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Unknown Wreck Site
Lowestoft
Suffolk Coast

Tree-ring Analysis of Timbers

Roderick Bale, Nigel Nayling, and Cathy Tyers

Discovery, Innovation and Science in the Historic Environment

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Front Cover: Sample from timber 6005 from the Unknown Wreck at Lowestoft on the Suffolk Coast.
Photogaph by Roderick Bale

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SUMMARY
Sections from five timbers from the Unknown Lowestoft Wreck, located in the North Sea off the Suffolk coast, were retrieved by Wessex Archaeology (ULW 1091), with a view to obtaining independent dating evidence by dendrochronology and so assisting in the process of characterisation, identification, and assessment for designation. The wreck is thought to be a late nineteenth- or early twentieth-century wooden merchant sailing ship of at least 300 tons. The ship was probably engaged in the home or Northern European/Atlantic trades, although no evidence of cargo has been found.

The timber sections consist of one ash (*Fraxinus* spp), two (*Pinus* spp), and two of larch or spruce (*Larix/Picea* spp). Four of the five timbers contained sufficient rings to warrant attempted tree-ring dating. All failed to produce a date when compared to British, European, and American reference chronologies.

CONTRIBUTORS
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ARCHIVE LOCATION
Historic England Archive
The Engine House
Firefly Avenue
Swindon SN2 2EH

HISTORIC ENVIRONMENT RECORD OFFICE
Suffolk Historic Environment Record
Suffolk County Council Archaeological Service
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DATE OF INVESTIGATION
2015–17

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INTRODUCTION

This document is a technical archive report on the dendrochronological analysis of five timber sections from the Unknown Lowestoft Wreck (ULW 1091, timbers 6001–6005), located off the Suffolk coast (Fig 1).

Alison James (then a Historic England Marine Archaeologist) requested tree-ring dating in an attempt to obtain independent evidence as to the date and provenance of the timbers. It was hoped that this would assist in characterising the wreck, thus potentially aiding identification and informing the designation assessment.

METHODOLOGY

The sections retrieved from five timbers by Wessex Archaeology were assessed at the Lampeter Dendrochronology Laboratory and subsequently cross-sectional samples were removed by handsaw for analysis.

Methods employed at the Lampeter Dendrochronology Laboratory in general follow those described in Historic England guidance (English Heritage 2004). As the samples were waterlogged the ring sequences were revealed by the use of razor blades. The complete sequence of growth rings in each sample was measured to an accuracy of 0.01mm using a micro-computer based travelling stage (Tyers 2004). Cross-correlation algorithms (Baillie and Pilcher 1973; Munro 1984) are employed to search for positions where the ring sequences are highly correlated against each other and also against relevant reference chronologies from, in this instance, Britain, elsewhere in Europe, and America.

Successful dating is dependent on trees over large geographical areas showing a similar relative pattern of wide and narrow annual rings as a result of climatic influences during the growing season. Of course, tree growth is not only affected by climate, and individual tree growth and trees in one cohort or area can be affected by a whole host of other environmental variables. For example, a tree growing on a flat area close to a stream with abundant water is less likely to exhibit a narrow ring in a dry year than a tree on a steep slope with thin soils, which is likely to exhibit a more sensitive ring-width series. Competition, age trends, injury, and human/animal interference (such as pollarding or foliage defoliation by insects) can result in ring-width patterns that are dominated by non-climatic influences and hence, hamper successful analysis. In order to reduce the effects of the background non-climatic 'noise' in individual tree/timber data, multiple radii may be measured and then combined into a single tree/timber series. This 'noise' is further reduced when these individual tree/timber series can be cross-matched within the site or phase to form a well-replicated site master chronology, the production of which enhances the chances of successful dating. The likelihood of a sample or site master chronology being dated is also dependent on the availability of well-replicated reference chronologies from the relevant time period and geographical source.

The *t*-values reported below are derived from the original CROS algorithm (Baillie and Pilcher 1973). A *t*-value of 3.5 or over is usually indicative of a good match, although this is with the proviso that high *t*-values at the same relative or absolute position must be obtained from a range of independent sequences, and that satisfactory visual matching supports these positions. A *t*-value of over 10 between individual samples is potentially indicative of the timbers represented originating from the same parent tree, although *t*-values of far less than 10 are often observed from measuring different radii across a single oak tree cross-section, thus this is only a guide to potential same-tree derivation. Correlated positions are checked visually using computerised ring-width plots.

