A MILLENIUM OF FISHING STRUCTURES IN STERT FLATS, BRIDGWATER BAY, INNER BRISTOL CHANNEL

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Large numbers of wood and stone fish weirs are known to exist along the coast of Somerset but curiously little analytical work has been undertaken on them. As a first step towards answering some of the many research questions about these structures, a small sampling exercise was undertaken in the Stert Flats area of Bridgwater Bay. The objective was to characterise the wood species used in the weirs and obtain dating samples from differing structural types. The exercise was successful and suggests that there may be almost a thousand years of fishing structures present in the area, beginning in the late Saxon period, with four distinct types of weir in use. The types of Saxon and medieval weirs identified correspond very well to examples from Magor Pill, showing that weir development was consistent on both sides of the estuary. The late Saxon weirs are also similar to dated examples from Essex and Suffolk, suggesting a shared technological tradition across a large geographical area. An extension of this minimal sampling, characterising and dating exercise would no doubt provide evidence of further complexity but would also help to firmly establish structural typologies chronologically secured by scientific dating.

BACKGROUND

Very large numbers of wood and stone fish weirs are known to exist along the shores of the Severn Estuary. They have been recorded on maps, plotted from aerial photographs and located in the inter-tidal area. The recent history of such structures has been well documented (eg Waters 1947; Green 1992; Neufvillle Taylor 1974; Brown 1980) and some of the structures are still in use today (eg at Minehead and Goldcliff). A recent paper (Allen 2005) has characterised the evidence for fishing from the area and identified three broad stages in the development of fish weirs. In combination with fishing from boats, these structures, have played a major role in the evolving economy and region.

More recently, Phase 1 (desktop study) of the Rapid Coastal Zone Assessment (RCZA) for the English side of the Severn has, for the first time, produced comprehensive evidence of the extent and scale of the fishing structures present along the coast. This work was achieved by plotting the positions of structures seen on aerial photographs of differing dates onto a GIS base as part of the National Mapping Programme. Many of the sites seen on the photographs are no longer visible on the ground, either because they have been eroded or because they are obscured by mobile sediment. This work complements the earlier desktop and field surveys carried out for CADW along the Welsh side of the estuary.

Despite this wealth of knowledge about the location, extent and diversity of the fishing structures surprisingly few archaeologists have waded out into the mud to record and sample them. Some of the most intensive work was undertaken in advance of the Second Severn Crossing (eg Godbold and Turner 1993) which not only plotted the position and shape of the structures but also dated them and even excavated a fishing basket associated with one structure.

More recent recording and sampling exercises undertaken at Magor Pill (Nayling 2000) have also added very significantly to our knowledge of the dating and composition of the structures.

STERT FLATS FIELDWORK

The Stert Flats area of Bridgwater Bay has long been known to contain numerous wood and stone fish weirs. The most detailed examination of the structures was made as part a rapid preliminary archaeological assessment of Bridgwater Bay for RCHME (McDonnell 1994, 1995). Although this survey identified numerous structures, no dating or wood-species samples were taken, because such work was not part of the brief for the project. During this survey the structures were located by prismatic compass, although the RCHME field survey team added a small number of fixed points.

Many additional fish weirs are also known to exist along the River Parrrett as it cuts through the inter-tidal mudflats. These are shown on an 1831 map by Lieutenant Denham (RN) of 'The Parret or Bridgwater River and the Bar' (Taunton Hydrographic Office H.485 shelf Qe) in addition to a small number of weirs on the flats themselves.

This frustrating situation of knowing the existence and approximate location of many archaeological features, but having almost no information about their date, led Somerset County Council Heritage Service to undertake fieldwork to rectify this gap in our knowledge. This was accomplished in two excursions to Stert Flats by a group of three archaeologists in May and September 2003. The success of the initial sampling visit, and associated tree-ring spot dating, led to English Heritage involvement which allowed a more extensive scientific dating exercise to be undertaken as part of the second sampling project.

The three objectives of the fieldwork were to: 1) more accurately locate the structures than had been previously possible; 2) provide a detailed description of the structures and identify the materials used in their construction, and 3) date the structures. In addition, information was gathered on the potential vulnerability of the structures to erosion.

METHODOLOGY

A team of three was chosen for health and safety reasons, in order to enable a variety of tasks to be undertaken within the low-tide window and to allow the burden of equipment and samples to be shared for what can be a long and tiring slog through the inter-tidal mudflats. The objectives were to make a brief photographic and descriptive record of the structures examined, plot their position using a hand-held GPS (Garmin 12 XL horizontal accuracy *c* 2-6 m depending on number of satellites receiving), take samples for tree-ring dating, species identification and radiocarbon-dating, and plan the structures to locate the samples and assist in characterisation. In practice planning was kept to a minimum because of time constraints and the prioritisation of collecting dating samples. The radiocarbon determinations have been calibrated with data from Reimer *et al* (2004) using OxCal (v3.10) (Bronk Ramsey 1995; 1998; 2001). The date ranges have been calculated according to the maximum intercept method (Stuiver and Reimer 1986), and are cited at two sigma (95% confidence).

Rowena Gale undertook species identification using standard sample preparation methods (Gale and Cutler 2000) followed by matching to reference slides of modern wood. Identification of oak wood and rapid assessment of tree-ring potential was carried out in the field by the author.

Nigel Nayling, Cathy Groves and Christine Locatelli carried out the dendrochronological dating. Their methodology is detailed in full in their report (Groves *et al* 2004), which is available from the Somerset Historic Environment Record or from English Heritage. A sapwood estimate of 10-46 annual rings was used to calculate felling dates or dates after which the tree was felled, as presented below.

The precise surface conditions for any particular visit can vary enormously but always include stretches of deep mud and quicksand areas. This, combined with the extremely rapid ingress of the tide across the flats and possibility of being cut off from the shore by water entering behind, makes the area extremely dangerous to visit without local knowledge. Sampling, planning and recording were severely limited by

the brevity of the safe working window between high-tides.

RESULTS

The locations and descriptions of the structures were recorded in two reports (McDonnell 2003a and b). The full tree-ring dating report (Groves *et al* 2004) is available from the Somerset Historic Environment Record or from English Heritage. A total of 18 structures were examined during the project (Figure 1). These can be divided into four categories: 1) large individual V-shaped weirs; 2) rows of smaller conjoined v-shaped stake arrangements; 3) long stone and timber rows, and 4) long double rows of posts.

