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Technical Report: Fish remains from the Cattewater Wreck

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Summary

A very small assemblage of cod bones was recovered from a shipwreck of early 16th century date near Plymouth. All of the bones were identified as cod. Given the sizes and elements found, these were most likely preserved provisions intended for long term storage. The small number of fragments and the presence of other preserved meats on board the vessel suggests these were ship provisions rather than a separate cargo in their own right. Isotopic analysis of selected cod remains indicated most were found in relatively local waters of the Southern North Sea or English Channel, but one was definitely imported, most likely from the North Atlantic region.

KEYWORDS: COD, SHIPWRECK, FISH TRADE, ZOOARCHAEOLOGY

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Introduction

The Cattewater Wreck was a wooden, three-masted vessel that is likely of early 16th century date, found in waters near to Plymouth. The vessel was found during dredging in the early 1970s, and following underwater investigation and excavation, publication of the results followed in the early 1980s (Redknap 1984, 1997). More recently, a programme of reassessment has been applied to both the site of the wreck and the remains recovered from it.

The fish remains found in conjunction with the ship's ballast were initially identified by Alwyne Wheeler, and summarised in a single paragraph in the 1984 publication. This reanalysis of the fish remains examines the original bone fragments and uses both traditional zooarchaeology and innovative isotopic testing to determine the provenance of the cod remains found on board the ship.

Methods

The fish remains were identified using the extensive reference collection held at the Fishlab, Department of Archaeology, University of York. Sizes were estimated based on comparison with modern specimens of known length.

Cod samples were selected for $\delta^{13}C$ and $\delta^{15}N$ bone collagen analysis from the subset of bone fragments that were large enough for full identifications of size, side and element. A range of samples ensured different elements and fish sizes were represented, and samples were taken from different context numbers to reduce the likelihood of sampling the same individual twice. In most cases, the bones were subsampled with the remaining bone archived. The samples were processed by mass spectrometer at the Department of Archaeology, University of Bradford following the methods described in Barrett *et al.* (2011, 1520). Any samples that produced extreme outliers or abnormal C:N ratios (following DeNiro 1985) have not been included.

Results of the $\delta^{13}C$ and $\delta^{15}N$ analysis were compared to the published 'base map' of isotopic signatures for cod from the North Atlantic region (Barrett *et al.* 2008, 2011). These studies have shown it is possible to trace the route of traded preserved cod from producer to consumer regions using isotopic signatures. The 'producer' regions demonstrate some overlap but allow distinctions to be made between Arctic Norway, the Eastern Baltic, the Kattegat and Western Baltic, Newfoundland, the North-east Atlantic (including Iceland and the Northern Isles), and the Southern North Sea region; these differences are a result of differing local food webs, trophic levels, temperature and salinity, amongst other factors.

The bones

The assemblage consists of about 35 bone fragments, with numerous tiny fragments remaining unquantified. These were found buried under ballast from this ship, and thus were definitely identified as cargo, rather than incidental finds in the vicinity of the ship (Wheeler 1984). All identifiable bones were positively identified as cod (*Gadus morhua*), while the remaining unidentified fragments were consistent with this species. Bone condition was variable, but only moderate to good in most cases. Most samples showed evidence of recent breakage after excavation, probably as a result of curation, study and shipping in recent decades.

Fish elements and sizes are described for each sample below. However, these fragments form a uniform pattern. They are all either vertebrae or appendicular elements from the 'shoulder'

region, all are from large fish, and there is a high degree of butchery in the assemblage. Despite the small quantity of fragments found in this assemblage, this pattern is immediately recognisable: these fish are very likely to have been preserved, ready-prepared cod intended for long-term storage.

Cod and related fish, including haddock and ling, have a long history of use as a preserved and traded foodstuff (Barrett *et al.* 2004a, 2004b; Harland 2006). Typically, these fish are caught and prepared by removing the head anterior to the cleithra, the large pair of elements at the very back of the head. The anterior vertebrae are often removed as well, and left at the producer site along with the cranial elements. The fish is then preserved by air-drying, salting, or a combination of both, sometimes with associated splitting along the spine. Both vertebrae and cleithra (and associated elements) are often found butchered. The resulting product can be stored or traded over several years, and can often be found at some distance from its place of manufacture. Preserved fish can be recognised and distinguished from fish that have been caught locally and consumed fresh by a detailed study of the elements present, their sizes and their quantities, as well as by consideration of the butchery patterns present.

