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Technical report: Fish remains from Mount Grace Priory, N Yorkshire

by

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Summary

Bulk samples of sediments excavated at Mount Grace Priory produced a large quantity of well preserved fish remains from the kitchen and Prior's cell areas. This report deals with the quantification, analysis and interpretation of this fish material.

A wide range of species was identified which included freshwater, migratory and marine forms. The marine fishes were dominant within the assemblage with small numbers of remains from freshwater fish. This material, therefore, contradicts long-held views about the importance of freshwater fishes bred in ponds at monastic sites. Season at death of salmon (Salmo salar) *has been determined from vertebrae.*

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Introduction and background

Mount Grace Priory, a monastery of the Carthusian order, is situated in North Yorkshire. The priory was founded in 1398 and dissolved in 1539. The fish material described here was recovered during the excavations directed by Dr G. Coppack in 1989-92.

Evidence for fishponds together with documentary sources associated with rural monastic sites all bear witness to the importance of fishes in the diet and economy of medieval monasteries. Monastic rules prevented the consumption of quadrupeds, except in special circumstances. However, excavation reports rarely contain mention of fish remains (Jones 1989). The presence of large numbers of fish remains in the kitchen floor and other deposits at Mount Grace Priory (Bailey *et al.*.1994) provides, perhaps for the first time in Britain, the opportunity to examine a large body of evidence from a rural monastery.

A notable aspect of the research on the fish remains collected from Mount Grace Priory was the involvement of the general public in the interactive Archaeological Activity Area of the Archaeological Resource Centre, York.

This report deals with the full analysis of fish bones from eight bulk samples from the 33 collected and has produced a wide range of fish species. The amount of material which could be examined was limited by project constraints.

Methods

Bulk samples of sediment were taken by the excavators from the floor of the kitchen area and the Prior's cell. The kitchen floor samples were taken from context 1833, which was the largest deposit within the kitchen area, and bulk samples from contexts 1508, 1909, 1913 and 1941 were also recovered. The bulk samples from the Prior's cell were also without full records, although the volume of sediment in litres was recorded for all samples. The lack of precise locations for bulk samples has precluded any spatial analysis beyond comparison of the two rooms.

Processing of material was carried out in two phases. The dried sediment residues, from bulk-sieving to 1mm, were first sorted at the Archaeological Resource Centre, York, under the supervision of AKGJ. The bulk of the sorting was done by parties of school children and members of the general public who were provided with illuminated magnifiers and tweezers. The sorting was supervised by experienced ARC demonstrators and all finds were checked before being bagged. The sorting activity was enhanced with photographs and plans of the excavations at Mount Grace together with a short piece of text describing the nature of the work. In addition, 100 g sub-samples of each sample were sorted by trained archaeological demonstrators away from the public sorting area to see if any kinds of fish remains were being systematically overlooked by visitors and to see if the sorting done by visitors was recovering fish remains not present in the 100g sub-samples.

The assemblage is large by comparison with other sites of this type. However, limited time allocated to the project has precluded detailed analysis of all samples. The following recording protocol was developed with a view to maximising the information gleaned in the time available.

The bones from the dried residues were sorted into four main categories at the ARC as follows :

Head and tail bones
Vertebrae

Ribs and fin spines
Others (scales, teeth, otoliths and scutes)

All categories were weighed separately; data are given in Table 1 for each sample. Weights for identifiable head bones from those samples selected for full analysis were also recorded in order to determine the ratio of identifiable to unidentifiable material from each context.

Recording of the cranial elements was based on the best preserved and most diagnostic fragments. These are:

Maxilla
Pre-maxilla
Articular
Dentary
Quadrate
Ceratohyal
Urohyal (for flatfish)
Opercular
Cleithrum
Post-temporal
Teeth

These eleven elements permitted the identification of a range of species. Other cranial elements have been examined and were recorded where they could be identified to species or family. The bones listed above are all bio-symmetrically paired elements, except the urohyal, and they provided data for the estimation of the minimum number of individuals. These eleven elements are sufficiently robust in British teleosts to allow comparison across families. As a consequence of this strategy more time could be taken in identifying fish remains to the lowest taxonomic level.

Vertebrae were generally recorded to family; however, a small number were determined to species.

Systematic nomenclature follows Wheeler (1969), and skeletal element nomenclature follows Wheeler and Jones (1989).

Measurements were only taken on articulars and quadrates. These elements were present for most species. The measurements were taken as follows:

Articular
1. Greatest dorso-ventral length of articular surface.
2. Greatest latero-medial width of articular surface.

Quadrate
1. Greatest dorso-ventral length of articular surface.
2. Greatest latero-medial width of articular surface.

