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Dendrochronological sampling of medieval fishweirs on the Fergus Estuary, Co. Clare, Ireland
Executive Summary

At the spring tides, during the summer of 2011, a team from the School of Archaeology, University College Dublin, made several research trips to a complex of medieval fishweirs at a location close to Boarland Rock on the Fergus estuary, Co. Clare, Ireland (fig. 1). The purpose of these visits was to obtain samples for part of a Marie Curie funded IEF fellowship. In this phase of the project two case studies from the fishweir complex are underway using dendrochronological techniques to refine approaches to understanding their construction and use history along the River Fergus.
Background

Innovative survey of the coastal zone of the Shannon Estuary by the Discovery Programme in the years 1992-97 demonstrated that extensive archaeological remains were to be found in this zone (O’Sullivan 2001). Sites accessible by foot were discovered in the Fergus Estuary and recorded, ranging in date from the Neolithic to post-Medieval period. The areas around the estuary’s many islands had not been examined at this time, as these were only accessible by boat. In 2008, the Heritage Council funded further survey in the Fergus Estuary, carried out by Aidan O’Sullivan and Mary Dillon (O’Sullivan & Dillon 2009), of the intertidal zone around Boarland Rock (Heritage Council archaeology grant 16355). Here, extensive remains of a total of 14 fishweirs were recorded, and found by C14 analysis to date to the mid 13th to the early 15th centuries. Further survey in 2009 (Heritage Council grant 17499) of the Fergus Estuary islands has recorded a wealth of additional archaeological sites (O’Sullivan & Dillon 2009). The sites at Boarland Rock were again the focus for study in 2010 (Heritage Council Research Grant R00412) (O’Sullivan et al 2010). In that year’s recording, a terrestrial laser scanning technique was employed, to record the complex of fishweirs, Boarland Rock 1 and 2. From June 2011 to June 2013 structures around the Fergus Estuary Islands are the main focus of the project “Chronology, Culture and Archaeology” generously funded by the Marie Curie Intra-European Fellowship (IEF), based at the School of Archaeology, University College Dublin. The traps Boarland 1 and 2 (fig. 2) have been selected for analysis, and this report describes the sampling that was undertaken during summer 2011, and the techniques of analysis that will be employed.

**Fig 2.** Boarland Rock 1 & 2, medieval fishweirs
Case Study: Boarland Rock 1 & 2

Two of the larger fishweirs in the Boarland Rock complex were chosen as case studies for this project (BR1 & BR2 (fig. 3)). BR1 seems to be the more complex of the two traps, with at least four parallel post rows, and these probably derive from different construction phases. BR2 is positioned just over 12 metres east of BR1, and seems to incorporate fewer parallel post rows, suggesting a less complex structure, or perhaps, a shorter period of use. The western arm of BR2 intersects the eastern arm of BR1 (figs. 2 and 3). C14 datings of the two indicate that BR1 is from cal. AD 1419-1447 (Grn-29005 485±20BP) while BR2 is earlier, cal. AD 1296-1402 (UBA-10053 612±29BP). It is possible that the tree-ring analysis might allow a more precise determination of the chronological relationship between the two to emerge.

All of the weirs in the Boarland Rock complex present a challenge from a dendrochronological perspective; not only are they constructed from a variety of species but they also represent very short ring sequences (see below for further discussion).

Fig 3. Plan of the sampled posts from the two fishweirs at Boarland Rock (BR1 and BR2).
Logistics

As the sites lie out at low tide, across a vast expanse of estuarine mudflats, which are exceedingly treacherous, they are not accessible by foot/wheeled transport. The most efficient way to approach the site is by boat, and for this we rely heavily on local knowledge of these waters. Particularly at low tide, rocks at various locations along the river channel present a real danger when travelling by boat.

The mudflats around the sites are stable, and it is possible to walk around the area for recording the remains, probably much in the same way that the builders of the structures operated, some 550 years ago (fig 4).

Fig 4. Boarland Rock 1, as the tide advances to cover the site again. The picture views the eastern arm of BR1, curving off into the distance. The almost submerged posts in the middle of the photo, running in a line from right to left intercepting BR1, is the western arm of the earlier BR2.

Tides

BR1 and BR2 are situated at low spring tide. Tides are influenced by the orbit of the moon, and spring tides are every two weeks, at new moon and full moon, when the moon and the sun are aligned. The tidal range at the spring and autumn equinox is largest, consequently there are only a
few days in the year that both traps are exposed and accessible for archaeological survey. BR1 is slightly higher than BR2, and is thus exposed more often, and for longer intervals, whereas BR2 is only visible for a couple of hours at the lowest spring tides in spring and autumn.

**Sampling technique**

As a result of the tidal time constraints sampling and recording needs to be undertaken speedily and efficiently. Preparation of equipment was thus done on land, before boating out to the site. To enable coordination of the sampling and precise survey of every individual post, labels were pre-numbered sequentially and the normally two-person team then each carried out their role – one sampling an upright and bagging the sample with its label, the other plotting the position of the post. On return to the laboratory the samples have been lightly washed, wrapped in cling film and re-bagged, ready for analysis.

**Sampling strategy**

The tree-ring and wood-use study of these two fishweirs represents a highly detailed level of study, a natural next step in these inter-tidal estuary studies. The Fergus Estuary study has been carried out on an “increasingly focussed scale of investigation” (O’Sullivan 2010, 14). A comprehensive sampling approach was therefore planned from the outset, not least because as the river meander moves gradually westwards these delicate structures are slowly being eroded away.

