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Technical Report: The fish bone from Hostel Yard, Corpus Christi College, Cambridge (site code HYC04)

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Summary

This report presents an analysis of the fish bones from Hostel Yard, Corpus Christi College, Cambridge. This small assemblage comprises sieved and hand collected material from the 14th and 16th centuries. Results indicated a reliance on herrings and eels, with a variety of freshwater and marine remains found. Species diversity increased through time, indicating a wider range of marine habitats were becoming exploited. Cod and marine cod family fish were only found in any quantity in the 16th century, when they were eaten both fresh and as traded, preserved fish. Overall, a surprisingly high quantity of freshwater fish was consumed; this may be related to site status. Declining quantities of burbot through time may point to an increase in pollution levels in local freshwater river systems.

KEYWORDS: CAMBRIDGE, FISH BONES, ZOOARCHAEOLOGY, MEDIEVAL

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The fish bone from Hostel Yard, Corpus Christi College, Cambridge (site code HYC04)

Introduction

This report details the analysis of 1026 identified fish bones from Hostel Yard, Corpus Christi College, Cambridge. Of these, 938 were derived from sieved deposits and a further 88 were collected by hand. Fish were recovered from two major phases, dating to the 14th and 16th centuries respectively. The 14th century material came from a pit, while the later 16th century material was derived from four pits and two stone lined shafts. Bone was recovered both by sieving to 2mm and by hand collection, and, barring one of the 16th century pits, every feature included sampled material.

The small size of the assemblage necessarily means that the conclusions that can be drawn are limited. It will be possible to speculate on some change through time, between the 14th and 16th centuries, with regards to fish species and sizes exploited. It may also be possible to speculate on changing proportions of freshwater and marine fish. The two relatively large, sieved feature types excavated in the 16th century make it possible to examine variation between the pits and stone lined shafts. However, the small quantity of identified fish from each of the four pits and each of the two stone lined shaft make it difficult to explore variation at the level of the individual feature.

The fish could have been caught locally in the River Cam, part of the River Great Ouse system that flows into the North Sea at King's Lynn. Marine fish probably came from nearby regions of the North Sea, although the widespread medieval trade in cod and cod family fish means some may have been traded from long distances, and thus originally caught in a variety of northern European waters (Barrett *et al.* 2008).

Methods

This assemblage was recorded using the York System, an Access database utility designed for recording zooarchaeological assemblages, as well as the extensive reference material available in the Department of Archaeology, University of York. The recording protocol is fully detailed in Harland *et al.* (2003). Briefly, this entails the detailed recording of the 18 most commonly occurring and easily identified elements, termed quantification code (QC) 1. For each of these, the element, species, approximate size, side, fragmentation, texture, weight and any modifications are recorded in detail. Fish vertebrae (QC2) are recorded in more limited fashion, with counts, element and species recorded. Some elements are unusual and particularly diagnostic, like otoliths, and are fully recorded (QC4). The final category of material (QC0), includes elements not routinely identified as well as unidentifiable material. Elements that are from very unusual species, or that are butchered, are recorded in detail even if not from the QC1 category. Data analysis involved structured database queries, as well as manipulation using Excel.

The complete archive has been submitted to the excavators as both an Access file and as simple text files containing the same data. These are also kept on file in the Fishlab at the University of York.

Preservation

The fish from Hostel Yard Corpus are generally well preserved (Table 1). Bone surface textures were all recorded as good or fair, with no poorly textured bone observed. There was a slight tendency for bone to be better preserved in the later 16th century phases compared to the 14th century. This was mirrored in bone percent completeness scores: the 16th century deposits were more likely to contain whole or more complete bones than the 14th century material. The proportion of burning was relatively high in the 14th century pit, at just under 5% of all fish bone, while smaller values of 1% and 4% were observed for the two 16th century features. Carnivore gnawing was minimal, with only one example found, but there was a high incidence of crushing in the 16th century phases. In the shaft deposits, almost 12% of all fish bones were crushed, while in the pit, only 1% were crushed. These tended to be eels, herring and smelt, all of which may have been crushed by chewing and subsequent passage through the digestive system. It is therefore possible that the material from the 16th century shaft included cess.