Evidence of butchery was sought for all recorded elements. Generally fish bones are cut with knives except in the case of large fish which are chopped into segments; chopped vertebrae are usually very obvious in archaeological material as they show both a clean cut and some compression of the vertebral body.

Aberrant and pathological bones were recorded, the most obvious being hyperostosis in the haddock cleithra and mackerel vertebrae.

Post-mortem attrition of the fish bone has been scored for individual bones using a five point system as follows:

1. Complete - 100% of bone present
2. Slight damage - 80-95% of bone present
3. Moderate damage - 40-79% of bone present
4. High damage - 20-39% of bone present
5. Identifiable simply as fish bone - 1-19% of bone present

The taphonomic variables which may have caused bone breakage and loss are considered within each sample description. The main factors which influence bone survival/attrition within the Mount Grace assemblages are as follows :

Category
1. Excavation and storage damage
2. Chemical damage
3. Old breaks and erosion
4. Human and carnivore damage in antiquity

Identification of category
1. Fresh breaks
2. Bone surface etching
3. Rounded break points
4. Gnaw marks and deformities

Other evidence which directly relates to taphonomic histories is provided by descriptions of fishbone *in situ* both by the excavators and AKGJ. These consist of statements about articulating vertebrae and head bones, etc., found in approximately their anatomical relationships, which give primary information on taphonomy.

The fish bone assemblage is considered in two stages; the first covers the quantification of the material and the second the fully recorded material (see Figure 1).

Quantification (stage one)

The material from bulk samples, when sorted, was weighed as skeletal element groups, as described above. The results are presented in Table 1. They show considerable variation in both skeletal part representation (Figure 2) and weight of fish bone per volume/weight unit of sediment (Figure 3). There is a wide variation in the numbers of fishbones per sample, with the lowest concentration coming from the samples from the Prior's cell. The largest bone assemblage, that from context 1833, from the kitchen, shows a wide variation in fish bone concentration over the sampled area.

The percentages of cranial elements, vertebrae and ribs/fin spines when plotted (Figure 2), show a similar pattern across all samples. This probably results from the bias in fishbone weight across a range of elements.

Analysis (stage two).

A total of eight bulk samples were recorded using the above criteria (see methods section). The samples were chosen to represent context type, room function and all those site phases which had been bulk sampled. The samples chosen were 1833(06), 1833(16), from 1833, the largest context; and 1508(1), 1508(2), 1909(1), 1913(2) and 1941(2), all from the kitchen floor area. The bulk samples from the Prior's cell 1037(1) and 1037(2) were recorded for comparative purposes.

The material is described here according to chronological site phase. The phases and dates are as follows:

Phase 2. Erection or remodelling of building (*c.* 1420-30).

Phase 3. Possible third phase of building (*c.* 1470).

Phase 4. Latest phase of building (1520s) and initial robbing and demolition of 1539.

Kitchen deposits

A total of 3381 fish bones were fully recorded from the kitchen floor deposits. The results are summarised in Table 2. The deposits were described by the excavators as food waste. This description can, in the light of the evidence presented here, be revised to 'kitchen processing waste'. This is based on *in situ* descriptions of articulating vertebrae and skeletal representation from the laboratory analysis.

Phase 2bi

There are fourteen identified species and three families represented within this material. The assemblage is dominated by marine fishes, with haddock and flatfishes making up the bulk of the material. Bones of ling, mackerel and grey gurnard have been recorded from this phase only. There is a general paucity of freshwater material with the exception of the Cyprinidae (carp family). Also worthy of note is the absence of both herring and eel, two species which are well represented from other phases.

Phase 2bii

Deposits from this phase include contexts 1833, 1909 and 1913. The material is dominated by herring, haddock, other gadids and flatfishes, and has a very broad diversity of species.

There is an increase in the range and frequency of freshwater species. Salmon is represented throughout the three contexts, as is eel, suggesting a local fishery which concentrated on migratory fishes. The family Cyprinidae is represented by six identified species which may have been cultured locally in ponds.

Phase 3

A single context, 1508, produced only 116 identifiable bones. There is a bias toward marine species from this phase, with only a very small amount of freshwater material. The largest numbers of fragments came from the cod family and herring. An unusual species is the cuckoo wrasse, which is not an important food fish but is, nevertheless, edible. The pollack also occurs exclusively within this phase.

The kitchen material covers three phases of site occupation, 2bi, 2bii, 3, and shows some trends in both species diversity and species utilised. This information is summarised in Tables 3 and 4.