The structures are listed below with the numbers given in the McDonnell reports and with their Somerset Historic Environment Record (SHER) primary record numbers. Tree-ring samples were obtained from five structures, radiocarbon samples from six and wood species identification samples from ten structures. The sampling exercise was concentrated on the large individual V-shaped weirs because the presence of split oak posts suggested that dendrochronological dating might be possible and because the wood condition suggested that they would be the earliest structures, which proved to be the case.

TYPE 1 - LARGE INDIVIDUAL V-SHAPED WEIRS

A long sequence of V-shaped weirs were recorded in a rough north-east to south-west alignment across Stert Flats. The RCZA Stage 1 work has shown that these structures extend over a considerably longer distance to the south than was visible during the site visits in 2003, with up to 30 weirs stretching over *c* 700 m south of the Gutterway and *c* 450 m to the north. Structure

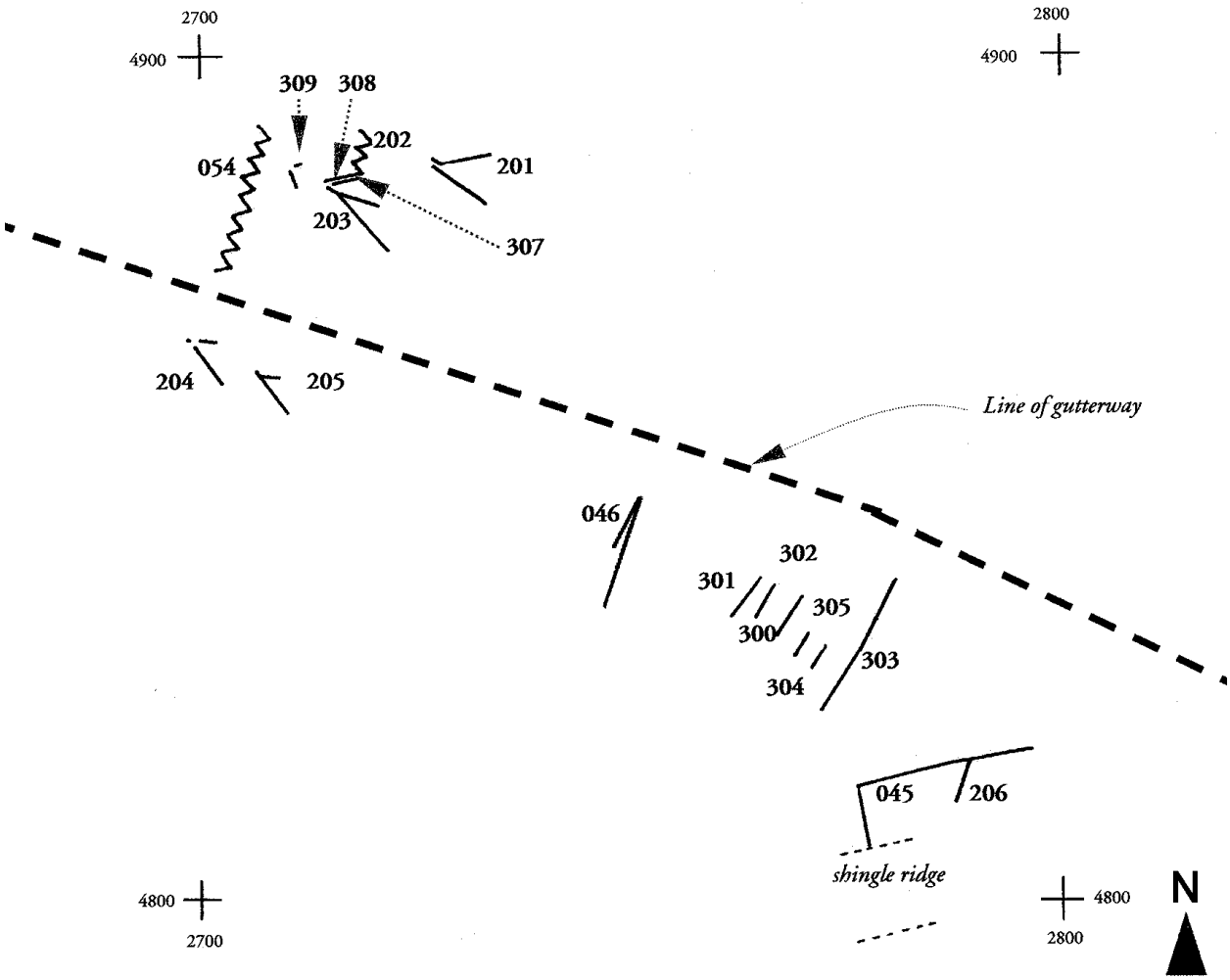

Figure 1. Plan of surveyed structures (from McDonnell 2003b).

Table 1. Dendrochronological results.

Wood No.	Description	Width (mm)	Thick (mm)	Annual Rings	Dendrochronological Date
201.1	radial plank	138	37	76	-
201.2	radial plank	132	30	116	From same tree. Felled after 932 AD
201.3	radial plank	147	63	63	
201.4	radial plank	90	45	57	-
203.1	radial plank	95	37	98	Felled after 966 AD

SHER 27926 was visible as a V-shaped scour depression on aerial photographs taken in 2000 at ST 2646 4808 (NMR entry ST 24 NE93 24/10/2007). Structure SHER 27927 was similarly visible on photographs of 1963 and 2000 and was located at ST 2665 4812 (NMR entry ST 24 NE93 11/1/2007). Some of the weirs appear as a tick shape rather than a V, with one arm noticeably shorter than the other. This may be due to erosion of one arm by the Gutterway or concealment of one arm by mud, sand or stone. The two leading arms of the weirs are visible over lengths up to 30 m but in all cases their full dimensions are unknown because of possible erosion or concealment by mobile sediment. It is unclear if the arms of the V were used to support wattle panels or if roundwood was woven directly between the posts.

Structure 201 (SHER 27936)
Apex of weir at c ST 27275 48878

It was not possible to record the full extent of this structure, as only the timbers at the apex were

Figure 2. Split oak posts at the apex of the Faxon Trap (Structure 201). The leading arms are covered by liquid mud.