Results

Species

The assemblage was dominated by herrings and eels, together comprising over 90% of the sieved material (Table 2). Other species from the sieved deposits include, in order, carp family, burbot, smelt, pike, herring family, allis shad or twaite shad, cod, halibut family, plaice, whiting, Atlantic horse-mackerel or scad, bleak, Perciformes order and dab (see Table 6 for full taxonomic names). The hand collected material was naturally biased towards larger fish, and thus did not have the high proportions of herring, eel or smelt. Pike was the most common fish, at one quarter of the hand collected material, followed by, in order, cod, halibut family, haddock, plaice, conger eel, carp family, herring, ling, common bream?, chub?, eel and whiting.

Some changes through time were visible in the sieved assemblage, between the 14th and 16th century phases, as well as between the two separate feature types dating to the 16th century. Herring was the most common species in the 14th century pit, at 80% of all sieved material, but this was reduced by the 16th century to approximately 60% in the pits and less than 40% in the shafts. Eels increased through time from less than 10% in the 14th century to just over 25% in the 16th century pits and over 50% in the 16th century shafts. Herrings and eels were both found in trace quantities in the hand collected material. They are both common finds in English medieval assemblages, although the low proportion of eels in the 14th century deposits is surprising, given that the fens was an ideal environment for them (Fort 2003). A 13th century merchant's poem mentions "Eels of Cambridge...Herring of Yarmouth...Cod of Grimsby" (Kowaleski 2000), implying their importance in the city. They were likely a low status fish, commonly and cheaply available in the fens and the River Great Ouse, which is joined by the River Cam (Pinder *et al.* 1997; Lucas 1998). The low levels in the 14th century may indicate this material is from relatively wealthy households, or it may indicate a real preference for other fish.

Most cod family fish were found at trace levels throughout the sieved material, although they are conspicuously absent from the 16th century shafts – but their presence in the hand collected assemblage suggests cod and related species were indeed being consumed at this time. Their absence from the sieved material is difficult to account for, given that cod is usually present above trace levels in medieval English sites (Barrett *et al.* 2004a; Barrett *et al.* 2004b; Serjeantson and Woolgar 2006). Cod, haddock, ling and whiting were all recovered from the 16th century hand collected material. Cod represented just over 20% of these fish in the 16th century pits, but less than 10% in the shafts. However, haddock represented about 25% in the shafts. These important cod family fish will be looked at in greater detail below, in fish sizes and element patterning, in order to determine if any were arriving as traded, preserved fish.

Burbot were recorded from the 14th century sieved deposits (at 8% of the total) and in the 16th century sieved pits (at less than 1% of the total), suggesting a decline between the 14th and 16th centuries. This freshwater cod family fish is susceptible to riverine pollution and over-exploitation, and is now very likely extinct in British waters (Jones 1988; Buczacki 2002), so this decline probably marks a real change in the freshwater ecosystem of the River Cam. Pike and smelt were both present at trace levels in the sieved assemblage, with little change through time in these freshwater species. Pike represented almost 50% of the hand collected 16th century pit material, a very high quantity compared to the small numbers of other hand collected, 16th century English sites available for comparison (Serjeantson and Woolgar 2006). However, 14 of these 22 pike bones probably originated from the same pike head recovered from a single discrete context, which accounts for some of this abnormally high proportion.

The carp family fish were present only at trace levels in the 14th century, and then at between 3 and 5% in the 16th century sieved material, and between 2 and 11% in the hand collected material, indicating a slight increase through time. Some, including the putative common bream identified in the 16th century, may have been raised in fishponds for high status consumption; these were often given as luxury gifts, and as such were worth more as a social symbol than as a foodstuff (Aston 1988; Dyer 1988).

High proportions of freshwater fish were found in the sieved deposits. In the 14th century, 21% of identified fish were freshwater, rising to 33% in the 16th century pits and 62% in the shafts. This increase through time is contrary to the general trend among English sites, following the opening of marine fisheries and the ready availability of cod and herring from the beginning of the second millennium AD (Barrett *et al.* 2004a; Barrett *et al.* 2004b). This may indicate a real and deliberate avoidance of large-scale marine fish consumption, possibly linked to site status; contemporary deposits from the Grand Arcade site in Cambridge had a much higher, and more typical pattern of marine fish consumption (Harland 2008).