Prior's cell deposits

Phase 4

The fish remains from context 1037, the floor of the Prior's cell, were very different, being much more fragmentary with far fewer cranial bones than those from the kitchen area. It is unfortunate that this context is the only one which was from phase 4. The species representation possibly results from the personal table preferences of a single Priory occupant. It is, however, worth noting the complete absence of primary freshwater fishes. Migratory fishes were represented by the salmon and eel and marine fishes include thornback ray, herring, flatfishes and gadids.

Assessment of the samples (Bailey *et al.* 1994) revealed one species not present in the selected samples. Sturgeon *Acipenser sturio* L. scute fragments were noted in one sample.

Discussion

The occupation period represented by the contexts examined spans approximately one hundred years. This extremely accurate dating, over a short archaeological time span, presents a unique opportunity for the study of change in food economy over this interval.

A striking feature is the changing frequency of cyprinid bone fragments and species numbers. Two obvious factors may influence this change: sample size, which may cause bias in the species represented, or a real change in the dietary preferences of the monks which might be related to fishponds falling into disuse. The cyprinid material shows a peak during the phase 2bii occupation both in species represented and overall numbers. It may be that fish farming was established during this period and declined later, during phase 3. The sample size, however, is not statistically valid to confirm this hypothesis.

There are other general trends through the phases. The most common species were haddock, whiting and herring, giving the food economy of the site a maritime flavour. The utilisation of marine fishes at this site, on such a scale, is perhaps at first sight puzzling when the geographical location of Mount Grace (approximately 20 miles from the nearest fishing port) and the presence of fishponds are considered.

However, the work of economic historians such as Littler (1979) and Harvey (1993) confirm the importance of marine fishes in the monastic diet. The medieval towns along the east coast of England all had fishing fleets taking herring, cod and other species from the North Sea and beyond in the fourteenth and fifteenth centuries. The assemblages from Mount Grace contain many of the same species of fish that were found at Valle Crucis Abbey (Barker 1976), Taunton (Wheeler 1984), Westminster Abbey (Jones 1976), Austin Friar's, Leicester (Thawley 1981), Battle

Abbey (Locker, 1986) and Øm, Denmark (Rosenlund 1984). Close comparison of the Mount Grace material with fish remains from these sites is not justifiable because the local topography, the location of finds within the monasteries and the methods of recovery are so different.

The assemblage of fish bones most similar to that at Mount Grace is that of the abbey of St Salvator, Ename, Flanders (Ervynck and Van Neer 1992) located on the river Schelt. Freshwater dominate this assemblage but many of the marine taxa present at Mount Grace also occurred. At both sites the methods used to recover fish remains from kitchen floor deposits produced large representative samples of bones, scales and other remains which provide an accurate picture of the fishes present at each site.

Ervynck and Van Neer (1992) have assumed the accumulation of fish remains at Ename occurred under a boarded floor because the bones are so well preserved. No evidence for a suspended wooden floor has been located in the kitchen of Mount Grace, and it seems likely that the rapidly accumulating layers provided excellent conditions for the preservation of fragile bones.

The Mount Grace assemblage includes freshwater taxa which have been found at other monastic sites, for example, Owston fish ponds (Shackley *et al.* 1988) and Øm, Denmark (Rosenlund 1984). These records clearly demonstrate that medieval monasteries exploited a vast range of species and traded fish over considerable distances.

Fresh or preserved fish?

The evidence from skeletal representation of the marine fish suggest that whole animals were being brought onto the site. A small number of bones of large gadids, mainly cod, showed clear evidence of butchery; all consistent with the kinds of processing which occurs in a kitchen. One dentary bore two large chop marks suggesting it had been roughly chopped prior to being cooked in soup or stew. Some gadid vertebrae had been split anterio-posteriorly, in a way reminiscent of cutlets being divided in half. No clear evidence for stock fish was observed.

The size of the haddock and whiting, reconstructed by comparison of quadrate measurements with specimens of known length is around 50 - 60cm total length. Cod and ling measured up to 1.2m.

The *in situ* kitchen floor assemblage showed articulation of vertebrae and head bones, which clearly demonstrate what by today's standards would be filthy and unhygienic conditions within a kitchen. This material was generally in attrition states 2-3 which is unusually well preserved for medieval fish remains.

Season at death

Migratory species, such as the salmon and eel, occurred throughout the latter part of the sequence. The salmon was represented by well preserved vertebrae permitting the identification of season at death.

The annual growth bands ('annuli') on fish vertebrae provide information on both growth and time of death (Casselman 1987, Irving *in prep.*). The standard technique, used in modern fisheries analysis, was readily adapted to the archaeological material. By 'reading' the growth bands this it has been established that the salmon died during autumn, probably during October or November.

