The fish bones

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Introduction and methods

The highly organic, waterlogged early 12th- to later 14th-century deposits of central Perth provided a favourable environment for the survival of fish remains of many kinds. Fragile scale fragments, otoliths, and cranial bones from small fish were recovered, in addition to vertebral centra and robust head bones of large gadid (cod family) fish. Table 31 shows which elements were present for the recorded taxa. (For a discussion of the kinds of fish remains which can be encountered in archaeological deposits, see Wheeler 1978). The majority of the fish bones from the site were unabraded and were dark brown in colour, typical of those recovered from urban waterlogged deposits.

Two procedures were used to recover fish remains. A group of approximately 1,500 identifiable large bones was hand collected by excavators sorting trowelled soil during both the 1975–6 and 1977 seasons. A second group of 219 identified bones was collected from the dry residues of approximately 40 one kilogram soil samples sieved on 300micron meshed sieves. Fish bones were identified by comparing archaeological specimens with modern reference skeletons in the collection at the Environmental Archaeology Unit, University of York. Nomenclature follows Wheeler (1969).

It is well understood that hand collected assemblages of fish remains are subject to considerable bias favouring

Table 31 *Fish remains by species and bone.*

bone	SEL	HER	SAL	SME	EEL	SAI	COD	HAD	LIN	PLE	HAL
articular							+		+	*	
ceratohyal							+		+		
cleithrum							+	+	+		+
dentary			+			+	+*		+		
denticle	*										
hyomandibular		*			*		+		+		
maxilla		*					+	*	+	*	
opercular		*						*		*	
otic bulla		*									
otolith							+*	+			
parasphenoid							+		+		
post temporal							+	*	+		
preopercular							+				
premaxilla						+	+*	*	+		
pterygiophore										+	
quadrate							+	*		*	
rib			*								
supracleithrum							+			*	
vertebral centrum (vc)	*	*	+*	*	*	+	+*	*	+*	*	+
vomer							+			*	

notes/key

+	bone recovered by hand excavation
*	bone recovered from sieved samples

SEL	Selachii (cartilaginous fishes)
HER	herring (*Clupea harengus L.*)
SAL	Salmonid (probably *Salmo salar L.*)
SME	smelt (*Osmerus eperlanus L.*)
EEL	eel (*Anguilla anguilla L.*)
SAI	saithe (*Pollachius virens L.*)
SAI	saithe (*Pollachius virens L.*)
COD	cod (*Gadus morhua L.*)/Gadid
HAD	haddock (*Melanogrammus aeglefinus L.*)
LIN	ling (*Molva molva*)
PLE	Pleuronectid (Flatfish/plaice/flounder)
HAL	halibut (*Hippoglossus hippoglossus L.*)

the large bones of large fish (Jones 1982). The hand collected material was identified rapidly. All the vertebrae, the small number of otoliths and readily recognisable head bones (principally dentaries, premaxillae, articulars, quadrates, hyomandibulars and maxillae) were identified. Less easily determined bones (for example cranial bones) were not studied in detail. Large numbers of fin rays, branchiostegal rays, ribs and small fragments were not determined. The unidentified material was composed almost exclusively of bones from large gadid fish; it probably comprised only the remains of fish which were represented by vertebrae or other elements.

An attempt was made to identify as much of the sieved bone as possible. Many remains were assigned to species but some elements could only be identified to genus or family. A considerable number of fin rays, branchials and other relatively featureless bones were left unidentified.

Notes on the identifications

The remains of cartilaginous (selachian) fish were of three kinds: mineralised cores of vertebral centra, teeth and denticles similar in form to rose thorns. All were assigned to the ray family, Rajidae, although it is possible that the teeth may have come from some other kind of cartilaginous fish.

Salmonid (salmon family) vertebrae were all large (>7mm diameter) and were considered to be from salmon *Salmo salar* L., rather than trout, *S. trutta* L. Salmon dentaries and large salmonid rib fragments were also present.

Some of the cod family vertebrae proved particularly difficult to identify. Centra from cod, *Gadus morhua* L., and saithe, *Pollachius virens* L., were not always assigned to species and were frequently placed in the family Gadidae. Ling vertebral centra were assigned to the genus *Molva* but not to species.

