'Dark Age Economics' revisited: the English fish bone evidence AD 600-1600

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When did the market economy come to Europe? Fish might seem an unlikely commodity to throw light on the matter, but the authors use fish bones from English sites to offer a vivid account of the rise and rise of the market as a factor in European development from the late tenth century.

Keywords: England, Europe, medieval, Dark Age, fish, trade, market

Introduction

Twenty-two years ago – when Richard Hodges (1982) published his influential monograph *Dark Age Economics* – two observations regarding early medieval economy seemed clear. Firstly, the transition from exchange of high-value prestige goods to low-value staples (and thus, in his view, from gift-exchange to market trade, from proto-urban settlements to true towns and from substantivist to formalist economics) was central to an understanding of European socio-economic change. Secondly, although complex and uneven in detail, this transition could be dated to the tenth and eleventh centuries. Hodges was, of course, not alone in these observations. The growth of trade and urbanism had long played an important role in defining the Viking Age (e.g. Arbmann 1939; Jankuhn 1956; Blindheim 1975; Bencard 1981). Moreover, *Dark Age Economics* was one contribution to a movement within medieval archaeology that was heavily influenced by economic and neo-evolutionary anthropology (e.g. Grierson 1959; Callmer 1977; Randsborg 1980; Jankuhn 1982). It thus found an audience primed for either reception or resistance (Astill 1985; Sawyer 1989).

Since then, however, archaeology has confirmed the existence of early (particularly eighth century) antecedents to many of North-western Europe's first towns, and of other early markets without urban populations (Cowie & Whytehead 1988; Hill *et al.* 1990; Ulriksen 1994; Kemp 1996; Feveile & Jensen 2000; Gardiner *et al.* 2001; see contributions in Hansen & Wickham 2000; Hill & Cowie 2001; Prestell & Ulmschneider 2003). Concurrently, accessible surveys of the relevant historical evidence have emphasised the existence and scale of commercial transactions – including the exchange of basic staple goods – in Carolingian times (e.g. Verhulst 1995; 2002). Wider paradigm shifts within archaeology have also peripheralised the neo-evolutionary basis of Hodges' original argument (Gosden 1999:88-105; Gerrard 2003:172, 217-231). It is thus not surprising to find that interpretations have

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changed with the times. For example, the economic complexity once associated with the end of the Viking Age is now attributed to the reign of Charlemagne (Hodges 1988; 2000).

These changing perspectives have not, however, forged a consensus regarding when market trade of basic commodities really began on a meaningful scale. There now exist both 'early' (*c.* eighth century) and 'late' (tenth-eleventh century or later) schools of thought. Many histories of medieval economy continue to espouse the traditional end of the first millennium, or even the twelfth and thirteenth centuries, as the period of fundamental economic change – including the growth of trade and urbanism (Andrén 1989:593-594; Saunders 1995:42-50; Moore 2000:30-39; Dyer 2002:101; Spufford 2002:12; Griffiths 2003:97-104). Moreover, given the scattered source material, historical studies of market trade in earlier centuries are seldom able to quantify the relative scale of this activity *vis-à-vis* later developments. This problem is critical. Almost fifty years ago, Grierson (1959) unequivocally demonstrated that market and non-market trade coexisted in early medieval Europe. Answering the question 'when did fundamental economic change really happen?' thus becomes a matter of assessing the *degree* of market trade, or more realistically, of the relative importance of staple over prestige goods in exchange transactions (Barrett *et al.* 2000:15).

The present paper addresses this last critical issue. It asks when an unambiguously low-value, high-bulk, product – marine fish – was first harvested and traded on a large scale in medieval England. In doing so, it is possible to provide one measure of the character and chronology of the distinction between 'Dark Age' and high medieval economy. Previous work in Scotland (e.g. Barrett 1997) has demonstrated the potential of fish bone evidence to answer questions of this kind, and here we apply similar methods to the issue of economic change in medieval England and its European context. We argue that the most important change in English fishing between AD 600 and 1600 occurred within a few decades of AD 1000 and involved large relative increases in catches of herring (*Clupea harengus*) and cod (*Gadus morhua*), many of which were probably distributed by trade. It has long been suspected that marine fishing increased at some point in the Middle Ages (Jones 1981, 1988; Locker 1988a), but the chronology, clarity and rapidity of the trend can now be fully appreciated. Sea fish were caught and transported to inland sites, such as the proto-urban 'wic' of York, in earlier centuries, but the change in scale of this activity around the end of the first millennium is remarkable. Evidence of similar developments is slowly emerging across Europe, from the Baltic Sea region to the Northern Isles of Scotland (Barrett *et al.* 2000; Enghoff 2000; Van Neer & Ervynck 2003). Although it is uncontroversial that the importance of trade increased in tenth and eleventh century Europe (Fossier 1999:27; Griffiths 2003), it has rarely been possible to quantify the relative scale of activity either side of AD 1000 – and thus to contextualise the significance of 'Dark Age' commerce.

Identifying medieval fish trade

With a few exceptions, syntheses of early medieval economic history have largely ignored fish trade (cf. Hodges 1982; Dyer 2002; Verhulst 2002). For historians, the reason is clear. They are limited to discussing the earliest written evidence rather than the origin of the practice itself. In an English context, most discussion begins in the thirteenth and fourteenth centuries with very limited inference possible from earlier sources (Nedkvitne 1976; Childs & Kowaleski 2000; Kowaleski 2000; Fox 2001). In Scotland, the earliest detailed historical evidence is of fifteenth century date (Friedland 1983; McNeill & MacQueen 1996:241). In

Norway, where cod constituted *c.* 80 per cent of exports by the high Middle Ages (Nedkvitne 1976:250), the earliest reliable historical evidence dates to the twelfth century (Christensen & Nielssen 1996:148). In Denmark and Sweden, the earliest references to the importance of herring are of similar date (Holm 1996:177-178). In none of these cases is the earliest historical evidence likely to date the beginning of the trade. One must rely on the material record.

