[] Dendrochronology Program Library Run BEAL Program COF 11:26 Fri 05 May 2017 Page 1

[] P R O G R A M C O F E C H A Version 6.06P 30077

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QUALITY CONTROL AND DATING CHECK OF TREE-RING MEASUREMENTS

Title of run: GOSH2\_BEAL\_Corr4-50

File of DATED series: GOSH2\_BEAL\_Corr4

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 1918 to 2016 99 years

Continuous time span is 1918 to 2016 99 years

Portion with two or more series is 1919 to 2016 98 years

>> 1109B 2014 absent in 1 of 28 series, but is not usually narrow: master index is .801

>> 1109B 2015 absent in 2 of 28 series, but is not usually narrow: master index is 1.335

>> 1112B 1960 absent in 1 of 24 series, but is not usually narrow: master index is .206

>> 1114B 2013 absent in 1 of 28 series, but is not usually narrow: master index is .304

>> 1118A 2015 absent in 2 of 28 series, but is not usually narrow: master index is 1.335

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

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

\*O\* Master series 1918 2016 99 yrs \*O\*

\*F\* Total rings in all series 1990 \*F\*

\*E\* Total dated rings checked 1989 \*E\*

\*C\* Series intercorrelation .398 \*C\*

\*H\* Average mean sensitivity .283 \*H\*

\*A\* Segments, possible problems 24 \*A\*

\*\*\* Mean length of series 71.1 \*\*\*

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

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

1109B 3 absent rings: 2014 2015 2016

1112B 1 absent rings: 1960

1114B 3 absent rings: 2011 2013 2016

1118A 2 absent rings: 2015 2016

9 absent rings .452%

1950 -.253 18 2000 .093 28

1951 .610 18 2001 .257 28

1952 .762 19 2002 -.315 28

1953 .216 20 2003 -1.111 28

1954 .660 20 2004 .501 28

1955 1.346 21 2005 -1.156 28

1956 .307 21 2006 -.544 28

1957 .311 21 2007 .439 28

1958 -.312 23 2008 -.397 28

1959 -.665 23 2009 1.384 28

1960 .206 24 1<< 2010 .530 28

1961 .209 25 2011 -1.050 28 1

1962 .122 25 2012 .315 28

1963 .504 25 2013 .304 28 1<<

1964 1.120 25 2014 .801 28 1<<

1965 .607 25 2015 1.335 28 2<<

1966 .531 25 2016 -1.008 28 3

1967 -.107 25

1918 -3.976 1 1968 .282 25

1919 -4.717 2 1969 -1.422 25

1920 .191 2 1970 -.585 25

1921 1.315 3 1971 -1.895 25

1922 1.268 3 1972 -.949 25

1923 .744 3 1973 -.751 25

1924 -.018 3 1974 -1.381 26

1925 -.646 3 1975 .242 27

1926 -1.099 3 1976 .113 27

1927 .031 4 1977 -.038 27

1928 1.034 4 1978 .610 27

1929 .597 4 1979 .974 27

1930 .044 4 1980 .868 27

1931 1.320 4 1981 -.225 27

1932 .746 4 1982 1.397 27

1933 .264 5 1983 -.508 27

1934 .520 6 1984 .189 27

1935 -.806 6 1985 -.351 27

1936 -.581 6 1986 -.404 27

1937 -.287 10 1987 -.310 27

1938 .178 10 1988 .603 27

1939 .693 11 1989 .530 27

1940 .830 11 1990 .922 28

1941 .941 13 1991 -.721 28

1942 1.005 13 1992 .828 28

1943 .514 14 1993 .507 28

1944 1.259 14 1994 .663 28

1945 -.964 15 1995 -1.156 28

1946 -2.056 15 1996 -.388 28

1947 -.355 18 1997 .010 28

1948 -1.687 18 1998 .269 28

1949 -1.015 18 1999 .240 28

PART 5: CORRELATION OF SERIES BY SEGMENTS: GOSH2\_BEAL\_Corr4-50 11:26 Fri 05 May 2017 Page 5

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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 1900 1925 1950 1975

1949 1974 1999 2024

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

1 1108A 1958 2016 .55 .59

2 1108B 1947 2016 .30B .35 .36

3 1109A 1961 2016 .47 .58

4 1109B 1960 2016 .13B .12B

5 1110A 1939 2016 .35 .10B .23B

6 1111A 1945 2016 .13B .06B .26A

7 1111B 1941 2016 .55 .32A .41

8 1110C 1934 2016 .33 .21B .34

9 1112A 1918 2016 .27B .42B .58 .66

10 1112B 1919 2016 .45B .45 .49 .58

11 1114A 1952 2016 .41 .48

12 1114B 1958 2016 .40 .40

13 1115A 1947 2016 .42 .42 .35

14 1116A 1953 2016 .45 .28A

15 1116B 1955 2016 .43 .45

16 1117A 1943 2016 .61 .57 .52

17 1117B 1941 2016 .46 .36 .36B

18 1118B 1937 2016 .41 .42 .46

19 1119A 1937 2016 .48 .47 .59

20 1119B 1921 2016 .34 .32A .60 .67

21 1120A 1937 2016 .51 .39 .44

22 1120B 1937 2016 .34 .44 .44

23 1121A 1974 2016 .28B

24 1121B 1975 2016 .40

25 1122A 1927 2016 .35B .28A .45

26 1122B 1990 2016 .70

27 1115B 1947 2016 .16B .09B .21A

28 1118A 1933 2016 .13B .09B .33

Av segment correlation .35 .37 .36 .43

PART 6: POTENTIAL PROBLEMS: GOSH2\_BEAL\_Corr4-50 11:26 Fri 05 May 2017 Page 5

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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

