FISH BONES

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Introduction

This report is concerned with the fish remains recovered during the flotation of soil samples from three sites in Ipswich. Particular care was taken to ensure that those deposits sampled for fish bones were sealed and securely dated; there is little chance of contamination from reworked or intrusive material. All the bones from Vernon Street, Stoke (IAS 7402), and Lower Brook Street (IAS 5502) are of Middle Saxon date and were retrieved under the supervision of the author in 1975. The bones from the Turret Lane site (IAS 4302) are Saxo-Norman and medieval and were retrieved in 1978 by Peter Murphy.

Methods

The bones from the 1975 excavations were recovered from column samples of soil, usually 20cm square taken from the centres of features, and divided for convenience into blocks of 15 litre volume (1 bucket). However, at Vernon Street, a 40cm square column was taken from ditch 90 and, after the columns had been taken from pits 237 and 281, the remaining fill was processed. The majority of soil processing and residue sorting was done by volunteer school children under the author's supervision.

The fish bones excavated in 1978 were similarly retrieved from the residue of soil flotation and described by Peter Murphy elsewhere in this volume (page....).

The fish bones were identified using comparative skeletal material, at the British Museum (Natural History) and at the Environmental Archaeology Unit at York University. A number of bones, notably ribs, fin rays and branchio-stegals proved to be unidentifiable. Bones which could not be assigned to family or species have been omitted from tables 00 to 00.

Measurements of certain bones were taken using conventional sliding callipers. Premaxillae and dentaries of whiting and cod were measured using the points described by Wheeler and Jones (1976). Three measurements were taken on selected vertebral centra.

1. The maximum width of the anterior articulating surface.

2. The median dorso-ventral depth of the anterior articulating surface.

3. The median anterior/posterior distance.

Results

The results of both sites are given in Tables 00 to 00. Bracketed numbers represent the total of vertebral centra, unbracketed numbers represent other identified bones.

A full list of identified bones and measurements is housed with the Suffolk Archaeological Unit and is available on request.

TABLE 1
Middle Saxon Fish Bones from Vernon Street, Stoke (IAS 7402)

Context No	Volume of Soil Processed	Elasmo-branch	Thornback Ray	Shad	Herring	Eel	Whiting	Cod	Haddock	Flatfish	TOTAL
0090	622 1					(1) 2	(5) 4	(7) 6		(6) 1	(19) 13
0237	435 1	(8)	7		(2) 1	(5)	1	(3)		(4) 2	(22) 11
0281	475 1	(2)	2	1		(1)	(15) 10	(83) 17	1	(16) 1	(117) 32
Sub Total	1532 1	(10)	9	1	(2) 1	(7) 2	(20) 15	(93) 23	1	(26) 4	(158) 56

Note: Numbers in brackets denote vertebral centra, unbracketed numbers are other identified bones.

TABLE 2
Middle Saxon Fish Bones from Brook Street (IAS 5502)

Context No	Volume of Soil Processed	Elasmo-branch	Herring	Salmon/ Trout	Pike	Cyprinid	Eel	Conger Eel	Whiting	Cod	Flatfish	TOTAL
0537	75 1				(1)		(52)		(1)			(54)
0113	60 1	(1)	(I)		(1)		(32) 1	(1)	(1)	(1) 1	(12)	(50) 2
0229	65 1			(1)			(1)					(2)
0369	40 1		(1)			(1)	(2)		(4)		(3)	(11)
0374	55 1	(1)	(2) 1				(5)			(1)	(4)	(13) 1
0434	60 1		(1)				(63)			(1)		(65)
Sub Total	355 1	(2)	(5) 1	(1)	(2)	(1)	(155) 1	(1)	(6)	(3) 1	(19)	(195) 3

TABLE 3
Saxo-Norman Fish Bones from Turret Lane (IAS 4302)

Context No	Date	Volume of Soil Processed	Elasmo-branch	Thorn-back Ray	Herring	Eel	Gar-fish	Whiting	Cod	Gadid	Mackerel	Flatfish	TOTAL
0070	Unstrat	51			(5)	(2)							(7)
0032	C9/C10	101			(7)								(7)
0038	C9/C10	101			(2)	(165) 3		(1)					(168) 3
0029	C11	151	(1)	1	(15)		1	(1)	(2) 5		(1)	(2)	(26) 7
0031	C11	151			(4)			(1)					(10)
0035	C11	201			(10)	(4) 2		(1)		2		(2)	(17) 4
0047	C11	51			(1)	(3)							(4)
0048	C11	51			1				1			(1)	(1) 2
0050	C11	101			(1)	(98) 6							(99) 6
Sub Total		90 1	(1)	1	(45) 1	(281) 11	1	(4)	(2) 6	2	(1)	(5)	(339) 22