Salmon would probably spawn in the local River Wiske, a tributary of the River Swale, during the autumn. Small rivers such as the Wiske are typical spawning places for salmon, and, while spawning, they become an easy target for the fisherman.

Conclusion

The most obvious feature of the assemblage of fish remains from Mount Grace is the dominance of marine species over freshwater forms. The evidence from the kitchen floor and the Prior's cell make it clear that, despite the maintenance of extensive fish ponds at the site, the monks were dependent on imported marine fish, notably herring, cod, haddock and whiting. Other species were represented by small numbers of bones but demonstrate the monks were able to acquire a vast range of species including highly prized fishes such as sturgeon and turbot.

This project was an experiment in public archaeology and has been judged by all to have been extremely successful. It shows how high-level academic work can be integrated with the presentation of archaeology to the public, given sufficient supervision by experienced staff.

It is stressed that research should be carried out on the rest of this material should further funding become available. There are a range of further research questions which may be addressed by this well preserved and closely dated assemblage.

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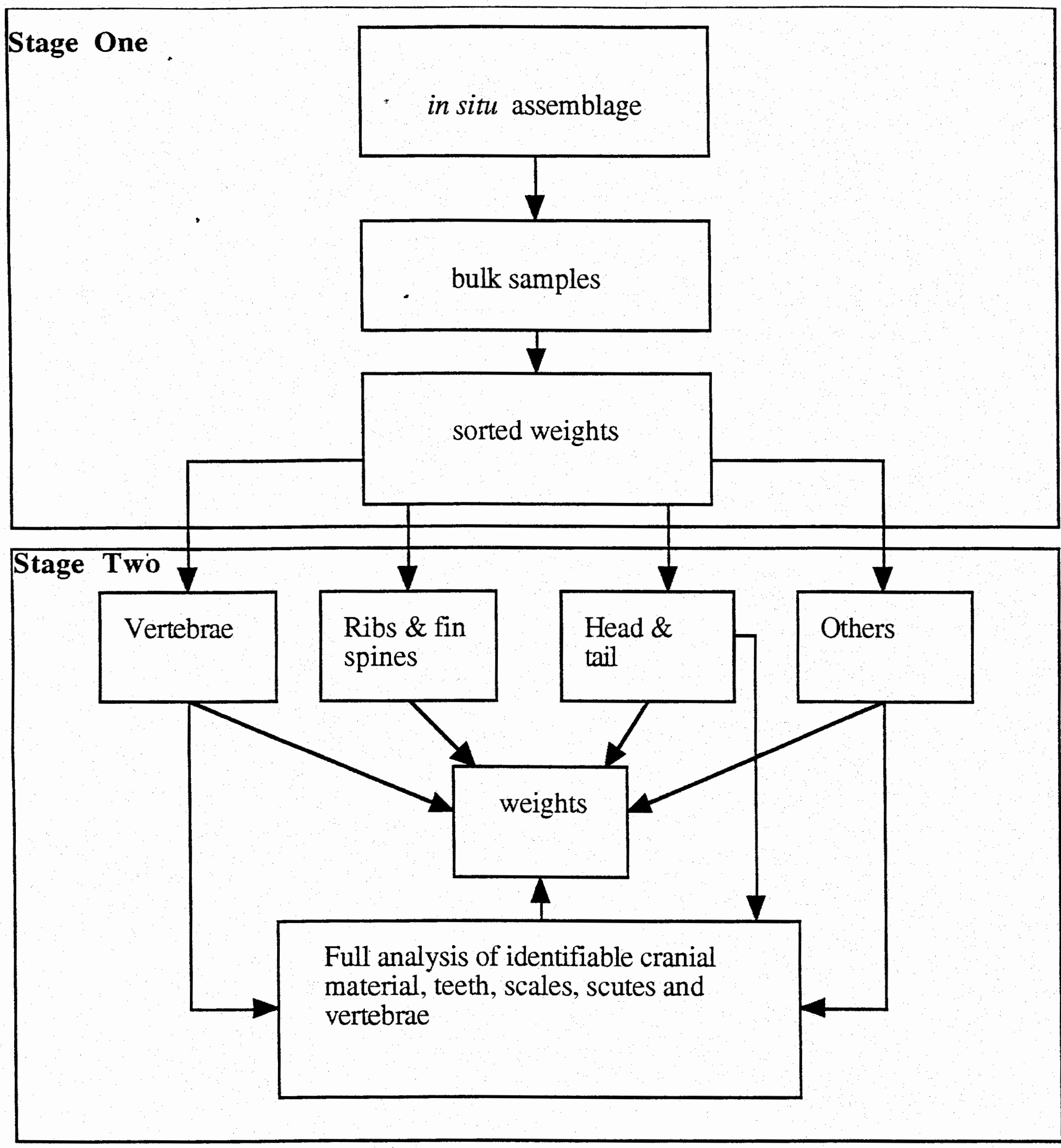

