Ancient Monuments Laboratory
Report 85/97

THE SAXON, MEDIEVAL AND POST MEDIEVAL FISH BONES FROM EXCAVATIONS AT CASTLE MALL, NORWICH, NORFOLK

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Summary

Over 14,000 fish bones were identified to species or family level from Castle Mall and are summarised in Table 1. The assemblage was dominated by marine fish, particularly herring as expected in such close proximity to the East Anglian herring fisheries centred on Great Yarmouth. Cod and related species were also important along with flatfishes and rays. The species composition was remarkably consistent through all periods and no differences in lateral distribution were observed in contrast with the animal bones where some fluctuations between species occurred (Albarella et al 1997). Consumption of freshwater species seems to have been relatively unimportant, except for eel.

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The Saxon, Medieval and Post Medieval Fish Bones from Excavations at Castle Mall, Norwich.

Alison Locker. May 1997

Methods.

Fish bones were recovered from 7 main periods of occupation described as follows and a summary of the development of the castle can be found in Albarella, Beech and Mulville 1997.

Period 1; Pre Conquest (Late 9th-11th centuries).

Sub Period 2. Early Pre Conquest (Late 9th-11th centuries).
Sub Period 3. Pre Conquest (C11th)
Sub Period 4. Pre/Post Conquest (Late C11th).

Period 2; Conquest Timber Castle (c.1068-1094 Late 11th-early 12th centuries).

Sub Period 1. Conquest/Early Castle Defences (c. 1068-1094 Late C11th- EarlyC12th).
Sub period 2. Early fills of castle ditches & contemporary activity (Late C11th-Early C12th).
Sub period 3. Continued infilling of ditch (Late C11th-Early C12th)

Period 3; Stone Castle (c. 1094-1122 12th century).

Sub Period 1. Stone castle defences & contemporary activity (c.1094-1122/Early C12th).
Sub Period 2. Fills of castle ditches & contemporary activity (C12th).

Period 4; Medieval Developments (Late 12th to Mid 14th century).

Subperiod 1. Medieval defensive alterations & contemporary activity (Late C12th -C13th).
Sub Period 2. Medieval activity (C13th-C14th).

Period 5; Late Medieval Transitional (Mid Late 14th - Mid 16th centuries).

Sub Period 1. Post 1345 - Mid to Late C14th-C15th.
Sub Period 2. C15th-Mid C16th.

Period 6; Post Medieval (Late 16th to 18th centuries).
Sub Period 1. Early Post Medieval (Late C16th - Mid C17th).
Sub Period 2. Post Medieval (Mid C17th -Early C18th).
Sub Period 3. C18th (1738 Cattle market)

Period 7; Modern (19th - 20th centuries).
Sub Period 1. Modern (C19th, 1862 Cattle market).
Sub Period 2. Modern (C20th)

The fish bones were retrieved by three methods, the combined total number of identified fish are shown in Table 1. Fish only recovered by hand picking are shown in Table 2, site riddling to 8 mm in Table 3 and bulk sieving using a 0.5 mm mesh in Table 4. The selectivity of both the hand picked and site riddled samples in Tables 2 and 3 is clearly demonstrated by comparison with the bulk sieved assemblage in Table 4. Only 7% of all identified fish were hand collected and 15% were from site riddled samples, where there is a bias favouring the larger species, particularly cod and other gadids, 11 species were only recovered from bulk sieved samples.

Only the material identified to species and/or family level is shown on the tables, indeterminate fragments including ribs and fin rays were not quantified, though all potentially identifiable material was recorded.

In the more detailed tables grouping similar contexts the bones are listed by anatomy groups to indicate any preference of skull remains over vertebrae or vice versa, here fish recovered by all three retrieval methods have been amalgamated. There appeared to be no variation in recovery rate between periods for the mammal and bird bones (Albarella *et al* 1997) and this also seems to be true for the fish.

Any association of bones indicating part of a single individual, or any cut marks were also recorded.

Species Present.

The following species/families were identified; Elasmobranch indet., spurdog (*Squalus acanthias*), Rajidae, roker (*Raja clavata*), eel (*Anguilla anguilla*), conger eel (*Conger conger*), herring (*Clupea harengus*), sprat (*Sprattus sprattus*), pilchard (*Sardina pilchardus*), Salmonidae, trout (*Salmo trutta*), smelt (*Osmerus eperlanus*), pike (*Esox lucius*), ?carp (*Cyprinus carpio*), tench (*Tinca tinca*), roach (*Rutilus rutilus*), Cyprinidae, cod *(Gadus morhua*), Gadidae, haddock (*Melanogrammus aeglefinus*), whiting (*Merlangius merlangus*), pollack (*Pollachius pollachius*), saithe (*Pollachius virens*), ling (*Molva molva*), Triglidae, sea scorpion/bullrout (*Taurulus bubalis/Myoxocephalus scorpius*), perch (*Perca fluviatilis*), ruffe (*Gymnocephalus cernuus*), bass (*Dicentrarchus labrax*), scad (*Trachurus trachurus*), black sea bream (*Spondyliosoma cantharus*), pandora (*Pagellus erythrinus*), Sparidae, red mullet (*Mullus surmuletus*), thin-lipped grey mullet (*Liza ramada*), ballan wrasse (*Labrus bergylta*), catfish (*Anarchus lupus*), ?dragonet (*Callionymus lyra*), mackerel (*Scomber scombrus*), Scombridae, turbot (*Scophthalmus maximus*), brill (*Scophthalmus*

rhombus), plaice (*Pleuronectes platessa*), flounder (*Platichthys flesus*), halibut (*Hippoglossus hippoglossus*), sole (*Solea solea*) and flatfish indet.

Distribution of Species through Time.