A variety of archaeological methods have been used to identify fish trade (e.g. Barrett 1997; Perdikaris 1999; Locker 2001:135-165; Van Neer *et al.* 2002). At the simplest and most effective level, it is possible to identify the transport of marine fish (such as cod and herring) to inland sites and the long-range transport of northern North Sea and North Atlantic species (such as ling, *Molva molva*, and saithe, *Pollachius virens*, allowing for some historical changes in fish distributions) to southern sites. Distinctive butchery marks and skeletal element distributions can also indicate the presence of fish preserved for transport, but the necessary data are seldom published. Other more complex methods exist – based, for example, on differences in growth rates or stable isotopic signatures between fish populations – but these have thus far proven unreliable (Van Neer *et al.* 2002; Ervynck *et al.* in press). Guided by the principle of Ockham's Razor, this study addresses the origins of fish trade by exploring chronological and spatial patterns in the relative abundance (by number of identified specimens or NISP) of the most important marine and freshwater species exploited in England between AD 600 and 1600.

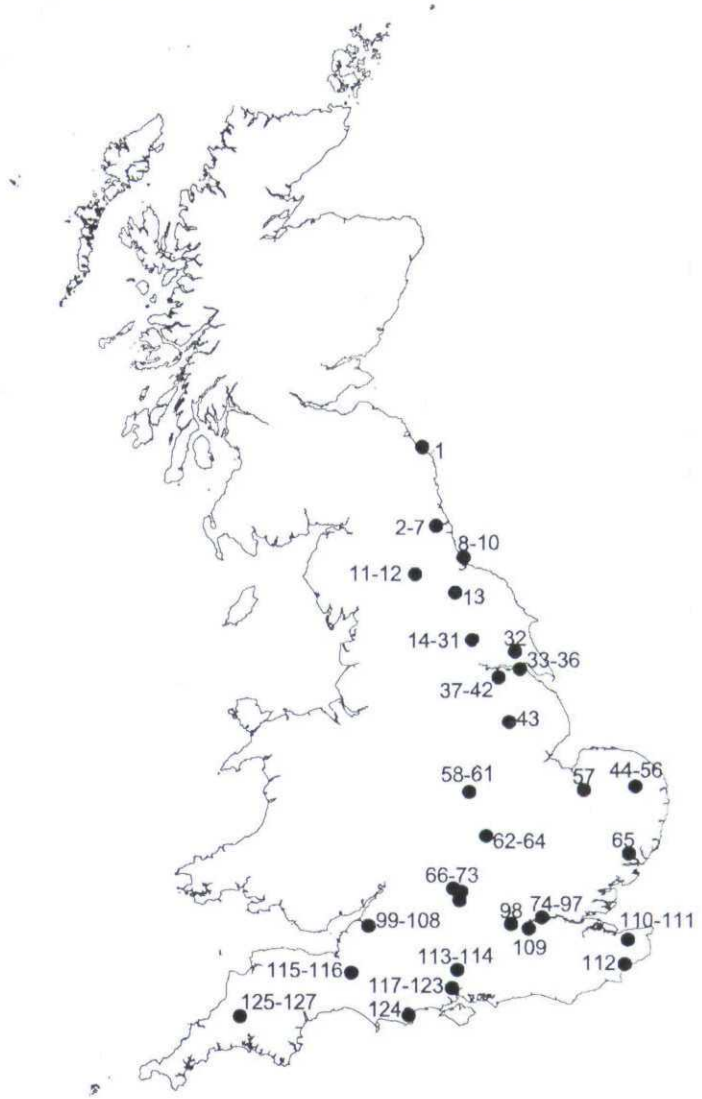

Figure 1. Location of the 127 English fish bone assemblages, dating from AD 600-1600, considered in this study.

Appendices 1 and 2 (available at http://antiquity.ac.uk/ProjGall/barrett/) provide a summary of the 127 English (including Cornish) assemblages surveyed, many of which are published for the first time (Figure 1). Collections

were excluded from consideration if they were not recovered at least in part by sieving, could not be attributed to one of five two-century periods or did not yield at least 50 identified specimens. A few assemblages have also been excluded because they represent unique circumstances – such as shipwrecks (Hamilton-Dyer 1995) and fish gut contents (Irving 1998). The corpus is dominated by urban and 'proto-urban' sites, but effort has been made to include as many rural settlements as practicable without introducing poor-quality information (from unsieved assemblages, for example).

The sample size threshold is set low (cf. Amorosi *et al.* 1996:133) given the small number of fish bones from most pre-eleventh century (particularly rural) settlements. The sieving requirement is necessary given the impact of poor recovery on species representation (Jones 1982; Vale & Gargett 2002). Although it was not always possible to distinguish the sieved and unsieved portions of mixed assemblages, the degree to which sieving was practiced (partially or totally) does not show chronological patterning (Chi-Square = 5.62, df = 4, p = 0.230) and is thus unlikely to bias the overall results. Where known, the minimum mesh size used does vary by period (Kruskal-Wallis Chi-Square = 19.42, df = 4, p = 0.001), but the use of finer sieves is associated with eleventh century and later assemblages. Thus it is unlikely to be responsible for the patterns identified, in which large cod and related species became more common at the expense of smaller taxa such as eel and cyprinids (see below). It could, however, have a minor impact on the relative abundance of herring. Data are not available to compare preservation differences between samples (cf. Barrett 1997), but it is reasonable to assume that the species under consideration were not differentially preserved in different periods.