Figure 1. *Analysis breakdown through two stages.*

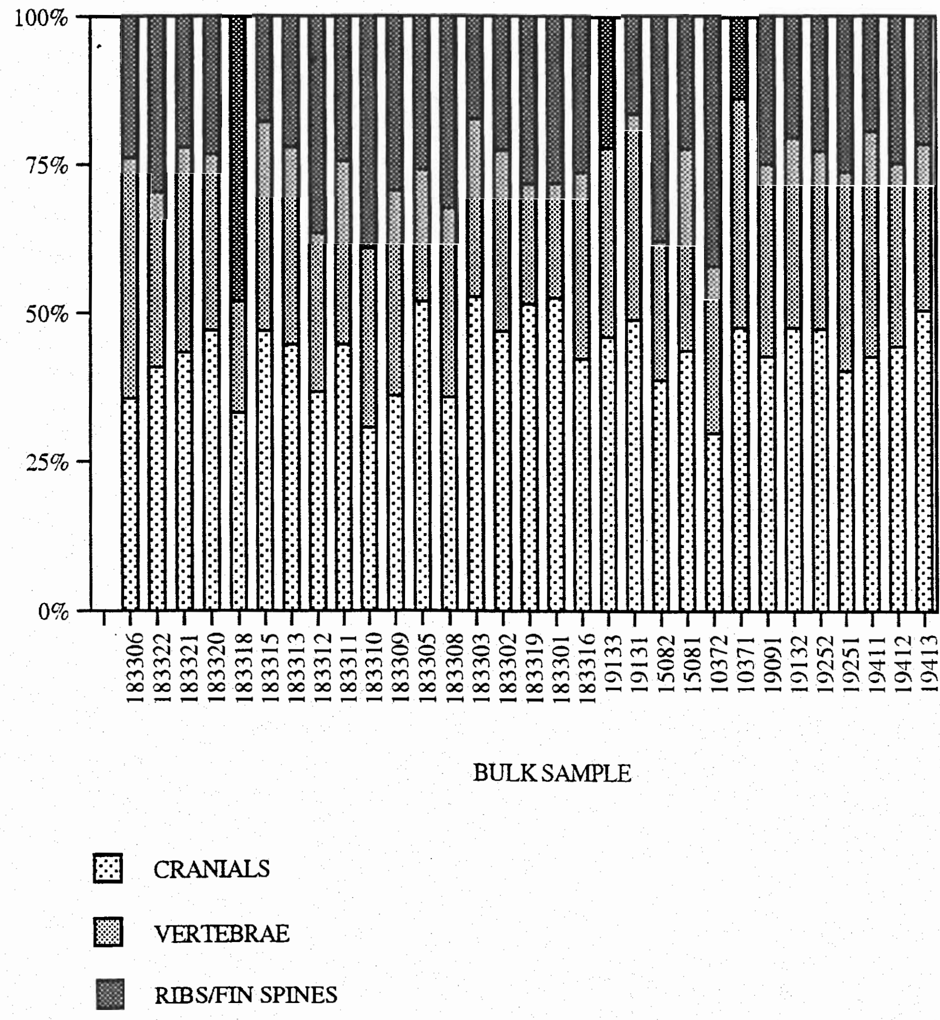

Figure 2. *Percentages of fish bone groups by bulk sample.*

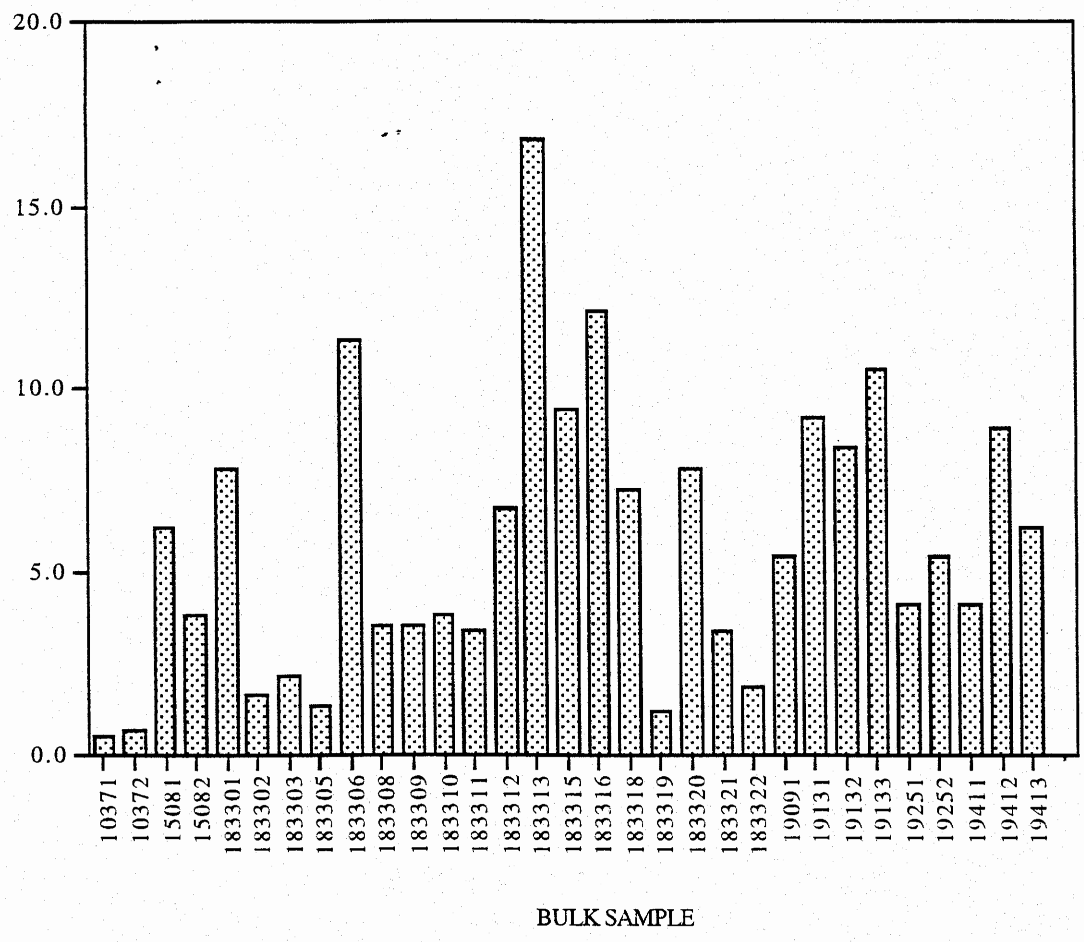

Figure 3. *Weight of fish bone per bulk sample volume/weight unit.*

SITE	CONTEXT	SAMPLE	TOTAL gms	CRANIAL gms	% CRANIAL	VERTEBRAE gms	% VERTEBRAE	RIBS/FINS gms	% RIBS/FINS	BS WT/VOL	grammes FISHBONE per BS WT/VOL
MG92	1037	10371	18.9	9	47.62%	7.3	38.62%	2.6	13.76%	37	0.51
MG92	1037	10372	41.3	12.3	29.78%	11.5	27.85%	17.5	42.37%	63	0.66
MG92	1508	15081	130.1	56.9	43.74%	43.9	33.74%	29.3	22.52%	21	6.20
MG92	1508	15082	15.2	5.9	38.82%	3.5	23.03%	5.8	38.16%	4	3.80
MG92	1833	183301	31.2	16.4	52.56%	6	19.23%	8.8	28.21%	4	7.80
MG92	1833	183302	58.7	27.6	47.02%	17.8	30.32%	13.3	22.66%	37	1.59
MG92	1833	183303	44.1	23.3	52.83%	13.1	29.71%	7.7	17.46%	21	2.10
MG92	1833	183305	10.4	5.4	51.92%	2.3	22.12%	2.7	25.96%	8	1.30
MG92	1833	183306	260.7	93	35.67%	105.2	40.35%	62.5	23.97%	23	11.33
MG92	1833	183308	70.6	25.3	35.84%	22.4	31.73%	22.9	32.44%	20	3.53
MG92	1833	183309	53.2	19.2	36.09%	18.3	34.40%	15.7	29.51%	15	3.55
MG92	1833	183310	18.9	5.8	30.69%	5.7	30.16%	7.4	39.15%	5	3.78