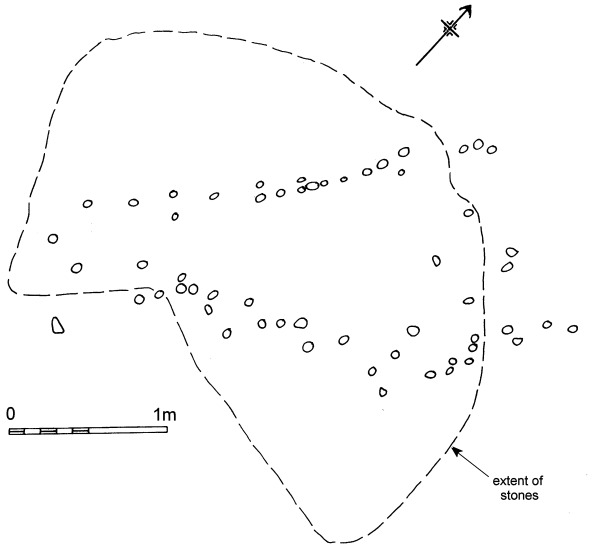

Figure 3. Plan of structure 204.

clearly visible above the mud and water (Figure 2). The wooden stakes forming the two converging arms were only just visible under water and it was not possible to sample them to assess their character and species composition. Four samples were taken from the apex of this structure. These samples were all oak (*Quercus* sp.) and were selected because they were thought to represent the most suitable timbers for dendrochronological analysis. Two of the timbers (201.1 and 201.3) cross-matched and were thought to derive from the same tree because of the excellent match between their ring patterns. Neither timber had any sapwood, so successful matching with reference chronologies only showed that the tree was felled after AD 932 (Table 1).

Structure 203 (SHER 27938)
Apex of weir at c ST 27163 48832

This structure was located north of the Gutterway with two long arms of posts leading towards the apex. The ends of both arms were obscured in mud and shingle. The east end of the north arm disappears into mud at ST 27212 48829, whilst the east end of the southern arm disappears into shingle at ST 27225 48767. At the apex were a series of split oak posts that extended for a considerable extent in a somewhat irregular pattern. This may partly be a product of successive rebuilding associated with the creation of other leading arms represented by structures 307 and 308, which ran parallel to the northern arm of Structure 203. All the northern leading arms shared a similar orientation and could have used the southern arm of structure 203. If this was the case the apex for 307 would be slightly west of that for 203 and the apex for 308 further west again. The relative chronology of the structures is uncertain.

A brief visual assessment suggested that only one of the posts from the apex of 203 was likely to possess sufficient rings for tree-ring analysis and that post was sampled (ST 27146 48847). Dating was successful, demonstrating a felling date sometime after AD 966 as no sapwood was present (Table 1). The sample location suggests that it is possible that the dated timber may have formed part of the apex of structure 307 (see below).

Structure 307
NE end ST 27192 48849
SW end ST 27152 48845

This structure comprised a line of stakes running roughly northwest to southeast parallel to northern leading arm of structure 203. It may therefore represent an earlier or later part of the structure, along with a similar line (308), which ran parallel just a few metres to the north (ST 27187 48849 to ST 27152 48845).

No timbers appeared suitable for tree-ring dating from this structure, as all the stakes appeared to be small roundwood. Two samples were taken from stakes in the structure for radiocarbon-dating. These provided measurements suggestive of construction at some point in the 8th to 10th centuries AD (Table 2). The latter part of this range includes the dendrochronological date after which a tree was felled for a timber for the apex of structure 203. This reinforces the possibility that 203, 307 and 308 are from the same period.

Structures 204 and 306
Apex of weir at ST 27000 48659

Structure 204 is a large individual V-shaped weir lying just south of the Gutterway (Figure 3). The apex of the weir ends in a small heap of stones of *c* 3 m diameter, possibly to prevent erosion around the stakes at this spot (Figure 4). The northern arm of the weir was visible over a distance of *c* 17

Table 2. Radiocarbon-dating results.

Sample	Material	Lab code	RC Age BP	Calibrated date (95% confidence)
307.1	*Corylus avellana* roundwood, diameter 50 mm	GU-6002	1090+/-50	780-1030 Cal AD
307.2	*Alnus glutinosa*, roundwood, 40 mm diameter 7 rings	GU-6003	1150+/-50	720-1000 Cal AD
204.12	*Alnus glutinosa*, roundwood, 60 mm diameter	GU-6010	1060+/-50	890-1040 Cal AD
204.18	*Quercus* sp. with sapwood	GU-6011	1160+/-50	680-1020 Cal AD
306.1	*Alnus glutinosa*, roundwood, 27 mm diameter	GU-6008	960+/-50	980-1220 Cal AD
306.2	*Alnus glutinosa*, roundwood, 40 mm diameter	GU-6009	1050+/-50	890-1160 Cal AD
205.6	*Alnus glutinosa*, roundwood	GU-6039	940+/-50	990-1220 Cal AD
205.7	*Corylus avellana* roundwood, diameter 50 mm	GU-6038	1050+/-50	890-1160 Cal AD
309.1	*Betula* sp. roundwood, *c* 10 rings	GU-6004	1150+/-60	690-1020 Cal AD
309.3	*Quercus* sp., radial split – outer 5 rings of sapwood used for dating	GU-6005	1170+/-50	690-990 Cal AD
202.1	*Quercus* sp. roundwood 8 rings	GU-6006	430+/-50	1410-1630 Cal AD
202.2	*Fraxinus excelsior* roundwood 8 rings	GU-6007	340+/-50	1440-1660 Cal AD

m (east end of northern arm: ST 27015 48666), and the southern arm over a distance of *c* 34 m before it was obscured by sediment (eastern end of south arm: ST 27028 48615). The northern arm ended at the Gutterway, which may have eroded the rest of the structure in that direction.

Some horizontal roundwood and short planks were just visible over *c* 1 m length running parallel to the northern arm on its outside. These were given the structure code 306 and were thought to probably represent the remains of a trackway along the edge of the weir to facilitate its use and repair. Sand and stones obscured the remainder of the feature.

A rank of conjoined small v-shaped weirs lay immediately to the south of weir 204. In the first of these small v-weirs a woven fishing basket had previously been seen but not sampled.

Twenty samples were taken for species analysis or identified in the field (only oak). The large split oak timbers from the apex were deliberately selected for their tree-ring potential but the non-oak were a random sample from the arms of the weir. All the oak timbers had been radially split with widths between 46 mm and 70 mm (Table 3). The leading arms of the weir were all roundwood 25-37 mm in diameter, mainly

Figure 4. The apex of structure 204 amongst a pile of stones with the leading arms in the background partly hidden by mud. Scale 1 m. The Gutterway channel is visible on the left

Table 3. Character of wood samples from structure 204.