The 'fish event horizon'

Over the millennium under consideration, eight taxonomic groups dominate English fish assemblages. The marine taxa are herring and cod-like fishes ('gadids' – for present purposes this group is treated as including the related hake, *Merluccius merluccius*, and excluding the freshwater burbot, *Lota lota*). The freshwater taxa are fishes of the carp family (cyprinids) and pike (*Esox lucius*). The migratory taxa are European eel (*Anguilla anguilla*), salmon and trout (salmonids), smelt (*Osmerus eperlanus*) and flatfish (a group which includes flounder, *Platichthys flesus*, that enters fresh water, but also marine species). When these groups are compared using Correspondence Analysis (CA) (Baxter 2003:136-145), it is clear that virtually all 'catches' from the seventh to the tenth centuries were dominated by freshwater and migratory species (particularly cyprinids and eels) (Figure 2a). Conversely, most eleventh century and later 'catches' had far more herring and/or gadids. Flatfish are predictably intermediate between these groups, given their mix of freshwater and marine species. In the thirteenth to sixteenth centuries some assemblages were dominated by gadids alone. There is no distinctive pattern associated with the fifteenth to sixteenth centuries, when the English cod fishery expanded first to Iceland and later to Newfoundland (Jones 2000). This implies that changes in fishing in the eleventh to twelfth centuries were more dramatic than better known later developments.

There are few exceptions to these general patterns. One thirteenth to fourteenth century case (Grant 1988) and one fifteenth to sixteenth century assemblage (Wheeler 1979) resemble pre-eleventh century examples because they are specialised collections consisting almost entirely of eel. Other outliers are related to site location. The few early assemblages with relatively

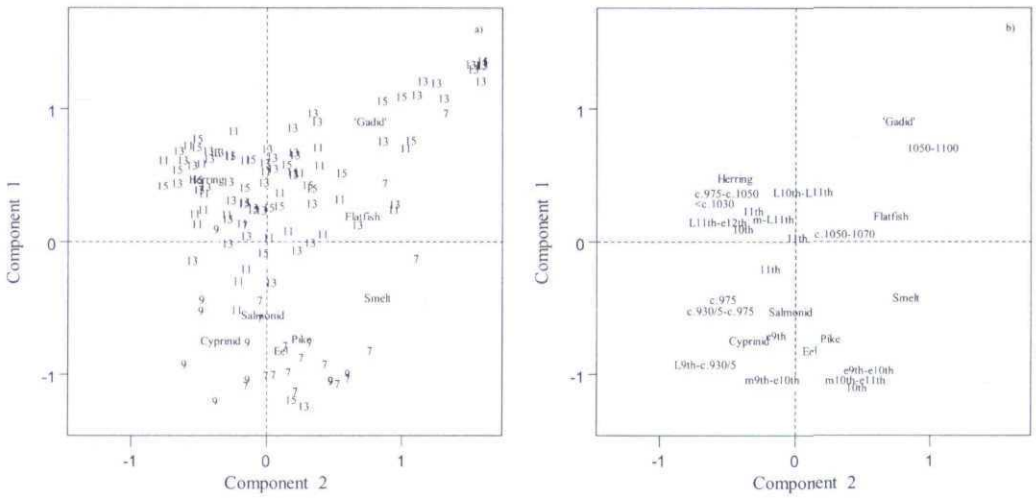

Figure 2. (a) Axes 1 and 2 of a Correspondence Analysis based on the abundance (by NISP) of the eight most common fish taxa in 127 English archaeological assemblages. Each assemblage is coded by the two-century period to which it best belongs: seventh to eighth (7), ninth to tenth (9), eleventh to twelfth (11), thirteenth to fourteenth (13) and fifteenth to sixteenth (15). The taxa with the highest contributions (out of a total of 1) to component 1 are eel (0.44), gadids (0.23), herring (0.16) and cyprinids (0.12). Gadids (0.36), herring (0.35) and flatfish (0.16) contribute most to component 2. With the exception of a few unusual cases discussed in the text, assemblages that predate the eleventh to twelfth centuries are associated with eel and cyprinids – migratory and freshwater taxa – rather than herring and gadids. (b) The Correspondence Analysis in (a) redisplayed to show only those assemblages from around the end of the first millennium AD that can be dated to within c.100 years. One assemblage predating approximately AD 1030, but without a clear start date, is also included. The abbreviations indicate early (e), middle (m) and late (L) within a century. These results suggest that the marked increase in herring and gadid fishing occurred within a few decades of AD 1000.

high proportions of gadids and/or herring are all coastal (≤10km from the shore) or estuarine as one might expect: two are from Hartlepool (Locker 1988b), one is from Ipswich (Locker & Jones 1985), one is from London (Locker unpublished), one is from Sandtun, Kent, (Hamilton-Dyer 2001) and one is from Southampton (Bourdillon 1993). It may also be relevant that several of these latter outliers were wics (see below).

Site location does not bias the results as a whole. Only six coastal assemblages are recorded overall, and these are spread from the seventh and eighth to the fifteenth and sixteenth centuries (see Appendix 1). There is an uneven distribution of estuarine (59 in total) and inland (62 in total) site locations by period (Chi-Square = 15.42, df = 4, p = 0.004). However, it is inland sites that are under-represented prior to the eleventh century, not *vice versa*. Thus this pattern strengthens the observation that non-marine species were preferred prior to the end of the first millennium AD.