MG92	1833	183311	64	28.6	44.69%	19.7	30.78%	15.7	24.53%	19	3.37
MG92	1833	183312	180.7	66.4	36.75%	47.9	26.51%	66.4	36.75%	27	6.69
MG92	1833	183313	269.5	120.4	44.68%	89.1	33.06%	60	22.26%	16	16.84
MG92	1833	183315	112.2	52.7	46.97%	39.4	35.12%	20.1	17.91%	12	9.35
MG92	1833	183316	303.2	128.3	42.32%	95	31.33%	79.9	26.35%	25	12.13
MG92	1833	183318	158.4	52.6	33.21%	29.7	18.75%	76.1	48.04%	22	7.20
MG92	1833	183319	6	3.1	51.67%	1.2	20.00%	1.7	28.33%	5	1.20
MG92	1833	183320	78.3	36.9	47.13%	23.1	29.50%	18.3	23.37%	10	7.83
MG92	1833	183321	33.6	14.6	43.45%	11.5	34.23%	7.5	22.32%	10	3.36
MG92	1833	183322	21.5	8.8	40.93%	6.3	29.30%	6.4	29.77%	12	1.79
MG92	1909	19091	75.7	32.4	42.80%	24.3	32.10%	19	25.10%	14	5.41
MG92	1913	19131	64.6	31.6	48.92%	22.2	34.37%	10.8	16.72%	7	9.23
MG92	1913	19132	219.2	104.3	47.58%	69.7	31.80%	45.2	20.62%	26	8.43
MG92	1913	19133	84.3	38.8	46.03%	26.8	31.79%	18.7	22.18%	8	10.54
MG92	1925	19251	66.1	26.7	40.39%	22	33.28%	17.4	26.32%	16	4.13
MG92	1925	19252	166.1	78.7	47.38%	49.3	29.68%	38.1	22.94%	31	5.36
MG92	1941	19411	113.5	48.6	42.82%	42.7	37.62%	22.2	19.56%	28	4.05
MG92	1941	19412	223.2	99.2	44.44%	68.3	30.60%	55.7	24.96%	25	8.93
MG92	1941	19413	56.2	28.4	50.53%	15.6	27.76%	12.2	21.71%	9	6.24

