[] Dendrochronology Program Library Run BEAL Program COF 13:55 Thu 24 May 2018 Page 1

[]

[] P R O G R A M C O F E C H A Version 6.06P 30461

------------------------------------------------------------------------------------------------------------------------------------

QUALITY CONTROL AND DATING CHECK OF TREE-RING MEASUREMENTS

Title of run: LEMP5\_BEAL\_Corr3-50

File of DATED series: LEMP5\_BEAL\_Corr3

CONTENTS:

Part 1: Title page, options selected, summary, absent rings by series

Part 2: Histogram of time spans

Part 3: Master series with sample depth and absent rings by year

Part 4: Bar plot of Master Dating Series

Part 5: Correlation by segment of each series with Master

Part 6: Potential problems: low correlation, divergent year-to-year changes, absent rings, outliers

Part 7: Descriptive statistics

RUN CONTROL OPTIONS SELECTED VALUE

1 Cubic smoothing spline 50% wavelength cutoff for filtering

32 years

2 Segments examined are 50 years lagged successively by 25 years

3 Autoregressive model applied A Residuals are used in master dating series and testing

4 Series transformed to logarithms Y Each series log-transformed for master dating series and testing

5 CORRELATION is Pearson (parametric, quantitative)

Critical correlation, 99% confidence level .3281

6 Master dating series saved N

7 Ring measurements listed Y

8 Parts printed 1234567

9 Absent rings are omitted from master series and segment correlations (Y)

Time span of Master dating series is 1740 to 2015 276 years

Continuous time span is 1740 to 2015 276 years

Portion with two or more series is 1740 to 2015 276 years

>> 451B 1833 absent in 1 of 12 series, but is not usually narrow: master index is -.116

>> 453B 1944 absent in 1 of 27 series, but is not usually narrow: master index is .231

>> 453B 1953 absent in 3 of 27 series, but is not usually narrow: master index is -.226

>> 453B 1955 absent in 1 of 27 series, but is not usually narrow: master index is .066

>> 455A 1998 absent in 1 of 26 series, but is not usually narrow: master index is -.265

>> 455B 1950 absent in 1 of 27 series, but is not usually narrow: master index is .245

>> 1009A 1993 absent in 1 of 26 series, but is not usually narrow: master index is .161

>> 1016A 1953 absent in 3 of 27 series, but is not usually narrow: master index is -.226

>> 1016B 1952 absent in 1 of 27 series, but is not usually narrow: master index is 1.191

>> 1016B 1953 absent in 3 of 27 series, but is not usually narrow: master index is -.226

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

\*C\* Number of dated series 28 \*C\*

\*O\* Master series 1740 2015 276 yrs \*O\*

\*F\* Total rings in all series 4715 \*F\*

\*E\* Total dated rings checked 4715 \*E\*

\*C\* Series intercorrelation .534 \*C\*

\*H\* Average mean sensitivity .332 \*H\*

\*A\* Segments, possible problems 17 \*A\*

\*\*\* Mean length of series 168.4 \*\*\*

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

ABSENT RINGS listed by SERIES: (See Master Dating Series for absent rings listed by year)

451A 2 absent rings: 1968 2006

451B 3 absent rings: 1833 2000 2006

453A 1 absent rings: 1954

453B 5 absent rings: 1944 1945 1953 1954 1955

455A 3 absent rings: 1766 1998 2006

455B 4 absent rings: 1895 1949 1950 2001

457A 2 absent rings: 1985 1999

457B 1 absent rings: 1985

1009A 2 absent rings: 1993 2000

1009B 6 absent rings: 1999 2000 2001 2006 2012 2013

1016A 2 absent rings: 1953 1954

1016B 3 absent rings: 1952 1953 1954

34 absent rings .721%

PART 2: TIME PLOT OF TREE-RING SERIES: LEMP5\_BEAL\_Corr3-50 13:55 Thu 24 May 2018 Page 2

------------------------------------------------------------------------------------------------------------------------------------

1050 1100 1150 1200 1250 1300 1350 1400 1450 1500 1550 1600 1650 1700 1750 1800 1850 1900 1950 2000 2050 Ident Seq Time-span Yrs

: : : : : : : : : : : : : : : : : : : : : -------- --- ---- ---- ----

. . . . . . . . . . . . . . . .<===================> . 451A 1 1814 2015 202

. . . . . . . . . . . . . . . <====================> . 451B 2 1804 2015 212

. . . . . . . . . . . . . . . . . <==========> . 452A 3 1909 2015 107

. . . . . . . . . . . . . . . . . <============> . 452B 4 1880 2015 136

. . . . . . . . . . . . . . . .<===================> . 453A 5 1819 2015 197

. . . . . . . . . . . . . . . .<===================> . 453B 6 1814 2015 202

. . . . . . . . . . . . . . . .<===================> . 454A 7 1810 2015 206

. . . . . . . . . . . . . . . <=====================> . 454B 8 1793 2015 223

. . . . . . . . . . . . . . <==========================> . 455A 9 1740 2015 276

. . . . . . . . . . . . . . <==========================> . 455B 10 1740 2015 276

. . . . . . . . . . . . . . . . <============> . . 456B 11 1856 1986 131

. . . . . . . . . . . . . . . . <=======> . . . 456A2 12 1856 1933 78

. . . . . . . . . . . . . . . <====================> . 457A 13 1801 2015 215

. . . . . . . . . . . . . . . <=====================> . 457B 14 1799 2015 217

. . . . . . . . . . . . . . . . . <============> . 459A 15 1889 2015 127

. . . . . . . . . . . . . . . . . <==========> . 459B 16 1903 2015 113

. . . . . . . . . . . . . . . .<===================> . 1009A 17 1813 2015 203

. . . . . . . . . . . . . . . . <=================> . 1009B 18 1833 2015 183

. . . . . . . . . . . . . . . . . .<=========> . 1013A 19 1916 2015 100

. . . . . . . . . . . . . . . . . .<=========> . 1013B 20 1916 2015 100

. . . . . . . . . . . . . . . . <===============> . 1016A 21 1858 2015 158

. . . . . . . . . . . . . . . . <===============> . 1016B 22 1851 2015 165

. . . . . . . . . . . . . . . . .<==============> . 1286A 23 1866 2015 150

. . . . . . . . . . . . . . . . .<==============> . 1286B 24 1866 2015 150

. . . . . . . . . . . . . . . . <================> . 1292A 25 1847 2015 169

. . . . . . . . . . . . . . . . <================> . 1292B 26 1847 2015 169

. . . . . . . . . . . . . . . . . <============> . 1293A 27 1888 2015 128

. . . . . . . . . . . . . . . . . <===========> . 1293B 28 1894 2015 122

: : : : : : : : : : : : : : : : : : : : :

1050 1100 1150 1200 1250 1300 1350 1400 1450 1500 1550 1600 1650 1700 1750 1800 1850 1900 1950 2000 2050