Flatfishes first make an appearance in the 16th century, indicating expanding fishing grounds or increased demand for a variety of fish. They are found in relatively high quantities in the hand collected material, at approximately 15% in the 16th century pits and almost 50% in the shafts. They tended to be higher value fish (Serjeantson and Woolgar 2006). Other species were only found in the 16th century material, including conger eel and Atlantic horse-mackerel or scad; these support the idea that a wider range of fish was being exploited and consumed at this time.

Fish sizes

Cranial elements (QC1) were sized during identification and are summarised in Table 3. Most of the herrings were between 15 and 30cm total length, an expected size. Eels were mostly between 30 and 50cm total length, with a few smaller and larger, again within expected values.

The one cod from sieved 14th century deposits was small, between 30 and 50cm total length, making it unlikely to have been imported as prepared, preserved fish (Cutting 1955). However, the hand collected 16th century material contains some larger cod that may have been imported, including some of 80-100cm total length and a few of greater than 100cm total length. Some of the haddock from the hand collected material was too small to have been imported as prepared fish, but the ones of 50 to 80cm total length are of a suitable size, as was the single very large ling. The ling is unlikely to have been fished from local North Sea waters given its modern distribution (Froese and Pauly 2007), making it a likely candidate for importation from more northerly regions.

Most of the carp family fish tend to be small, but the one putative common bream identified from the 16th century was substantial, between 50 and 80cm total length. This is further evidence that this and others may have originated in a managed fishpond.

Element distribution
Most of the fish being consumed at Hostel Yard were likely deposited in their entirety, although the small size of the features makes it difficult to fully assess element variation (Table 4).

A variety of herring elements were recovered from the 14th and 16th century sieved deposits. If herrings are cured for long term storage, often several elements from the gill region are removed during initial processing (Enghoff 1999; Childs 2000). This was not observed here. These herrings were probably lightly cured, which left all elements intact, and which required eating within a short time. Equal quantities of abdominal and caudal vertebrae would be expected, given that processing for preservation should not remove any vertebrae, but in the 16th century pits, a number of caudal vertebrae are 'missing'. The reverse pattern was observed in 14th century deposits from Grand Arcade (Harland 2008), perhaps indicating differential cooking and consumption of the herring bodies compared to the tails. However, it is also possible this results from the small sample size of this assemblage, as when all 16th century material is examined together, the proportion is less skewed.

The hand collected 16th century cod are biased towards those elements that are found in preserved, imported fish. This includes the cleithra, a pair of elements found at the back of the head and often left in the preserved product, and these are sometimes accompanied by the supracleithrum and posttemporal, both found anatomically in close association with the cleithra (Barrett 1997). The one find of a parasphenoid, a cranial element, suggests at least some cod were being brought to Hostel Yard whole, and thus likely freshly caught. A variety of haddock elements were found, including several from the head, making it unlikely these were from preserved fish. However, the two ling elements include a cleithrum and a vertebrae, both of which could be from preserved fish – which is likely given the preference of ling for more northern waters.

Butchery
Four examples of butchery were found, all from cod (Table 5). One 14th century cleithra – the only 14th century cod bone recovered – was butchered. It was too small to have been dried or preserved, and thus was likely butchered during preparation for fresh consumption. Three examples from 16th century features are definitely indicative of butchery to create a preserved product. Two cleithra show characteristic butchery marks in various anatomical planes, very similar to ones observed in slightly earlier deposits from York (Harland *et al.* in press). A caudal vertebrae was found chopped in the sagittal plane (dividing the fish into left and right halves), from a fish of 80 to 100cm total length. Although this sagittal butchery strategy is not yet fully understood, comparative material has been found from 14th century deposits at Grand Arcade (Harland 2008), as well as from York (Harland *et al.* in press) and Berwick-upon-Tweed (Harland 2007). At these sites, the sagittally chopped vertebrae were not found with cranial elements of similar size and proportion, making them very likely to have been imported as preserved fish. The butchery may have been caused by splitting the carcass into two halves to aid drying or preserving, and they may be associated with a particular geographic region. Samples have been taken from these butchered cleithra and vertebrae for $\delta^{15}N$ and $\delta^{13}C$ stable isotopic testing, which should determine if these cod were imported as a preserved foodstuff, and if so, where they were likely caught; this is part of the ongoing Medieval Origins of Commercial Sea Fishing Project (Barrett *et al.* 2008).