AR.1985.24 ?
This sample contains about 20 small fragments, with more tiny fragments suggestive of recent breakage. Identifiable portions included the anterior edge of a small portion of the middle of a left cleithrum, from a cod of about 80-90cm TL (total length); the posterior portion of the dorsal tip of a right cleithrum, from a cod of about 80-90cm TL; and a few fragments of neural or haemal spine from a large cod vertebra.

AR.1985.24 CW78 318
Three cod caudal vertebrae (group 1) were contained in this sample. All were in good condition. One was from a cod of about 100-105cm TL and the other two were from fish of about 90-100cm TL; one of the latter was successfully sampled for isotopic results.

Figure 1: Vertebrae from CW78 318 (scale 1cm)

AR.1985.24 CW78 319
This sample contained a single right cod cleithrum from a fish of about 80-85cm TL (which successfully produced isotopic results). Only the dorsal half remains. Although this sample is displaying surface lamination, a small shallow knife mark has been tentatively noted on the lateral side, made diagonally.

Figure 2: Cleithrum from CW78 319, potentially butchered (scale 1cm)

AR.1985.24 CW77 134 ?

This sample contained the dorsal tip of a cod left cleithrum, from a fish of about 80-90cm TL. This was recently fragmented, as evidenced by breakage removing part of an acquisition number that had been written on the bone at some point in the recent past.

AR.1985.24 CW77 140
This sample contained four cod caudal vertebrae (group 1). One vertebra was from a fish of 100-110cm TL. A very small knife mark was present on the left side of the centrum; this was cut in the transverse plane, done when the bone was fresh. This vertebra produced successful isotopic results. Three others were from cod of about 80-90cm TL. A few other small fragments were consistent with these vertebrae.

Figure 3: Vertebrae from CW77 140; inset shows butchery detail (scale 1cm)

AR.1985.24 CW77 163
A single cod right cleithrum was noted, recently broken into two large sections and a number of tiny fragments. This was from a fish of about 95-105cm TL. Only the dorsal half was found. Three large butchery marks were observed, on the anterior edge and extending onto the lateral side, in the frontal plane and angled slightly towards ventral, and extending about 2mm into the bone. Another sequence of about seven or eight very faint, shallow butchery marks were found parallel but ventral to these three. This cleithrum produced successful isotopic results.

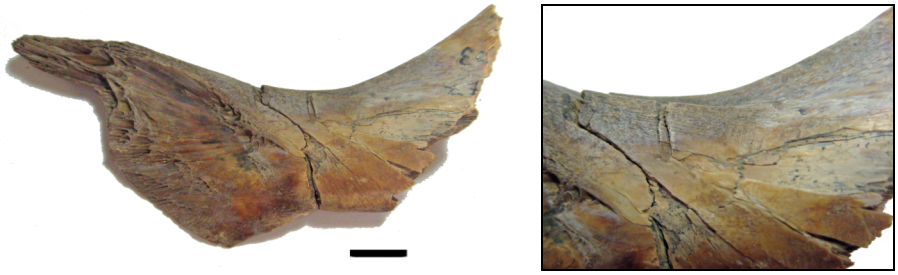

Figure 4: Cleithrum from CW77 163; inset shows butchery detail (scale 1cm)

AR.1985.24 CW78 273
A single right cod cleithrum was found, from a fish of about 90-100cm TL. Only the dorsal top third remains. This was successfully sampled for isotopic data.

Figure 5: Cleithrum from CW78 273 (scale 1cm)

AR 1985.24 CW78 321
A single left cod cleithrum was found, in very poor condition and highly fragmented. Only the middle half of the cleithrum was found, missing both the dorsal tip and the ventral third.