The chronological patterning evident in the CA is largely dependent on the abundance of herring and gadids. The proportions of both show significant increases in the eleventh to twelfth centuries (Figures 3a-3b). Herring did occur in seventh to tenth century sites, particularly the wics of York, Ipswich, London and Hamwic (Southampton). However, its importance increased fourfold in the eleventh to twelfth centuries (Mann-Whitney U = 35.00, p ≤ 0.001). For cod-like fishes, different species show slightly different chronological patterns. Cod itself was virtually unexploited prior to the end of the first millennium AD. It first appeared as a significant component of the medieval 'catch' in the eleventh to twelfth

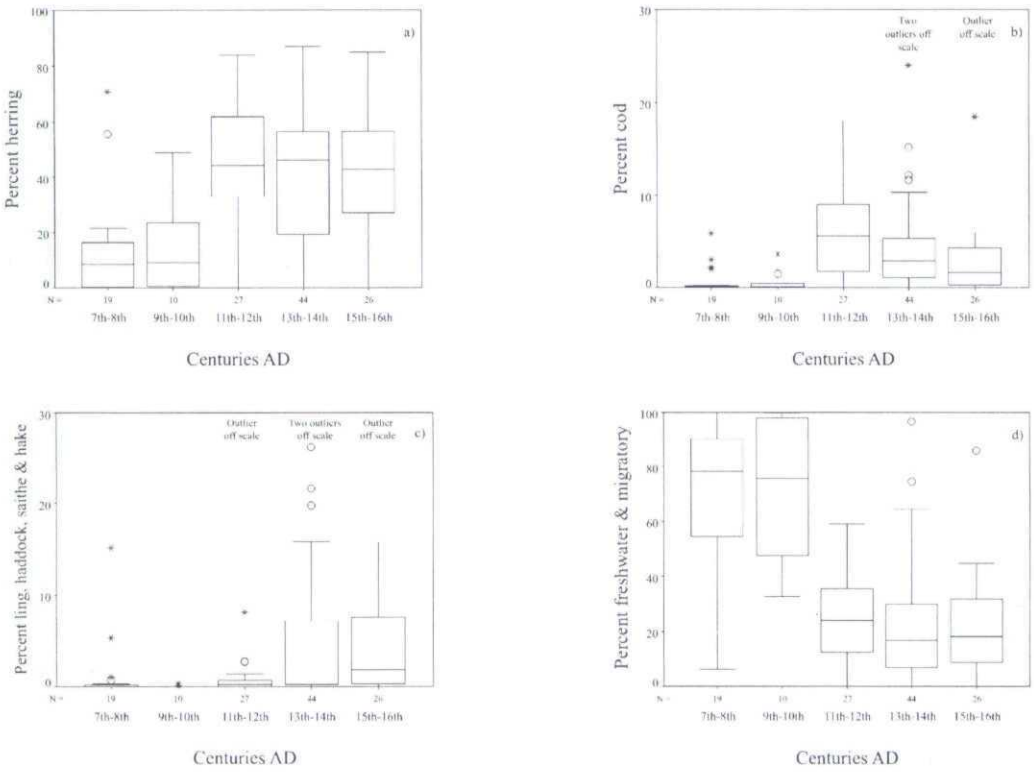

Figure 3. (a through c) Boxplots showing the percentages of common marine species in English fish bone assemblages from AD 600 to 1600 (based on the number of identified specimens). (d) For comparison, the percentage of freshwater and migratory taxa is also shown – based on cyprinids, pike, perch, eel, smelt, salmonids and flatfish (many of which are probably flounder, which enters fresh water).

centuries (Mann-Whitney U = 41.00, $p \leq 0.001$), after which its proportion of the total declined as it was joined by related species such as haddock, ling, saithe and hake (Figure 3c). It is thus not surprising that recent research has shown that there was not even a word for cod in the Anglo-Saxon language of pre-Norman England (Sayers 2002). As the marine species became more important, the proportion of freshwater taxa in the bone assemblages declined (Figure 3d).

Some indication of the rapidity of these changes can be achieved by focusing on 19 assemblages from the end of the first millennium that are datable to within c.100 years (Figure 2b). These suggest that the increase in herring and cod fishing began between c.975 and the mid-eleventh century in York (Jones 1988; O'Connor 1989), by c.1050 to 1070 in London (Locker 1997), prior to c.1030 in Southampton (Hamilton-Dyer 1997), between the late tenth and late eleventh century in Norwich (Jones 1983), by the late eleventh to early-twelfth century at Eynsham Abbey (Ayres *et al.* 2003) and by the eleventh century at Northampton (Locker 1999). There is also a high proportion of herring in one tenth century assemblage from Northampton, but it contains only 55 bones and could be misleading (Locker 1999). In short, the marked increase in marine fishing was probably revolutionary in archaeological terms. This 'fish event horizon' must have occurred within a few decades either side of the end of the first millennium AD.

The wider European context and the fish trade hypothesis

The English chronology established here is broadly consistent with similar patterns emerging from zooarchaeological research across Europe (Benecke 1982; Heinrich 1983; Perdikaris 1999; Barrett *et al.* 1999; 2000; Enghoff 2000; Clavel 2001; Makowiecki 2001; Van Neer & Ervynck 2003). Examples include the eleventh century introduction of herring to the interior of Poland (Makowiecki 2001:238), the ninth or tenth century appearance of this species at Menzlin, inland Germany (Benecke 1987 in Enghoff 2000:126), the mid tenth to late twelfth century rise of gadids and herring in inland Belgium (Van Neer & Ervynk 2003:40-41) and the thirteenth century increase in marine fish at inland sites in northern France (Clavel 2001). There appears to be both inter-regional variability and a general trend towards the increasing importance of herring and gadids around or after the end of the first millennium. Future research must establish the degree to which the variation is apparent or real and thus whether the shift to marine fish consumption was as rapid elsewhere in Europe as it was in England. It would be surprising, however, if there was not some regional variability due to environmental or socio-economic factors and there are several clear exceptions to the general trend.

The main exceptions to the rule are Norway and the islands of the Baltic where marine species were of considerable importance in earlier centuries – arguably because fish were very accessible and other resources more limited in availability. In Norway, gadids (particularly cod, saithe and ling) and in some instances herring dominated the catch (Lie 1988; Perdikaris 1999; Enghoff 2000; Barrett *et al.* 2003). In the Baltic islands, herring was the fish of choice (Benecke 1982; Enghoff 1999).