Table 4

Medieval Fish Bones from Turret Lane (IAS 4302)

Context No	Date	Volume of Soil Processed	Elasmo-branch	Thorn-back Ray	Herring	Eel	Gar-fish	Whiting	Cod	Gadid	Mackerel	Flatfish	TOTAL
0060	C12	101	(1)		(17) 3	(4)		(2) 1	(1)	(1) 2			(26) 6
0034	C13-C15	151	(1) 1		(13) 2	(4)		(2)		(2) 2			(22) 5
0042	C13-C15	151	(4)		(13) 4	(3) 2		(1)				(4)	(25) 6
Sub Total		401	(6) 1		(43) 9	(11) 2		(5) 1	(1)	4			(73) 17

Notes on the Identified Species

Elasmobranch Remains

Elasmobranch skeletons are composed of cartilage, a substance which decomposes rapidly, thus little evidence of sharks and rays survives in archaeological deposits. Teeth and dermal denticles persist, but these are extremely small and usually not diagnostic to species. A few "bucklers", dermal denticles with greatly swollen bases, were recovered and have been attributed to thornback ray. A number of mineralised cores of elasmobranch vertebral centra were identified but these proved impossible to assign to species. It is possible that a large variety of small sharks and rays were brought onto the site but have left no trace.

Thornback Ray, Raja clavata L

This fish is the most abundant ray occurring in British inshore waters today, being found in depths between 2-60 metres. It can grow to a length of 85cm, a breadth of 61cm and a weight of at least 17.25 kg. The presence of highly distinctive bucklers enabled the identification of this species. It is usually captured in trawls, or on hooks and lines.

Shad, Alosa sp

Shads are large members of the herring family (Clupeidae) and grow to 50-60cm length. They are pelagic plankton feeders which migrate into rivers to spawn. There are two British species, the allis shad, A alosa (L) and the thwaite shad, A fallax (Lace'pLle); they have similar distributions and are only separated after detailed morphological examination; the single ceratohyal could have come from either species. The paucity of shad remains suggests they were infrequently caught. Today shads are usually taken in seine or drift-nets but will take a baited hook.

Herring, Clupea harengus L

This well known pelagic fish formerly occurred in immense shoals around the British Isles. It is most common in late Autumn in the southern North Sea where it grows to 40cm length. Herring skull bones, vertebral centra and a few scales were recovered, being particularly abundant at the Turret Lane site. Until the introduction of the mid-water trawl, herring were usually caught in drift or seine nets.

Salmon/Trout, Salmo salar L/S trutta L

Both salmon and trout live in freshwater, estuaries and salt water at various stages in their breeding cycles although there are sub-species of trout which spend their entire life in freshwater. One large salmonid vertebral centrum was recovered, its size (13.4mm x 12.6mm x 8.9mm) suggesting that it is from a salmon or large sea trout measuring in the region of 80-90cm total length. Such a fish may have been caught in drift-nets, with hook and line or in specially constructed traps.

Pike, Esox lucius L

Pike is a carnivorous freshwater fish which lies in wait for its prey under the cover of aquatic plants until a fish comes close enough to be seized. It frequently grows to 100cm and 14kg and has palatable flesh, rendering it a valuable food source. Of the two pike bones identified only one was sufficiently complete to allow measurements to be taken; this Centrum (4.7mm x 4.8mm x 3.7mm) would have come from a fish measuring about 40cm. Pike is caught by live-baiting or spinning with an artificial lure, although a wide variety of other techniques are used by anglers; commercial fisheries most frequently employ nets or traps.

Common Eel, Anguilla anguilla (L)

Depending on the season, eel can be caught in salt, brackish or freshwaters. Eel can grow to over a metre in length but the vertebral centra found on all sites may indicate that the fish did not exceed 50cm. Nearly all soil samples contained eel remains suggesting that this species is of considerable dietary significance. It can be caught in large numbers using a variety of techniques which include hook and line, nets, traps and eel-spears or leisters.