The most striking aspect of the assemblage from Castle Mall is the similarity in species distribution both temporally and spacially, therefore to avoid repetition this report has not been divided by period. Some observations have been made regarding differences between periods, relating to both sample size and changes in the representation of species. This is followed by a discussion on the local marine fishery and the possible sources of more distant water fish.

The largest assemblages come from periods 1 and 5, 29% and 33% of the entire identified assemblage respectively. The greatest weight of bulk sieved material also came from these periods (see Table 5), though period 5 was relatively richer per gram than period 1. This is influenced by the rich deposit in the Barbican Well in sub period 5.2. which weighed 252 gms.

In Table 6 the relative percentage of each main food species/group is shown. Assuming the selective effects of hand collection and site riddling affects all periods in a similar manner as for the animal bone, these percentages may be used as a broad indicator of relative species occurrence.The elasmobranchs occur in small numbers, but regularly in all periods. Rays and spurdog have been identified from teeth, denticles and spines but are likely to be greatly under represented as their cartilaginous skeletons do not survive well.

The highest percentage for eel was in period 1, which might reflect a more intensive exploitation of local rivers for eel, but not other freshwater species, in the earliest period. Eels have more vertebrae than other fish and so are reliably only compared against their own occurrence between periods.

Herring was identified in large numbers in all periods and is easily the most frequently occuring species, though under represented in hand picked and site riddled deposits because of the small size of it's bones. This is unsurprising given the proximity of the East Anglian herring fishery which was centred on Great Yarmouth.

Fish, particularly herring, were considered by Campbell (1975) to have been a possible major source of wealth in Norwich in the 11th century (sub periods 1.3 and 1.4) which was said to have been a fishing port up until the time of William of Malmesbury in 1152, (Cutting 1955, 54) and well placed to receive the abundant catches of herring from the North Sea. After Norwich became a river port fish would have been landed at Yarmouth and brought upstream. The importance of herring is evident throughout all periods, although the assemblage may show some decline in period 6, it is well represented in period 7, but in a comparatively small assemblage. In the late 16th century Norwich was still documented as an important centre for curing herrings brought from Yarmouth (Williams 1988, 168). However there is no evidence from any of the features for fish processing and it is assumed that the fish bones are all the remains of consumption.

Groups of contexts tabulated for period 1 (tables 7-11) show herring prevailing over all other species, but in period 1.3, in the refuse pits and wells (Table 10), eel, cod and large gadids are more evident than in other contemporary features. In terms of body part distribution, herring vertebrae are much more prevalent than skull fragments, a trend evident in all other periods and may be a consequence of survival and/or recovery. This also applies to eel, but to a lesser degree with cod and the other gadids, including whiting.

The fish from other features tabulated from later periods (Tables 12-17) are consistant with those from period 1 and there is no evidence for differential disposal between different types of deposit, the same species predominate.

In period 5.2, the Barbican well, was particularly rich in fish remains. 10 contexts produced a large assemblage, originally analysed separately (Locker unpublished) but now incorporated into this report (see Table 18). The Barbican well fish assemblage is typical of this site with herring representing 57% of all fish despite the hand collected bone being 15% of the total and the site riddled 33% (double the proportion of the rest of the site), which would have biased recovery against herring and other small species.

Although herring dominates numerically throughout, the larger 'whitefish' particularly cod and whiting, but also including haddock, pollack, saithe and ling would have formed a large proportion by weight of the fish consumed. Flatfishes show a steady increase through time, culminating in period 5. Plaice and/or flounder were most common, larger flatfishes fish such as turbot (possibly indicative of a higher status meal) and halibut were also eaten occasionally.

Evidence of burning was seen in a number of deposits affecting a variety of species, individual bones showed varying degrees of burning consistent with the occurrence of charcoal in almost every context (Murphy 1996).

Although evidence of human cess was found in the same deposits as some fishbones (Murphy 1996), the bones did not exhibit the distortion and partial destruction associated with faecal material.

The Marine Fishery

The two main commercial fisheries represented in all periods at Castle Mall are for herring and cod. The establishment of the East Anglian herring fishery is well documented. As early as the 7th century the bishop of East Angles is said to have built the church of St Benet on the Greenhill in Yarmouth in 647 to pray for the health and success of the fishermen that come to Yarmouth in the herring season (Cushing 1988, 79). Norwich was a centre for curing herrings brought from Yarmouth after the river became too shallow for seagoing craft (Williams 1988, 62). Norwich became the second city in the land by the 16th century and the increased river trade from Yarmouth caused the latter's growth from fishing town to port.

The herring fishery was seasonal and huge numbers of fish were caught to meet the requirements of the many compulsory fish days imposed by the church up to the Reformation. Both fresh and stored herrings are likely to be represented here,

particularly as curing was carried out in the town. The herrings were salted (white), pickled, and smoked, a combination of salting and smoking produced the famous 'red' herring from the from the 14th century onwards. These strongly flavoured fish became a famous regional delicacy traded throughout Britain and abroad.

Sprats are closely related to herring, the young of both species being caught together in estuaries and sold as whitebait. Sprats were sometimes cured in the same manner as red herring and were netted in large numbers in January, particularly near Aldeburgh (Williams 1988, 165). The largest numbers of bones from this species were identified from medieval deposits in sub period 4.2, 5.1 and 5.2.

Cod were caught on lines, the total length of cod in this assemblage ranged from 45-125 cms (n = 83). These sizes were calculated from measurements taken on the premaxilla and dentary (after Wheeler and Jones 1976) and are shown in Figure 1. The larger fish of around 120 cms would have weighed about 11 kg (Wheeler 1978, 150). The smaller fish could have been caught closer inshore although there is a certain amount of seasonal movement from deep to shallower water.