This was from a fish of about 95-105cm TL. This bone was butchered in three places. A substantial chop in approximately the transverse plane removed the dorsal tip. Two small knife marks extended a few millimetres into the bone below this chop mark, and parallel to it; these indicated the direction of butchery was from ventral towards dorsal. A chop mark in the sagittal plane removed a very small sliver of bone from the lateral side in the middle of the cleithrum. Contrary to the note contained within the sample bag, this specimen is definitely from the left side of the fish and not the right.

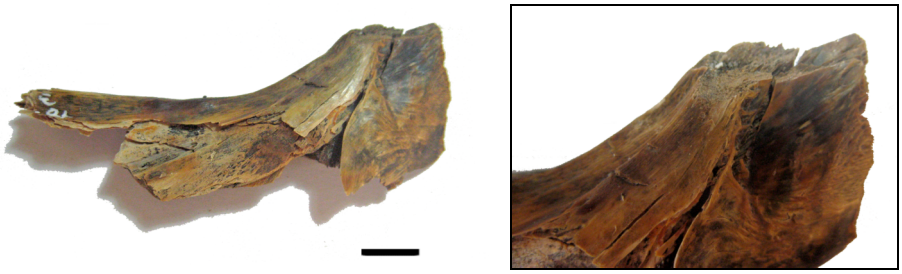

Figure 6: Cleithrum from CW76 321; inset shows butchery detail (scale 1cm)

AR.1985.24 CW78 286/CW78 289
This sample contained three cod vertebrae, two in good condition and one in two fragments, with a number of other small fragments consistent with these identifications. All three were caudal (group 1) vertebrae, from fish of about 80-90cm TL.

Figure 7: Vertebrae from CW78 286/CW78 289

Isotopic analysis

Ten bone fragments were selected for isotopic analysis, including a few reserved in case of null results. Of these, six returned usable results, summarised in Table 1. Each fragment was processed two or three times and, where both or all runs returned consistent results, averages have been included and it is these values that have been plotted.

Context	Element	Total length (cm)	Sample detail	Wt mg	%N	$\delta^{15}N$	%C	$\delta^{13}C$	C/N
CW77 140	Caudal vertebra group 1 (butchered)	100-110	First fragment, first run First fragment, second run Second fragment, first run Second fragment, second run *Average*	0.89 0.52 0.91 1.14	14.1 12.8 13.4 12.6	16.78 16.58 17.40 17.45 *17.05*	40.5 38.3 38.0 38.2	-12.35 -12.53 -12.08 -12.76 *-12.43*	3.36 3.48 3.32 3.55
CW78 273	Cleithrum	90-100	First run Second run *Average*	0.86 1	11.1 7.1	17.44 17.44 *17.44*	31.7 21.1	-12.64 -12.93 *-12.79*	3.33 3.48
CW77 163	Cleithrum (butchered)	95-105	First run Second run *Average*	1 0.93	13.0 15.4	16.39 16.47 *16.43*	36.7 43.1	-12.26 -12.10 *-12.18*	3.30 3.27
CW78 318	Caudal vertebra group 1	90-100	First run	0.76	10.6	14.58	31.3	-13.29	3.44
CW78 319	Cleithrum (butchered)	80-85	First run Second run Third run *Average*	0.91 0.99 0.85	17.6 10.3 14.7	17.40 17.26 17.16 *17.27*	48.1 28.4 40.2	-12.19 -12.24 -12.10 *-12.18*	3.19 3.22 3.19

Table 1: Sample details and results

The large, butchered vertebra CW77 140 was sampled twice, both fragments then returning positive results; these provide a useful check of the methods. These have been averaged in the following figures, but the independent values are included above. The difference between samples is small and well within the expected range (derived from multiple sampling from the same individual animals (Barrett *et al*. 2011, 1520)).

The results can be plotted against the 'base map' of isotopic controls, established during a comprehensive study of archaeological and modern cod bone taken from numerous sites in the North Atlantic region (Figure 8 displays the sources of 'control', or locally caught cod, together with the isotopic signatures for each region, while Figure 9 displays the Cattewater results plotted along with all isotopic controls).