Summary and conclusions

The small fish assemblage from Hostel Yard indicates a variety of freshwater and marine fish species were exploited, with an emphasis on herrings and eels. Cod was only found in any quantity in the 16th century, and was likely eaten both fresh and as a traded, imported and well preserved foodstuff. The related cod family fish were eaten either fresh (haddock) or preserved (ling), and again were only found in

the 16th century. Herrings were likely imported from the North Sea with a light cure, and thus would have been a relatively seasonal resource for the autumn and early winter. The unusually high proportions of freshwater fish in both the 14th and 16th century phases, when compared to contemporary English material, is difficult to interpret and may indicate a mild avoidance of marine foods. That said, the 16th century saw an increase in marine species diversity, which likely reflects both wider exploitation of fishing grounds and a willingness to consume more types of fish.

Some of the freshwater carp family fish may have been raised in managed fishponds, which were exclusively reserved for higher status, wealthy consumption. Together with the unusually high proportions of freshwater fish, this may indicate the Hostel Yard remains are those of relatively high status kitchen or table waste. The low proportion of eels in the 14th century would conform to this hypothesis, as they tended to be cheap and widely available. The decline in the quantity of burbot, a pollution-sensitive freshwater fish, may indicate a decrease in water quality between the 14th and 16th centuries, a pattern also observed in the larger contemporary Grand Arcade assemblage.

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Bibliography

Aston, M (ed) (1988). *Medieval Fish, Fisheries and Fishponds in England*. Oxford: British Archaeological Reports British Series 182.

Barrett, J, C Johnstone, J F Harland, W Van Neer, A Ervynck, D Makowiecki, D Heinrich, A K Hufthammer, I Enghoff, C Amundsen, J Christiansen, A K G Jones, A Locker, S Hamilton-Dyer, L Jonsson, L Lougas, C Roberts and M Richards (2008). 'Detecting the medieval cod trade: a new method and first results', *Journal of Archaeological Science* 35, 850-861.

Barrett, J H (1997). 'Fish trade in Norse Orkney and Caithness: A zooarchaeological approach', *Antiquity* 71, 616-638.

Barrett, J H, A M Locker and C M Roberts (2004a). ''Dark Age Economics' revisited: the English fish bone evidence AD 600-1600', *Antiquity* 78 (301), 618–636.

Barrett, J H, A M Locker and C M Roberts (2004b). 'The origins of intensive marine fishing in medieval Europe: The English evidence', *Proceedings of the Royal Society of London B* 271, 2417-2421.

Buczacki, S (2002). *Fauna Britannica*. London: Hamlyn.

Childs, W (2000). 'Fishing and Fisheries in the Middle Ages: The Eastern Fisheries' in D. Starkey, C. Reid and N. Ashcroft (eds), *England's Sea Fisheries: The Commercial Sea Fisheries of England and Wales since 1300*, 19-23. London: Chatham Publishing.

Cutting, C L (1955). *Fish Saving: a History of Fish Processing from Ancient to Modern Times*. London: Leonard Hill.

Dyer, C (1988). 'The Consumption of Fresh-water Fish in Medieval England' in M. Aston (ed) *Medieval Fish, Fisheries and Fishponds in England*. Oxford: British Archaeological Reports British Series 182.

Enghoff, I B (1999). 'Fishing in the Baltic region from the 5th century BC to the 16th century AD: Evidence from fish bones', *Archaeofauna* 8, 41-85.

Fort, T (2003). *The Book of Eels: On the Trail of the Thin-heads*: Harper Collins.

Froese, R and D Pauly (eds) (2007). *FishBase*: World Wide Web electronic publication. www.fishbase.org, version (11/2007).

Harland, J F (2007) 'Technical Report: The fish bone from Berwick Workspace, Berwick-upon-Tweed (site code BTW06)', Reports from the Centre for Human Palaeoecology, University of York 2007/05.