Wood No.	Species	Radius (R) or width (w) and thickness (t) mm	Ring count sapwood (s)	Conversion
204.1	*Alnus glutinosa* (alder)	R34	-	Roundwood
204.2	*Alnus glutinosa* (alder)	R25	-	Roundwood
204.3	*Alnus glutinosa* (alder)	R35	-	Roundwood
204.4	*Alnus glutinosa* (alder)	-	-	Roundwood
204.5	*Betula sp*. (birch)	R35	8+	Roundwood
204.6	*Quercus* sp. (oak)	R30	9	Roundwood
204.7	*Alnus glutinosa* (alder)	-	-	-
204.8	*Quercus* sp. (oak)	R37	*c* 24	Roundwood
204.9	*Salix* sp. (willow) or *Populus* sp. (poplar)	R25+	-	Roundwood
204.10	*Corylus avellana* (hazel)	-	-	Roundwood
204.11	*Quercus* sp. (oak)	R30	31+	Roundwood
204.12	*Alnus glutinosa* (alder)	R30	-	Roundwood
204.13	*Alnus glutinosa* (alder)	-	-	Roundwood
204.14	*Alnus glutinosa* (alder)	R18	-	Roundwood
204.15	*Quercus* sp. (oak)	w/t 71 x 41	41 (16s)	Radial split
204.16	*Quercus* sp. (oak)	w/t 46 x 41	55	Radial split
204.17	*Quercus* sp. (oak)	w/t 51 x 21	77	Radial split
204.18	*Quercus* sp. (oak)	w/t 65 x 12	39 (15s)	Radial split
204.19	*Quercus* sp. (oak)	w/t 48 x 29	41 (16s)	Radial split
204.20	*Quercus* sp. (oak)	w/t 70 x 33	53 (13s)	Radial split

alder with single examples of birch, hazel and willow or poplar (Table 3). There is a possibility that the rank of conjoined small v weirs once extended across structure 204 before subsequent erosion, so it is possible that one or two of the sampled roundwood posts may be from that structure.

Four samples (204.13,16, 17 and 20) from weir 204 and one sample from 306 (306.3) were sent for tree-ring dating but all had short ring sequences and failed to produce a match. Therefore two samples of roundwood from each structure were radiocarbon-dated (Table 2). The results suggest that both features could be contemporary and were probably constructed in the 10th or early 11th centuries AD.

Structure 205
Apex ST27071 48617

This large individual V-shaped weir was located south of the Gutterway to the south-east of structure 204 (Figure 5). A series of split oak timbers were located at the apex of the two leading arms and the timbers that appeared to have most potential for tree-ring dating were sampled (Table 4). The northern arm was traced over *c* 28 m although its was obscured in places by sand (east end of north arm: ST 27096 48620). The southern arm was visible over *c* 14 m (east end of south arm: ST 27082 48609).

Two of the split oak timbers were extracted whole to assess their depth of burial (Figures 6 and 7). Timber 205.4 was 90 mm long and 205.5

Table 4. Character of wood samples from structure 205.

Wood No.	Species	Rings Sapwood (s)	Cross section Dimensions (mm)	Conversion
205.1	*Quercus* sp. (oak)	89	80 x 30	Radial split
205.2	*Quercus* sp. (oak)	51	75 x 42	Radial split
205.3	*Quercus* sp. (oak)	140	92 x 45	Radial split
205.4	*Quercus* sp. (oak)	41	82 x 25	Radial split
205.5	*Quercus* sp. (oak)	38	60 x 38	Radial split
205.6	*Alnus glutinosa* (alder)	-	-	Roundwood
205.7	*Corylus avellana* (hazel)	-	50 diameter	Roundwood
205.8	*Quercus* sp. (oak)	98 (10s)	65 x 46	Radial split
205.9	*Quercus* sp. (oak)	64	75 x 35	Radial split

was 427 mm long. Both had been cut to a point with blows on their side faces, from 230 mm above the tip on 205.5 and over the whole surviving length of 205.4. These shallow depths emphasise the fact that such timbers are very vulnerable to loss by erosion, especially because erosion gullies form around the large posts and along the leading arms. Several timbers may already have been lost from this and many of the other structures.

Five of the split oak timbers (205.1, 2, 3, 8 and 9) were sent for dendrochronological dating but no cross matching was achieved. Two of the small roundwood components from the arms of the structure were selected for radiocarbon-dating (Table 2). The two results are consistent and suggest construction took place at some point in the 10th to 13th centuries AD.

Structure 309
NW end of feeder arm ST 27113 48851
SE end of feeder arm ST 27116 48839

This structure was located north of the Gutterway and west of a shingle ridge running north-south that obscured all of the structure except for the apex and a few metres of the two feeder arms (Figure 8). It was very similar to the other structures of this type having split oak timbers at the apex and roundwood stakes forming the two feeder arms.

One radially split oak timber from the apex (309.3) was sampled for tree-ring dating but was not assessed because it only had 32 rings. Its cross section dimensions were 51 mm by 49 mm. One of the roundwood stakes (309.4) was extracted whole to assess the depth of burial of the timbers (Figure 9). It was 210 mm long and 45 mm in diameter, suffering from decay but retaining its bark. It was cut to a pencil-type point over 190 mm with numerous blows delivered at a shallow angle.

Two of the timbers were selected for radiocarbon-dating. The two results are consistent and suggest construction took place at some point in the 7th to 10th centuries AD (Table 2).

TYPE 2 - ROWS OF CONJOINED SMALL V-SHAPED SETTINGS

The RCZA Stage 1 draft report noted that this

Figure 5. Structure 205 looking from the apex towards the leading arms of small roundwood (scale 1 m).

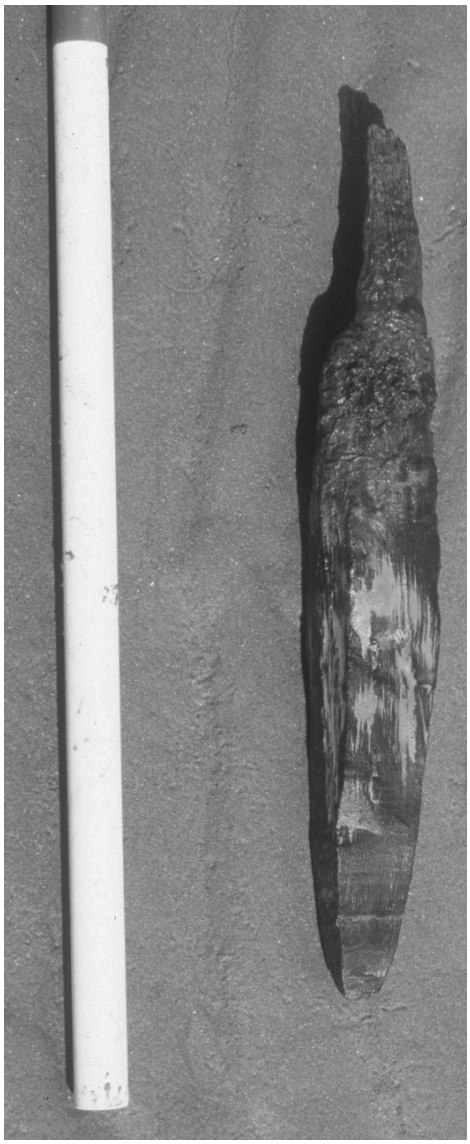

Figure 6. Stake 205.5 showing shallow depth of burial and erosion at the top (scale 0.5 m).