1750 .643 2 1800 .397 4 1850 .910 14 1900 .571 24 1950 .245 27 1<<

1751 1.216 2 1801 1.155 5 1851 1.094 15 1901 -.325 24 1951 .176 27

1752 .305 2 1802 -.660 5 1852 -.893 15 1902 -.298 24 1952 1.191 27 1<<

1753 .959 2 1803 .380 5 1853 -.508 15 1903 .221 25 1953 -.226 27 3<<

1754 1.301 2 1804 1.204 6 1854 -.485 15 1904 .172 25 1954 -.831 27 4

1755 1.637 2 1805 -.668 6 1855 -.668 15 1905 -1.263 25 1955 .066 27 1<<

1756 1.415 2 1806 -1.241 6 1856 .702 17 1906 .631 25 1956 -.109 27

1757 .803 2 1807 -.547 6 1857 1.222 17 1907 .784 25 1957 .302 27

1758 .917 2 1808 -.880 6 1858 -.644 18 1908 .911 25 1958 .690 27

1759 1.201 2 1809 -1.529 6 1859 .167 18 1909 .528 26 1959 -.220 27

1760 1.027 2 1810 -1.290 7 1860 .196 18 1910 -.212 26 1960 .923 27

1761 -.207 2 1811 .093 7 1861 .448 18 1911 .365 26 1961 .891 27

1762 -1.481 2 1812 .913 7 1862 1.089 18 1912 .906 26 1962 -.609 27

1763 -.705 2 1813 .905 8 1863 1.624 18 1913 -.374 26 1963 -.922 27

1764 .393 2 1814 1.837 10 1864 .583 18 1914 -.719 26 1964 .558 27

1765 -.736 2 1815 1.477 10 1865 .726 18 1915 -.437 26 1965 -.498 27

1766 -3.919 2 1 1816 .387 10 1866 -.687 20 1916 .826 28 1966 -1.510 27

1767 -.526 2 1817 -2.222 10 1867 -.304 20 1917 .817 28 1967 -.622 27

1768 .648 2 1818 -.501 10 1868 -.900 20 1918 -2.424 28 1968 -.935 27 1

1769 1.747 2 1819 .641 11 1869 -.528 20 1919 -1.264 28 1969 .357 27

1770 -1.537 2 1820 -.178 11 1870 -.743 20 1920 .032 28 1970 .350 27

1771 -.632 2 1821 -.907 11 1871 -1.122 20 1921 .355 28 1971 -.889 27

1772 1.264 2 1822 .202 11 1872 -1.970 20 1922 .574 28 1972 .504 27

1773 1.892 2 1823 -.332 11 1873 -.477 20 1923 -.278 28 1973 .419 27

1774 1.937 2 1824 -2.031 11 1874 .754 20 1924 .000 28 1974 -.495 27

1775 .524 2 1825 -.456 11 1875 .045 20 1925 .078 28 1975 -.146 27

1776 -3.121 2 1826 .542 11 1876 -.516 20 1926 -.709 28 1976 .263 27

1777 -.449 2 1827 .753 11 1877 -.115 20 1927 .170 28 1977 1.609 27

1778 -.718 2 1828 2.173 11 1878 -.742 20 1928 .715 28 1978 .649 27

1779 -1.942 2 1829 2.030 11 1879 .201 20 1929 .229 28 1979 -.007 27

1780 .002 2 1830 -.311 11 1880 .001 21 1930 .201 28 1980 .901 27

1781 -.179 2 1831 -.236 11 1881 1.225 21 1931 .283 28 1981 1.218 27

1782 .085 2 1832 -.331 11 1882 .763 21 1932 1.055 28 1982 1.186 27

1783 -1.786 2 1833 -.116 12 1<< 1883 .780 21 1933 .559 28 1983 .095 27

1784 1.722 2 1834 .521 12 1884 -.538 21 1934 .049 27 1984 -2.485 27

1785 -.320 2 1835 -.227 12 1885 .311 21 1935 -.298 27 1985 -1.164 27 2

1786 .284 2 1836 -1.300 12 1886 -.232 21 1936 -.399 27 1986 -.189 27

1787 -1.157 2 1837 .432 12 1887 .786 21 1937 -1.703 27 1987 .105 26

1788 -1.655 2 1838 -.112 12 1888 .623 22 1938 -.333 27 1988 -.115 26

1789 -1.577 2 1839 -.943 12 1889 -.031 23 1939 1.172 27 1989 .014 26

1740 1.124 2 1790 -1.485 2 1840 -1.885 12 1890 .072 23 1940 .940 27 1990 -.265 26

1741 .465 2 1791 .723 2 1841 -.693 12 1891 -.437 23 1941 .124 27 1991 -.278 26

1742 .045 2 1792 .191 2 1842 -1.401 12 1892 .869 23 1942 -.130 27 1992 -.576 26

1743 -.887 2 1793 -.419 3 1843 .596 12 1893 .775 23 1943 -.086 27 1993 .161 26 1<<

1744 -4.018 2 1794 .572 3 1844 1.259 12 1894 .488 24 1944 .231 27 1<< 1994 .565 26

1745 .779 2 1795 1.691 3 1845 .881 12 1895 -2.930 24 1 1945 -.493 27 1 1995 -.036 26

1746 1.101 2 1796 1.659 3 1846 .808 12 1896 -1.421 24 1946 -.230 27 1996 .282 26

1747 -.437 2 1797 1.121 3 1847 .030 14 1897 -.364 24 1947 1.217 27 1997 1.165 26

1748 -1.425 2 1798 1.835 3 1848 .686 14 1898 .472 24 1948 -.626 27 1998 -.265 26 1<<

1749 -1.697 2 1799 .780 4 1849 -1.058 14 1899 -.386 24 1949 -1.047 27 1 1999 -1.253 26 2

2000 -1.444 26 3

2001 -1.051 26 2

2002 -.443 26

2003 -.214 26

2004 1.079 26

2005 1.260 26

2006 -1.502 26 4

2007 .519 26

2008 .929 26

2009 .958 26

2010 .241 26

2011 -.309 26

2012 -1.018 26 1

2013 -.484 26 1

2014 1.639 26

2015 .005 26

PART 5: CORRELATION OF SERIES BY SEGMENTS: LEMP5\_BEAL\_Corr3-50 13:55 Thu 24 May 2018 Page 5

------------------------------------------------------------------------------------------------------------------------------------

Correlations of 50-year dated segments, lagged 25 years

Flags: A = correlation under .3281 but highest as dated; B = correlation higher at other than dated position

Seq Series Time\_span 1725 1750 1775 1800 1825 1850 1875 1900 1925 1950 1975

1774 1799 1824 1849 1874 1899 1924 1949 1974 1999 2024

--- -------- --------- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ----

1 451A 1814 2015 .63 .63 .56 .50 .43 .41 .63 .59

2 451B 1804 2015 .56 .69 .80 .56 .45 .56 .46 .52

3 452A 1909 2015 .62 .53 .65 .70

4 452B 1880 2015 .47 .74 .65 .56 .68

5 453A 1819 2015 .68 .64 .77 .75 .47 .31A .47 .51

6 453B 1814 2015 .76 .62 .58 .58 .48 .44 .60 .49

7 454A 1810 2015 .66 .60 .60 .60 .52 .52 .59 .47

8 454B 1793 2015 .58 .56 .56 .50 .38 .39 .54 .49 .57

9 455A 1740 2015 .54 .60 .72 .73 .63 .69 .69 .50 .60 .60 .57

10 455B 1740 2015 .56 .61 .69 .59 .53 .53 .35 .49 .58 .58 .70

11 456B 1856 1986 .50 .67 .66 .41 .47

12 456A2 1856 1933 .38 .52 .49

13 457A 1801 2015 .66 .66 .70 .47 .26A .36 .44 .63

14 457B 1799 2015 .67 .69 .77 .70 .51 .52 .47 .48 .62

15 459A 1889 2015 .44 .53 .38B .39B .53

16 459B 1903 2015 .70 .57 .66 .58

17 1009A 1813 2015 .54 .44B .49 .42 .41 .48 .59 .59

18 1009B 1833 2015 .56 .46 .37B .37 .23B .30A .38

19 1013A 1916 2015 .37B .42 .57 .69

20 1013B 1916 2015 .49 .47 .33 .52

21 1016A 1858 2015 .62 .54 .43 .31B .31B .44

22 1016B 1851 2015 .41 .52 .37 .23B .23B .42

23 1286A 1866 2015 .37 .43 .37 .49 .61 .69

24 1286B 1866 2015 .27A .50 .45 .47 .57 .63

25 1292A 1847 2015 .64 .61 .70 .49 .41 .56 .56

26 1292B 1847 2015 .48 .45 .65 .66 .55 .46 .40

27 1293A 1888 2015 .36 .31A .58 .51 .61

28 1293B 1894 2015 .21B .23B .46 .64 .50

Av segment correlation .55 .61 .67 .64 .60 .55 .51 .47 .46 .51 .56

PART 6: POTENTIAL PROBLEMS: LEMP5\_BEAL\_Corr3-50 13:55 Thu 24 May 2018 Page 6

------------------------------------------------------------------------------------------------------------------------------------

For each series with potential problems the following diagnostics may appear:

[A] Correlations with master dating series of flagged 50-year segments of series filtered with 32-year spline,

at every point from ten years earlier (-10) to ten years later (+10) than dated

[B] Effect of those data values which most lower or raise correlation with master series

Symbol following year indicates value in series is greater (>) or lesser (<) than master series value

[C] Year-to-year changes very different from the mean change in other series

[D] Absent rings (zero values)

[E] Values which are statistical outliers from mean for the year

====================================================================================================================================

451A 1814 to 2015 202 years Series 1

[B] Entire series, effect on correlation ( .554) is:

Lower 2001< -.010 1879< -.008 1943< -.007 1894< -.007 1907< -.007 2000> -.007 Higher 2006 .029 1984 .024

[D] 2 Absent rings: Year Master N series Absent

1968 -.935 27 1

2006 -1.502 26 4

[E] Outliers 1 3.0 SD above or -4.5 SD below mean for year

1968 -4.9 SD

451A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1814 349 188 163 79 98 80