Table 1. *Breakdown of skeletal element group weights with their percentage representation for each sample and combined weights for each bulk sample.*

CONTEXT	PHASE	kitchen food waste	Priors cell occupation	Grand Total fish bones
1037	4	0	113	113
1508	3	116	0	116
1833	2bii	2095	0	2095
1909	2bii	190	0	190
1913	2bii	377	0	377
1941	2bi	603	0	603
Grand Total	fish bones	3381	113	3494

Table 2. *Numbers of identified fish bones according to context, site phase by room and context type.*

		1037	1508	1833	1909	1913	1941	Grand Total
	TAXON	4	3	2bii	2bii	2bii	2bi	
Marine elasmobranch	*Raja clavata* L. thornback ray	4	2	12	2	59	3	82
Freshwater and migratory	CYPRINIDAE (carp family)	0	4	138	23	32	57	254
	Tinca tinca (L.) tench	0	0	1	0	0	0	1
	Abramis brama (L.) common bream	0	0	1	0	0	0	1
	Blicca bjoerkna (L.) silver bream	0	0	1	0	0	0	1
	Leuciscus leuciscus (L.) dace	0	0	1	0	1	0	2
	Leuciscus cephalus (L.) chub	0	0	0	0	1	1	2
	Rutilus rutilus (L.) roach	0	0	2	0	0	0	2
	Salmo salar L. atlantic salmon	3	0	10	10	2	0	25
	Salmo trutta L. sea/brown trout	0	0	1	0	0	3	4
	Perca fluviatilis L. perch	0	0	0	2	1	0	3
	Anguilla anguilla (L.) eel	11	51	72	15	28	0	177
	Esox lucius L. pike	0	1	0	4	0	0	5
Marine	*Conger conger* (L.) conger eel	0	2	0	0	0	2	4
	Clupea harengus L. herring	39	11	1318	0	2	0	1370
	GADIDAE (cod family)	26	11	69	62	59	169	396
	Gadus morhua L. cod	0	3	23	0	6	1	33
	Melanogrammus aeglefinus (L.) haddock	2	12	155	20	104	140	433
	Merlangius merlangus (L.) whiting	0	9	59	4	4	26	102
	Pollachius pollachius (L.) pollack	0	1	0	0	0	0	1
	Molva molva (L.) ling	0	0	0	0	0	17	17
	Merluccius merluccius (L.) hake	0	0	0	1	0	0	1
	LABRIDAE (wrasse family)	0	1	0	0	0	0	1
	Labrus mixtus L. cuckoo wrasse	0	1	0	0	0	0	1
	Scomber scombrus L. mackerel	0	0	0	0	0	3	3
	TRIGLIDAE (gurnard family)	0	3	2	0	0	0	5
	Eutrigla gurnardus (L.) grey gurnard	0	0	0	0	0	1	1
	Scophthalmus maximus (L.) turbot	1	1	6	0	7	3	18
	PLEURONECTIDAE (flatfish family)	8	1	72	4	13	33	131
	Platichthys flesus (L.) flounder	1	1	11	0	2	2	17
	Pleuronectes platessa L. plaice	1	1	11	0	15	3	31
	Solea solea (L.) sole	0	0	1	0	0	1	2
	Indeterminate	17	0	129	43	41	138	368
	Grand Total	113	116	2095	190	377	603	3494