A flatfish maxilla was identified as plaice, *Pleuronectes platessa* L.; however, a number of other small flatfish bones, including vertebral centra, while consistent with plaice, may have come from flounder, *Platichthys flesus* L. Halibut, *Hippoglossus hippoglossus* L., a member of the flatfish family Pleuronectidae, was recognised by its distinctively large vertebral centra and cleithra fragments.

Results

Tables 32 and 33 indicate that the assemblage collected by hand comprised a different species composition to that recovered by sieving. The hand collected assemblage was dominated by cod (80%), while ling occurred in many layers. Saithe, haddock *Melanogrammus aeglefinus* L., flatfish (both ?plaice and halibut) and salmon were also present, but were represented only by small numbers of bones. By contrast, the sieved assemblage was dominated by herring, *Clupea harengus* L. (54%). The sieved sample contained all the species collected by hand except saithe and halibut and in addition included remains of cartilaginous fish, Rajidae, smelt (sparling) *Osmerus eperlanus* L. and eel *Anguilla anguilla* L.

All of the site phases produced large gadid head bones and vertebrae indicating that whole, and therefore probably locally caught, fresh fish were imported on to the site. The distribution of skeletal elements of large gadid fish on archaeological excavations has been used by Wilkinson (1979, 75) to suggest that some of the cod imported to Exeter arrived dried, as 'split fish'. Large gadids are usually decapitated and gutted as the first stage of processing, thus an archaeological assemblage composed of large gadid vertebral centra, with no head bones, may be interpreted as the remains of dried fish.

Of particular interest in the hand collected material was a large number of cod upper and lower jaws (premaxillae and dentaries respectively). These were measured at points described by Wheeler and Jones (1976). Using these measurements and the procedure outlined (ibid) it was possible to estimate the modal size of the large cod brought on to the site and to give some idea of the maximum size of fish eaten. The cod were mainly 110cm long, with a maximum length of 130cm. Using the cod jaw bone measurement data, it was possible to compare the bones collected by hand at the site with those recovered by hand at Great Yarmouth (Wheeler and Jones 1976). Although the results from the hand collected bone sample show that cod ranging from 50–130cm in length were present, the modal length of the Perth cod was 20cm larger than those recovered by hand at Great Yarmouth. It would however be unwise to assume that the hand collected cod bones reflect the total population of cod brought on to the site. Only three measurable cod jaw bones were present in the sieved sample and all were from small fish, c35–45cm total length, indicating that many small cod were also present in the deposits, but were overlooked during hand excavation. Only cod bones were sufficiently abundant to allow comparison with other published data. The haddock, ling, saithe, halibut and salmonid bones were all from medium to large animals (approximately 75cm total length or larger). The first anal pterygiophores of flatfish were from fish smaller than 50cm. The sieved assemblage, on the other hand, was dominated by small and medium sized fish. Only ling, cod and salmonid remains were from fish larger than 75cm. (It is not possible to estimate the size of the cartilaginous fish with the same accuracy but it seems likely that these too were about 100cm long).

Thus, contrasting, but mutually complimentary, pictures emerge from the analysis of the hand collected and sieved fish bones. However, both assemblages were composed largely of marine species, with a small number of migratory fish.

Table 32 *Fish bones collected by hand (arranged by species and period).*

number of contexts	period	SAL	SAI	COD	HAD	LIN	FLA	total
21	I	1*		20*				21
				9	1			10
7	I–II			4*	1*			5
				4	1			5
40	II		23*	80*		7*		110
			1	28	2	3		34
12	II–III			36*		2*		38
				1		3		4
3	II–IV			3*				3
				1				1
20	III	1*	5*	38*		1*		45
		2		28	2	2		34
5	III–IV			23*		3*		26
						1		1
104	IV	1*	3*	246*		33*	1*	284
			5	80	3	8	1	97
23	IV–V		2*	30*		10*		42
				9		3		12
102	V		19*	283*		62*	1*	365
			2	122	4	18	2	148
5	V–VI			78*		27*		105
				16		1		17
3	VI			1				1
				3				3
4	Area 5			5*		1*		6
				2		1		3
1	Area 6			1				1
7	u/s		1*	32*		17*		50
		2	1	16		1		20
	total vertebral centra (vc)	3	53	879		164	2	1101
	total other bones	4	9	320	11	43	3	390
	grand total	7	62	1199	11	207	5	1491

note * indicates number of vertebral centra (vc)