Species identification was undertaken on the sampled timbers by Roderick Bale. Transverse, radial, and tangential thin sections were obtained using a razor blade, and species identified according to anatomy using the criteria identified by Schweingruber (1978).

RESULTS AND DISCUSSION

Details of the timbers sampled are provided in Table 1. Photographs of each timber and sample are provided in Figures 2–6.

ULW 1091/6001 proved to be *Fraxinus* spp and contained 88 rings. ULW 1091/6002 and ULW 1091/6003 are *Pinus* spp and contained sufficient rings to warrant analysis. Due to a crack in ULW 6002 it was necessary to measure an inner and outer radius separately, and then combine the two ring-width series at the offset suggested by cross matching (Table 2). Two radii from two separate pieces of ULW 1091/6003 were measured (Fig 4), and combined at the offset indicated by the cross-matching to make a single mean ring-width series (ULW 6003_2R; Table 3) for this timber. ULW 6004 and ULW 6005 are *Larix/Picea* spp. ULW 6004 contained insufficient rings to warrant analysis.

No cross-matching was obtained between any of the ring-width series from the four measured samples. Each individual ring-width series was thus compared with a wide range of reference chronologies from Britain, elsewhere in Europe, and America but without success.

The inability to successfully date these sequences is not surprising due to the limited number of samples available, which include timbers of three different species, potentially associated with different phases of construction or repair. It serves to emphasise the importance of obtaining samples from multiple timbers for each potential phase of construction/repair, so that the ring-width series can be subsequently cross-matched to produce a long well-replicated site chronology. Such chronologies have a significantly higher likelihood of being successfully dated.

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TABLES

Table 1: Details of the five cross-sectional samples retrieved from the Unknown Lowestoft Wreck (ULW 1091). ARW= average ring width

Timber	Location	Conversion	Dimensions	Species	Rings	Sapwood/ bark	ARW (mm)	Date range
ULW 1091/6001	Timber of almost square cross section with remains of brass fitting with rivets	radial	180x120	*Fraxinus* spp	88	-	1.32	1-86
ULW 1091/6002	probable futtock	radial	170x100	*Pinus* spp	116	-	0.87	1-116
ULW 1091/6002i	*ditto* (inner)	radial	170x100	*Pinus* spp	75	-	0.63	1-75
ULW 1091/6002o	*ditto* (outer)	radial	170x100	*Pinus* spp	71	-	1.13	46-116
ULW 1091/6003	probable ceiling plank	radial	180x70	*Pinus* spp	71	-	1.38	1-71
ULW 1091/6003A	*ditto*	radial	170x80	*Pinus* spp	71	-	1.38	1-71
ULW 1091/6003B	*ditto*	radial	110x80	*Pinus* spp	69	-	1.45	1-69
ULW 1091/6004	probable futtock, fragmented during recovery	radial	70x50	*Larix/Picea* spp	10	-	-	-
ULW 1091/6005	sample cut from 5012 outer hull plank	radial	270x110	*Larix/Picea* spp	92	-	1.93	1-92

Table 2: t-*value matrix between ULW 6002 inner and outer radii.*

Filename		ULW 6002i	ULW 6002o
	Relative year	1-75	46-116
ULW 6002i	1-75	*	6.46
ULW 6002o	46-116	*	*

Table 3: t-*value matrix between ULW 6003_1 and 6003_2*

Filename		ULW 6003_A	ULW 6003_B
	Relative year	1-71	1-69
ULW 6003_A	1-71	*	7.26
ULW 6003_B	1-69	*	*