The presence of so many cod skull bones suggests that the fish were purchased whole (after gutting) and fresh. However, some cut and chopmarks on the cleithra of 8 specimens from periods 1, 3, 5 and 6 are typical of those made while preparing stockfish in which the head is removed leaving the cleithrum at the back of the skull. Other cut marks on branchiostegal rays and articulars as well as chop marks across two precaudal vertebrae close to the head and caudal vertbrae close to the tail are also evidence of fish preparation, whether initial processing or in the kitchen prior to cooking cannot be determined. Large numbers of stockfish (dried cod) and salted cod and ling were brought back from Iceland to East Anglian ports throughout the 15th and 16th centuries, (Williams 1988, 87), the numbers were so substantial that in some East Anglian ports, such as Kings Lynn, stockfishmongers set up in business trading in these fish alone.

Ling were also marketed salted and dried, the Norfolk coastline is the extreme south of it's range and some of the bones identified are likely to be from dried and salted fish caught farther north and west. In the 17th century Yarmouth fishermen could be found off the coast of Ireland fishing for cod and ling through March to September before returning to Yarmouth for the autumn herring fishery (Elder 1912, 30). Williams' (1988, 167) records that in the second half of the 16th century most of the cod and ling landed at Yarmouth went to feed Norwich.

Pollack and saithe, also relatives of cod, could have been caught locally. Skull bones from both species are present suggesting whole, ?fresh fish, although they can be salted and dried in the same manner as cod and ling. Pollack are often found inshore and both species would have been caught on lines.

Haddock would also have been caught on lines, they were most frequent in period 5, but large haddock were evidently being caught before the Conquest as two cleithra from sub periods 1.2 and 1.3 were from fish of 70 and 75 cms total length (after Beerenhout 1994, 431) close to the maximum size found today (Wheeler 1978, 152). In the south of their range, which includes the Norfolk coastline, haddock come into

shallower water in the winter and the fishermen may have taken advantage of this winter migration. The other haddock remains were from fish of more average size, 40-50 cms in length.

Whiting are common in inshore shallow water and could have been caught all year, whole gutted whiting were commonly salted and dried. Since none of the skeleton was discarded during processing it is not possible to suggest whether any of the bones are from stored fish, fresh fish would have been easily available from Yarmouth, but stored fish may also have been purchased.

Mackerel were often identified in small numbers throughout the deposits, as can be seen in Table 1. They school in large numbers near the surface and are migratory being found in May off the Norfolk coastline (Williams 1988, 166).

The flatfishes are an important component of the food fishes identified from Castle Mall. Plaice and flounder are the most common and sole was frequently identified. These could have been caught along the shoreline in tidal traps, or on lines in shallow water.

Halibut, turbot and/or brill were less common, but larger. Halibut is a deep water fish, which can grow to 2.5 metres in length (Wheeler 1978, 360), but the flesh of the biggest fish tends to be coarse. All the identifications of halibut were of single large vertebrae, one of which showed evidence of a knifecut and was of a similar size to that of a reference specimen of 193 cms total length whose gutted weight was 76kg. Another halibut vertebral fragment was burnt and had been chopped. The bones seem to be the remains of pieces of fish cut from large individuals. It is doubtful that halibut is an indicator of high status food at the castle, since they do not seem to have been highly regarded until relatively recently. In the early 1800s when the cod fisheries were exploited off the coast of New England any halibut that were caught with the cod were regarded as a nuisance, although later salted halibut was marketed (Cutting 1955, 172).

Turbot has always been esteemed as a prime food fish, but the few occurrences within these deposits are insufficient to suggest high status.

The remains of the smaller flatfishes and rays may represent the enterprise of small scale fisheries operating along the coastline, marketing their catches directly in Norwich, rather than through merchants selling the larger more commercial catches of the Yarmouth fishing fleets. Similarly there are a number of marine species (shown in Table 1) which occur sporadically in small numbers; conger eel, mullet, bream, bass etc and provide a record of fish eaten less regularly. All these species could have been caught on the local coastline and brought to Norwich.

Migratory Species caught in freshwater.

Eels were identified in all periods, in most sieved contexts, forming 9% of the identified assemblage. Measurement of the skull bones suggested these were largely from individuals around 30-35 cms in total length, eels return to the sea to spawn and could have been caught while migrating downstream. A variety of methods were used

including special spears and traps built across rivers. A seasonal catch, unless kept in ponds, eels were eaten fresh and were also salted or pickled for storage.

Salmon were only identified from vertebrae, the skull bones do not survive well so they are probably under represented, vertebrae are poorly represented in all periods. In the late 16th century a few barrels of salmon were sent to Norwich every year, possibly from Berwick and were regarded as a delicacy (Williams 1988, 179).

Smelt are a small migratory species, related to salmon they also enter estuaries and rivers to spawn. Prior to river pollution they were found in sufficient numbers in the Thames to have been the object of a seasonal fishery (Wheeler 1979, 48). Smelt were also identified from St Martin-at-Palace-Plain (Locker 1987, 115) and Fishergate (Locker 1994, 42), both in Norwich so there is some evidence for a local fishery. These fish are regarded as a delicacy, they smell of cucumber and are eaten fresh.

Freshwater Fish

The freshwater species were few, pike was identified in the early deposits through to the late medieval, but was not identified from post medieval or later periods.

The cyprinids include tench, whose numbers are increased by the partial remains of two individuals in sub period 1.2, roach and perch were also eaten. The tentative identification of two carp cleithra from sub period 1.3 (context 40102, group2/08) is an early record for this introduced species but the light texture suggests they may be intrusive from a later level, no other fish were found in this context.

Conclusion.

The strong representation of marine food species; herring, cod, gadids, rays and flatfishes complements the findings from the mammal, bird (Albarella, Beech and Mulville (1996) and botanical (Murphy 1996) assemblages, in that they show no evidence for the royal status of the castle. The fish reflect the daily fare available to people living in what became a major city, close to the coast and fishing ports which would have supplied the fishmongers and markets of Norwich. As a centre for curing herring, the large numbers of herring bones identified attest to the importance of this fishery and curing industry throughout the period of occupation .