Figure 8. Looking along the southern arm of structure 309 where it emerges from the shingle towards the apex (buried in mud). The northern arm is marked by two (1 m) ranging rods.

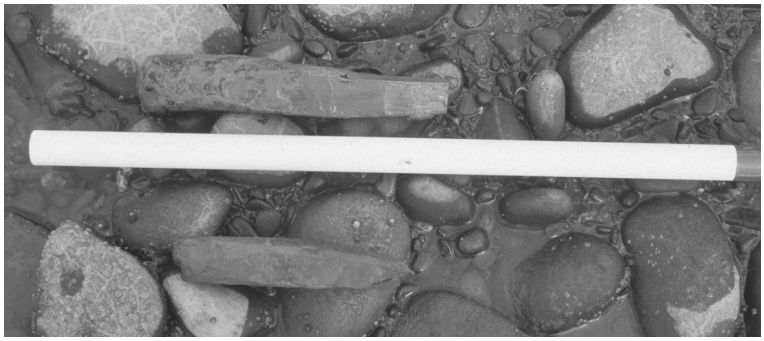

Figure 9. Two stakes from structure 309, showing the shallow depth of their survival (white scale 0.5 m).

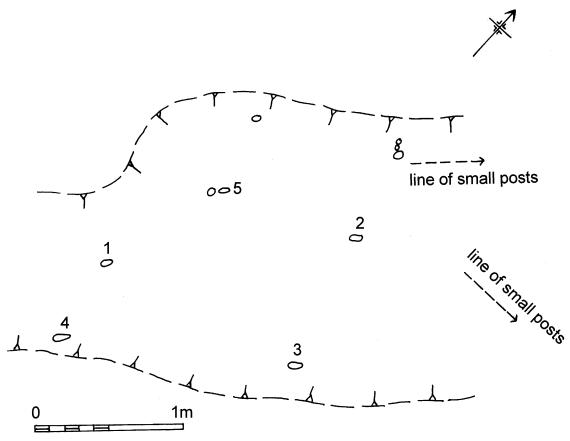

Figure 7. Plan of structure 205.

Figure 10. Sampling structure 202 (scale 1 m).

Figure 11. Looking along structure 054. Richard McDonnell and Keith Faxon providing scale.

type of weir, which appears as a continuous zig-zag pattern on aerial photographs, was only seen in the Stert Flats area of Bridgwater Bay and nowhere else along the present Somerset coast. Aerial photographs showed several lines of these features running roughly north-south on either side of the Gutterway. The presence of numerous stakes along the sides of the Vs suggests that they were used to support woven fences, either as attached panels or woven directly around the uprights. The fences would drive fish towards a collection point at the apex of each V where a basket or net would capture them.

Structure 202 (no SHER number yet)
Northern visible end ST 27191 48894
Southern visible end ST 27181 48840

This structure ran north-south for *c* 45 m with the northern end obscured by mud and the southern end by shingle. Two samples of small diameter roundwood were taken from the arms of this weir for radiocarbon-dating at ST 27180 48868 (Figure 10). Sample 202.1 had a diameter of 60 mm. The size of the other timber sampled was not recorded. The two measurements are consistent and suggest construction at some point in the 15th to 17th centuries (Table 2).

Structure 054 (no SHER number yet)

A control peg was installed in this line using differential GPS at ST 27065.586 48873.115 by Hazel Riley of RCHME.

This rank of conjoined V-shaped structures runs roughly north-south to the north of the Gutterway (Figure 11). A similar structure exists south of the Gutterway on roughly the same alignment overlapping with the large individual V-shaped weir 204. It is possible that they were originally part of the same structure that was cut through by erosion associated with the creation of the Gutterway. Its extent north of the Gutterway is at least 125 m.

A single timber was removed from the structure. This proved to be a quartered piece of oak heartwood (*c* 21 rings surviving) that had been squared off on four sides and cut to a point on each face over 200 mm of its length. It survived to a length of 248 mm and its other dimensions were 45 mm by 45 mm. At a distance of 205 mm from the tip there was a 10 mm wide depression on one face as though the timber had been pressed against a piece of horizontal roundwood. This provides slight evidence for roundwood being woven around the post settings. No detailed planning or sampling was undertaken on this structure.

TYPE 3 - DOUBLE POST ROWS

Nine double post row structures were recorded on Stert Flats during the fieldwork. These comprised discrete clumps of stakes forming the ends of a V

Figure 12. Structure 206 looking south from the junction with structure 045 (scale 1 m).

shape with the point to seaward. They therefore appear to represent ranks of large woven baskets secured by stakes either side of the open mouth and at the end of the basket. They are distinguished from the conjoined rows of V-shaped weirs by the absence of any stakes along the sides of the V. No radiocarbon-dating was attempted for these structures because the condition of the posts and the use of non-native species (see below) suggest that too recent a date was likely for such a technique to provide useful results.

Structures 300-305 (SHER 27946)

A group of six double post rows were recorded on the south side of the Gutterway. These double rows of stakes were unexpectedly discovered on the second field visit and were therefore only located but were not planned or sampled. The Gutterway may truncate the northern ends and the southern ends are concealed by mud. The observed lengths varied between *c* 32 m (structures 304 and 305) and 132 m (structure 303). Brief visual examination of the condition of some of the posts suggested a post-medieval date was probable.

Structure 046 (SHER 12654)
South end of western row c ST 27477 48416
South end of eastern row c ST 27451 48342

These two structures run in a south-westerly direction from the Gutterway. The longer eastern structure consists of a double row of stakes, spaced *c* 3 m between the rows. A shorter double row of stakes exists immediately to the west, converging with the western side of the longer eastern double row part way along its length. This structure was not planned or recorded in detail because of time constraints. A single sample from the western row proved to be elm (*Ulmus* sp.) roundwood. Brief visual examination of the condition of some of the posts suggested a probable post-medieval date.