FIGURES

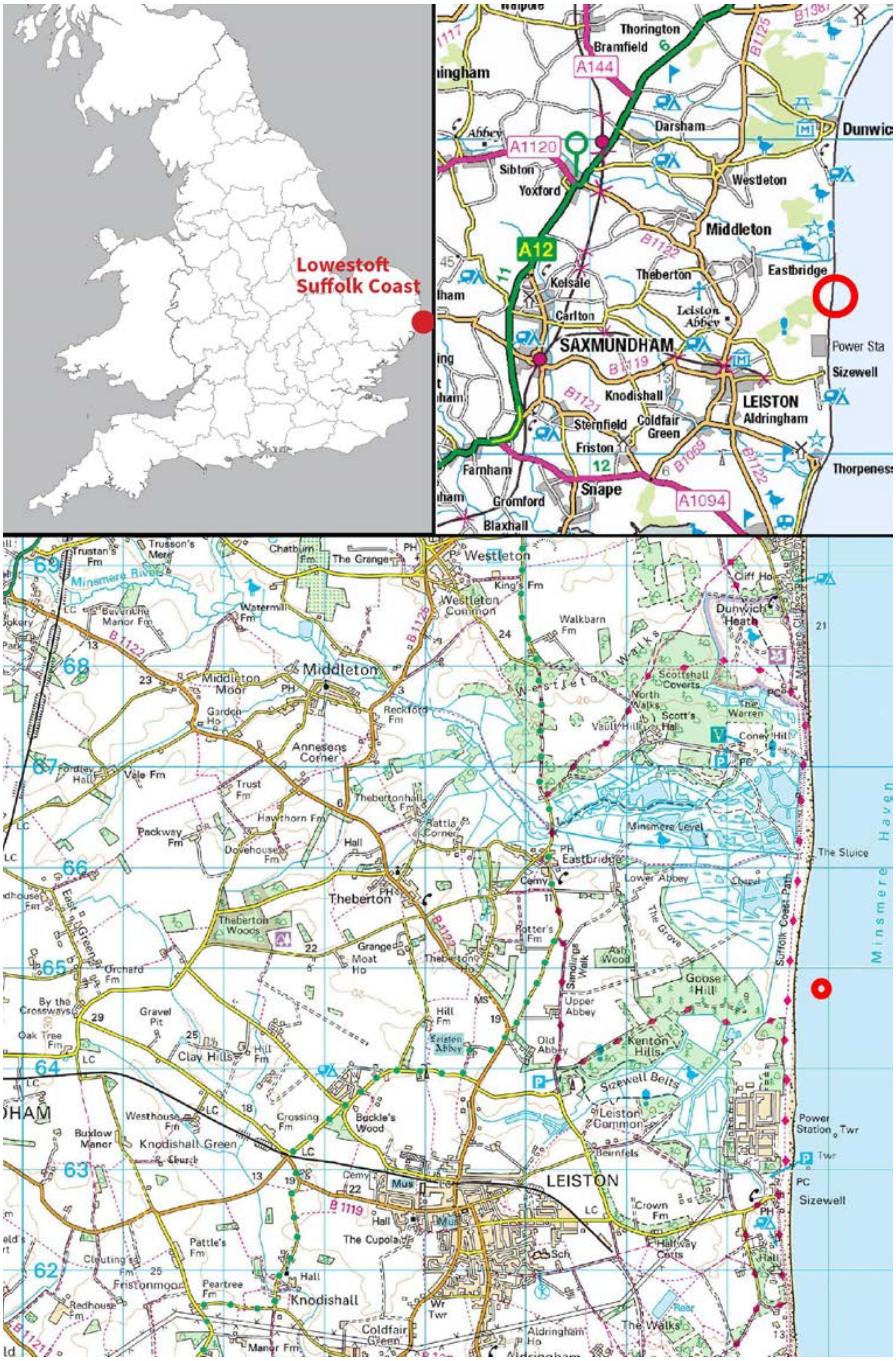


Figure 1: Maps to show the location of Lowestoft on the Suffolk Coast marked in red; top right scale 1:160,000; bottom scale 1:50,000 © Crown Copyright and database right 2021. All rights reserved. Ordnance Survey Licence number 100024900. © British Crown and SeaZone Solutions Ltd 2021. All rights reserved. Licence number 102006.006. © Historic England.