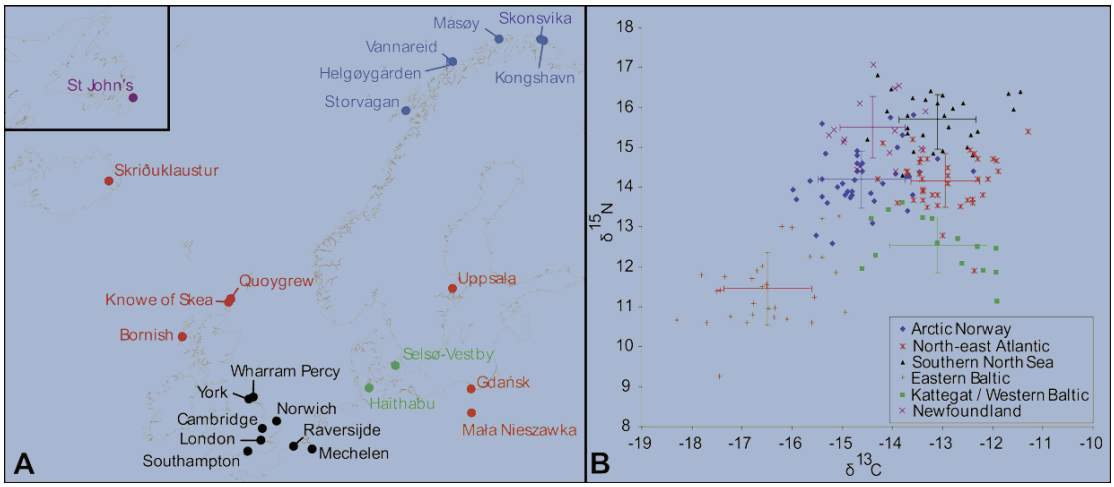

Figure 8: Map indicating sources of cod bones from locally caught fish (left), used to establish a provenance 'base map' of isotopic control data (right; error bars show the mean for each region, +/- one standard deviation) (copied from Barrett *et al.* 2011, Figure 3)

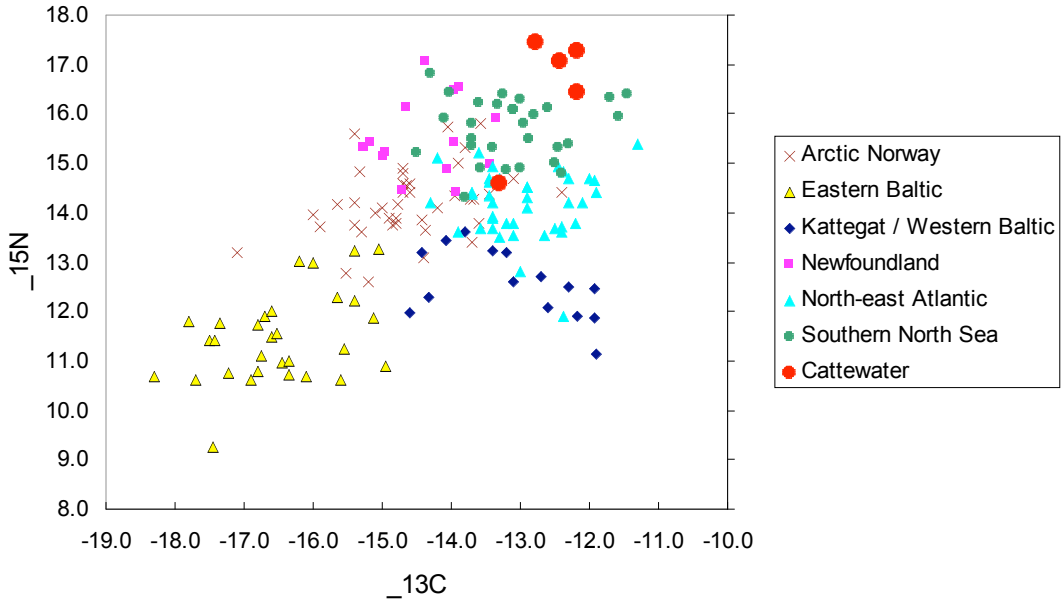

Figure 9: The Cattewater fish plotted alongside isotopic control data (derived from Barrett *et al.* 2011)

The five bones that have returned isotopic results fall into two categories. A single sample displays markedly lower $\delta^{15}N$ values compared to the remaining four samples, which form a discrete cluster in the Southern North Sea region of the control plot. While the latter are most likely locally caught cod from the Southern North Sea or the English Channel, the former is more unusual. It is likely an import, but from which region? This specimen just falls within the one standard deviation from the mean values for the North-east Atlantic region (e.g. Iceland or the Northern Isles), but there is a possibility that it might have come from Arctic Norway.