The most striking feature of the fish assemblage from Castle Mall is the uniformity in species composition both temporally and laterally, particularly from periods 1 to 5 (pre conquest to late medieval). The assemblage is also very similar to those identified from other Norwich sites; St Martin-at-Palace Plain (Locker 1987), Fishergate (Locker 1994), Alms Lane (Jones and Scott 1985) and Whitefriars Street (Jones 1983) showing a strong dependency on herring and cod, with little exploitation of freshwater fish apart from eel.

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Figure 1 The total length of cod using measurements from the premaxilla and dentary. (after Wheeler and Jones 1976).

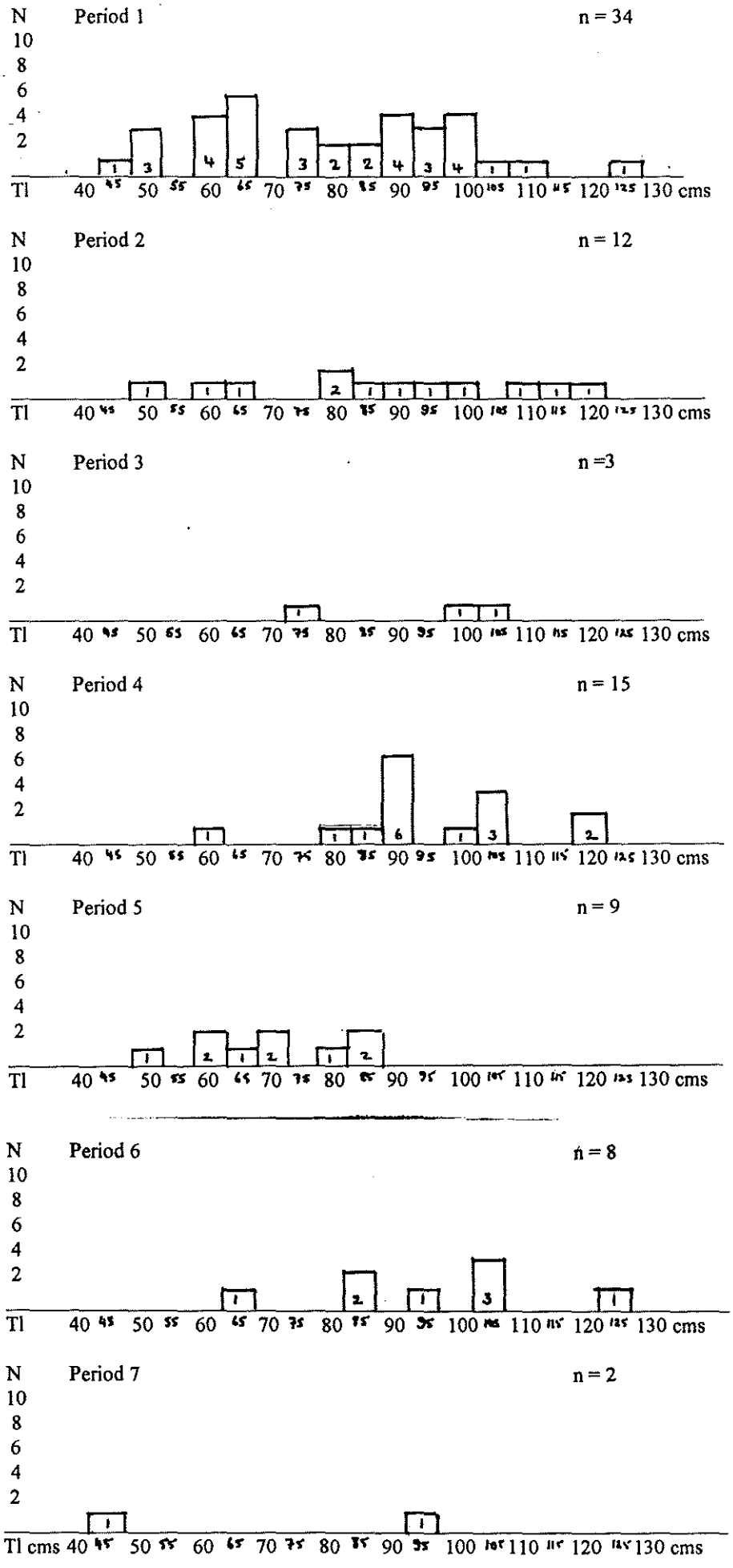

Table 1, Summary Table of the Fish identified from Each Period at Castle Mall, Norwich.