Harland, J F (2008) 'Technical Report: The fish bone from Grand Arcade, Cambridge (site code GAD05/06)', Reports from the Centre for Human Palaeoecology, University of York 2008/5.

Harland, J F, J Barrett, J Carrott, K Dobney and D Jaques (2003). 'The York System: An integrated zooarchaeological database for research and teaching', *Internet Archaeology* 13.

Harland, J F, C J Johnstone and A K G Jones (in press). 'A case study from the Medieval Origins of Commercial Sea Fishing Project: Zooarchaeological results from York' in P. Béarez, S. Grouard and B. Clavel (eds), *Archéologie du poisson. 30 ans d'archéo-ichtyologie au CNRS. Hommage aux travaux de Jean Desse et de Nathalie Desse-Berset*. Antibes

Jones, A K G (1988). 'Provisional remarks on fish remains from archaeological deposits at York' in P. Murphy and C. French (eds), *The Exploitation of Wetlands*, 113-127. Oxford: British Archaeological Reports British Series 186.

Kowaleski, M (2000). 'The expansion of the south-western fisheries in late medieval England', *Economic History Review* LIII, 429-454.

Lucas, G (1998). 'A Medieval Fishery on Whittlesea Mere, Cambridgeshire', *Medieval Archaeology* 42, 19-44.

Pinder, L C V, A F H Marker, R H K Mann, J A B Bass and G H Copp (1997). 'The River Great Ouse, a highly eutrophic, slow-flowing, regulated, lowland river in Eastern England', *Regulated Rivers: Research and Management* 13, 203-219.

Serjeantson, D and C Woolgar (2006). 'Fish consumption in Medieval England' in C. Woolgar, D. Serjeantson and T. Waldron (eds), *Food in Medieval England: Diet and Nutrition*, 102-130. Oxford: Oxford University Press.

Tables

Table 1: Taphonomy data

Burning and other modifications

All material, combined recovery methods					
Phase	Burned		Carnivore gnawing	Crushing	
14th c. pit	16	4.8%			
16th c. pits	5	0.9%		6	1.1%
16th c. shafts	26	3.5%	1	89	11.8%
Total	47	2.9%	1	95	5.9%

Percent completeness of elements

QC1, all recovery											
Phase	1-20%		20-40%		40-60%		60-80%		80-100%		Total
14th c. pit	1	14%	4	57%			1	14%	1	14%	7
16th c. pits	4	6%	11	16%	7	10%	17	25%	29	43%	68
16th c. shafts	2	4%	5	9%	12	23%	15	28%	19	36%	53
Total	7	5%	20	16%	19	15%	33	26%	49	38%	128

Surface texture

QC1, all recovery					
Phase	Good		Fair		Total
14th c. pit	4	57%	3	43%	7
16th c. pits	50	74%	18	26%	68
16th c. shafts	41	77%	12	13%	53
Total	95	74%	33	26%	128

Quantities of diagnostic elements per phase

Recovery	Phase	QC0		QC1		QC2		QC4		Total
>2mm	14th c. pit	124	40%	7	2%	181	58%			312
	16th c. pits	77	24%	29	9%	211	66%	1	0%	318
	16th c. shafts	77	13%	34	6%	475	81%			586
	Total	278	23%	70	6%	867	71%	1	0%	1216
Hand collected	14th c. pit	21	100%							21
	16th c. pits	170	78%	36	16%	11	5%	2	1%	219
	16th c. shafts	128	77%	16	10%	20	12%	3	2%	167
	Total	319	78%	52	13%	31	8%	5	1%	407