Northern Scotland, which was under Scandinavian rule until the late Middle Ages (Crawford 1999:95-96), provides an example of how the general trend could be mediated by local socio-economic circumstances. Pre-Viking Age ('Pictish') fishing was limited in scope, producing modest numbers of bones from small fish easily caught from shore. In the ninth and tenth centuries, fishing for large cod, ling and saithe expanded, possibly due to the introduction of new food preferences by Norse migrants (Barrett *et al.* 1999; 2001). However, the intensity of fishing, particularly for these species, increased far more in the eleventh to twelfth centuries – consistent with the English and wider European trend (Barrett *et al.* 2000). These changes are indicated by stable carbon isotope analysis of human bone, the absolute quantity of fish bone recovered, the ratio of fish to mammal bone, the ratio of inshore to offshore taxa and the ratio of cod family to other species (Figures 4a-4d). In western Scotland, also under Scandinavian control, herring may have increased in importance following a broadly similar chronology (Ingrem 2000; Cerón-Carrasco 2002). In the eleventh to twelfth centuries, distinctive fish middens also appear which may derive from processing cod and related species for export (Barrett 1997; Barrett *et al.* 2000).

The main species involved in the 'fish event horizon', herring and cod, were cured and widely traded by the time detailed historical records first appear – principally the twelfth century. Cod and other gadids were typically exchanged in dried (stockfish) or dried and salted form, whereas herring were salt-cured wet in barrels (Robinson 2000:10). The Norwegian stockfish trade and the great herring fairs of the Sound, the Baltic and East Anglia are the most well known examples. All except the last are first recorded in the twelfth century (Christensen & Nielssen 1996:148; Holm 1996:177-178). The East Anglian herring

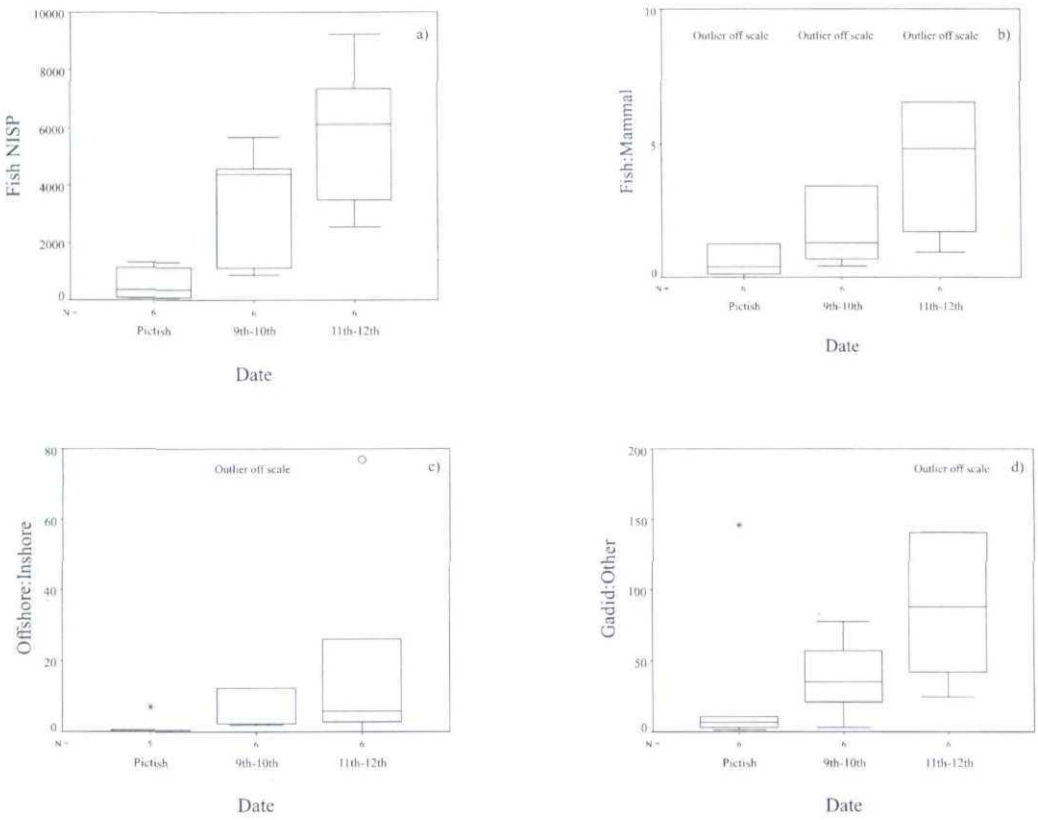

Figure 4. Boxplots showing increases in the intensity of fishing, and the importance of cod and related species, in northern Scotland during both the ninth/tenth and eleventh/twelfth centuries AD. The preceding 'Pictish' period covers approximately the fourth to eighth centuries. (a) The number of fish bones recovered. (b) The ratio of fish bone to mammal bone. (c) The ratio of inshore to offshore taxa – based on a comparison of ling (Molva molva) and Torsk (Brosme brosme) to rocklings (Ciliata or Gaidropsarus species), wrasse (Labridae) and cottids (Cottidae). (d) The ratio of cod family to all other fish. The data are based on NISP figures and have been taken from Barrett and Oltmann (1998); Barrett et al. (1999; 2001) and references therein.

fishery may have existed by 1086 based on the record of fishermen at Great Yarmouth in Domesday Book (Taylor 1988:466), but earlier evidence is anecdotal at best (e.g. Cushing 1988:79-80). It is a reasonable hypothesis that the increasing catch of herring and cod around AD 1000 was concurrent with the early development of this pan-European fish trade – which then took approximately a century to enter the historical record.

In support of this suggestion, it is clear that marine species were increasingly abundant at both coastal (or estuarine) settlements, where local catches were possible, and inland sites (such as York, Northampton and Eynsham Abbey), where an element of trade can be assumed (Figures 5-6). Butchery evidence is not consistently available to assess how the fish were processed (cf. Barrett 1997; Enghoff 1996; Locker 2001), but some of them must have been cured for inland transport and storage. Many of the fish bones from coastal and estuarine settlements (such as London, on the tidal Thames) may also represent preserved fish acquired by trade, but this is more difficult to prove.