Period	1	2	3	4	5	6	7	Total
Elasmobranch	31	9	6	10	21	9	0	86
Spurdog	0	0	0	0	1	0	0	1
Ray	9	3	2	11	7	0	0	32
Roker	19	19	6	18	13	16	2	93
Eel	739	75	60	33	394	45	3	1349
Conger eel	0	0	1	1	5	0	0	7
Herring	2358	949	949	566	2281	238	73	7414
Sprat	3	0	0	62	202	2	1	270
Pilchard	0	0	0	0	1	0	0	1
Salmonid	1	2	3	3	3	4	0	16
Smelt	5	6	2	3	6	2	0	24
Pike	13	7	35	1	29	0	0	85
?Carp	2	0	0	0	0	0	0	2
Tench	72	0	0	0	0	1	0	73
Roach	3	0	4	0	12	0	0	19
Cyprinid	4	3	12	7	115	6	2	149
Cod	389	336	220	309	505	206	21	1986
Lge Gadid	428	92	118	253	322	56	4	1273
Sm Gadid	1	2	13	3	10	0	1	30
Haddock	10	7	22	12	100	9	2	162
Whiting	64	68	39	65	301	23	3	563
Pollack	1	0	0	0	7	0	0	8
Saithe	2	0	0	2	2	0	0	6
Ling	1	0	4	6	16	5	1	33
Gurnard	2	1	7	1	0	0	0	11
Sea Scorpion/Bullrout	0	0	0	0	2	0	0	2
Perch	0	0	0	0	1	0	0	1
Ruffe	0	0	0	0	4	0	0	4
Bass	0	1	0	0	1	0	0	2
Scad	1	2	2	1	0	0	1	7
Black Sea Bream	1	0	0	0	0	0	0	1
Pandora	0	0	0	0	1	0	0	1
Sea Bream indet.	2	2	1	1	1	0	0	7
Red Mullet	3	0	0	0	0	0	0	3
Thin Lipped Grey Mullet	1	0	2	1	0	0	0	4
Ballan Wrasse	0	0	0	0	6	0	0	6
Catfish	0	0	0	0	1	0	0	1
?Dragonet	0	0	0	0	1	0	0	1
Mackerel	65	25	14	10	25	9	0	148
Scombrid	0	0	0	0	1	0	0	1
Scombrid/Mullet	0	1	0	0	0	0	0	1
Turbot	0	0	2	0	2	4	0	8
Turbot/Brill	2	0	0	0	0	0	0	2
Plaice	1	2	6	7	19	9	0	44
Plaice/Flounder	21	25	75	25	201	41	5	393
Halibut	2	0	0	0	6	2	0	10
Sole	1	0	0	4	23	3	0	31
Flatfish indet.	9	6	3	12	17	14	1	62
Total	4266	1643	1608	1427	4665	704	120	14,433

Table 2 The Hand Retrieved Fish Bones from Castle Mall, Norwich

Sub Period	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	4.1	4.2	5.1	5.2	6.0	6.1	6.2	6.3	7.1	7.2	Total
Elasmobranch	1	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	4
Eel	0	0	0	0	0	0	0	0	0	0	1	18	0	0	1	0	0	0	20
Herring	0	0	0	0	0	0	0	0	0	0	3	233	0	0	12	0	0	0	248
Salmonid	0	0	0	0	0	0	0	0	1	0	0	0	0	2	0	0	0	0	3
Pike	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0	7
?Carp	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Cyprinid	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	8
Cod	21	29	5	3	1	78	2	20	19	4	16	117	60	16	6	3	2	0	402
Large Gadid	4	41	0	2	3	18	4	12	4	7	24	64	0	0	0	3	2	1	189
Small Gadid	0	0	0	1	0	0	0	0	0	0	5	0	0	0	0	0	0	0	6
Haddock	2	0	0	0	0	0	0	1	0	0	1	12	0	1	0	0	0	0	17
Whiting	0	0	0	0	0	0	0	0	2	0	8	26	0	3	0	0	0	0	39
Ling	0	0	1	0	0	0	0	4	0	0	2	12	0	0	0	0	0	0	19
Mackerel	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
Turbot	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	2
Plaice	0	0	0	0	0	0	1	0	0	0	1	1	0	1	0	0	0	0	4
Plaice/Flounder	0	1	0	0	0	0	0	0	0	0	1	15	0	0	0	0	0	0	17
Halibut	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	3
Sole	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
Flatfish	0	0	1	0	0	0	0	0	0	2	0	2	0	0	0	0	0	1	6
Total	28	73	7	6	4	96	7	37	26	14	65	520	60	24	19	6	4	2	998

Table 3 The Fish Bone from Site Riddled Samples at Castle Mall, Norwich.

Sub Periods	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	4.1	4.2	5.1	5.2	6.1	6.2	6.3	7.1	Total
Elasmobranch	0	0	0	0	0	0	0	0	0	1	0	4	2	0	0	0	7
Spurdog	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
Roker	0	2	0	6	0	0	0	0	3	2	2	4	0	0	0	0	19
Eel	0	0	0	0	0	0	0	0	0	0	1	56	0	1	0	0	58
Conger eel	0	0	0	0	0	0	0	1	0	1	3	1	0	0	0	0	6
Herring	0	1	8	10	0	0	1	4	0	3	12	431	4	0	0	1	475
Sprat	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0	7
Salmonid	0	0	0	0	0	0	0	1	0	0	0	2	0	0	0	0	3
Pike	0	0	1	0	0	0	0	3	0	1	2	8	0	0	0	0	15
Tench	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
Roach	0	0	0	0	0	0	0	1	0	0	0	9	0	0	0	0	10
Cyprinid	0	0	0	0	0	0	0	1	0	4	0	23	0	0	0	0	28
Cod	2	82	11	72	4	20	0	102	25	127	54	201	24	12	29	9	774
Large Gadid	3	151	10	28	15	3	0	11	1	40	16	99	6	8	6	0	397
Small Gadid	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	2
Haddock	0	2	0	0	0	1	2	8	3	5	21	18	4	1	0	1	66
Whiting	0	4	0	4	0	3	1	6	0	4	9	67	3	1	1	0	103
Pollack	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	0	3
Saithe	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	3
Ling	0	0	0	0	0	0	0	0	0	2	1	0	0	2	0	0	5
Perch	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
Ruffe	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
Pandora	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
Sea Bream	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	2
T L G Mullet	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
Ballan Wrasse	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	5
Catfish	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
Mackerel	0	1	0	1	0	1	1	2	1	1	1	2	1	1	0	0	13
Scombrid/Mullet	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
Plaice	0	0	0	0	0	0	0	2	0	2	7	0	1	0	1	0	13
Plaice/Flounder	0	0	1	13	0	0	1	15	2	3	18	53	3	1	0	0	110
Halibut	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
Sole	0	0	0	0	0	0	0	0	0	0	2	11	0	0	0	0	13
Flatfish	0	0	0	0	0	5	0	0	0	5	1	5	1	5	2	0	24
Total	5	244	32	135	20	33	6	159	35	202	156	1011	49	32	40	11	2170