Structure 206 (066)
North end ST 27894 48169
South end ST 27863 48101

This double post-row runs roughly north-south for over 75 m with its northern end joining the northern arm of the stone and post structure 045 (Figures 12 and 13). The rows are *c* 3 m apart. The northern row consisted of discrete clumps of

Figure 13. Looking along the northern arm of structure 045 (right) towards the apex and southern arm (distant background). In the left foreground is structure 206 (scale 1 m).

Table 5. Character of wood samples from structure 206.

Wood No	Species	Age	Diameter (mm)
066.1	*Ulmus* sp. (elm)	25+	-
066.2	*Picea* sp. (spruce) or *Larix* sp. (larch)	-	-
066.3	*Acer campestre* (field maple)	*c* 12	50
066.4	*Acer pseudoplatanus* (sycamore)	*c* 12	35
066.5	*Fraxinus excelsior* (ash)	-	-
066.6	*Ulmus* sp. (elm)	-	-

roundwood stakes that appeared to have been used to secure the open ends of woven traps. The southern row was composed of discrete clumps of roundwood stakes placed in the middle of the gap between the stakes on the northern line, presumably to secure the end of the woven traps. The clustering of posts possibly suggests a long period of reuse and rebuilding of the weir.

One clump of stakes was planned and sampled for species identification (Table 5). Rowena Gale noted that the species included sycamore, spruce and larch, none of which are native species, but have been in cultivation in Britain since the mid 16th and 17th centuries respectively (Mitchell 1974). The use of small roundwood points to a local source rather than to imported wood. The well-preserved condition of the posts suggests that they are of no great age. The presence of two different species of *Acer* in close proximity raises the possibility that they may both be of the same species and that an atypical ray structure may be present in one sample, especially since the wood was relatively juvenile.

TYPE 4 - LARGE STONE AND TIMBER WEIR

Structure 045 (SHER 12650)
Apex of weir at ST 27760 48135

This structure lies closer to the shore than any of the other weirs on Stert Flats. It consists of two long arms of roundwood stakes and stones that converge at an apex where post settings, largely obscured by mud and standing water, suggested that a large basket was situated (Figure 14). The

Figure 14. The apex of structure 045 with post settings inside it (scale 1 m).

Table 6. Character of wood samples from structure 206.

Wood No	Species	Age	Diameter (d) radius (r) mm
12650.1	*Corylus avellana* (hazel)	12	d 25
12650.2	*Salix* sp. (willow) or *Populus* sp. (poplar)	*c* 4	r 15
12650.3	*Quercus* sp. (oak)	*c* 12	r 25
12650.4	*Salix* sp. (willow) or *Populus* sp. (poplar)	-	-
12650.5	*Picea* sp. (spruce) or *Larix* sp. (larch)	30	r 15
12650.6	*Corylus avellana* (hazel)	-	d 30
12650.7	*Salix* sp. (willow) or *Populus* sp. (poplar)	2	r 15
12650.8	*Picea* sp. (spruce) or *Larix* sp. (larch)	-	d 25
12650.9	*Salix* sp. (willow) or *Populus* sp. (poplar)	-	-
12650.10	*Quercus* sp. (oak)	8	d 30+
12650.11	*Pinus* sp. *sylvestris* group (pine)	-	-
12650.12	*Alnus glutinosa* (alder)	-	d 25
12650.13	*Fraxinus excelsior* (ash)	12	d 40
12650.15	*Salix* sp. (willow) or *Populus* sp. (poplar)	?5	r 20
12650.16	*Fraxinus excelsior* (ash)	-	-

southern arm was traced over 60 m before becoming obscured under a shingle ridge and deep mud at ST 27750 48067. The northern arm extends for *c* 200 m (east end of northern am: ST 27971 48716). The density of stakes is such that large fish such as salmon may have been forced along the arms towards the apex without the need for horizontal roundwood woven between the posts or attached as panels.

A sampling transect across the eastern arm (0.4 m wide) showed that the posts extended over a 2.1 m width but were mainly concentrated over 1.1 m. Two main rows of posts were observed at either edge of the stones although a multitude of posts also existed between them. The density of posts suggests a prolonged period of use and rebuilding of the structure. All the posts appeared to be roundwood.

Fifteen samples were chosen randomly from the transect for species identification (Table

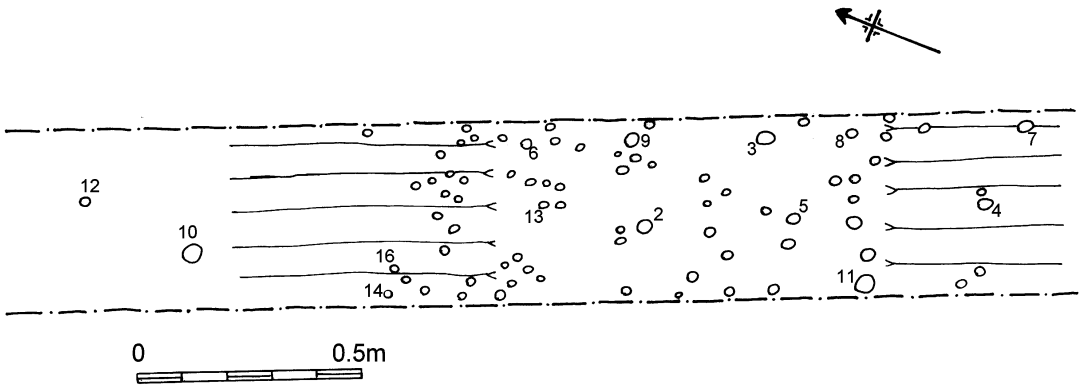

Figure 15. Plan of the sampled area of structure 045.