Table 2: Number of identified specimens (NISP) by species

Family	Taxa	14th c. pit		16th c. pits		16th c. shafts		Total		14th c. pit	16th c. pits		16th c. shafts		Total	
		>2mm		>2mm		>2mm		>2mm		Hc	Hc		Hc		Hc	
Clupeidae	Herring Family			2	1%	2	0%	4	0.4%							
	Atlantic Herring	150	80%	146	61%	190	37%	486	52%				2	5%	2	2.3%
	Allis Shad/ Twaite Shad			3	1%			3	0.3%							
Osmeridae	Smelt			2	1%	9	2%	11	1.2%							
Esocidae	Pike	5	3%	1	0%	5	1%	11	1.2%		22	45%			22	25%
Cyprinidae	Carp Family	1	1%	13	5%	15	3%	29	3.1%		1	2%	2	5%	3	3.4%
	Common Bream?												1	3%	1	1.1%
	Bleak			1	0%			1	0.1%							
	Chub?												1	3%	1	1.1%
Anguillidae	Eel	16	9%	63	26%	283	56%	362	39%				1	3%	1	1.1%
Congridae	Conger Eel										4	8%			4	4.5%
Gadidae	Cod	1	1%	2	1%			3	0.3%		11	22%	3	8%	14	16%
	Haddock										2	4%	10	26%	12	14%
	Whiting			2	1%			2	0.2%				1	3%	1	1.1%
	Ling										2	4%			2	2.3%
	Burbot	15	8%	1	0%			16	1.7%							
Perciformes order						1	0%	1	0.1%							
Carangidae	Atlantic Horse-mackerel/ Scad			2	1%			2	0.2%							
Pleuro-nectidae	Halibut Family			1	0%	2	0%	3	0.3%		3	6%	11	28%	14	16%
	Dab					1	0%	1	0.1%							
	Plaice			2	1%	1	0%	3	0.3%		4	8%	7	18%	11	13%
Total identified		188	100%	241	100%	509	100%	938	100%	0	49	100%	39	100%	88	100%
Unidentified Fish		124		77		77		278		21	170		128		319	
Total		312		318		586		1216		21	219		167		407	

Table 3: Fish size summary

Taxa	Size	>2mm			Hand collected	
		14th c. pit	16th c. pits	16th c. shafts	16th c. pits	16th c. shafts
Atlantic Herring	15-30cm	2	17	17		2
	30-50cm		1			
Smelt	15-30cm			2		
Pike	15-30cm	3			14	
	30-50cm		1		2	
	50-80cm				5	
Carp Family	<15cm		3			
	15-30cm			1		
Common Bream?	50-80cm					1
Bleak	<15cm		1			
Chub?	30-50cm					1
Eel	15-30cm		1	4		
	30-50cm	1	2	6		
	50-80cm			1		1
Conger Eel	>100cm				3	
Cod	30-50cm	1				
	50-80cm				1	
	80-100cm				5	1
	>100cm				2	
Haddock	30-50cm				1	
	50-80cm					6
Ling	>100cm				1	
Burbot	15-30cm		1			
Halibut Family	15-30cm			1		
Dab	30-50cm			1		
Plaice	15-30cm		1	1	1	4
	30-50cm		1		3	3

Table 5: Element quantification

Taxa	Element	>2mm			Hand collection	
		14th c. pit	16th c. pits	16th c. shafts	16th c. pits	16th c. shafts
Herring Family	Caudal Vertebra		2	2		
Atlantic Herring	Articular	1	2	1		
	Basioccipital	1		1		
	Cleithrum		2	1		
	Dentary		2	2		1
	Hyomandibular		1	1		
	Maxilla		6	3		
	Opercular		2	1		
	Parasphenoid					1
	Posttemporal			4		
	Quadrate		1			
	Supracleithrum		1	3		
	Vomer		1			
	Otic Bulla		1			
	First Vertebra	2	3	3		
	Abdominal Vertebra	70	81	78		
	Caudal Vertebra	75	39	92		
	Ultimate Vertebra	1	4			
Allis Shad/ Twaite Shad	Caudal Vertebra		3			
Smelt	Articular			1		
	Ceratohyal			1		
	Abdominal Vertebra		2	5		
	Caudal Vertebra			2		
Pike	Articular	1				
	Basioccipital				1	
	Ceratohyal				1	
	Cleithrum	1			4	
	Dentary	1			3	
	Maxilla				1	
	Opercular				2	
	Palatine				3	
	Parasphenoid				2	
	Posttemporal				1	
	Preopercular				1	
	Quadrate				1	
	Scapula		1			
	Supracleithrum				1	
	Abdominal Vertebra	2		5		
	Caudal Vertebra				1	
Carp Family	Cleithrum		1			
	Infrapharyngeal		2			
	Scapula			1		
	Abdominal Vertebra	1	6	6		1
	Caudal Vertebra		4	8	1	1
Common Bream?	Cleithrum					1
Bleak	Infrapharyngeal		1			
Chub?	Cleithrum					1
Eel	Basioccipital			1		