Table 3. *Fish species bone fragment representation by context and site phase.*

	TAXON	ARTICULAR	DENTARY	MAXILLA	PREMAXILLA	QUADRATE	CERATOHYAL	OPERCULAR	UROHYAL	FIRST VERTEBRA	CERVICAL VERTEBRA	ABDOMINAL VERTEBRA	CAUDAL VERTEBRA	CENTRUM	UROSTYLE	CLEITHRUM	POST-TEMPORAL	OTOLITH	SCALE	SCUTE	CRANIAL FRAG	PHARYNGEAL TOOTH	PHARYNGEAL BONE + TEET	TOOTH	Grand Total
Marine elasmobranch	*Raja clavata* L. thornback ray	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	79	0	0	0	3	82
Freshwater and migratory	CYPRINIDAE (carp family)	2	0	0	0	1	1	0	0	2	17	68	159	0	0	3	0	0	0	0	0	0	1	0	254
	Tinca tinca (L.) tench	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
	Abramis brama (L.) common bream	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
	Blicca bjoerkna (L.) silver bream	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
	Leuciscus leuciscus (L.) dace	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2
	Leuciscus cephalus (L.) chub	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	2
	Rutilus rutilus (L.) roach	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
	Salmo salar L. atlantic salmon	0	0	0	0	0	0	0	0	0	0	2	23	0	0	0	0	0	0	0	0	0	0	0	25
	Salmo trutta L. sea/brown trout	0	1	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	4
	Perca fluviatilis L. perch	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	1	0	0	0	0	0	3
	Anguilla anguilla (L.) eel	1	2	0	0	0	0	0	0	0	0	0	172	0	0	2	0	0	0	0	0	0	0	0	177
	Esox lucius L. pike	0	0	0	0	1	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	5
Marine	*Conger conger* (L.) conger eel	1	0	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	4
	Clupea harengus L. herring	7	1	0	0	0	13	0	0	0	0	0	1335	0	0	6	0	0	0	0	8	0	0	0	1370
	GADIDAE (cod family)	1	7	3	2	1	1	0	0	0	38	76	203	37	0	2	6	16	0	0	0	0	0	3	396
	Gadus morhua L. cod	4	2	1	11	1	3	1	0	0	0	0	0	0	0	2	0	8	0	0	0	0	0	0	33
	Melanogrammus aeglefinus (L.) haddock	28	8	16	37	14	18	19	0	0	24	100	132	0	0	25	12	0	0	0	0	0	0	0	433
	Merlangius merlangus (L.) whiting	19	8	6	9	26	1	1	0	4	0	0	0	0	0	4	24	0	0	0	0	0	0	0	102
	Pollachius pollachius (L.) pollack	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
	Molva molva (L.) ling	4	1	1	2	4	2	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	17
	Merluccius merluccius (L.) hake	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	LABRIDAE (wrasse family)	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Labrus mixtus L. cuckoo wrasse	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Scomber scombrus L. mackerel	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	3
	TRIGLIDAE (gurnard family)	0	0	0	0	0	0	3	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	5
	Eutrigla gurnardus (L.) grey gurnard	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
	Scophthalmus maximus (L.) turbot	0	0	0	1	0	0	0	0	0	0	1	6	0	0	3	0	0	0	7	0	0	0	0	18
	PLEURONECTIDAE (flatfish family)	4	2	2	2	1	0	0	0	0	3	28	82	0	0	7	0	0	0	0	0	0	0	0	131
	Platichthys flesus (L.) flounder	0	4	1	4	0	0	0	5	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	17
	Pleuronectes platessa L. plaice	5	8	1	7	2	0	0	3	0	0	0	0	0	1	4	0	0	0	0	0	0	0	0	31
	Solea solea (L.) sole	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
	Indeterminate	0	0	0	0	0	0	0	0	0	0	2	10	344	0	9	3	0	0	0	0	0	0	0	368
	Grand Total	78	44	32	78	51	39	25	8	6	85	277	2132	381	2	73	48	24	1	87	8	4	5	6	3494

Table 4. *Fish species bone fragment representation by skeletal element.*