1820 67 38 51 30 25 13 38 40 38 29

1830 14 10 9 3 23 16 15 21 18 19

1840 6 20 22 36 61 100 120 92 113 78

1850 80 87 53 63 48 43 50 125 71 107

1860 157 129 118 178 171 153 103 99 58 77

1870 66 55 32 40 47 55 42 53 53 32

1880 83 123 132 132 79 96 107 170 238 177

1890 147 142 131 150 77 49 86 135 160 77

1900 126 117 104 169 106 69 80 48 45 43

1910 33 52 83 62 58 44 76 85 52 50

1920 49 61 80 72 92 82 56 66 71 77

1930 50 63 54 73 72 58 67 48 53 65

1940 41 17 30 11 20 9 18 22 12 12

1950 23 28 29 18 20 39 49 41 33 30

1960 20 21 18 15 42 25 13 10 0 19

1970 31 24 37 45 37 40 55 61 55 42

1980 48 38 43 31 4 18 15 25 24 13

1990 16 8 16 28 28 18 23 27 15 16

2000 19 4 11 8 13 17 0 6 17 13

2010 9 18 2 11 26 25

====================================================================================================================================

451B 1804 to 2015 212 years Series 2

[B] Entire series, effect on correlation ( .585) is:

Lower 1918> -.031 1806> -.023 1965> -.013 1820> -.008 1833< -.008 1975< -.007 Higher 1895 .037 2006 .023

[D] 3 Absent rings: Year Master N series Absent

1833 -.116 12 1 >> WARNING: Ring is not usually narrow

2000 -1.444 26 3

2006 -1.502 26 4

[E] Outliers 2 3.0 SD above or -4.5 SD below mean for year

1806 +3.8 SD; 1918 +3.9 SD

451B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1804 177 134 179 141 116 94

1810 99 114 125 90 117 107 76 37 67 117

1820 128 78 84 42 41 36 51 64 82 53

1830 23 22 19 0 37 28 4 24 11 35

1840 26 30 32 58 57 113 175 173 178 133

1850 167 180 118 129 134 177 232 363 250 361

1860 376 292 322 322 223 216 149 200 129 145

1870 150 126 90 130 160 164 171 225 188 196

1880 262 375 324 313 278 251 244 282 232 235

1890 204 176 210 233 165 95 117 153 185 125

1900 154 151 181 178 206 121 187 129 116 114

1910 91 118 127 118 92 97 143 152 135 92

1920 86 75 92 66 105 112 92 108 104 131

1930 123 127 168 179 158 164 144 115 157 179

1940 178 135 148 171 187 114 112 151 103 77

1950 121 97 138 91 76 100 92 83 92 74

1960 71 66 55 75 90 102 66 58 37 42

1970 74 69 58 80 47 31 54 69 65 61

1980 86 105 116 88 54 78 77 72 54 29

1990 24 14 8 33 34 21 22 32 15 9

2000 0 3 10 6 6 18 0 12 15 16

2010 13 12 4 4 20 18

====================================================================================================================================

452A 1909 to 2015 107 years Series 3

[B] Entire series, effect on correlation ( .652) is:

Lower 1953> -.019 2001> -.018 1913> -.014 1945> -.012 1958< -.011 1999> -.009 Higher 1918 .059 1984 .028

[E] Outliers 2 3.0 SD above or -4.5 SD below mean for year

1918 -4.6 SD; 1919 -4.5 SD

452A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1909 148

1910 143 125 138 146 125 117 133 119 43 45

1920 119 129 131 114 160 220 169 162 158 127

1930 116 101 130 108 81 76 96 74 70 126

1940 157 135 151 131 112 136 90 115 47 50

1950 133 118 117 130 89 73 67 128 103 80

1960 128 151 142 136 169 127 131 163 146 178

1970 261 254 265 380 293 437 460 590 443 296

1980 341 356 419 311 160 185 275 270 248 250

1990 197 207 179 173 222 153 171 222 149 178

2000 188 281 243 302 286 259 109 130 137 165

2010 136 86 86 140 259 147

====================================================================================================================================

452B 1880 to 2015 136 years Series 4

[B] Entire series, effect on correlation ( .586) is:

Lower 1895> -.036 1951< -.013 1894< -.012 1886> -.012 1882< -.009 1994< -.008 Higher 1918 .043 2006 .023

[C] Year-to-year changes diverging by over 4.0 std deviations:

1894 1895 4.4 SD

452B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1880 73 99 58 72 83 93 173 195 96 57

1890 58 56 76 65 27 48 37 66 81 120

1900 129 119 158 192 137 76 163 161 159 90

1910 69 80 92 75 84 77 132 109 38 32

1920 80 114 130 124 136 117 76 152 135 154

1930 155 147 183 126 110 86 92 57 93 164

1940 124 125 122 72 73 117 83 142 63 67

1950 125 54 81 77 32 62 42 85 126 55

1960 105 81 77 52 121 81 45 73 46 83

1970 141 68 138 116 114 133 174 243 189 162

1980 183 187 250 199 126 152 235 320 214 196

1990 149 142 116 95 92 113 115 132 109 68

2000 85 85 93 99 121 115 48 68 113 108

2010 65 50 42 69 112 65

====================================================================================================================================

453A 1819 to 2015 197 years Series 5

[A] Segment High -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 +0 +1 +2 +3 +4 +5 +6 +7 +8 +9 +10

--------- ---- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- ---

1925 1974 0 -.25 -.09 .15 -.02 .02 .06 -.02 .17 -.20 -.17 .31\* .12 -.21 .19 .03 -.12 .06 -.27 .08 -.08 -.03

[B] Entire series, effect on correlation ( .580) is:

Lower 1937> -.014 1952< -.014 1940< -.013 1931< -.010 2006> -.010 1913> -.009 Higher 1895 .046 1918 .016

1925 to 1974 segment:

Lower 1937> -.063 1952< -.057 1940< -.050 1931< -.036 1971> -.027 1949> -.018 Higher 1947 .050 1939 .047

[D] 1 Absent rings: Year Master N series Absent

1954 -.831 27 4

[E] Outliers 1 3.0 SD above or -4.5 SD below mean for year

1872 -4.9 SD

453A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1819 199

1820 141 144 126 90 56 115 187 216 184 150

1830 59 60 114 131 150 111 96 137 118 100

1840 103 101 103 122 151 162 151 172 196 148

1850 157 103 55 85 75 57 109 171 111 180

1860 121 137 118 137 116 124 85 99 69 68

1870 76 84 33 92 108 127 123 160 138 224

1880 222 324 223 229 194 237 212 198 163 170

1890 196 180 261 186 191 75 80 105 133 141

1900 184 176 203 154 193 118 160 161 179 183

1910 159 204 261 266 170 232 286 277 162 177

1920 234 201 223 199 150 136 140 130 161 130

1930 128 72 112 95 56 72 33 67 69 119

1940 31 27 12 18 57 7 37 60 22 25

1950 21 15 4 4 0 5 18 26 40 22

1960 38 38 26 31 26 28 26 36 19 50

1970 42 83 113 164 74 81 107 204 170 180

1980 181 207 238 233 124 112 176 178 153 128

1990 139 122 118 156 178 69 54 149 134 78

2000 76 94 56 50 100 113 104 185 218 280

2010 165 185 209 138 295 95

====================================================================================================================================

453B 1814 to 2015 202 years Series 6

[B] Entire series, effect on correlation ( .550) is:

Lower 1874< -.018 2015< -.014 2003< -.010 1910< -.009 1898< -.009 1949> -.009 Higher 1918 .021 1984 .019

[D] 5 Absent rings: Year Master N series Absent

1944 .231 27 1 >> WARNING: Ring is not usually narrow

1945 -.493 27 1

1953 -.226 27 3 >> WARNING: Ring is not usually narrow

1954 -.831 27 4

1955 .066 27 1 >> WARNING: Ring is not usually narrow

[E] Outliers 2 3.0 SD above or -4.5 SD below mean for year

1876 -5.2 SD; 1910 -5.3 SD

453B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1814 226 135 106 52 80 149

1820 104 122 127 109 91 83 129 132 215 168

1830 104 132 128 134 116 92 72 125 129 96

1840 66 74 81 130 128 152 207 197 185 110

1850 141 102 41 56 81 84 112 169 126 173

1860 128 154 193 233 195 228 139 120 105 125

1870 182 167 104 148 86 55 48 96 145 204

1880 190 256 218 235 185 273 238 271 259 194

1890 243 293 447 338 285 142 114 211 160 158

1900 227 306 236 211 224 189 197 208 214 161

1910 99 121 190 153 118 198 235 233 114 118

1920 212 149 203 195 204 152 113 139 207 159

1930 60 34 19 15 14 15 12 15 12 27

1940 13 7 8 15 0 0 29 46 6 10

1950 9 9 6 0 0 0 14 10 6 8

1960 23 23 9 15 28 13 11 17 9 27

1970 28 37 66 110 98 109 149 160 124 128

1980 174 191 128 126 78 81 115 130 92 98

1990 85 85 91 83 75 57 80 93 90 61

2000 56 42 50 34 60 65 58 59 89 94

2010 83 101 111 102 170 88

====================================================================================================================================

