Dendrochronology of a historic wharf and pier at the Bryant-Barstow homesteads, Newcastle, Maine

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During the excavations of the Bryant-Barker Tavern and Hale homestead sites, logs were found buried along the bank of the Damariscotta River. The excavations were led by Tim Dinsmore, an Archeological Consultant for the Maine Historic Preservation Commission and the sites are located on the west bank of the upper Damariscotta River in Newcastle, Maine. The timbers were found in groups, mainly horizontal along with many rocks, suggesting that they were part of the base or cribbing used to support docks in an inter-tidal zone. There are only a few logs exposed, with more logs lying in the mud flats that are only partially exposed. The exposed logs supported two definable docks, one a large wharf (46 x 58 feet) and the second a long and narrow pier (15 x 146 feet); there is a 16-17 foot wide opening between these two [parallel?] features. These structures could have been built as early as 1765 by George Barstow and Nathaniel Bryant, two shipwrights that had settled along the river and commenced shipbuilding at that time. To determine whether the wharf and pier were indeed built in 1765 or at another time, whether or not they were constructed contemporaneously, and what species was used, Dinsmore requested a visit of dendrochronologist Peter I. Kuniholm to ask whether tree-ring dating could answer those questions. Kuniholm advised that Dinsmore collect a number of samples with sufficient ring counts and preserved bark or "waney edge" (only bark removed), if possible, and send them to me at the Cornell Tree- Ring Laboratory for tree-ring dating and species identification. Following his advice, the accessible timbers in the pier and wharf cribbing were carefully inspected. Four well-preserved logs were selected that contained over 60 rings, plus either bark or a possible waney edge. Two were from the wharf (samples A and B) and two from the pier (samples C and D). Cross-sections were sawn from the mid-section of each timber and the four samples were given to Kuniholm who brought them to the Cornell Tree-Ring Laboratory for analysis.

Methods

For each wet sample, the transverse surface was first roughly prepared with a steel razor blade to determine the best radii for ring measurement, then further prepped along the selected radii until the ring and cell structure were clearly visible. At this time the species of each sample was identified using both the binocular and slide microscopes with thin sections cut from the transverse, radial, and tangential surfaces, to determine at least the genus, and the species if possible. The ring-widths were measured under a binocular microscope using a moving table and

computer to measure and record the ring-width sequences. Metadata was recorded for each sample describing the nature of each sample – e.g. shape and size, whether the samples contained bark or a waney edge or an unknown number of rings had been cut or worn off, and whether the growth of the outermost ring was complete or incomplete. The measured ring-width sequences were then compared to each other by matching patterns in the ring widths over time ("crossdating"), both visually and statistically, to determine their relative positions in time. The samples' sequences were then detrended, removing growth patterns in the ring widths that are unique to each tree, such as a decrease in ring-widths over time, to retain the variations in ring growth that are common to the four trees. The relatively-dated detrended sequences were averaged into the Barstow-Bryant chronology.

The chronology was then similarly crossdated with established and calendar-dated site and regional chronologies of the same species. Successful results placed the site chronology securely in time and determined the year that the outer rings in each samples grew which is when the trees were felled for construction.

Results and Conclusions

Figure XX. Transverse surface showing the abrupt boundaries between early and latewood cells, and the absence of resin ducts.

The four samples from this site are all eastern hemlock (*Tsuga canadensis* L., Figure XX), the only hemlock species found in northeastern North America. This species was suggested by Dinsmore's observation of the deep burgundy red color of the bark, a diagnostic attribute of that species. It is a common species in Maine, with its growth limited only at the higher elevations in the Appalachian Mountain range.

The sample descriptions are listed in Table 1. Figure XX2 shows the growth patterns of the four samples and how they are relatively dated in Table 1. The growth patterns are very similar and crossdate securely, both visually and statistically. The samples all contain an incomplete outer ring, and end in the same year, indicating that the trees were felled at the same time during the growing season. Since there was no drying time necessary for logs used in this construction, the wharf and dock were built later in that same year.

Table 1. The Bryant-Barstow timbers are all complete logs. Their diameters, average ring widths, relative dates of the sequences, and final dates are listed below.

Samples	Measured rings at relative dates			Diameter (feet)	Avg ring width (inches)	Final dates, including the unmeasured rings		
	Begin	End	Number of rings			All rings*	Begin	End
Wharf A	1002	1077	76	10.5"	0.068"	p+ 76+ 1W	1721p	1798+W
Wharf B	1012	1073	63	12"	0.083"	p+ 63+ 5v	1731p	1798++v
Pier C	1004	1077	74	12"	0.072"	p+ 74+ 1W	1723p	1798+W
Pier D	1000	1077	78	13.5"	0.087"	p+ 78+ 1B	1719p	1798+B

* In this column, the “p” = pith (center of tree); “+1” = one partial outer ring;"+5" = 5 unmeasured rings beyond the outer measured ring; "v" = close to outer ring of tree; "W" = waney edge; and "B" = bark present.