Conger Eel, Conker conker (L)

This fish is usually found amongst rocks or on rough ground. It occurs in most British waters but is more often taken in the English Channel and western waters than in the North Sea. Most frequently it is captured on hooks at depths of 20-60 metres. Conger can grow to 120-150cm and has palatable flesh.

Garfish, Belone bellone (L)

The garfish is fairly common in inshore waters round the British Isles in the Summer and Autumn months, when it often enters estuaries. With an elongate body and prolonged beak-like snout, garfish can grow to 76cm and may weigh as much as l kg. A highly distinctive fragment of lower jaw allowed this species to be identified. Garfish has little value as a commercial fish partly because when cooked its bones are bright green in colour! It is usually caught in floating nets although it will take bait.

Whiting, Merlankius merlangus (L)

Whiting is a very common fish in the North Sea, inhabiting depths of 30-100 metres. Unlike other commercially important members of the Gadidae (cod family) it is not a large fish, rarely exceeding 70cm in length. Whiting remains were found on all three sites in Ipswich indicating that it has been eaten continuously from the earliest occupation of the town. Whiting is one of the most important fish to be caught by small boat fisheries, being most often taken in trawls and drift-nets although seine nets and hooks are also used.

Cod, Gadus morhua L

Cod is abundant in the North Sea occurring in both inshore and offshore waters. Today it is mainly taken in trawls but can be caught on baited hooks and in nets. It is a large fish which can grow to 150cm and 40kg. The large quantities of cod remains from the Middle Saxon deposits indicate that it was an important food fish in that period.

Haddock, Melanogrammus aeglefinsu (L)

This is a bottom-living fish rarely caught at less than 60 metres depth. Its present distribution in the southern North Sea is sporadic, although there is evidence to suggest that it was once more common. Haddock regularly grow to 80cm and 3kg. A single maxilla was the only bone identified as haddock; it would therefore appear that it was not frequently caught. Haddock can be taken on baited hooks or in nets, however, today trawls are most often employed.

Gadidae (cod family)
A number of vertebral centra and head bones have been assigned to this taxon because although clearly belonging to the family they could not be attributed to species with any certainty.

Mackerel, Scomber, scombrus L

Although this well known fish forms immense shoals in the Summer and Autumn around much of the British coast, it is only sporadically caught in the southern North Sea. Mackerel regularly grow to 35-45cm and can weigh up to 1.8kg. It is represented by a single vertebral centrum from Turret Lane and cannot be regarded as a significant food source for the Saxon and medieval period.

Flatfishes

Flatfish vertebral centra and pterygiophores (modified haemal spines) were present on all three sites studied. Unfortunately, jaw bones, the only bones that can be used to make reliable identifications, were not present, however, the size of the vertebrae and the shape of the anal pterygiophores suggest that the fish were either flounder, Platichthys flesus (L) or plaice, Pleuronectes platessa L. Flounder is a common inshore fish living in estuarine and coastal waters on sandy or muddy ground. Many methods are used in its capture, e.g. seine nets, set nets, hook and line and spearing. Plaice is a common flatfish living on similar ground to flounder but is exclusively marine. It is caught in trawls, seine nets, set nets and, occasionally, on hook and line around the British coast.

The Vernon Street, Stoke, Fish Bones (IAS 7402)

The fish bones retrieved from this site represent a Middle Saxon assemblage dominated by marine species. Cod remains occur most commonly, constituting over 50% of the total number of bones. It is possible to estimate the length and gutted weight of some of these code from measurements taken on their upper jaw bones (premaxillae). Details of this method are given in the recent fish bone report on remains recovered from Great Yarmouth (Wheeler and Jones, 1976). Four premaxillae proved to be measurable and size estimates are given in Table 00.

Table 00

Context No.	Premaxilla depth in mm	Left or Right	Estimates	
			Length in cm	Gutted weight in kg
0090	15.5	Right	100	8.5
0281	15.3	Left	100	8.5
0281	16.1	Left	105	10.0
0281	17.9	Left	115	13.0

Clearly the cod brought onto the Stoke site were large fish. If it can be assumed that the group of bones recovered from Stoke is a representative sample of the fish brought onto the site and that the inhabitants ate the whole of these fish, then it would appear that cod was the most important fish in the diet, for the remaining species represent only a few kilograms of edible fish.