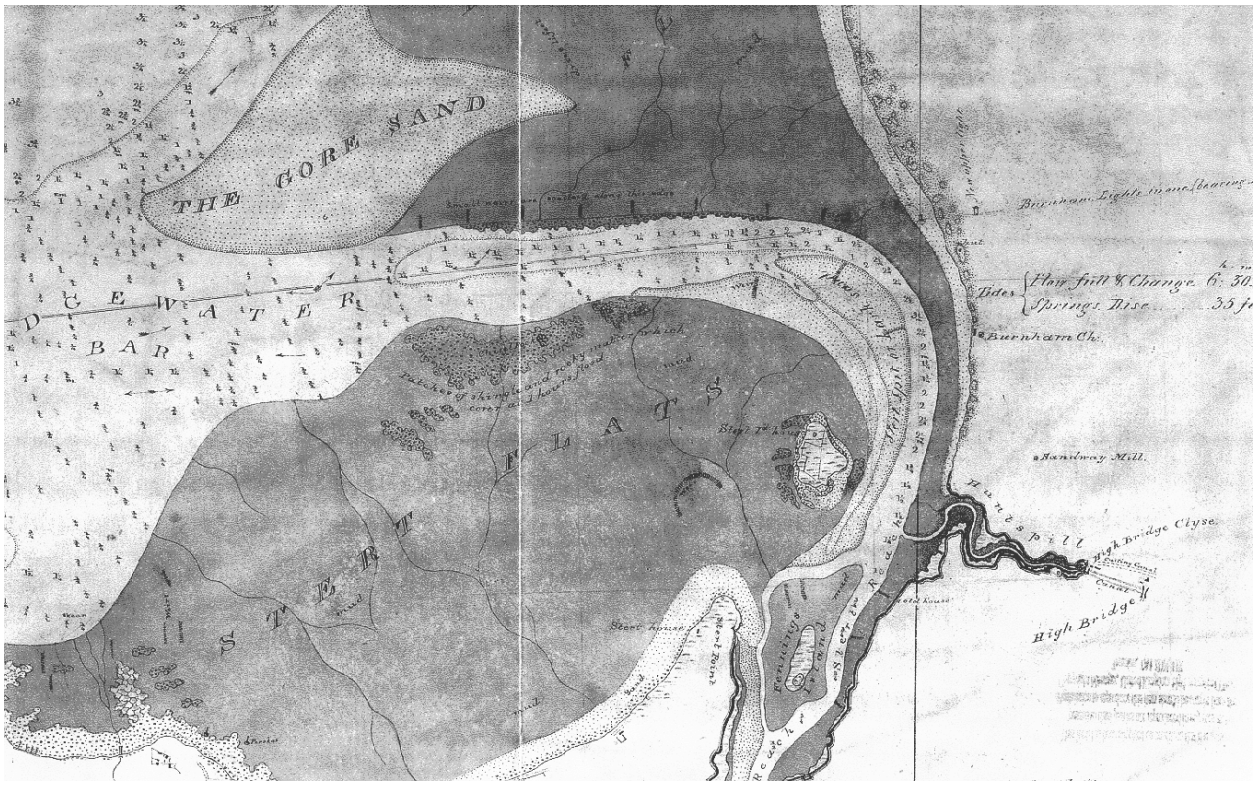

Figure 16. Detail of Lieut. Denham's map of the Parrett estuary (1832). Hydrographic office showing large semi-circular weir on Stert Flats and numerous short weirs along the River Parrett. Reproduced by permission of the Controller of Her Majesty's Stationary Office and the UK Hydrological Office (www.ukho.gov.uk).

6 and Figure 15). Rowena Gale noted that neither spruce nor larch are native species but have been in cultivation in Britain since the 16th and 17th centuries respectively (Mitchell 1974). The use of small roundwood suggests a local source rather than imported timber. The well preserved condition of the posts suggests that they are of no great age. This large weir may be the one shown on Lieut. Denham's map (Figure 16) of the Parrett estuary in 1831 (Taunton Hydrographic Office H.485 shelf Qe).

SUMMARY AND DISCUSSION

The rapid assessment of the fish weirs on Stert Flats identified four types of structure. Tree-ring and radiocarbon-dating and species identification has allowed a sequential chronology for these four types to be developed, all of which were designed to catch fish on the ebbing tide. This paper has deliberately refrained from discussing how these weirs correspond to the well documented putt and putcher weirs known from the last 200 years because of the danger of trying to make the archaeological data fit historical evidence from a much later period. With the exception of the double post row structures, none of the weirs recorded in the survey are similar to putt or putcher weirs.

The earliest structures are the large individual V-shaped weirs with leading arms of small roundwood posts of various species including alder, oak, hazel and willow or poplar. The apex of the structures contained woven baskets or nets secured by radially split oak timbers. Tree-ring dating shows this form of weir was in use from the late 10th century AD. The radiocarbon dates raise the possibility that some of the weirs of this type may be slightly earlier or later in date.

A woven basket of similar date has been found on the Welsh side of the Severn during the Second Severn Crossing investigations (Godbold and Turner 1993). Context 238 was a large woven basket 2.2 m long and 1.5 m across at the mouth with a radiocarbon date of 1012-1160 Cal

AD (Beta-54832 960+/-60BP). Perhaps baskets such as these may have been used at the apex of the Stert Flats weirs. Another weir of this date from the Severn is context 230 from the Second Severn Crossing investigations, which has a radiocarbon date of 789-1008 Cal AD (Beta-54828 1120+/-90BP). This took the form of a short collapsed wattle fence, which may have acted as a leader arm for a weir.

The construction and wood species used in this type of weir are extremely similar to examples from Magor Pill that have felling dates from split oak timbers of 1115/1122, 1119/1146, 1123, 1127, 1118-51 and 1190 (Nayling 2000). This demonstrates that the same types of structure were used on both sides of the estuary and provides confirmation of their use until the end of the 12th century AD. The felling dates suggest some sequential replacement of weirs and the same may be true at Stert Flats.

In the Blackwater Estuary, Essex, nine inter-tidal fish weirs have been radiocarbon dated to the later 7th to 9th centuries AD (Strachan 1997). The majority of these were large individual V-shaped weirs although some were more complex tick shapes with the long arm running parallel to the shore. More recently a large V-shaped weir at Holbrook Bay on the River Stour, Suffolk, has been dated to the mid to late Saxon period. Six samples from the main southern arm, or the wattle panels that run alongside it, returned a very similar date range after Bayesian modelling of 680–850 Cal AD (Everett 2007). Two samples were taken from the more ephemeral post line to the south of the main arm and crossing it at its eastern end, which returned a later date of 880–1025 Cal AD suggesting either later re-use of the feature or a repair. The posts from this structure were a mixture of alder, ash and willow/poplar, a similar composition to structure 204 at Stert Flats.

The limited scientific dating evidence from the Severn, Essex and Suffolk suggests that large individual V-shaped weirs were in use across a wide geographical area in the mid to late Saxon period. The information on the wood species used in these structures is extremely limited but suggests a preference for oak timbers at the apex and leading arms composed of a mixture of native trees with alder figuring prominently. More scientific dating is required to determine the true geographical and chronological extent of this type of weir.

