sieved materials from the 12th century onwards, both from coastal and inland sites. Herring must have been imported to the latter. Special mention must be made of the find from Ename, Abbey of San Salvator (15th-16th centuries) where abundant herring bones, among other remains, were found under the kitchen floor. It is of particular interest that these remains appear to represent gill-less herrings. This is thus an example of the product of the industry the refuse from which was found at Selsø-Vestby (DK, see above). Remains of gill-less herrings have also been found at a Dutch 17th century whaling station on the island of Spitsbergen in the Arctic Ocean (Seeman, 1986).

Herring bones occur commonly at English sites, to some of which the fish must have been imported. Examples are the Gilbertine Priory in York (12th-16th centuries), St. Gregory's Priory in Canterbury (12th-16th centuries AD) and Westminster Abbey in London (11th-13th centuries).

Van Neer & Pieters (1997) and Benecke (1982) argued that the narrow size range seen in some assemblages of herring bones from inland size can be taken as evidence that the herring had been processed and imported.

Trade in flatfish

Flatfish, in particular the plaice/flounder/dab-group, are well suited for drying and salting, and hence for trade. Accordingly, plaice/flounder/dab is represented at Danish monasteries such as Odense Sortebrødrekloster (13th-16th centuries, Rosenlund, 1976) and Øm Kloster (15th-16th centuries, Rosenlund, 1984) to where they must have been imported. As we saw with the herring, Sweden is different in this respect: there is not a single bone of plaice/flounder/dab from a Swedish inland site, and

thus no indication of trade in flatfish. Both plaice and flounder had reached the inland site of Dorestad (NL) by the 15th century, and plaice had reached Utrecht (NL) by the same time. Belgian assemblages generally contain plaice/flounder/dab from the 12th century onwards, an exception being Namur, which lies far inland.

The Belgian fishing village of Raversijde has produced a most interesting find relating to the 15th century fish industry: Remains of the head and tails of plaice were found together with bivalve shells interpreted as the fish's stomach contents. Maybe Raversijde was a source of flatfish exported to the Belgian interior.

Trade with flatfish also took place in England: From coastal Great Yarmouth (10th-13th centuries) to contemporaneous Norwich, and from the coast to high-status sites like the priory of the Gilbertine order in York and Westminster Abbey in London.

Trade in other fish species

Trade with pike seems to have played an important role in Sweden where this species appears to have been of great importance at Birka (10th century, Ericson *et al.*, 1988), Borganäs (14th-15th centuries, Sten, 1988), Uppsala (13th-17th centuries, Jonsson, 1986) and Stockholm (14th-15th centuries, Vretemark, 1982). Pike bones from the latter three sites have been interpreted, on the basis of butchering traces, as remains of dried pike, probably imported from northern Sweden (Jonsson, 1986). Finds of pike represented solely by the head and shoulder bones have been made at the Polish sites of Tolkmicko (7th-5th centuries BC, Filuk, 1968) and Szczecin (9th-11th centuries AD, Chelkowski, 1959), and at German Schleswig (11th-14th centuries AD). These finds may also represent the remains of dried pikes.

Many other species have been subject to trade. For instance, the fish bone evidence reflects intensive fishing for sturgeon which was regarded as a precious fish, often reserved for the upper class. Sturgeon is accordingly seen in assemblages from monasteries and similar sites. Salmon, trout and thornback ray seem to have been similarly highly esteemed, the latter possibly only in the Nordic countries.

A particularly illustrative example of how varied the import of marine fish to an inland site could be, is provided by the material from Ename, Abbey of St. Salvator (B, 15th-16th centuries). The diet of the late Medieval inhabitants of this abbey included the following marine fish: thornback ray, herring, cod, whiting, haddock, turbot, plaice, flounder and common sole.

CONCLUDING REMARKS

Just as for the Baltic fishing (Enghoff, 1999), a chronological development in fishing is indicated by the North Sea fish bone assemblages. Furthermore, a joint consideration of both areas reveals some general tendencies. Starting with fishing for local consumption, a stage was reached, through the development of better methods for catching, processing and preserving fish, where fish could be exported to places where a demand had arisen due either to local over-fishing, pollution, or perhaps the Christian rules for food consumption during the fast (Lent).

A glance at the maps showing the sites dealt with in this review reveals that they are all located either on the coast or on a major watercourse (a river or the like). There can thus be no doubt that ships played a major role in man-fish relationships, either as fishing vessels or as a means of transportation.

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