**Survey Strategy and GIS integration**

Using state-of-the-art GPS surveying technology\(^1\), the centre of each post sampled is recorded, so that when the results of the species identification, dimensions and the tree-ring studies of each post is completed, the results can be mapped and analysed. All data from the project is being coordinated in a Geographical Information System\(^2\), this will enable analysis of potential constructional patterns across the sample set either from the perspective of woodland use (species and age distributions) and, if successful, from a chronological perspective.

The current survey augments previous surveys that included experimentation with the use of a 3D scanner on BR1 and BR2 (see background section above).

**Dealing with short ring sequences**

The tree-ring analysis of the material from this site forms the core of the project CCA, and this material presents us with the greatest challenge. Dendrochronology is conventionally carried out on long-lived wood, usually oak and pine in Northern Europe (e.g. Baillie 1995, Daly 2007, Hollstein 1980, Thun 2005, Wrobel at al 1996), while other species are analysed further south (e.g. cedar in the Mediterranean region (Kuniholm et al 2007)). While samples with greater than 100 tree-rings are ideal for dendrochronological dating, short-lived wood has been dated in some instances, particularly

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\(^1\) Trimble 5800 in conjunction with VRS Now mobile correction. This allows for precision of 1cm in XY and 2cm in Z. The mobile correction enables the Rover to be used without the need for a local fixed base station to be set up.

\(^2\) Currently ESRI ArcGIS
though when shorter-lived structural elements are found together with longer-lived timbers (e.g. Crone 1988 and 2000). A history of tree-ring studies of short series will be discussed in detail in a forthcoming report.

![Fig 5](image_url)

Fig 5. This photograph shows the section of one of the posts, during sampling.

The posts are preserved to bark edge. This means that with successful cross-matching of the tree-ring patterns the chronology of the structures and their numerous re-builds will be to annual precision.

During sampling we observed that there was indeed variation in the material. There was variation in the age of the posts, some with as few as c. 10 rings, some with over 20 (fig. 5). Variation in colour also indicated that we had several different wood species, sometimes following distinct lines, and this alone could be indicative of different phases. From a very cursory look at the wood we can see that we are to a large part dealing with diffuse porous species like alder, birch and hazel, but there are also posts of ash or elm. As sampling progressed it became clear that these two structures would yield extensive details of the building and usage of these fishweirs.

The main component of this project is to investigate whether tree-ring studies of these short-lived trees will facilitate the identification of phases in the structure. The wood used to build the fishweirs presents us with difficult material, in that the short-lived trees will challenge the limits of short-ring matching. While matching material from single phases should be achieved, we cannot be sure that
inter-phase matching will be possible. If several years have elapsed between phases, the short series will quite simply not have any actual overlap, and we will have a series of ‘floating’ phases.

However, as the position of every post is recorded, it is possible from the layout of the more-or-less parallel post rows to identify, to a certain extent, which posts are from which distinct phase. As measurement of the samples progresses and cross-matching results begin to appear, these will be continually examined in relation to their position in the construction, in GIS, to monitor the emerging analysis results.

Other proposed methods

With the availability of equipment at UCD for measuring the chemical content of geological or sediment cores (the Itrax core scanner (Turner & Monteys 2009)) experiments will be carried out to examine whether elements locked in the wood from the fishweirs can be detected, whether these vary during the tree’s life, and whether these can be used for cross-matching – so-called dendrochemistry (Pearson et al 2009). In this experiment, through cooperation with Dr. Jonathan Turner, UCD School of Geography, Planning & Environmental Policy, a small selection (c. 10) of the 553 wood samples will be chosen. We will examine whether there are incremental variations in the wood chemistry, and whether these variations occur in several samples, thus allowing inter-sample matching. Initially, only one wood species will be experimented with, and if we achieve a successful outcome, we will experiment with other species, testing especially for inter-species correlation. As the dominant species used for the upright posts in the structures is alder (Dillon & O’Sullivan 2008), it is planned to begin with this. As alder is a diffuse-porous species, it is hoped that its anatomy will cause fewer problems than the ring-porous types. Problems that will be tackled include questions of contamination of the wood, that is, which of the chemical components that are detected represent contamination after the tree was felled (due to its submersion for 550 years or so in the estuary waters or to contamination during sampling and subsequent washing and preparing) and which are derived from the wood at the time of its formation.

Also, through cooperation with Dr. Colin Kelleher of the National Botanic Gardens, experimentation with DNA analysis of the material is also envisaged. Again here, initially just one sample will be analysed, to see whether the wood DNA is still preserved in this waterlogged material. If this proves successful, new research strategies will be formulated concerning aspects of the history of Ireland’s woodland.

Conclusion

Increasingly detailed levels of analysis of the extraordinary remains on the Fergus Estuary inter-tidal zone will allow us to build on our knowledge of the history of the exploitation of the marine and terrestrial resources in this region of Ireland. At the same time, exploration and development of new methodologies will have implications not just for the study of these remains, but for the study of the many wetland archaeology sites not just within Ireland but also within a European context.
Literature


O'Sullivan, A., & Dillon, M., 2009. *Islands in Time The Maritime Cultural Landscapes of the Fergus Estuary’s Islands, Co. Clare*, UCD School of Archaeology


Chronology, Culture and Archaeology (CCA).

Funded through a Marie Curie Intra-European Fellowship (IEF) and based at the School of Archaeology, University College Dublin, the project is concerned with the precise dating of timber and wood from archaeological or historical contexts. As dating results emerge these are disseminated to project collaborators through this CCA report series. Full publication of the extensive material and methodological advancements will be prepared during the course of the project and submitted to peer review journals.