Whiting and flatfish remains are fairly abundant. These fish do not grow to the same size as cod, their flesh has good eating properties and they occur in large numbers in the southern North Sea.

Assessing the dietary significance of elasmobranchs in an assemblage of fish bones is not a simple task as the bulk of their skeletons degrade very quickly after death.

The Brook Street Fish Bones (IAS 5502)

This group of Middle Saxon fish bones is dominated by eel remains. Salmon/trout, pike and cyprinids are also present, these four fish types are all associated with freshwater habitats and are evidence that fishermen were exploiting rivers and streams. Marine fish are best represented by flatfish, while herring, conger eel and elasmobranch remains demonstrate the variety of fish that were consumed.

The Middle Saxon fish bones: A Comparison of the Stoke and Brook Street Assemblages

As flotation was used to retrieve both assemblages of fish bones, and because the amounts of identified bones from each site are very similar, it is reasonable to compare the results from these sites. In order to facilitate this, a scale of abundance has been devised.

Species with 15 or more identified bones are said to be abundant.
Species with 5-15 or more identified bones are said to be frequent.
Species with 1-5 or more identified bones are said to be present.

The application of this scale to each site highlights the differences in the species associations and their relative abundance.

At Stoke, fish can be said to be abundant are elasmobranch, whiting, cod and flatfishes. Eel are frequent while shad, herring and haddock are present. This assemblage is suggestive of an industrial offshore fishery. The picture that emerges when the Brook Street bones are considered is rather different. Here only eel and flatfishes are abundant; herring and whiting are frequent while elasmobranch, salmon/trout, pike/cyprinid, conger eel and cod are present. Such an assemblage would be typical of a locally based subsistence fishery supplemented by a small amount of marine offshore fish.

As yet no explanation is offered to account for this difference; further excavation is necessary to provide more samples of Middle Saxon fish bones. Only then will it be possible to discuss with any certainty the significance which fish played in the diet of the occupants of Middle Saxon Ipswich.

The Middle Saxon Fishing Industry

When the results from Stoke and Brook Street are considered together it is possible to obtain an overall view of the Middle Saxon fishing industry. The range of fish found on each site can be attributed to one of three broad ecological groups which reflect not only the biology of the fish but also the fishing methods most likely to have been employed in their capture.

1. Freshwater Fish**:**

   This group contains salmon/trout, pike, cyprinids and eel. These fish are most likely to have been taken from the Rivers Gipping or Deben using eel traps, spears and nets of some kind.

2. Fish of Shallow Estuaries:

Eels and salmon/trout occur in these conditions as do a range of flatfish. Seine nets, which can be worked from either the shore or from boats are particularly effective for catching flatfish. Alternatively, traps set between the low and high water mark may have been used. These methods are those most likely to have been used by fishermen exploiting the shallows of the River Orwell. Occasionally marine species, like herring and shad, can be caught in estuaries.

3. Marine Fish:

Most of the sea fish found in Middle Saxon deposits were probably caught using long lines each carrying several baited hooks. These would be set some distance from the shore and would suggest that the fishermen were not only using boats but also that they were competent mariners.

The Turret Lane Fish Bones (IAS 4302)

While the Middle Saxon sites of Vernon Street and Lower Brook Street produced contrasting groups of bones, the Saxo-Norman and medieval assemblages of fish remains from Turret Lane are remarkably similar in both the range of species present and the relative abundance of those species. In both periods, herring and eel bones are the most abundant with thornback ray/elasmobranch, whiting, cod, gadid and flatfish remains occurring less frequently. The absence of remains of exclusively freshwater fish, for example, pike and cyprinids, is a further character these assemblages share.

Only two species, garfish and mackerel, are not common to both groups of bones. Each are represented by a single bone in the earliest period and, therefore, do not appear to have been economically important. An explanation for their presence is proffered on page 00.

A number of medieval towns have produced similar groups of fish bones, for example, excavations in the sub-vault of the misericorde of Westminster Abbey, London (Jones 1976), a number of sites in Norwich, (Jones in preparation) and York (Spencer et al, in preparation). It would appear that the majority of the species found at Turret Lane have played a consistently important dietary and economic role from pre-conquest times until the present day in several urban centres.