Figure 2: Unknown Lowestoft Wreck, timber 6001. Sample as retrieved (upper), cross-section (lower; photographs Roderick Bale)

Figure 3: Unknown Lowestoft Wreck, timber 6002. Sample as retrieved (upper), cross-section (lower; photographs Roderick Bale)

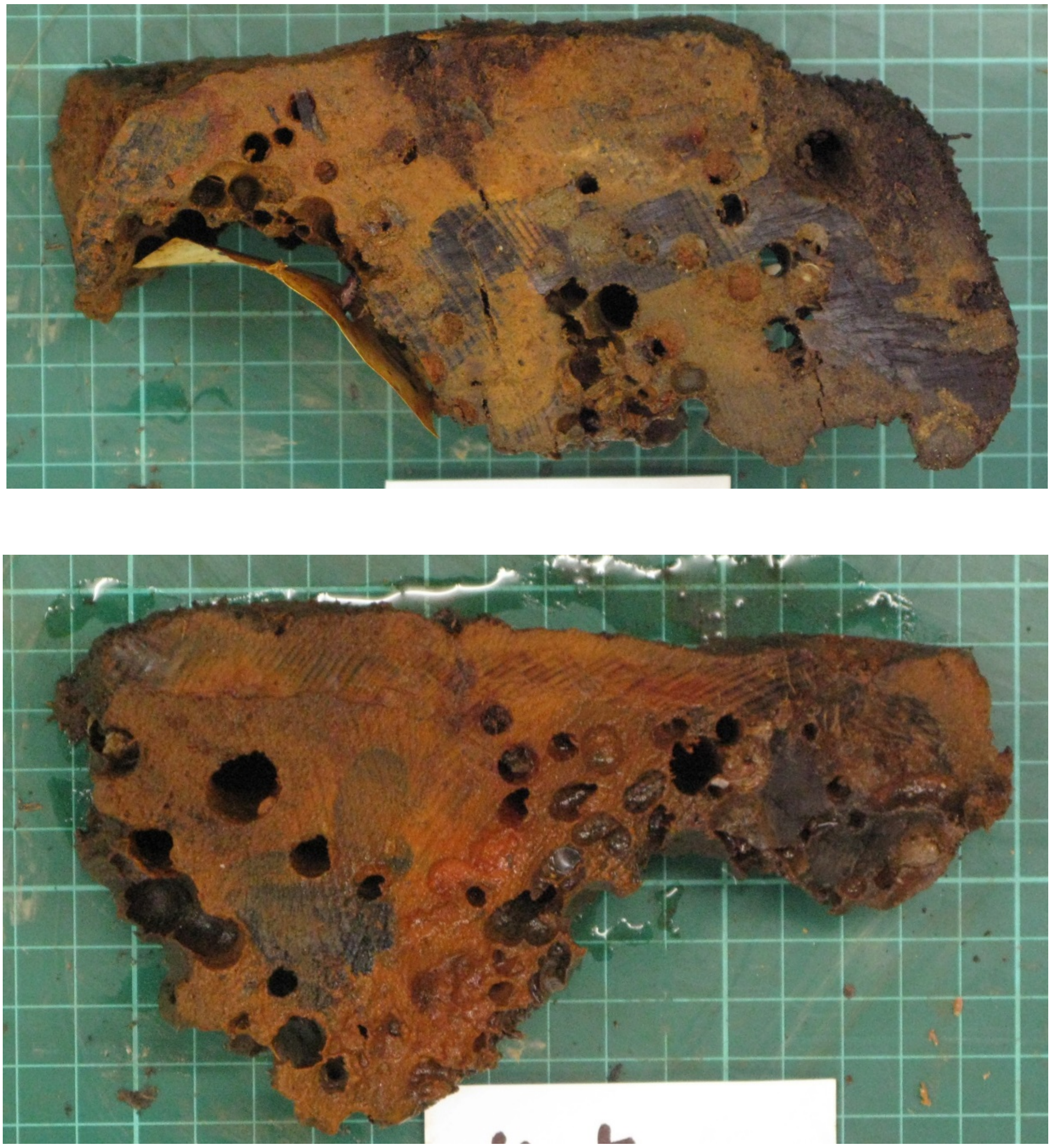


Figure 4: Sections from Unknown Lowestoft Wreck, timber 6003 A (upper) and B (lower; photographs Roderick Bale)