The remaining four specimens form a cluster with higher than usual $\delta^{15}N$ values, and are most likely locally caught fish from the Southern North Sea region. However, their raised nitrogen levels are worthy of further exploration. Two of these fish are within the same size ranges as the control data, i.e. between 50 and 100cm total length, while the remaining two exceed this range only slightly, up to a maximum of 110cm total length estimation; extreme size is therefore unlikely to explain the variation. The control samples immediately adjacent to these Cattewater specimens included cod that were likely caught near Southampton, as well as others from near London and the coast of Belgium – so it is possible that the Cattewater cod display slightly elevated nitrogen levels because they were caught further west than any others. It is also possible that they were caught in an estuarine environment, as fresh water inputs can result in elevated nitrogen levels.

Discussion

The fish remains from the Cattewater wreck form a small but informative assemblage that provides insight into the provisioning of a sea-going vessel. The fish found on board point strongly towards a cargo that contained some preserved cod. Not only were no other fish taxa found, but the fish sizes and elements found indicate the fish had been processed elsewhere, and brought onto the ship as a cured product suitable for long-term storage. It is difficult to speculate on the original size of the cargo, given the small number of fish bones that were recovered. Bones from domestic mammals were also found in association with the ship, and they too suggest that preserved meat was stored on board the ship (Redknap 1997, 79). It is

probable that these food remains were not the primary cargo of the ship, but were instead intended as provisions for the journey (Redknap 1997, 79).

Several fragments of cod bone were sampled for $\delta^{13}C$ and $\delta^{15}N$ analysis. Five specimens returned successful results, and when compared with an established base map of isotopic values, it was concluded that one specimen had likely been imported from the Northern North Atlantic region, which could include the Northern Isles or Iceland. Fish from the Northern North Atlantic and Arctic Norway make up a substantial minority of imports to urban centres like London and Cambridge in the 15th and 16th centuries (Barrett *et al.* 2011), so it is not too surprising that these imports are also reaching Plymouth and being included as ship provisions. The remaining samples from the Cattewater wreck were probably from cod that had been caught and preserved relatively locally in the Southern North Sea region. There is, unfortunately, no evidence to indicate that any new world cod were contained in the ship's cargo. The tantalising historical description of a shipwreck that took place in 1573 in Exmouth, "with the loss of 18,000 of the Newfoundland fish on board" (Redknap 1997, 85) indicates that new world fish were indeed being imported to Britain contemporary with the use of the Cattewater Wreck, but none of these fish appear to have been included in the provisions held in the hold of the Cattewater vessel.

Fish bones are not uncommon finds on shipwrecks, although the character of such assemblages is often very different compared to those from urban sites. Finds of preserved 'barrels' of fish are typical. The Mary Rose, which sank in the mid 16th century during battle, contained over 30,000 fragments of fish bone. These were interpreted as numerous barrels of preserved cod, haddock, conger eel, herring and others intended as provisions for the voyage, along with barrels of preserved meat from domestic mammals (Coy and Hamilton-Dyer 2005). On a more mundane scale, an early to mid 16th century vessel sank in Drogheda harbour with a cargo that appeared to contain numerous barrels of preserved herring (Harland 2009). In this case they were not intended as provisions, but were the primary cargo on board the vessel. The cod bones recovered from the Cattewater wreck were most likely provisions for the voyage rather than either a cargo in their own right or an immediate catch to be eaten fresh. Isotopic sampling indicates they were sourced from both fisheries local to southern Britain and from those from further afield in the Northern North Atlantic.

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