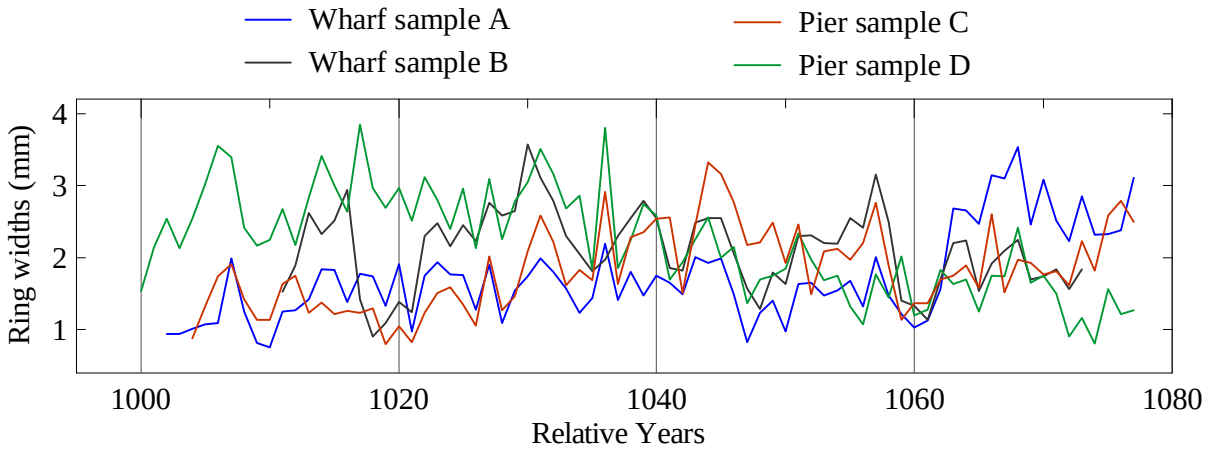

Figure 2. The ring-widths and relative placement of the four ring-width sequences. Sample B was the most degraded sample, and an additional, unmeasured, five rings were found only in one small part of the sample’s circumference.

The four tree-ring sequences were then detrended and combined into the Bryant-Barstow Hemlock Chronology. The 78-year chronology was securely dated to 1720 - 1797 (Figure 4) by crossdating it with our many historic site and regional hemlock chronologies from the New England coast across New England to upstate New York, and into southeastern Canada, and with forest chronologies from the same area built by ER Cook. The outer incomplete rings (not measured) on each sample date to 1798, indicating that the trees were all felled in the late spring to early summer of that year, and the wharf and pier were most likely built in the following months, in summer to fall 1798. Thus the two structures were not constructed at the start of the shipbuilding business, but built for the same trade about 30 years later.

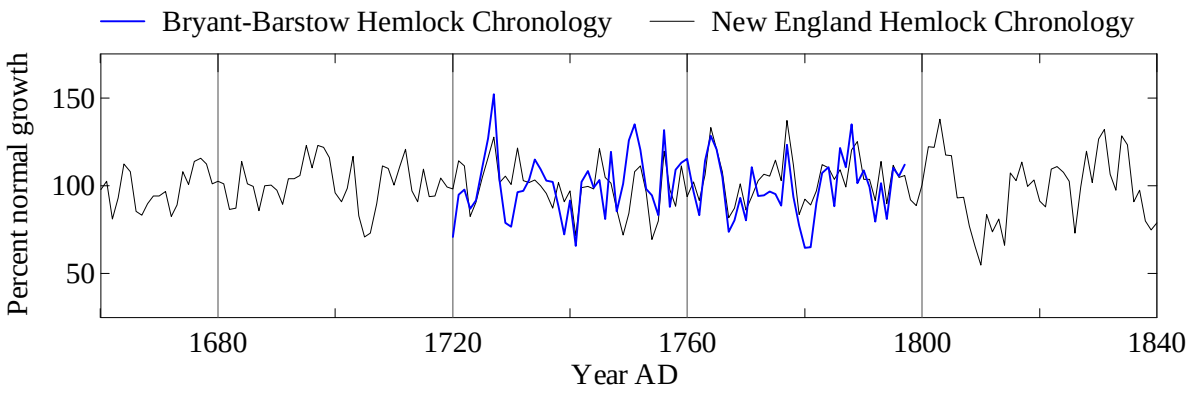

Figure 4. The placement of the Bryant-Barstow Hemlock Chronology on the New England Hemlock Chronology is shown here. Both are "detrended," as indicated by the Y-axis, to remove the normal growth patterns in ring-widths due to the life-span of the trees. The correlation coefficient between the two chronologies is 0.67; their t-score is 7.76, and the percentage of years that both sets either decrease or increase is 74%. All values are significant at the 0.01% probability level.

The source of the timbers is indicated by the striking similarity of the Bryant-Barstow Chronology to hemlock chronologies from three historic sites along the eastern seaboard – the Winkelman House in Gloucester, Massachusetts (1612-1834); the Ellis Wharf in Boston, Massachusetts (two phases, 1552-1820 and 1658-1821; wood from two sources); and the Tate House in Portland, Maine (1577-1753) – and from two forests, one straight north of the Damariscotta, in Matawaumkeag, Maine (AD 1697-1981; ER Cook), and one between Quebec City and the US-Canadian border (1526-1982; ER Cook). The Bryant- Barstow Chronology is very similar to all these chronologies, especially the Winkelman House and the Ellis Wharf chronologies, and to the combined regional chronology, indicating that the trees used for all these buildings and structures came from somewhere in interior northeastern New England (eastern Massachusetts to southeastern Quebec) where climate patterns are similarly influenced by the Atlantic Ocean, but not from coastal sites where more growth extremes are common, or from farther west . Figure 4 shows the Bryant- Barstow chronology in this position, AD1720-1797 with the regional northeastern New England Hemlock Chronology, and the Bryant-Barstow Hemlock Chronology will add another site's data set to the regional chronology.