Taxa	Element	>2mm			Hand collection	
		14th c. pit	16th c. pits	16th c. shafts	16th c. pits	16th c. shafts
	Cleithrum		1	2		
	Dentary	1		1		1
	Hyomandibular		1	1		
	Opercular			5		
	Parasphenoid			1		
	Quadrate		1			
	Abdominal Vertebra	9	25	113		
	Caudal Vertebra	6	35	159		
Conger Eel	Cleithrum				1	
	Opercular				1	
	Quadrate				1	
	Abdominal Vertebra				1	
Cod	Cleithrum	1			5	1
	Parasphenoid				1	
	Posttemporal				1	
	Supracleithrum				1	
	Abdominal Vert. Group 1		1			
	Abdominal Vert. Group 3				1	
	Caudal Vert. Group 1		1			2
	Caudal Vert. Group 2				2	
Haddock	Articular					1
	Cleithrum				1	
	Dentary					1
	Opercular					1
	Parasphenoid					2
	Posttemporal					1
	Abdominal Vert. Group 3					3
	Caudal Vertebra Group 1				1	1
Whiting	Caudal Vertebra Group 1		1			1
	Caudal Vertebra Group 2		1			
Ling	Cleithrum				1	
	Caudal Vertebra Group 2				1	
Burbot	Quadrate		1			
	Abdominal Vert. Group 1	4				
	Abdominal Vert. Group 2	4				
	Abdominal Vert. Group 3	2				
	Caudal Vertebra Group 1	3				
	Caudal Vertebra Group 2	2				
Perciformes	Caudal Vertebra			1		
Atlantic Horse-	Vertebra		2			

Taxa	Element	>2mm			Hand collection	
		14th c. pit	16th c. pits	16th c. shafts	16th c. pits	16th c. shafts
mackerel/ Scad						
Halibut Family	Maxilla			1		
	Abdominal Vertebra					1
	Caudal Vertebra		1	1	3	10
Dab	Premaxilla			1		
Plaice	1st Anal Pterygiophore				2	3
	Cleithrum				2	2
	Infrapharyngeal		1			
	Posttemporal			1		
	Preopercular		1			2

Table 5: Butchery summary

Species	Period	Element	Description	Interpretation	Total length	Recovery
Cod	14th c. pit	Cleithrum	Chopped in the frontal plane, on the medial side of the dorsal tip	?cooking preparation	30-50cm	>2mm
Cod	16th c. pit	Cleithrum	Several chops and cuts in approximately the frontal plane, on the anterior middle edge of the cleithra	Processing for preservation	>100cm	Hand collection
Cod	16th c. pit	Cleithrum	Chopped in the frontal plane through the ventral tip, two small diagonal knife marks on lateral side, in middle, and one small diagonal knife mark on the anterior edge, in middle	Processing for preservation	80-100cm	Hand collection
Cod	16th c. shafts	Caudal Vert. Group 1	Chopped on the right side, in the sagittal plane, removing a small slice to the anterior	Processing for preservation	80-100cm	Hand collection

Table 6: Summary of common and Latin names of fish mentioned in the text

Common name	Latin name
Herring Family	Clupeidae
Atlantic Herring	*Clupea harengus*
Allis Shad/ Twaite Shad	*Alosa alosa/Alosa fallax*
Smelt	*Osmerus eperlanus*
Pike	*Esox lucius*
Carp Family	Cyprinidae
Common Bream?	*Abramis brama?*
Bleak	*Alburnus alburnus*
Chub?	*Leuciscus cephalus?*
Eel	*Anguilla anguilla*
Conger Eel	*Conger conger*
Cod	*Gadus morhua*
Haddock	*Melanogrammus aeglefinus*
Whiting	*Merlangius merlangus*
Ling	*Molva molva*
Burbot	*Lota lota*
Perciformes order	Perciformes
Atlantic Horse-mackerel/ Scad	*Trachurus trachurus*
Halibut Family	Pleuronectidae
Dab	*Limanda limanda*
Plaice	*Pleuronectes platessa*