454A 1810 to 2015 206 years Series 7

[B] Entire series, effect on correlation ( .562) is:

Lower 1905< -.019 2007< -.012 1986< -.010 1909< -.007 1837< -.006 1913> -.005 Higher 1895 .027 1918 .021

[E] Outliers 1 3.0 SD above or -4.5 SD below mean for year

1905 -5.1 SD

454A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1810 123 195 265 209 203 203 179 90 90 120

1820 136 80 148 118 40 64 82 105 174 178

1830 103 77 88 98 114 71 63 62 71 59

1840 56 84 81 127 142 120 112 96 119 90

1850 159 313 229 201 247 188 345 268 173 327

1860 289 223 171 230 196 169 125 107 109 92

1870 117 98 52 52 125 85 64 78 45 68

1880 72 79 87 91 95 109 100 158 182 257

1890 322 277 330 238 293 116 159 165 172 140

1900 196 163 167 159 181 92 121 137 145 112

1910 111 134 160 156 114 113 163 170 101 154

1920 237 186 159 124 152 136 166 181 213 227

1930 276 210 221 196 112 97 74 34 64 118

1940 413 299 166 104 63 53 52 76 48 41

1950 51 52 61 67 47 86 79 105 110 61

1960 98 146 93 86 127 67 42 67 63 71

1970 95 92 144 234 217 317 279 417 337 221

1980 210 158 157 129 62 85 37 84 73 80

1990 62 54 50 107 79 43 45 76 50 36

2000 56 27 37 57 90 95 65 43 63 201

2010 206 212 150 183 247 127

====================================================================================================================================

454B 1793 to 2015 223 years Series 8

[B] Entire series, effect on correlation ( .517) is:

Lower 1902< -.030 1917< -.008 1977< -.007 1802< -.006 1805> -.006 1793< -.005 Higher 1830 .011 2006 .009

[C] Year-to-year changes diverging by over 4.0 std deviations:

1901 1902 -4.2 SD

[E] Outliers 2 3.0 SD above or -4.5 SD below mean for year

1842 -5.1 SD; 1902 -4.9 SD

454B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1793 209 245 295 319 279 290 224

1800 222 193 92 119 133 143 89 149 155 77

1810 104 181 242 205 229 221 150 54 68 145

1820 81 51 87 82 38 51 72 80 102 129

1830 57 84 108 107 87 88 62 67 69 34

1840 35 59 26 102 108 97 113 129 139 119

1850 223 298 201 215 167 119 145 136 80 77

1860 88 98 139 155 153 160 137 125 102 69

1870 58 49 48 45 73 59 78 58 66 75

1880 100 108 106 135 63 51 47 86 99 148

1890 184 125 99 104 95 56 67 130 146 119

1900 113 90 31 63 72 61 67 70 80 83

1910 81 89 128 85 47 45 60 44 33 68

1920 82 71 82 70 70 75 60 49 57 89

1930 119 165 226 190 105 61 42 35 28 42

1940 48 32 34 33 21 17 25 33 21 17

1950 17 24 51 37 25 26 19 22 23 12

1960 11 21 15 17 20 12 12 21 12 37

1970 32 30 24 25 13 9 14 18 30 27

1980 67 80 71 49 25 28 23 69 39 50

1990 55 44 45 42 56 46 43 37 21 19

2000 27 23 21 34 44 64 37 59 81 86

2010 57 49 27 42 64 46

====================================================================================================================================

455A 1740 to 2015 276 years Series 9

[B] Entire series, effect on correlation ( .611) is:

Lower 1747< -.013 1999> -.008 1763> -.008 1862< -.007 1864> -.006 1903< -.005 Higher 1895 .021 1766 .012

[D] 3 Absent rings: Year Master N series Absent

1766 -3.919 2 1

Present in series 10 455B time span 1740 to 2015

1998 -.265 26 1 >> WARNING: Ring is not usually narrow

2006 -1.502 26 4

455A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1740 60 59 56 51 42 80 68 42 44 53

1750 66 73 53 93 89 129 82 81 79 81

1760 63 35 17 50 44 42 0 31 40 86

1770 21 36 50 67 73 42 16 32 23 20

1780 36 39 39 25 69 48 59 44 58 56

1790 58 100 102 98 111 157 166 133 220 180

1800 141 179 128 99 129 75 19 21 15 8

1810 3 17 25 47 91 55 40 15 17 18

1820 7 9 12 20 5 23 22 20 66 100

1830 21 29 20 14 82 44 19 45 42 15

1840 14 72 79 138 199 129 146 120 181 129

1850 211 228 104 63 53 53 117 119 98 108

1860 119 199 110 132 197 122 99 109 90 81

1870 45 54 61 68 119 114 163 145 107 146

1880 141 180 166 152 87 132 97 110 98 66

1890 47 24 56 74 82 11 17 39 51 23

1900 67 37 42 27 74 59 70 111 91 79

1910 99 121 139 106 86 78 107 106 60 32

1920 33 62 68 78 82 90 43 79 85 70

1930 56 55 110 91 67 22 35 23 16 62

1940 46 54 17 27 30 28 56 81 46 45

1950 39 31 82 41 35 49 73 129 159 93

1960 124 186 73 70 129 55 45 53 57 93

1970 30 18 14 13 12 28 47 132 114 74

1980 99 143 140 66 20 13 21 24 19 10

1990 2 13 5 17 18 13 9 20 0 15

2000 3 7 5 5 23 19 0 8 15 19

2010 18 15 9 5 23 22

====================================================================================================================================

455B 1740 to 2015 276 years Series 10

[B] Entire series, effect on correlation ( .580) is:

Lower 1747> -.018 1827< -.010 1918> -.009 1763< -.007 1957< -.006 1833< -.006 Higher 1895 .021 2006 .012

[D] 4 Absent rings: Year Master N series Absent

1895 -2.930 24 1

1949 -1.047 27 1

1950 .245 27 1 >> WARNING: Ring is not usually narrow

2001 -1.051 26 2

[E] Outliers 1 3.0 SD above or -4.5 SD below mean for year

1747 +3.4 SD

455B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1740 52 50 52 49 37 58 82 88 59 47

1750 90 111 103 84 102 88 115 83 85 91

1760 97 76 59 34 65 30 12 37 62 61

1770 21 25 68 79 75 51 16 42 52 40

1780 67 67 84 72 133 94 112 107 87 101

1790 109 151 135 157 192 234 199 191 200 132

1800 131 145 137 146 195 119 26 34 26 20

1810 14 26 50 59 99 75 48 15 31 25

1820 11 18 22 13 5 17 9 3 16 24

1830 10 15 10 3 20 20 17 26 19 3

1840 3 17 20 77 90 74 85 86 62 43

1850 67 96 61 40 42 50 101 83 67 49

1860 87 59 68 86 60 69 31 44 49 58

1870 32 17 31 64 80 44 132 84 82 130

1880 151 274 178 142 75 122 94 84 96 52

1890 51 44 47 85 43 0 14 46 60 24

1900 53 34 17 20 68 50 115 124 63 59

1910 59 41 50 20 20 19 19 45 30 43

1920 29 37 23 18 9 4 6 12 18 14

1930 19 43 60 56 38 40 72 24 27 76

1940 69 49 34 34 43 18 23 56 11 0

1950 0 15 13 18 16 28 28 10 50 24

1960 31 45 16 26 55 29 23 31 20 33

1970 36 36 49 86 101 92 65 130 106 52

1980 80 71 31 30 6 10 31 48 47 40

1990 34 36 18 33 41 33 32 56 21 13

2000 5 0 18 7 17 28 4 21 20 15

2010 21 14 3 3 20 23

====================================================================================================================================

456B 1856 to 1986 131 years Series 11

[B] Entire series, effect on correlation ( .529) is:

Lower 1953> -.014 1986< -.012 1864< -.011 1959< -.011 1974> -.010 1970< -.010 Higher 1984 .042 1918 .036