The Saxo-Norman and Medieval Fishing Industry

A fishery, producing the range of species recovered from the Turret Lane excavations, was clearly exploiting salt waters. The estuary of the River Orwell and the area of the North Sea immediately beyond its mouth, would have been ideal grounds for catching all the fish represented in the assemblages under consideration. Had freshwater habitats been fished to catch eels (the only species in the groups of bones which lives in rivers and lakes), other non-marine species, such as members of the Cyprinidae, would be expected to have been present. The evidence suggests that by the Saxon-Norman period, the freshwater fishery that supplied Brook Street in Middle Saxon times had declined, while a small boat fishery exploiting shallow estuarine and coastal waters was supplying the site. Concomitant with the decline of bones of freshwater fish is a striking increase in the numbers of herring remains which have been recovered. Table 00 shows the numbers of herring bones expected in a standard sample of 100 litres of soil from each of the four archaeological situations, using the formula n x 100 . y

(n = no herring bone in assemblage; y = total volume of soil processed in 100 litres of deposit)

Table 00

Date of Assemblage	Site Name	No herring bones expected in 100 litres of deposit
Middle Saxon	Vernon Street	0.20
Middle Saxon	Brook Street	1.69
Saxo-Norman	Turret Lane	51.11
Medieval	Turret Lane	130.00

Although a very crude statistic, it is clear that considerably larger quantities of herring bones were being incorporated into rubbish deposits in the Saxon-Norman and medieval periods than in Middle Saxon times. It is suggested here that the observed increase in the abundance of herring remains is likely to have resulted from a technological innovation, the introduction of the drift-net.

The occurrence of garfish and mackerel in Saxo-Norman deposits may be seen as a further piece of evidence that suggests the drift-net was being used by approximately AD 1000. Both fish swim fairly close to the surface and are frequently caught in floating nets; thus it is possible that they arrived on the site as incidental catches to the herring fishery. It should, however, be pointed out that other fishing techniques, for example, hooks and line, will catch garfish and mackerel and their association with increased quantities of herring remains may be coincidental.

The date of the origin of the great East Anglian drift-net fishery has not yet been resolved. Hodgson (1957) states that "The East Anglian (herring) fishery is supposed to have begun about the year AD 495" and points out that there is no clue as to the place or date of origin of the drift-net. Considering the size of Middle Saxon Ipswich and its extensive trade links with the Continent and other regions of the British Isles, it would seem unlikely that, had the drift-net been invented, that a technological development of such moment would have been ignored. Similarly, if such a fishery was extant, larger quantities of herring remains would be expected; however, by the time the Saxo-

Norman era began, it would appear that a drift-net herring fishery was providing the inhabitants of Ipswich with relatively large amounts of herring.

Despite its incompleteness, the Domesday Book is a valuable source of information concerning the Saxo-Norman fishing industry. Darby (1952) cites eighteen places in Suffolk which were associated with fisheries of varying size; however, no reference is made to their value. The entry for Exning (in Domesday Cambridge) states that the fishery yielded 1,200 eels and that three mills in the same village yielded a further 7,000 eels. It is almost certain that, like other counties in Eastern England, large quantities of eel were caught by these inland fisheries. In addition herring are recorded at eighteen places, of which five have yet to be identified. The size of the herring "renders", 25,000 from Southwold, 60,000 from Beccles and 68,000 from Dunwich, were almost certainly made possible by the use of the drift-net. A third type of fishery is indicated in the entry for Southwold where some kind of sea shore fishing activity is mentioned. This has been interpreted by Round (1903) as involving a weir made from a zigzag wattle fence running along the beach, the lower angles of the weir being just below the low-water mark and were provided with conical wicker baskets in which fish were trapped.

The historical information concerning fishing techniques given in the Domesday Book accords well with the interpretation based on archaeological finds of fish remains. However, it is only by detailed objective study of excavated deposits that the full range of fish species consumed by the past inhabitants of Ipswich becomes apparent. Furthermore, the meshing of historical and archaeological data for the Saxo-Norman period suggests that the interpretation of excavated material where little or no documentation survives can be made with increased confidence.

A small number of fish remains were recovered from the Brook Street and Vernon Street excavations by conventional excavation techniques. These bones add little of significance to the data presented in this report and will be discussed in Jones (in preparation). A lower jaw bone (dentary) of cod from IAS 5502 0374 is of some interest as it displays an aberrant growth form. It is seen in Figure 00 compared with a normal cod dentary from a modern fish of approximately the same size.

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