Figure 5: Unknown Lowestoft Wreck, timber 6005. Sample as retrieved (left), showing growth-rings (right; photographs Roderick Bale)

Figure 6: Unknown Lowestoft Wreck, timber 6005. Sample as retrieved (upper), cross-section (lower; photographs Roderick Bale)

APPENDIX

Ring width values (0.01mm) for the measured series

6001

213	149	152	209	100	156	257	203	151	266
250	202	158	139	155	153	155	140	110	91
93	117	118	102	78	114	120	100	104	135
158	128	107	101	114	116	83	97	85	111
120	83	108	97	108	117	113	140	70	77
97	107	97	107	77	87	111	77	120	96
108	99	115	155	150	155	126	139	162	170
192	137	175	157	145	146	119	123	102	138
192	154	144	153	125	122	129	147		

6002 inner

311	157	111	155	64	58	53	54	25	48
22	16	9	20	32	35	41	25	65	57
27	52	42	36	31	28	20	35	16	16
15	13	15	8	13	17	36	27	29	44
67	55	69	60	49	66	135	136	162	154
106	76	98	38	39	41	51	86	74	73
54	63	76	83	88	63	48	67	49	83
94	151	76	91	137					

6002 outer

60	97	95	120	136	105	64	99	57	53
52	64	88	74	91	62	95	125	130	122
62	66	82	72	88	96	102	75	81	144
173	143	159	256	171	128	185	121	112	63
108	86	175	211	68	92	120	154	185	197
212	175	131	175	100	135	147	55	46	45
72	82	113	133	157	149	111	122	74	88
141									

6003A

152	184	176	175	188	184	117	113	279	385
226	203	148	160	149	150	125	108	92	137
149	61	85	65	151	111	95	84	51	88
68	63	68	120	149	171	115	109	62	63
96	140	176	155	120	111	98	137	144	134
122	145	185	256	246	203	121	142	153	142
108	125	126	103	121	122	119	123	121	168
157									

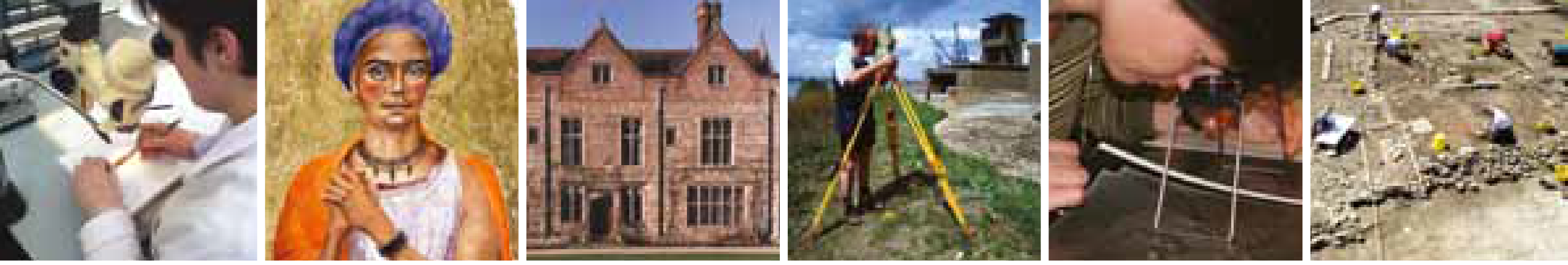
6003B

313	209	214	172	174	130	113	133	311	329
239	215	158	135	150	139	124	159	164	160
155	78	76	83	124	149	94	87	74	68
72	61	93	94	153	186	138	117	83	76
102	126	146	162	154	159	108	172	134	115
129	173	220	216	225	221	92	153	132	155

167	137	100	122	116	104	112	151	116	

6005

317	333	393	364	263	357	270	197	154	168
160	192	277	210	208	172	150	187	223	319
349	333	233	256	269	266	290	272	266	266
292	283	319	396	360	271	263	216	234	227
269	206	165	266	232	261	189	148	172	102
136	163	174	150	154	128	99	83	134	221
218	161	108	96	134	121	121	147	177	95
86	124	153	177	147	135	101	100	102	104
94	97	96	97	159	106	83	76	81	92
80	97								



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