456B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1856 185 251 106 86

1860 62 67 87 85 44 65 55 56 35 48

1870 37 47 55 60 85 81 58 85 90 70

1880 89 81 85 88 66 55 47 71 116 112

1890 106 99 138 127 104 36 25 36 84 78

1900 80 62 70 73 67 67 151 156 191 182

1910 185 182 159 145 119 111 152 152 93 108

1920 174 192 174 135 128 118 113 162 156 141

1930 146 148 169 143 134 104 67 70 76 137

1940 167 75 47 89 90 69 109 165 119 114

1950 166 174 202 196 183 118 113 117 137 73

1960 130 148 80 93 119 107 104 98 120 159

1970 101 92 172 171 168 141 107 111 73 74

1980 109 97 104 81 41 67 47

====================================================================================================================================

456A2 1856 to 1933 78 years Series 12

[B] Entire series, effect on correlation ( .488) is:

Lower 1895> -.051 1933< -.030 1887< -.026 1878> -.024 1926> -.014 1881< -.011 Higher 1918 .145 1858 .021

456A2 Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1856 137 136 56 90

1860 76 71 78 83 46 62 30 33 44 62

1870 46 57 53 78 94 84 51 81 91 68

1880 50 48 65 67 46 48 32 29 54 40

1890 58 49 76 95 74 60 61 67 76 62

1900 61 64 68 93 86 75 167 205 255 202

1910 162 133 110 96 75 82 88 113 30 46

1920 89 86 85 66 88 82 86 79 78 81

1930 77 108 90 63

====================================================================================================================================

457A 1801 to 2015 215 years Series 13

[A] Segment High -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 +0 +1 +2 +3 +4 +5 +6 +7 +8 +9 +10

--------- ---- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- ---

1900 1949 0 .16 -.15 -.32 -.09 .19 -.07 -.12 .03 .07 -.16 .26\* .05 -.08 .10 -.20 .08 .22 -.16 .01 -.10 .23

[B] Entire series, effect on correlation ( .550) is:

Lower 1908< -.016 1926> -.011 1888< -.007 1963< -.007 1995> -.007 1920< -.006 Higher 1895 .040 2006 .015

1900 to 1949 segment:

Lower 1908< -.066 1926> -.045 1920< -.023 1912< -.023 1942> -.017 1916< -.015 Higher 1948 .067 1905 .045

[D] 2 Absent rings: Year Master N series Absent

1985 -1.164 27 2

1999 -1.253 26 2

[E] Outliers 1 3.0 SD above or -4.5 SD below mean for year

1849 -4.6 SD

457A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1801 394 165 224 239 62 58 92 78 69

1810 62 88 95 150 179 191 93 39 55 55

1820 59 30 117 79 54 88 112 162 206 164

1830 99 95 78 111 90 87 85 124 119 102

1840 93 127 112 182 207 135 123 82 98 44

1850 100 188 107 77 101 139 137 172 125 112

1860 120 114 116 171 118 135 107 117 75 84

1870 78 39 30 90 149 121 103 117 128 151

1880 229 282 166 125 88 96 99 94 42 17

1890 45 46 76 81 136 36 96 139 125 77

1900 132 89 158 201 147 78 172 198 98 146

1910 149 167 118 123 131 98 94 102 84 113

1920 70 149 183 132 59 61 127 96 84 80

1930 57 44 68 68 24 22 25 17 10 18

1940 15 5 40 27 26 15 26 26 3 10

1950 6 27 28 8 17 30 26 26 14 15

1960 22 30 23 3 9 16 8 22 24 42

1970 52 40 56 67 59 41 39 73 37 59

1980 81 87 92 47 4 0 6 15 24 14

1990 28 29 11 13 9 29 22 17 12 0

2000 5 11 5 21 25 32 9 42 32 29

2010 29 33 20 27 39 41

====================================================================================================================================

457B 1799 to 2015 217 years Series 14

[B] Entire series, effect on correlation ( .595) is:

Lower 1958< -.021 1920< -.010 1908< -.009 2008< -.008 1922< -.008 1817> -.008 Higher 2006 .020 1918 .020

[D] 1 Absent rings: Year Master N series Absent

1985 -1.164 27 2

[E] Outliers 1 3.0 SD above or -4.5 SD below mean for year

1963 -4.8 SD

457B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1799 246

1800 170 260 119 251 290 67 65 112 90 91

1810 111 165 175 168 180 209 97 61 72 104

1820 53 34 38 45 40 76 84 107 149 150

1830 74 62 59 77 80 70 73 108 126 104

1840 67 103 112 144 179 138 129 122 131 78

1850 110 201 96 82 93 96 115 147 106 94

1860 118 124 131 156 113 114 106 80 52 42

1870 64 36 40 99 133 129 94 129 163 377

1880 423 396 218 177 115 84 58 62 40 27

1890 59 62 72 77 124 51 67 103 91 82

1900 118 101 88 129 71 80 192 183 78 111

1910 185 127 117 74 83 83 101 102 40 75

1920 45 39 30 46 38 33 46 49 53 43

1930 68 57 75 82 69 50 57 21 24 73

1940 47 41 51 31 26 16 29 28 16 10

1950 21 31 46 20 18 33 20 16 6 13

1960 18 23 18 4 27 24 15 36 59 76

1970 99 65 74 106 143 100 78 168 122 136

1980 166 185 141 83 24 0 12 9 33 22

1990 17 21 16 28 25 27 40 36 23 3

2000 24 20 20 23 52 74 15 39 29 22

2010 22 60 21 24 50 42

====================================================================================================================================

459A 1889 to 2015 127 years Series 15

[A] Segment High -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 +0 +1 +2 +3 +4 +5 +6 +7 +8 +9 +10

--------- ---- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- ---

1925 1974 -8 -.38 .00 .40\*-.18 -.18 -.02 .06 .24 -.25 -.05 .38|-.21 -.15 .06 .01 .19 .01 -.02 .35 .10 -.03

1950 1999 5 -.05 .12 .18 -.19 -.11 .14 .01 -.02 -.28 -.07 .39|-.17 -.25 -.14 -.06 .43\* .22 .06 .24 .02 .00

[B] Entire series, effect on correlation ( .464) is:

Lower 1895> -.027 1924< -.021 1993< -.018 1979< -.015 1937> -.014 2004< -.009 Higher 1918 .060 1984 .027

1925 to 1974 segment:

Lower 1937> -.039 1954> -.026 1929< -.021 1960< -.018 1936> -.018 1957< -.015 Higher 1952 .035 1966 .031

1950 to 1999 segment:

Lower 1993< -.055 1979< -.045 1954> -.025 1960< -.015 1971> -.013 1994< -.013 Higher 1984 .115 1977 .032

459A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1889 84

1890 138 123 169 142 141 115 111 147 137 131

1900 150 150 119 110 118 93 218 328 402 314

1910 300 311 249 247 209 296 363 261 89 115

1920 176 187 199 258 145 292 176 208 316 202

1930 306 316 322 272 246 190 261 234 219 227

1940 162 110 102 99 121 71 66 165 141 72

1950 99 192 296 181 178 194 89 61 70 107

1960 112 108 94 130 165 137 76 65 61 103

1970 142 138 213 184 141 109 80 139 95 47

1980 63 81 109 94 53 71 111 96 67 72

1990 50 52 54 40 41 51 52 70 54 43

2000 28 39 39 50 44 47 31 66 59 74

2010 64 28 29 57 115 66

====================================================================================================================================

459B 1903 to 2015 113 years Series 16

[B] Entire series, effect on correlation ( .632) is:

Lower 2011< -.024 1947< -.017 1954> -.012 1968> -.009 2001> -.008 1996< -.008 Higher 1918 .060 1984 .015

459B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1903 179 207 123 262 270 335 250

1910 244 226 185 154 107 121 168 176 54 122

1920 120 144 207 177 124 267 189 183 365 190

1930 281 211 273 253 174 125 148 122 158 224

1940 206 151 136 105 67 31 33 51 47 46

1950 89 118 177 98 118 121 94 99 99 79

1960 131 94 55 45 82 83 55 86 109 126

1970 84 60 166 106 95 69 150 248 143 73

1980 108 141 153 111 49 65 111 67 51 67

1990 66 44 62 54 55 56 42 62 43 35

2000 32 50 45 61 68 80 49 61 63 54

2010 72 32 52 79 116 91

====================================================================================================================================

1009A 1813 to 2015 203 years Series 17

[A] Segment High -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 +0 +1 +2 +3 +4 +5 +6 +7 +8 +9 +10

--------- ---- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- ---

1825 1874 6 -.11 -.13 .09 -.06 .18 -.18 -.21 -.05 -.10 -.16 .44| .01 .02 .03 -.07 -.04 .52\*-.04 -.10 -.02 -.16

[B] Entire series, effect on correlation ( .507) is:

Lower 1830> -.012 1944< -.011 1868> -.010 1834< -.010 1846< -.009 1918> -.008 Higher 1817 .017 2006 .011

1825 to 1874 segment:

Lower 1834< -.042 1868> -.039 1846< -.039 1830> -.038 1840> -.022 1847< -.019 Higher 1828 .037 1858 .028

[D] 2 Absent rings: Year Master N series Absent

1993 .161 26 1 >> WARNING: Ring is not usually narrow

2000 -1.444 26 3

[E] Outliers 1 3.0 SD above or -4.5 SD below mean for year

1817 -4.9 SD

1009A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1813 73 84 89 61 32 77 91

1820 78 56 72 81 46 94 110 98 128 109

1830 94 78 62 77 57 73 66 104 80 73

1840 82 101 70 67 100 103 58 37 49 53

1850 89 105 60 77 78 52 81 64 44 74

1860 54 71 70 82 64 63 34 46 72 67

1870 52 39 39 59 70 73 56 63 27 62

1880 55 45 40 48 23 61 67 75 60 49

1890 35 34 48 65 87 44 77 37 46 36

1900 62 28 48 78 42 43 100 99 149 127

1910 78 97 116 43 29 25 60 64 49 75

1920 184 134 111 86 112 55 76 74 69 65

1930 68 55 70 65 128 109 98 85 178 337

1940 296 201 237 195 55 136 144 276 125 127

1950 108 114 167 109 127 211 166 273 225 183

1960 298 262 200 191 220 159 145 209 165 178

1970 208 85 140 189 129 117 72 125 79 106

1980 185 202 136 60 28 30 34 30 28 17

1990 15 16 6 0 25 18 22 29 18 18

2000 0 3 27 42 32 46 7 67 51 96

2010 43 41 28 22 25 10

====================================================================================================================================

1009B 1833 to 2015 183 years Series 18

[A] Segment High -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 +0 +1 +2 +3 +4 +5 +6 +7 +8 +9 +10

--------- ---- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- ---

1875 1924 4 -.10 .04 -.02 -.07 .30 -.01 -.10 -.21 .08 -.06 .37|-.14 -.15 .00 .38\* .08 -.08 -.16 .06 .11 -.05

- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

1925 1974 5 -.24 .20 .06 -.24 -.03 -.30 -.03 .22 -.01 -.02 .23|-.16 .05 .02 -.17 .35\*-.02 -.45 .29 .26 -.11

1950 1999 0 -.38 .17 .09 -.28 -.11 -.23 -.05 .08 -.13 .12 .30\*-.05 .17 .04 -.20 .25 .18 -.29 .15 .14 -.17

[B] Entire series, effect on correlation ( .402) is:

Lower 1957< -.034 1895> -.028 1982< -.027 1932< -.015 1839> -.014 1892< -.008 Higher 1852 .021 1984 .014

1875 to 1924 segment:

Lower 1895> -.101 1892< -.033 1891< -.024 1904< -.021 1886< -.009 1878> -.008 Higher 1881 .030 1918 .029

1925 to 1974 segment:

Lower 1957< -.127 1932< -.058 1962> -.023 1942> -.018 1933< -.014 1934> -.014 Higher 1947 .048 1965 .028

1950 to 1999 segment:

Lower 1957< -.126 1982< -.098 1998> -.025 1962> -.024 1993< -.017 1971> -.011 Higher 1984 .060 1977 .049

[D] 6 Absent rings: Year Master N series Absent

1999 -1.253 26 2

2000 -1.444 26 3

2001 -1.051 26 2

2006 -1.502 26 4

2012 -1.018 26 1

2013 -.484 26 1

[E] Outliers 2 3.0 SD above or -4.5 SD below mean for year

1895 +3.1 SD; 1957 -5.9 SD

1009B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1833 67 49 44 35 81 62 98

1840 73 46 43 71 103 79 85 90 86 86

1850 126 142 44 78 58 84 111 120 51 72

1860 63 58 117 107 84 58 40 60 28 58

1870 71 37 46 44 81 56 48 51 55 60

1880 57 76 52 63 50 53 32 41 59 42

1890 34 20 26 49 46 38 41 30 40 31

1900 53 17 20 57 25 26 86 80 93 106

1910 52 46 87 34 50 64 84 78 38 33

1920 66 119 92 56 41 44 48 61 56 44

1930 57 56 28 23 86 33 34 38 53 62

1940 71 99 179 140 92 51 94 170 98 97

1950 81 84 127 98 74 122 111 62 141 117

1960 123 157 132 92 127 93 94 107 96 117

1970 114 114 184 139 115 129 146 189 112 79

1980 70 99 29 32 23 25 23 41 39 29

1990 29 19 15 5 30 13 28 19 18 0

2000 0 0 19 14 22 19 0 23 22 23

2010 11 6 0 0 15 22

====================================================================================================================================

1013A 1916 to 2015 100 years Series 19

[A] Segment High -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 +0 +1 +2 +3 +4 +5 +6 +7 +8 +9 +10

--------- ---- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- ---

1916 1965 -5 -.24 .08 .23 .02 .10 .39\* .13 -.25 -.27 -.01 .37|-.02 -.29 .10 -.14 -.17 .06 -.19 .04 -.08 -.10

[B] Entire series, effect on correlation ( .546) is:

Lower 1937> -.026 1936> -.022 1942< -.021 1998> -.019 1918> -.019 1959> -.013 Higher 2006 .055 2014 .018

1916 to 1965 segment:

Lower 1937> -.046 1942< -.041 1936> -.041 1959> -.025 1955< -.017 1963> -.015 Higher 1947 .031 1939 .030

[E] Outliers 1 3.0 SD above or -4.5 SD below mean for year

1936 +3.0 SD

1013A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1916 74 33 6 19

1920 53 53 27 24 39 30 43 58 70 101

1930 111 101 133 139 142 126 224 179 170 222

1940 171 155 108 124 267 173 191 275 166 135

1950 161 234 215 136 122 148 218 281 262 292

1960 333 262 187 260 259 176 159 176 113 240

1970 194 145 196 153 116 190 168 246 226 228

1980 265 269 291 166 88 106 140 120 103 82

1990 65 132 90 118 104 47 158 72 112 42

2000 34 55 74 35 94 80 14 84 62 50

2010 48 61 66 41 158 74

====================================================================================================================================

1013B 1916 to 2015 100 years Series 20

[B] Entire series, effect on correlation ( .505) is:

Lower 1997< -.017 1962> -.016 1995< -.013 1947< -.012 1974< -.011 1966> -.011 Higher 2006 .054 1984 .032

1013B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1916 21 21 12 13

1920 77 97 126 55 106 112 92 89 102 68

1930 68 104 163 161 84 86 145 47 106 140

1940 152 135 100 117 155 121 97 113 85 99

1950 123 147 196 172 196 192 268 343 314 329

1960 403 353 369 341 342 288 331 386 332 497

1970 371 289 296 271 137 175 193 307 361 247

1980 293 224 291 236 129 136 214 195 190 161

1990 166 186 159 209 170 63 63 65 104 112

2000 96 63 90 96 136 185 49 79 114 195

2010 89 98 109 66 172 118

====================================================================================================================================

1016A 1858 to 2015 158 years Series 21

[A] Segment High -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 +0 +1 +2 +3 +4 +5 +6 +7 +8 +9 +10

--------- ---- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- ---

1925 1974 -8 -.19 -.07 .46\* .01 -.04 -.03 -.21 .26 -.06 -.15 .31|-.18 -.25 -.08 -.25 .17 -.12 -.03 .13 -.16 .12

1950 1999 -8 -.03 .08 .46\* .02 -.07 .02 -.15 .23 -.14 -.27 .31| .07 -.05 -.04 -.25 -.07 -.21 .01 .26 -.15 .06

[B] Entire series, effect on correlation ( .471) is:

Lower 1973< -.026 1952< -.016 1965> -.016 2006> -.013 1914> -.011 1905> -.009 Higher 1895 .081 1937 .013

1925 to 1974 segment:

Lower 1973< -.078 1965> -.056 1952< -.052 1935> -.016 1951< -.012 1959> -.012 Higher 1937 .059 1947 .050

1950 to 1999 segment:

Lower 1973< -.067 1965> -.054 1952< -.043 1985> -.024 1959> -.012 1988> -.012 Higher 1984 .047 1998 .024

[C] Year-to-year changes diverging by over 4.0 std deviations:

1895 1896 4.1 SD

[D] 2 Absent rings: Year Master N series Absent

1953 -.226 27 3 >> WARNING: Ring is not usually narrow

1954 -.831 27 4

[E] Outliers 1 3.0 SD above or -4.5 SD below mean for year

1895 -5.0 SD

1016A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1858 116 103

1860 100 107 159 168 104 79 61 72 60 54

1870 66 80 48 88 104 96 82 96 56 74

1880 54 54 54 53 49 58 68 93 87 91

1890 53 50 59 58 52 24 72 70 74 62

1900 63 51 48 78 67 72 82 75 86 70

1910 64 85 83 78 99 79 83 71 46 39

1920 39 25 55 42 59 67 25 36 41 49

1930 36 49 71 87 93 114 75 29 52 105

1940 78 88 68 52 126 102 85 173 73 61

1950 93 22 5 0 0 16 8 11 21 29

1960 37 28 20 26 33 62 46 48 48 68

1970 97 59 125 45 41 62 59 98 86 110

1980 138 121 166 126 84 174 204 119 156 161

1990 151 135 82 118 153 147 152 181 87 74

2000 107 198 234 247 276 228 182 182 173 227

2010 163 149 153 123 249 128

====================================================================================================================================

1016B 1851 to 2015 165 years Series 22

[A] Segment High -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 +0 +1 +2 +3 +4 +5 +6 +7 +8 +9 +10

--------- ---- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- ---

1925 1974 -8 -.21 -.07 .39\* .09 -.14 .04 -.13 -.04 -.13 -.05 .23|-.13 -.27 .02 -.08 -.06 -.09 .17 .09 -.19 .19

1950 1999 -8 -.04 .00 .35\*-.13 -.12 .08 -.17 .26 -.07 -.13 .23| .17 -.08 .03 -.07 -.02 -.11 -.01 .10 -.07 -.03

[B] Entire series, effect on correlation ( .365) is:

Lower 1851< -.040 1987< -.022 1905> -.015 1952< -.013 1948> -.013 1852> -.012 Higher 1895 .065 1872 .013

1925 to 1974 segment:

Lower 1948> -.061 1952< -.055 1973< -.038 1930< -.036 1965> -.031 1966> -.027 Higher 1937 .070 1947 .064

1950 to 1999 segment:

Lower 1987< -.068 1952< -.042 1965> -.028 1973< -.027 1966> -.025 1988> -.024 Higher 1984 .055 1977 .049

[C] Year-to-year changes diverging by over 4.0 std deviations:

1851 1852 4.9 SD

[D] 3 Absent rings: Year Master N series Absent

1952 1.191 27 1 >> WARNING: Ring is not usually narrow

1953 -.226 27 3 >> WARNING: Ring is not usually narrow

1954 -.831 27 4

[E] Outliers 2 3.0 SD above or -4.5 SD below mean for year

1851 -5.7 SD; 1905 +3.1 SD

1016B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1851 61 93 110 125 106 103 152 138 126

1860 111 134 180 166 111 109 98 123 127 89

1870 118 117 70 102 123 112 105 87 72 69

1880 65 106 96 96 97 77 76 109 110 110

1890 80 66 90 80 77 46 79 75 83 56

1900 69 59 57 62 93 85 65 65 70 58

1910 52 47 86 29 44 55 75 58 36 43

1920 30 43 80 67 47 40 32 39 71 79

1930 39 55 93 93 59 67 68 44 63 104

1940 100 91 100 97 160 110 121 199 157 89

1950 93 34 0 0 0 12 3 7 2 3

1960 11 10 12 17 15 35 40 41 53 69

1970 74 56 80 34 35 61 73 121 120 118

1980 150 116 134 88 55 85 119 39 103 74

1990 73 79 44 63 50 47 42 51 33 26

2000 32 46 88 104 104 84 61 132 124 90

2010 72 69 43 55 104 55

====================================================================================================================================

1286A 1866 to 2015 150 years Series 23

[B] Entire series, effect on correlation ( .485) is:

Lower 1877< -.036 1866> -.025 1918> -.018 1945> -.018 1948> -.012 1947< -.007 Higher 1895 .020 1937 .018

[E] Outliers 2 3.0 SD above or -4.5 SD below mean for year

1866 +3.1 SD; 1945 +3.5 SD

1286A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1866 151 71 80 92

1870 58 83 83 83 110 124 115 45 54 127

1880 121 236 168 196 126 142 124 161 138 136

1890 132 143 189 122 119 71 93 85 135 98

1900 123 118 139 91 66 74 98 123 121 104

1910 96 100 116 65 82 134 191 119 79 56

1920 83 96 163 116 138 158 68 162 166 140

1930 151 131 247 227 133 165 164 72 95 215

1940 194 173 141 199 203 321 184 127 139 151

1950 201 115 158 134 78 105 86 145 147 106

1960 172 129 86 93 192 144 137 108 130 163

1970 156 63 133 191 132 98 197 290 190 127

1980 151 181 172 97 51 59 92 105 61 101

1990 60 46 48 56 66 81 48 70 30 38

2000 26 30 30 37 51 47 28 56 60 46

2010 39 40 30 47 89 50

====================================================================================================================================

1286B 1866 to 2015 150 years Series 24

[A] Segment High -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 +0 +1 +2 +3 +4 +5 +6 +7 +8 +9 +10

--------- ---- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- ---

1866 1915 0 .01 .07 .02 -.13 -.05 -.14 .02 -.17 -.01 .24 .27\* .08 .03 -.14 -.22 .23 .03 .08 -.02 .20 -.19

[B] Entire series, effect on correlation ( .485) is:

Lower 1920< -.024 1868> -.016 1906< -.016 1872> -.015 1953> -.011 1866> -.010 Higher 1918 .055 2006 .029

1866 to 1915 segment:

Lower 1906< -.052 1868> -.046 1872> -.041 1867< -.029 1866> -.027 1888< -.021 Higher 1895 .066 1881 .032

[E] Outliers 1 3.0 SD above or -4.5 SD below mean for year

1872 +3.1 SD

1286B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1866 67 57 74 74

1870 57 61 80 67 87 74 52 68 68 60

1880 65 109 141 96 48 93 54 109 59 41

1890 49 74 92 64 53 42 34 58 76 75

1900 103 91 84 68 55 55 54 97 115 93

1910 78 80 91 70 96 83 108 82 49 102

1920 72 88 91 80 106 145 101 116 141 125

1930 95 69 82 89 54 87 79 49 142 167

1940 70 100 58 49 91 89 69 79 82 82

1950 133 135 153 127 52 93 77 69 84 61

1960 128 126 45 37 86 73 71 57 86 143

1970 89 41 56 73 64 98 116 142 90 80

1980 124 167 142 51 36 53 58 74 73 101

1990 54 74 55 37 37 68 44 56 27 30

2000 42 28 39 78 83 100 22 48 59 43

2010 41 34 43 51 88 62

====================================================================================================================================

1292A 1847 to 2015 169 years Series 25

[B] Entire series, effect on correlation ( .571) is:

Lower 2006> -.013 1937> -.012 1880< -.010 1980< -.008 1874< -.008 1872> -.007 Higher 1895 .053 1852 .011

1292A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1847 82 119 75

1850 122 110 74 93 94 112 120 106 72 67

1860 84 79 125 114 101 86 77 103 80 94

1870 96 94 90 96 75 64 58 64 52 72

1880 48 92 124 109 111 174 141 145 134 159

1890 119 118 154 112 117 68 89 91 141 133

1900 120 99 117 134 152 116 156 175 190 168

1910 165 179 155 132 116 151 161 204 147 133

1920 192 190 169 132 141 177 155 200 188 129

1930 115 115 131 118 143 168 151 159 181 198

1940 268 195 130 156 122 119 101 142 120 86

1950 134 136 173 90 134 110 117 170 209 153

1960 192 187 119 104 122 46 36 51 52 49

1970 34 38 45 54 62 92 85 129 101 91

1980 72 87 86 67 58 53 113 110 97 137

1990 148 126 121 109 120 87 91 124 66 39

2000 3 20 27 30 55 72 52 75 87 91

2010 43 31 24 51 72 45

====================================================================================================================================

1292B 1847 to 2015 169 years Series 26

[B] Entire series, effect on correlation ( .524) is:

Lower 2014< -.019 1880< -.017 1857< -.014 1984> -.013 1881< -.008 1870> -.007 Higher 1918 .052 1895 .018