The next oldest forms of weir were the ranks of conjoined small v-shaped weirs. The leading arms of these were formed of roundwood from species such as oak and ash and from the evidence from one structure, date to the 15th to early 17th centuries. Very similar weirs were recorded from Magor Pill (Nayling 2000) where a radiocarbon date of 1470-1650 Cal AD (SWAN-249 320+/-40BP) corresponds to the ones from the Stert Flats. Very similar structures were found during the investigations of sites 2, 4 and 6 on the Welsh side of the Severn for the Second Severn Crossing (Godbold and Turner 1993). These three weirs produced radiocarbon dates of 1285-1398 Cal AD (Beta-54823 620+/-50BP), 1283-1401 Cal AD (Beta-54825 620+/-60 BP) and 1279-1395 Cal AD (Beta-54824 640+/-60 BP) respectively, suggesting that they were in use 200-300 years before the examples at Magor Pill and Stert Flats.

The third type of weir represent a significant change in construction away from weirs with arms leading towards a collection point at an apex. Instead, the posts appear to have supported ranks of woven baskets, such as the putcher weirs well documented from the recent past in the Severn. The species range of the roundwood used in their construction was only examined in one location, where the presence of sycamore and larch or spruce suggested construction must post-date the mid 16th century AD. Once again very similar structures were recorded at Magor Pill (Nayling 2000) where larch or spruce were also being used. One of the Magor structures had a single radiocarbon date of 1490-1680 and 1740-1800 Cal AD (SWAN-278 260+/-40BP).

The fourth type of weir was a large stone and post weir that channelled fish towards an apex where they were either caught in a woven structure or were simply netted from the remaining water at low tide. The presence of larch or spruce again suggested that construction must post-date the mid 16th century AD. The well preserved condition of the wood in this type and in the type 3 weirs suggests that they are all of relatively recent origin.

The fieldwork phase of the Rapid Coastal Zone Assessment of the English side of the estuary should help to clarify the relative chronologies of the structures and characterise the materials used in their construction. This will allow a fuller comparison with the evidence from the Welsh side of the estuary. The shallow depth of the posts and the scoured erosion around them suggest that such sampling is urgently required. Stert Flats are vertically eroding at the rate of 16mm/year (R. Kirby pers. comm. 2007) and such figures are supported by comparison of Environment Agency LiDAR data from 2001 and 2003. Since the 2003 sampling exercise several additional posts appear to have eroded from some of the structures (R. McDonnell pers. comm. 2007). Present and continuing sea level rise will inevitably lead to the erosion of such inter-tidal exposures that are trapped in front of immovable hard sea defences. The threat to the survival of the inter-tidal archaeological resource may never have been greater than it is today.

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REFERENCES

Allen, J.R.L. (2005) Fishtraps in the middle Severn Estuary: air photographic evidence from the mid twentieth century. *Archaeology in the Severn Estuary* 15, 31-48.

Bronk-Ramsey, C. (1995) Radiocarbon calibration and analysis of stratigraphy. *Radiocarbon* 36, 425-430.

Bronk-Ramsey, C, (1998) Probability and dating. *Radiocarbon* 40, 461–474.

Bronk-Ramsey, C. (2001) Development of the radiocarbon calibration program. *Radiocarbon* 43, 355–363.

Brown, M.C. (1980) Mud horse fishing in Bridgwater Bay. *FolkLife* 18, 24-27.

Everett, L. (2007) Targeted inter-tidal survey. Ipswich. Suffolk County Council Archaeological Service Report No. 2007/192.

Gale, R. and Cutler, D. (2000) *Plants in Archaeology.* Westbury and Royal Botanic Gardens, Kew.

Godbold, S. and Turner, R.C. (ed) (1993) *Second Severn Crossing: Archaeological Response Phase 1 - the intertidal zone in Wales.* Cardiff: Cadw, 51-57.

Green, C. (1992) The Severn Fisheries, *Severn Estuary Levels Research Committee Annual Report* 1992, 69-76.

Groves, C., Locatelli, C. and Nayling, N. (2004) Tree-Ring Analysis of oak samples from Stert Flats fish weirs, Bridgwater Bay, Somerset. *Centre for Archaeology Report 43/2004*. English Heritage.

McDonnell, R. (1994) Bridgwater Bay: a summary of its geomorphology, tidal characteristics and intertidal cultural resource. *Archaeology in the Severn Estuary* 5, 87-114.

McDonnell, R. (1995) Island Evolution in Bridgwater Bay and the Parrett Estuary: an historical geography. *Archaeology in the Severn Estuary* 6, 71-84.

McDonnell, R. (2003a) *Bridgwater Bay Archaeological Memoir 08.09.03*. Holford: Unpublished report for Somerset County Council Heritage Service.

McDonnell, R. (2003b) *Bridgwater Bay Archaeological Memoir 14.05.03*. Holford: Unpublished report for Somerset County Council

Heritage Service.

Mitchell, A. (1974) *A Field Guide to the Trees of Britain and Northern Europe.* London: Collins.

Nayling, N. (2000) Medieval and later fish weirs at Magor Pill, Gwent Levels: coastal change and technological development. *Archaeology in the Severn Estuary 10*, 99-113.

Neufville Taylor, J. (1974) *Fishing in the Lower Severn*. Gloucester: Gloucester City Museums.

Reimer, P.J., Baillie, M.G.L., Bard, E., Bayliss, A., Beck, J.W., Bertrand, C.J.H., Blackwell, P.G., Buck, C.E., Burr, G.S., Cutler, K.B., Damon, P.E., Edwards, R.L., Fairbanks, R.G., Friedrich, M., Guilderson, T.P., Hogg, A.G., Hughen, K.A., Kromer, B., McCormac, G., Manning, S., Bronk-Ramsey, C., Reimer, R.W., Remmele, S., Southon, J.R., Stuiver, M., Talamo, S., Taylor, F.W., van der Plicht, J., and Weyhenmeyer, C.E., (2004) IntCal04 Terrestrial radiocarbon age calibration, 0–26 Cal Kyr BP. *Radiocarbon*, 46, 1029-1058

Strachan, D. (1997) C14 Dating of some inter-tidal fish weirs in Essex: dates and discussion. Essex County Council Unpublished report.

Stuiver, M. and Reimer, P.J. (1986) A computer program for radiocarbon age calculation, *Radiocarbon* 28, 1022–1030

Waters, B. (1947) *Severn Tide*. London: JM Dent.