Given the chronology of the zooarchaeological evidence, it may not be coincidental that two of the earliest explicit Anglo-Saxon references to fish trade also date to the end of the

Figure 5. The percentage of cod (by NISP) in English inland fish assemblages of the (a) ninth/tenth and (b) eleventh/twelfth centuries. London is omitted as it lies on the tidal Thames and is thus estuarine.

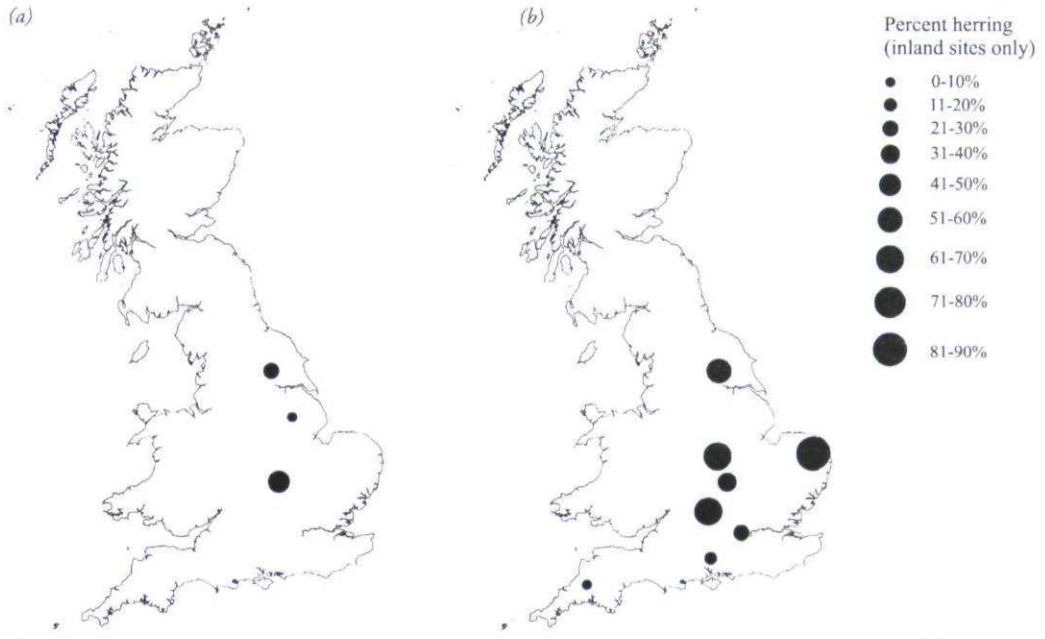

Figure 6. The percentage of herring (by NISP) in English inland fish assemblages of the (a) ninth/tenth and (b) eleventh/twelfth centuries.

first millennium. The fictional fisherman of *Ælfric's Colloquy* (*c.* 987-1002) claimed "*I can't catch as many as I can sell*" (Swanton 1975:110) and the laws of Æthelred (code IV, *c.* 991-1002) set out tolls in London for boats containing fish (Robertson 1925:73).

Unfortunately, despite the likelihood that the 'fish event horizon' recognised here was partly associated with pan-European trade, it is not yet possible to differentiate local fishing and long-distance imports. The suggestion that some cod at eleventh century English sites may represent Norwegian stockfish, and that some herring could have come from the Baltic region, must remain a hypothesis. It is not until the thirteenth and fourteenth centuries that species such as ling and saithe, previously common in Norwegian assemblages, also appear in England in measurable numbers (Figure 3c). This may indicate that only regional trade blossomed in the eleventh/twelfth centuries, to be supplemented by long-distance trade in the thirteenth/fourteenth centuries. We think it more likely, however, that additional species such as ling and saithe were simply added to the repertoire of both regional and long-range trade once cod could no longer satisfy demand. This latter interpretation is supported by the observation that other species (such as hake) that were produced by English rather than Scandinavian fisheries also became more common in the thirteenth to fourteenth centuries (Figure 3c; cf. Kowaleski 2000).

In sum, regional, and probably long-distance, fish trade began on a significant scale around the end of the first millennium. It presumably developed from the more modest transport of herring to inland sites such as York that can be observed from the seventh to tenth centuries. This earlier pattern probably also represents trade in a market sense, but could alternatively be explained by more socially embedded provisioning arrangements sometimes referred to as indirect subsistence (Hoffmann 1996: 636; O'Connor 2001). It is in these terms that one can understand early records of satellite fisheries, such as one on the North Devon coast granted to the inland monastery of Glastonbury by King Ethelwulf in the mid ninth century (Fox 2001:47). Prior to *c.* AD 1000 much professional fishing may have been done for elite patrons rather than public sale (cf. Hoffmann 1996).

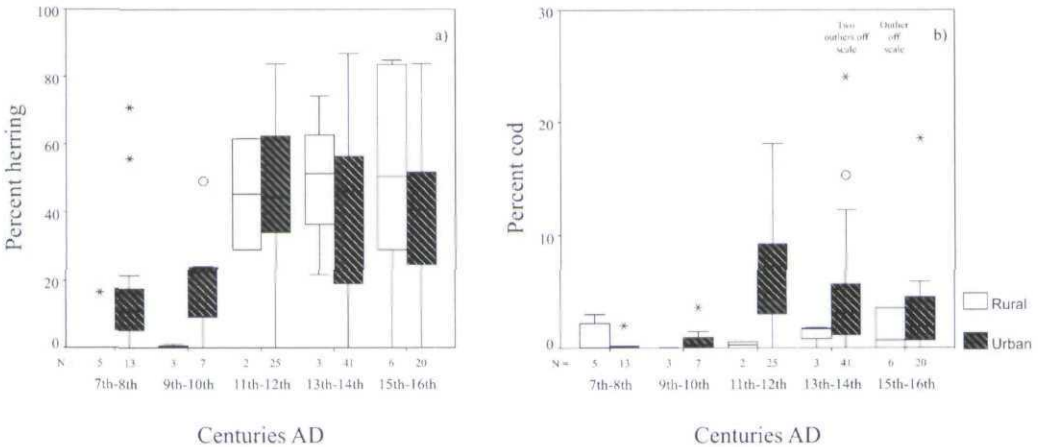

Figure 7. Boxplots showing the percentages of (a) herring and (b) cod in English urban (including proto-urban 'wic') and rural settlements from AD 600 to 1600 (based on NISP).