Table 4 The fish bones from Bulk Samples from Castle Mall, Norwich

Period	1			2			3			4			5				6				7		
Sub Period	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	4.1	4.2	5.1	5.2	6.0	6.1	6.2	6.3	7.0	7.1	TI
Elasmobranch	15	5	10	6	3	0	3	3	0	9	8	6	0	5	2	0	0	0	75
Ray	4	5	0	3	0	0	0	2	0	11	4	3	0	0	0	0	0	0	32
Roker	7	5	5	7	3	3	2	4	2	11	4	3	0	2	12	1	0	2	73
Eel	161	366	212	37	22	16	5	55	6	27	149	169	0	38	5	1	3	0	1272
Conger eel	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
Herring	939	716	694	721	106	112	225	719	100	463	618	984	5	168	26	23	56	16	6691
Sprat	0	2	1	0	0	0	0	0	0	62	50	145	0	0	2	0	1	0	263
Pilchard	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
Salmonid	0	1	0	1	0	1	0	2	1	1	1	0	0	1	1	0	0	0	10
Smelt	1	1	3	6	0	0	0	2	0	3	5	1	0	2	0	0	0	0	24
Pike	0	0	12	5	1	1	26	6	0	0	5	7	0	0	0	0	0	0	63
Tench	0	72	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	72
Roach	0	1	2	0	0	0	1	2	0	0	1	2	0	0	0	0	0	0	9
Cyprinid	0	2	2	3	0	0	7	4	0	3	22	62	0	6	0	0	2	0	113
Cod	116	76	47	107	23	28	14	82	24	110	42	75	1	38	6	11	6	4	810
Lge Gadid	109	82	28	9	6	8	14	77	77	124	46	73	0	23	2	8	0	1	687
Sm Gadid	0	0	0	0	0	0	2	11	0	3	4	1	0	0	0	0	1	0	22
Haddock	0	5	1	2	3	1	3	8	1	3	36	12	0	3	0	0	0	1	79
Whiting	26	16	18	56	5	0	7	25	10	49	96	95	2	7	6	0	0	3	421
Pollack	1	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	5
Saithe	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	3
Ling	0	0	0	0	0	0	0	0	0	4	0	1	0	2	0	1	1	0	9
Gurnard	1	1	0	1	0	0	0	7	0	1	0	0	0	0	0	0	0	0	11
S Scorpion/Bullrout	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	2
Ruffe	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	3
Bass	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	2
Scad	1	0	0	1	1	0	0	2	0	1	0	0	0	0	0	0	0	1	7
Black Sea Bream	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Sea Bream indet.	0	0	1	2	0	0	0	0	0	1	0	1	0	0	0	0	0	0	5
Red Mullet	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Thin Lipped Grey Mullet	0	0	1	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	3
Ballan Wrasse	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
?Dragonet	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
Mackerel	27	13	24	19	2	2	0	11	2	5	15	7	1	5	0	1	0	0	134
Scombrid	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
Turbot	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	4	0	0	6
Turbot/Brill	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Plaice	0	1	0	2	0	0	0	3	1	4	10	0	1	5	0	0	0	0	27
Plaice/Flounder	3	6	10	7	2	3	13	46	4	16	45	69	0	25	0	12	3	2	266
Halibut	1	1	0	0	0	0	0	0	0	0	0	3	0	0	0	1	0	0	6
Sole	0	1	0	0	0	0	0	0	0	4	8	1	3	0	0	0	0	0	17
Flatfish	6	2	0	0	0	1	1	2	2	3	2	7	0	2	0	4	0	0	32
Total	1420	1384	1073	996	177	176	325	1074	231	919	1177	1736	13	332	62	67	73	30	11,265

Table 5; Weight of the Whole Earth Bulk Sieved samples from Each Period.

Period 1	Sub period 2 = 482	
	Sub period 3 = 388	
	Sub period 4 = 213	
		Total for period 1 = 1083 gms
Period 2	Sub period 1 = 375	
	Sub period 2 = 108	
	Sub period 3 = 103	
		Total for period 2 = 586 gms
Period 3	Sub period 1 = 94	
	Sub period 2 = 291	
		Total for period 3 = 385 gms
Period 4	Sub period 1 = 119	
	Sub period 2 = 238	
	Sub period 3 = 45	
		Total for period 4 = 402 gms
Period 5	Sub period 1 = 323	
	Sub period 2 = 430	
		Total for period 5 = 753 gms
Period 6	Sub period 1 = 139	
	Sub period 2 = 55	
	Sub period 3 = 38	
		Total for period 6 = 232 gms
Period 7	Sub period 1 = 42	
	Sub period 2 = 10	
		Total for period 7 = 52 gms
		Total for all periods = 3,493 gms

Table 6; Percentages of the Main Food Fishes in Each Period.

Period	1	2	3	4	5	6	7
All Elasmobranchs	1%	2%	0.7%	3%	1%	3%	2%
Eel	17%	5%	4%	2%	9%	13%	2%
Herring	55%	58%	60%	40%	56%	35%	60%
Cod	9%	20%	14%	21%	11%	30%	17%
Large Gadid	10%	4%	7%	18%	7%	10%	2%
Haddock	0.2%	0.4%	1%	0.8%	2%	1%	2%
Whiting	2%	4%	2%	5%	7%	3%	3%
All Flatfish	0.8%	2%	4%	3%	6%	10%	4%
Total	95%	95.4%	92.7%	92.8%	99%	99%	92%

Table 7; The Fish from Group 6/4. Period 1.2. Structure/Building

	Denticles	Skull frag	Vertebrae	Total
Elasmobranch	0	0	6	6
Roker	2	0	0	2
Eel	0	0	8	8
Herring	0	13	180	193
Cod	0	2	6	8
Large Gadid	0	0	1	1
Haddock	0	0	1	1
Whiting	0	2	2	4
Saithe	0	0	1	1
Black Sea Bream	0	0	1	1
Mackerel	0	0	1	1
Plaice/Flounder	0	1	1	2
Halibut	0	0	1	1
Flatfish	0	1	2	3
Total	2	19	211	232

Table 8; Group 2/11. Period 1. Aligned Refuse Pits.