Table 33 *Fish bones collected by sieving (arranged by species and period).*

number of contexts	period	SEL	HER	SAL	SME	EEL	COD	HAD	LIN	PLE	total
1	II		2*								2
				1			1				2
1	III		2*								2
26	IV		57*		2*	1*	5*	5*	1*	17*	88
		3	3	1				4		3	14
12	V	1*	45*		1*	3*	3*	4*		23*	80
			3	2		1	4	4	1	4	19
2	u/s		7*			1*				3*	11
				1						1	2
	total vc	1	113		3	5	8	9	1	43	183
	total other	3	6	5		1	5	8	1	7	36
	grand total	4	119	5	3	6	13	17	2	50	219

abbreviations as Table 32; u/s = unstratified

Discussion

Differences both in species composition and size of the fish collected by hand and by sieving are marked. These differences demonstrate how recovery techniques can influence what is learnt from an excavation. A number of authors have shown how assemblages of fish collected by hand are dominated by large-boned species, while sieved samples produce a more representative group of bones (for example Wheeler and Jones 1976). Problems of recovery can be readily tackled by the institution of carefully conceived sieving programmes. Other biases are less easily assessed. Fish do not all contain the same number of bones and these bones are not equally resistant to mechanical and chemical damage under burial conditions. These aspects must be borne in mind when considering any archaeological fish bone assemblage. Nevertheless, it is clear that the townsfolk of Perth exploited a considerable variety of fish in their diet, and it is likely that the overall picture presented by the two assemblages reflects the main trends in fish consumption. Clearly marine fish were the most frequently eaten. Remains of exclusively freshwater fish (for example pike and roach) were absent from the assemblages, while bones of migratory species (salmon, eel and smelt) were not present in very large numbers.

Marine fish, mainly herring and gadids, appear to have played a more important role in feeding the medieval population of Perth than locally available migratory species. This indicates that the demand for fish was probably greater than the river's capacity to supply food. The Tay is navigable and tidal as far upriver as Perth and the importation of fresh marine fish caught in the North Sea (and possibly of preserved fish caught and prepared at some distance from the site) would have been relatively easy. Migratory and estuarine species could have been taken locally. It is impossible to be certain of the fishing methods used by the ancient fishermen, but it is clear that several different techniques must have been employed to catch the range of fish found at the site. Most of the marine fish were probably caught using hook and line; several fish hooks were recovered from the site (see Fascicule 2, The metalwork). Large cod, ling, saithe, haddock, plaice and halibut are traditionally taken on handlines in Scotland although trawling is now widespread. Such fish were probably fairly readily taken from the east coast of Scotland. Herring, by contrast, almost never take hooks and are usually caught using floating nets. Unfortunately, there is no evidence to indicate whether the herring were brought to the site as fresh fish or if

they were imported preserved in barrels or smoked. The history of the Scottish herring fishery dates back to at least 1410. At this time William, Count of Holland, was assisting the Dutch to make reprisals against the Scots for having ill-treated Dutch fishermen who had attempted to catch herring in Scottish waters. By 1423 there was a considerable export trade in herring and duties were imposed by James I (Samuel 1918, 86). It thus seems likely that herring were caught by Scottish fishermen throughout the medieval period.

As for locally available migratory species, a number of different kinds of net and trap may have been set in the Tay to catch eel, smelt and salmon.

Unfortunately, it is impossible to use these results to compare the roles of large gadids and smaller marine species (small cod and herring) as components of human diet because it is not possible to determine how well the assemblages compare with the actual quantities of food fish consumed or traded on the site. However, it is apparent that during the 12th century a large number of different kinds of fishes were brought to Perth, adding to the variety of food available to the townsfolk. In addition, it is reasonable to conclude that supplying fish to the town was an important aspect of the medieval economy.

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