Technological innovation, environmental change and Christian fasting practices

Having raised the argument that marine fish became common around the end of the first millennium due to the growth of trade, it remains necessary to address alternative interpretations and other contributing factors. Three of the most important potential 'confounding variables' are the impact of technological innovation, environmental change and Christian fasting practices. Each will be discussed in turn.

It has long been suggested that the rise of sea fishing in medieval Europe was attributable to the adoption of floating 'driftnets' (Jones 1981; Benecke 1982; Van Neer & Ervynck 2003). Reservations regarding the danger of technological determinism aside, the zooarchaeological evidence is no longer consistent with this interpretation. Driftnets are unsuitable for cod, which was increasingly exploited at the same time. This species was caught predominately by hook and line throughout the Middle Ages (Robinson 2000:12).

Environmental change has the potential to act as a push or a pull factor – driving medieval Europeans to the sea by limiting terrestrial resources or pulling them in by increasing the availability of marine fish. The first possible push factor, a reduction in agricultural production, can be ruled out from the start. The centuries around the end of the first millennium marked the height of the Medieval Warm Period (Dahl-Jensen *et al.* 1998; Barber *et al.* 2003) and a time of large-scale intensification of agriculture in Britain and Europe (Fossier 1999; Dyer 2002:26). The expansion in sea fishing was contemporary with these developments.

It is more convincing that the shift to marine fish consumption and trade was partly related to a decrease in the availability of freshwater fish – due to siltation from more intensive and extensive agriculture, the proliferation of mill dams, increased nutrient loads (from growing urban populations and industries) and the intensity of inland fishing itself (Hoffmann 1996; cf. Ervynck & Van Neer 1994). The English fish bone data surveyed here do show a decrease in the proportion of freshwater and migratory fish after the end of the first millennium (Figure 3d), but it is not yet possible to demonstrate whether this was an absolute decrease in the catch or simply a relative decline *vis-à-vis* marine species. Changes in the relative contributions of fish compared with other forms of food in England cannot be assessed due to the common practice of analysing only sub-sets of fish bone from each excavation, which cannot be compared to the quantity of mammal bone. Based on other evidence, however, it is clear that freshwater fishing was both more regulated and more intensively practiced in the centuries after AD 1000. Elite control of fisheries became the norm (Hoffmann 1996:653), many excavated fish traps (principally for migratory species such as eel and salmon) from Britain and Ireland were built in the eleventh to thirteenth centuries (e.g. O'Sullivan 2001:295; Turner 2002:105) and formal pisciculture in fishponds was probably introduced to England in the eleventh and twelfth centuries (McDonnell 1981; Taylor 1988:466). Thus the growth in marine fishing was concurrent with attempts (successful or unsuccessful) to expand and secure access to supplies of freshwater fish.

Environmental changes influencing the abundance or distribution of herring and cod, and thus their accessibility, are potential pull factors. Climate influences the basic productivity of both species, which in turn has an impact on their spatial distributions (e.g. Alheit & Hagen 1997). However, palaeoenvironmental evidence suggests that the years around AD 1000 were probably a time of low rather than high productivity for the fish available to most

English and European fishermen. Cod and herring are arcto-boreal species, thus temperature affects them differently in different parts of their ranges. In the North and Baltic Seas, warmer temperatures depress production, while in northern waters such as the Norwegian and Barents Seas, warm weather increases productivity (Brander 2000; MacKenzie & Visser 2001; Hamre 2003). Climate proxies across the North Atlantic and from cored sediments of the Skagerrak support the view that temperatures were anomalously warm around AD 1000 (Hass 1996; Dahl-Jensen *et al.* 1998; Barber *et al.* 2003). This suggests that increased local availability is unlikely to have been a factor driving the growth in fish exploitation shown here. Climate could only have been a relevant variable if *most* of the fish remains represent imports from, for example, Norway. A 'butterfly effect' of this kind, in which distant increases in fish availability might have a dramatic effect on English diet and economy, is conceivable but unlikely. It is argued above that some Norwegian cod may have been imported, but it is highly improbable that such imports constitute the majority of the English material. Moreover, a predominately northern origin can be ruled out for herring given the Baltic and North Sea foci of its main medieval fisheries (Robinson 2000).

Temporal changes in Christian fasting practices may have influenced the level of marine fish consumption. The role of fish in early medieval Christian diet remains poorly understood. It is clear, however, that the practice of fasting formalised by St. Benedict's Rule and subsequent monastic regulations (Dembinska 1986) was also applied to the English *secular* community by seventh century and later Anglo-Saxon law (Swanton 1975:3; Hagen 1992:131). The precise number of fast days per year varied through time and according to the rigor of the community in question. Nevertheless, the meat of quadrupeds would typically have been forbidden during 40 days of Lent, 40 days of Advent before Christmas, possibly 40 days following Pentecost and on the eves of Christian celebrations throughout the year (Hagen 1992:127-134). This practice is known to have had a major impact on the demand for fish in the later Middle Ages (Woolgar 2000). However, some authorities dispute that they were widely accepted as components of monastic fasts prior to the twelfth century (McDonnell 1981:22; Dembinska 1986:155), or suggest that monastic reforms following the Norman conquest were largely responsible for spreading this fashion among England's wider population (Woolgar 2000:36).