	Period 1.2	Period 1.3			Period 1.4			
	Vertebrae	Skull	Vert	Tl	Skull	Vert	Frag	Tl
Elasmobranch	2	0	1	1	0	3	0	3
Eel	10	0	0	0	0	44	0	44
Herring	22	0	23	23	9	201	0	210
Tench	0	11	60	71	0	0	0	0
Cod	0	2	1	3	0	3	0	3
Large Gadid	0	2	1	3	0	0	4	4
Whiting	0	0	1	1	0	0	0	0
Saithe	0	0	0	0	0	1	0	1
Mackerel	0	0	0	0	0	8	0	8
Plaice/Flounder	0	0	0	0	0	1	0	1
Total	34	15	87	102	9	261	4	274

Table 9; Group 8/6. Period 1. Pitting.

		Period 1.2				Period 1.3			
	Dent	Skull	Vert	Frag	Tl	Skull	Vert	Frag	Tl
Ray	1	0	0	0	1	0	0	0	0
Herring	0	0	23	0	23	4	137	0	141
Cod	0	3	4	0	7	1	7	0	8
Large Gadid	0	2	1	2	5	2	0	6	8
Gurnard 0	0	0	0	0	0	0	1	0	1
Mackerel	0	0	2	0	2	0	7	0	7
Total	1	5	30	2	38	7	152	6	165

Table 10; Group 9/19. Period 1. Refuse Pits and Wells.

		Period 1.2			Period 1.3					
	Dent	Skull	Vert	Tl	Tooth	Dent	Skull	Vert	Frag	Tl
Ray	2	0	0	2	1	0	0	0	0	1
Roker	2	0	0	2	0	3	0	0	0	3
Eel	0	0	32	32	0	0	3	146	0	149
Herring	0	21	103	124	0	0	5	125	0	130
Roach	0	0	0	0	1	0	0	0	0	1
Cod	0	2	8	10	0	0	20	30	0	50
Large Gadid	0	3	1	4	0	0	18	2	90	110
Haddock	0	1	0	1	0	0	1	1	0	2
Whiting	0	0	1	1	0	0	1	3	0	4
Red Mullet	0	0	1	1	0	0	0	0	0	0
Mackerel	0	0	1	1	0	0	0	1	0	1
Plaice/Flounder	0	2	0	2	0	0	1	1	0	2
Total	4	29	147	180	2	3	49	309	90	453

Table 11; Group 9/48. Period 1.2. Sunken Building.

	Skull	Vert	Frag	Total
Elasmobranch	0	2	0	2
Eel	1	2	0	3
Herring	56	46	1	103* (39 bones from 1 fish)
Cod	2	5	0	7
Whiting	1	0	0	1
Scad	0	0	1	1
Mackerel	1	1	0	2
Total	61	56	2	119

Table 12; Groups 1/43, 1/44. Period 2.1. Fills of Pre Conquest/Conquest Ditch.

	1/43					1/44				
	Dent	Skull	Vert	Frag	Tl	Dent	Skull	Vert	Frag	Tl
Ray	0	0	0	0	0	1	0	0	0	1
Roker	2	0	0	0	2	0	0	0	0	0
Eel	0	0	2	0	2	0	0	0	0	0
Herring	0	9	175	0	184	0	1	1	10	12
Cyprinid	0	0	1	0	1	0	0	0	0	0
Cod	0	23	43	0	66	0	2	1	0	3
Large Gadid	0	3	3	10	16	0	0	0	2	2
Whiting	0	5	9	0	14	0	0	0	0	0
Red Mullet	0	0	1	0	1	0	0	0	0	0
Mackerel	0	0	3	0	3	0	0	0	0	0
Plaice/Flounder	0	6	3	0	9	0	0	0	0	0
	2	46	240	10	298	1	3	2	12	18

Table 13; Group 2/9, Period 2.1. Pits post dating levelling of Hornwork Ditch Ramparts

	Tooth	Skull	Vert	Total
Elasmobranch	0	0	2	2
Ray	1	0	0	1
Eel	0	1	5	6
Herring	0	3	129	132
Smelt	0	0	6	6
Pike	0	0	4	4
Cod	0	3	6	9
Large Gadid	0	2	0	2
Whiting	0	0	6	6
Mackerel	0	0	3	3
Scombrid	0	0	1	1
Total	1	9	162	172

Table 14; Group 1/57. Period 3.2. Outer Castle Ditch Fill.

	Tooth	Dent	Skull	Vert	Frag	Total
Ray	0	1	0	0	0	1
Roker	0	3	0	0	0	3
Eel	0	0	1	66	0	67
Conger	0	0	0	1	0	1
Herring	0	0	23	505	0	528
Salmonid	0	0	0	3	0	3
Smelt	0	0	0	2	0	2
Pike	1	0	4	4	0	9
Roach	2	0	1	0	0	3
Cyprinid	0	0	1	3	0	4
Cod	0	0	13	174	0	187
Large Gadid	0	0	3	3	15	21
Small Gadid	0	0	0	1	0	1
Haddock	0	0	0	16	0	16
Whiting	0	0	3	25	0	28
Ling	0	0	0	4	0	4
Gurnard	0	0	1	6	0	7
Sea bream	0	0	0	1	0	1
Thin lppd grey mullet	0	0	0	2	0	2
Mackerel	0	0	0	9	0	9
Plaice	0	0	2	1	0	3
Plaice/Flounder	0	0	4	40	0	44
Total	3	4	56	866	15	944

Table 15; Groups 8/16, Period 4.1 & Group 8/17, Period 4.2. S Bailey Ditch.