[E] Outliers 2 3.0 SD above or -4.5 SD below mean for year

1880 -4.6 SD; 1918 -5.4 SD

1292B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1847 73 115 71

1850 118 107 92 134 115 90 100 78 65 98

1860 94 115 112 99 105 145 79 89 76 79

1870 102 102 90 83 103 80 76 82 75 79

1880 50 64 75 79 73 104 100 141 132 147

1890 120 115 162 152 138 89 94 101 166 151

1900 147 149 178 171 158 121 162 175 210 208

1910 181 153 139 112 125 116 124 140 63 111

1920 117 113 111 119 139 149 135 120 108 101

1930 150 178 181 124 96 106 100 62 103 110

1940 137 135 90 120 113 102 93 113 102 59

1950 118 122 135 52 60 90 90 114 129 104

1960 118 105 90 84 95 23 24 28 41 27

1970 38 29 70 50 23 49 37 82 88 71

1980 67 91 68 53 50 40 66 33 42 24

1990 53 66 90 68 74 124 172 135 81 68

2000 37 63 80 61 78 72 41 85 108 100

2010 99 58 55 56 40 35

====================================================================================================================================

1293A 1888 to 2015 128 years Series 27

[A] Segment High -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 +0 +1 +2 +3 +4 +5 +6 +7 +8 +9 +10

--------- ---- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- ---

1900 1949 0 -.05 -.13 -.03 -.01 .01 .00 .06 -.04 -.27 -.08 .31\* .08 -.21 -.24 .07 .21 -.22 .03 .19 -.03 -.14

[B] Entire series, effect on correlation ( .507) is:

Lower 1918> -.057 1906< -.016 1899> -.013 1974> -.010 1945> -.009 1900< -.009 Higher 1895 .039 2006 .038

1900 to 1949 segment:

Lower 1918> -.166 1906< -.037 1945> -.026 1900< -.019 1908< -.011 1939< -.010 Higher 1937 .086 1948 .055

[E] Outliers 1 3.0 SD above or -4.5 SD below mean for year

1918 +3.7 SD

1293A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1888 208 181

1890 196 188 167 182 181 99 113 173 138 161

1900 92 62 68 108 91 61 41 45 46 57

1910 47 66 70 46 63 116 148 173 199 185

1920 262 270 183 160 201 161 147 207 258 199

1930 251 289 247 200 211 173 124 98 211 189

1940 262 156 206 216 222 240 175 249 144 125

1950 159 135 227 141 125 137 117 135 152 137

1960 138 100 61 57 78 86 33 70 106 144

1970 128 85 98 71 117 102 171 143 68 49

1980 73 69 71 61 44 64 54 77 65 116

1990 87 74 119 133 149 110 131 110 46 32

2000 30 47 53 70 123 75 25 54 86 61

2010 77 61 52 73 129 72

====================================================================================================================================

1293B 1894 to 2015 122 years Series 28

[A] Segment High -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 +0 +1 +2 +3 +4 +5 +6 +7 +8 +9 +10

--------- ---- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- ---

1894 1943 8 .06 -.10 -.02 -.12 .02 .03 -.11 -.07 .06 -.05 .21|-.06 -.13 -.06 .12 -.05 -.19 -.02 .27\*-.04 .00

1900 1949 8 .04 -.11 .05 -.17 .00 .06 -.03 -.04 -.04 -.10 .23|-.09 -.10 .01 .00 .06 -.22 -.06 .30\*-.09 -.03

[B] Entire series, effect on correlation ( .398) is:

Lower 1907< -.034 2006> -.032 1936< -.030 1968> -.014 1899> -.011 1955< -.009 Higher 1984 .060 2014 .016

1894 to 1943 segment:

Lower 1907< -.066 1936< -.042 1899> -.022 1922< -.012 1939< -.011 1910< -.009 Higher 1895 .075 1937 .019

1900 to 1949 segment:

Lower 1907< -.071 1936< -.040 1939< -.014 1922< -.012 1916< -.010 1913> -.008 Higher 1947 .049 1948 .025

1293B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1894 129 50 69 58 67 132

1900 116 110 120 108 139 97 123 64 88 108

1910 73 122 146 131 136 93 112 198 130 137

1920 232 223 137 109 132 126 126 159 229 192

1930 219 254 234 180 218 247 129 161 240 214

1940 227 200 282 266 266 259 190 385 213 215

1950 248 270 340 161 128 118 149 224 183 177

1960 218 197 130 137 157 123 83 197 256 260

1970 259 132 177 159 120 136 173 128 93 75

1980 95 122 108 75 22 65 69 67 46 95

1990 104 87 97 137 136 70 69 97 79 52

2000 42 67 39 29 120 90 86 95 65 46

2010 62 38 70 64 124 61

====================================================================================================================================

PART 7: DESCRIPTIVE STATISTICS: LEMP5\_BEAL\_Corr3-50 13:55 Thu 24 May 2018 Page 7

------------------------------------------------------------------------------------------------------------------------------------

Corr //-------- Unfiltered --------\\ //---- Filtered -----\\

No. No. No. with Mean Max Std Auto Mean Max Std Auto AR

Seq Series Interval Years Segmt Flags Master msmt msmt dev corr sens value dev corr ()

--- -------- --------- ----- ----- ----- ------ ----- ----- ----- ----- ----- ----- ----- ----- --

1 451A 1814 2015 202 8 0 .554 .58 3.49 .494 .850 .392 2.53 .362 -.040 1

2 451B 1804 2015 212 8 0 .585 1.14 3.76 .802 .911 .319 2.58 .421 -.002 1

3 452A 1909 2015 107 4 0 .652 1.75 5.90 .971 .844 .229 2.47 .340 .056 2

4 452B 1880 2015 136 5 0 .586 1.08 3.20 .500 .672 .320 2.71 .504 -.031 2

5 453A 1819 2015 197 8 1 .580 1.26 3.23 .688 .785 .324 2.60 .380 .002 1

6 453B 1814 2015 202 8 0 .550 1.16 4.47 .787 .862 .322 2.74 .387 -.031 2

7 454A 1810 2015 206 8 0 .562 1.35 4.17 .777 .761 .287 2.66 .311 -.047 3

8 454B 1793 2015 223 9 0 .517 .83 3.19 .626 .880 .285 2.80 .411 -.062 2

9 455A 1740 2015 276 11 0 .611 .66 2.28 .487 .781 .445 2.62 .375 -.018 1

10 455B 1740 2015 276 11 0 .580 .55 2.74 .446 .826 .466 2.81 .485 .038 1

11 456B 1856 1986 131 5 0 .529 1.08 2.51 .451 .732 .232 2.61 .499 -.059 2

12 456A2 1856 1933 78 3 0 .488 .80 2.55 .395 .782 .241 2.64 .370 -.007 1

13 457A 1801 2015 215 8 1 .550 .80 3.94 .607 .776 .429 2.65 .418 -.044 2

14 457B 1799 2015 217 9 0 .595 .84 4.23 .661 .792 .374 2.73 .423 -.090 5

15 459A 1889 2015 127 5 2 .464 1.39 4.02 .861 .821 .273 2.64 .495 .003 3

16 459B 1903 2015 113 4 0 .632 1.20 3.65 .722 .742 .315 2.65 .400 .013 1

17 1009A 1813 2015 203 8 1 .507 .86 3.37 .615 .786 .372 2.67 .434 -.039 1

18 1009B 1833 2015 183 7 3 .402 .64 1.89 .400 .742 .388 2.68 .485 -.042 2

19 1013A 1916 2015 100 4 1 .546 1.36 3.33 .787 .779 .364 2.79 .480 .008 1

20 1013B 1916 2015 100 4 0 .505 1.70 4.97 1.031 .857 .282 2.64 .474 .009 1

21 1016A 1858 2015 158 6 2 .471 .88 2.76 .534 .798 .308 2.57 .361 -.004 1

22 1016B 1851 2015 165 6 2 .365 .76 1.99 .381 .763 .305 2.56 .403 -.053 1

23 1286A 1866 2015 150 6 0 .485 1.16 3.21 .545 .636 .304 2.75 .473 .011 3

24 1286B 1866 2015 150 6 1 .485 .78 1.67 .305 .490 .309 2.59 .447 -.078 2

25 1292A 1847 2015 169 7 0 .571 1.11 2.68 .460 .798 .235 2.69 .412 .009 1

26 1292B 1847 2015 169 7 0 .524 .98 2.10 .393 .771 .239 2.54 .311 -.037 1

27 1293A 1888 2015 128 5 1 .507 1.25 2.89 .641 .804 .281 2.77 .500 .054 1

28 1293B 1894 2015 122 5 2 .398 1.40 3.85 .711 .744 .287 2.66 .431 .031 1

--- -------- --------- ----- ----- ----- ------ ----- ----- ----- ----- ----- ----- ----- ----- --

Total or mean: 4715 185 17 .534 .99 5.90 .597 .784 .332 2.81 .418 -.020

- = [ COFECHA BEAL COF ] = -