These arguments are both problematic in the present context. The fact that fish were seen as delicacies by the first generation of the austere Cistercian reform (McDonnell 1981:22) tells us little about what was eaten during Lent in eleventh and twelfth century English towns and villages. Even within a monastic setting, Cistercian sources may reflect reforming zeal more than previous ecclesiastical practice. The late tenth or early eleventh century poem, *The Seasons for Fasting*, is probably the most important source relating to this vexed problem. It ridicules a wayward priest for eating oysters and other fish before noon during Lent (Magennis 1999:87). This text could be interpreted as implying that fish were unacceptable in a period of fasting. However, a close reading makes it clear that the timing, not the content, of the meal was at issue. Rather than indicating that fish were unacceptable for fasting around the end of the first millennium this source actually implies the reverse. The poem also weakens Woolgar's (2000:36) argument that a fashion for rigorous lay fasting, and thus increased fish consumption, was inspired by reform movements introduced following the Norman conquest (presumably including the Cistercians). This hypothesis can now be laid to rest by the archaeological evidence itself. The increase in marine fish consumption predated the Norman

conquest in England and is not evident until the thirteenth century in northern France (Clavel 2001).

If one were to seek an explanation for increased fish consumption in changes of monastic fashion the best candidate would be the Benedictine reform of the tenth century. In England, it culminated *c.* 970 in production of the *Regularis Concordia* (Symons 1953) and the translation of St. Benedict's Rule into Old English (Kornexl 1998:119). Neither of these sources, however, provide specific instructions regarding the role of fish in monastic diet (Symons 1953:xxxv; Fry 1981). We are thus left in rather murky water, cleared only by knowledge that earlier monastic communities did maintain fisheries (such as the North Devon example belonging to Glastonbury noted above). It thus seems likely that fish were part of monastic diet (and by implication, presumably secular fasts) long before the 'fish event horizon' (see also Hoffmann 1996:638).

The commercial revolution

Having dismissed several alternative explanations for the increase in sea fishing – in whole or in part – it is necessary to return to the growth of urbanism and the trade of staple goods. The connection between these developments and the 'fish event horizon' is more convincing. When herring and cod first appeared in the zooarchaeological record of medieval England it was predominately in urban rather than rural sites. The chronology differs by species, but each was first eaten in wics or towns, and only later in rural settlements (Figures 7a-7b). Herring are found almost exclusively in urban settlements until the eleventh century. When cod were introduced to the English diet around AD 1000, consumption of this species also took *c.* 400 years to spread to the hinterland. There are not enough rural sites yielding ≥50 identified fish bones to compare the data statistically (see Appendix 1), but this problem itself confirms the pattern. Herring and cod are simply not found in the countryside in any great numbers until long after their introduction to towns, even in cases where preservation and recovery were both excellent (e.g. Barrett 2002). Sea fish also first appear in inland urban rather than rural settlements in tenth and eleventh century Belgium, where some of the best comparative evidence exists (Van Neer & Ervynck 2003:40-41).

The possible relationship between urbanism, fishing and fish trade is further highlighted by more anecdotal evidence. Verhulst (1999:84) has observed that in many of medieval Europe's earliest cities "*the location of a fish market denotes one of the oldest urban nuclei*". Moreover, the eleventh century increase in sea fishing is concurrent with an archaeologically documented increase in the capacity of Northern European cargo ships, from a maximum of *c.*20 tons around AD 1000 to *c.*60 tons by AD 1025 (Crumlin-Pedersen 1999:12). It seems likely that the concentration of population in England's (and continental Europe's) early towns produced a demand for fish, particularly during periods of fasting, which outstripped the potential of freshwater resources (due to both social and environmental limitations on this resource) – leading to an increase in sea fishing and the development of long-range trade in this product. The herring found at England's wics are early portents of these interrelationships, but events around the year 1000 mark their most significant expression.

In some respects these conclusions are exactly as current research on medieval economy might lead us to expect. Firstly, there *was* a modest trade of a low-value staple product – marine fish – to England's proto-urban settlements from their inception to the tenth century.

Whether these goods represent market transactions or indirect subsistence may depend on one's *a priori* assumptions, but there is no theoretical basis on which to exclude the former. In addition to the arguments of Grierson (1959) and Verhulst (2002) cited in the introduction above, it is worth noting that recent reassessments of economic anthropology (including early work on the Trobriand Islands – on which *Dark Age Economics* and related studies were based) also illustrate the co-existence rather than mutual exclusion of non-market and market trade (Gregory 1997:41-70). Secondly, the large-scale increase in fishing and fish trade coincided with the traditional start of the so-called commercial revolution of the Middle Ages, around the end of the first millennium (Lopez 1976; Moore 2001:4). It is thus entirely consistent with a variety of historical indicators. As Fossier (1999:27) has put it, "*almost all the observations which one can make, whatever the preoccupations of the individual historians, points to the tenth century as the age of growth, of take-off, of rising, or some such phrase.*"

The importance of the present evidence, however, lies in the fact that it clearly represents the beginning of an economic phenomenon – rather than simply the earliest historical documentation of that phenomenon. It is also remarkable that the English transition to marine fishing was so rapid, and that it seems to represent the clearest change in a time-series that includes well documented later developments such as England's fifteenth century Iceland fishery (Jones 2000). The long-term *archaeological* 'histories' of other bulky low-value products – such as querns (Parkhouse 1997), meat (O'Connor 2000; Rixson 2000) and grain (Rowley-Conwy 1988) – remain to be fully written. For the time being, however, fish bones may join more traditional materials such as pottery as one of the clearest archaeological indicators of the distinction between 'Dark Age' and later medieval trade.

Appendix 1 (see http://antiquity.ac.uk/ProjGall/barrett/)

Summary information regarding the 127 fish bone assemblages surveyed (see Appendix 2 for references).

Appendix 2 (see http://antiquity.ac.uk/ProjGall/barrett/)

Full references for the assemblages surveyed.

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