	8/16					8/17			
	Dent	Skull	Vert	Frag	Tl	Dent	Skull	Vert	Tl
Elasmobranch	0	0	1	0	1	0	0	0	0
Roker	2	0	0	0	2	3	0	0	3
Eel	0	0	8	0	8	0	0	0	0
Herring	0	0	48	0	48	0	0	4	4
Salmonid	0	0	1	0	1	0	0	0	0
Cod	0	5	41	0	46	0	6	71	77
Large Gadid	0	6	16	1	23	0	1	0	1
Small Gadid	0	1	0	0	1	0	0	0	0
Haddock	0	0	1	0	1	0	0	4	4
Whiting	0	4	20	0	24	0	0	0	0
Gurnard	0	0	0	0	0	0	0	1	1
Mackerel	0	0	0	0	0	0	0	1	1
Turbot/Brill	0	0	0	0	0	0	1	0	1
Plaice	0	1	0	0	1	0	0	0	0
Plaice/Flounder	0	1	9	0	10	0	1	2	3
Flatfish	0	0	3	0	3	0	2	0	2
Total	2	18	148	1	169	3	11	83	97

Table 16; Group 45/1. Period 4.3. Medieval Pits

	Skull	Vert	Frag	Total
Elasmobranch	0	3	0	3
Eel	1	2	0	3
Herring	1	48	0	49
Smelt	0	1	0	1
Cod	8	13	0	21
Large Gadid	9	0	22	31
Whiting	1	8	0	9
Mackerel	0	3	0	3
Plaice	0	1	0	1
Plaice/Flounder	0	5	0	5
Sole	0	1	0	1
Total	20	85	22	127

Table 17; Group 9/104, Period 5.1 Pits & Group 9/105, Period 5.1. Linear Feature

	9/104					9/105		
	Tooth	Skull	Vert	Frag	Tl	Skull	Vert	Tl
Elasmobranch	0	0	2	0	2	0	0	0
Eel	0	2	32	0	34	0	3	3
Conger	0	1	0	0	1	0	0	0
Herring	0	4	119	0	123	0	2	2
Pilchard	0	1	0	0	1	0	0	0
Pike	0	2	0	0	2	0	0	0
Perch	0	1	0	0	1	0	0	0
Roach	1	0	0	0	1	0	0	0
Cyprinid	0	0	13	0	13	0	0	0
Cod	0	12	26	0	38	2	4	6
Large Gadid	0	6	8	25	39	0	0	0
Small Gadid	0	3	4	4	11	0	0	0
Haddock	0	9	39	0	48	0	0	0
Whiting	0	21	33	0	54	1	1	2
Pollack	0	1	0	0	1	0	0	0
Saithe	0	0	2	0	2	0	0	0
Pandora	0	0	1	0	1	0	0	0
Ballan wrasse	0	0	1	0	1	0	0	0
?Dragonet	0	0	1	0	1	0	0	0
Mackerel	0	1	8	0	9	0	0	0
Plaice	0	2	1	0	3	0	0	0
Plaice/Flounder	0	8	26	0	34	0	0	0
Halibut	0	0	1	0	1	0	0	0
Sole	0	0	6	0	6	0	0	0
Flatfish	0	0	1	0	1	0	0	0
Total	1	74	324	29	428	3	10	13

Table 18 The Fish Bone from the Barbican Well (sub period 5.2) Castle Mall, Norwich.

(Showing the bulk sieved, site riddled and hand collected bone).

	Bulk Sieved		Site Riddled		Hand Collected		Sub Total		Total
Elasmobranch		5v		4v		2v		11v	11
Ray indet		1d						1d	1
Roker		1d		4d				5d	5
Eel	10sk	145v	4sk	51v	3sk	15v	17sk	211v	228
Conger eel		1v		1v				2v	2
Herring	104sk	881v	113sk	317v	17sk	216v	234sk	1414v	1648
Sprat		56v		7v				63v	63
Salmonid				1v				1v	1
Smelt		1v						1v	1
Pike	2sk	9v	1sk	6v	6sk	1v	9sk	16v	25
Chub/Dace			1sk					1sk	1
Roach	2sk		4sk	5v			6sk	5v	11
Cyprinid	3sk	42v		22v		8v	3sk	72v	75
Cod	4sk	27v	29sk	152v	15sk	57v	48sk	236v	284
Haddock	2sk	8v	9sk	8v	7sk	5v	18sk	21v	39
Pollack		4v						4v	4
Whiting	3sk	71v	23sk	41v	1sk	25v	27sk	137v	164
Ling		1v			2sk	4v	2sk	5v	7
Gadid	16sk	37v	9sk	55v	8sk	25v	33sk	117v	150
Bass	1sk						1sk		1
Perch	1sk	1v	1sk				2sk	1v	3
Ruffe			1sk				1sk		1
Sea Bream		1v						1v	1
Wrasse				5v				5v	5
Mackerel		6v		1v				7v	7
Turbot/Halibut						2v		2v	2
Sole		3v		9v				12v	12
Plaice/Flounder	5sk	44v	16sk	36v	4sk	11v	25sk	91v	116
Flatfish		9v	1sk	2v		2v	1sk	13v	14
Subtotal	153sk	1352v 2d	212sk	723v 4d	63sk	373v	428sk	2448v 6d	
Total		1507		939		436			2882

Key; sk = skull fragment v = vertebrae d = denticle
skull = skull fragment vert = vertebrae dent = denticle
Tooth = Tooth or Pharyngeal fragment frag = indet fragment