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

1108A 1958 to 2016 59 years Series 1

[B] Entire series, effect on correlation ( .608) is:

Lower 2003> -.026 1991> -.019 1995< -.018 1997< -.018 2006< -.014 2000< -.010 Higher 2011 .023 2009 .019

1108A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1958 55 53

1960 97 123 132 229 232 222 263 131 91 45

1970 60 72 207 162 125 224 300 347 361 348

1980 348 245 283 187 274 201 292 260 280 318

1990 344 274 269 316 285 148 219 169 231 245

2000 175 214 246 254 273 173 116 232 211 369

2010 303 117 263 186 247 302 158

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

1108B 1947 to 2016 70 years Series 2

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

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

1947 1996 10 .02 .13 -.01 -.32 -.25 -.20 .09 -.32 .22 .04 .30| .10 .23 -.05 .03 -.38 .22 -.27 -.12 -.15 .32\*

[B] Entire series, effect on correlation ( .344) is:

Lower 1991> -.046 2003> -.032 1969> -.030 1957< -.022 2007< -.021 1985< -.019 Higher 2016 .059 1995 .036

1947 to 1996 segment:

Lower 1991> -.067 1969> -.043 1957< -.029 1948> -.026 1947< -.024 1985< -.018 Higher 1995 .059 1971 .037

1108B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1947 102 129 139

1950 135 162 197 160 242 174 96 30 44 43

1960 113 141 109 214 221 153 294 103 81 148

1970 176 102 138 133 119 183 267 215 223 204

1980 212 179 248 220 302 179 305 247 274 250

1990 343 341 276 355 291 161 190 174 197 244

2000 248 201 224 288 299 142 75 84 138 255

2010 257 189 177 203 186 220 101

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

1109A 1961 to 2016 56 years Series 3

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

Lower 1991> -.031 1969> -.030 2003> -.026 1966< -.018 1999< -.017 1998< -.013 Higher 2016 .052 2011 .023

1109A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1961 402 434 388 434 369 224 179 202 184

1970 116 119 96 126 50 122 147 108 144 155

1980 155 125 192 101 112 140 103 132 175 213

1990 150 125 134 121 89 53 57 54 33 17

2000 43 123 116 123 135 80 35 126 105 220

2010 181 73 107 172 212 273 86

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

1109B 1960 to 2016 57 years Series 4

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

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

1960 2009 1 -.12 .05 -.45 .11 -.12 -.04 -.01 .26 -.09 .06 .13| .33\*-.05 .03 -.05 .18 .03 -.31 - - -

1967 2016 -3 -.20 -.01 -.50 .00 -.10 -.08 .02 .32\*-.10 .07 .12| - - - - - - - - - -

[B] Entire series, effect on correlation ( .114) is:

Lower 1990< -.135 1991> -.077 2014< -.029 2003> -.026 2005> -.017 2015< -.016 Higher 1982 .039 1974 .035

1960 to 2009 segment:

Lower 1990< -.166 1991> -.096 2003> -.032 2005> -.021 1968< -.015 1966< -.009 Higher 1982 .046 1974 .042

1967 to 2016 segment:

Lower 1990< -.145 1991> -.080 2014< -.032 2003> -.027 2005> -.018 2015< -.016 Higher 1982 .047 1974 .035

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

1990 1991 5.7 SD

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

2014 .801 28 1 >> WARNING: Ring is not usually narrow

2015 1.335 28 2 >> WARNING: Ring is not usually narrow

2016 -1.008 28 3

>> WARNING: Last ring in series is ABSENT

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

1990 -4.6 SD

1109B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1960 370 318 328 293 289 221 158 200 126 131

1970 124 112 68 83 57 130 147 121 193 196

1980 156 110 181 116 108 127 103 85 134 120

1990 76 149 138 121 107 98 107 101 111 117

2000 106 133 92 129 151 135 71 111 118 134

2010 145 84 131 119 0 0 0

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

1110A 1939 to 2016 78 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

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

1950 1999 -2 .05 -.12 -.03 -.17 -.01 -.08 .06 -.05 .49\*-.07 .10| .01 .29 .05 -.01 -.15 .06 -.15 .00 .16 -.02

1967 2016 -2 .03 -.20 .21 -.22 .14 -.05 -.07 -.01 .25\* .00 .23| - - - - - - - - - -

[B] Entire series, effect on correlation ( .293) is:

Lower 1993< -.078 1991> -.044 1988< -.016 1974> -.011 1944< -.010 1981> -.010 Higher 2016 .051 2003 .023

1950 to 1999 segment:

Lower 1993< -.106 1991> -.071 1988< -.026 1981> -.016 1974> -.014 1975< -.012 Higher 1969 .055 1955 .039

1967 to 2016 segment:

Lower 1993< -.096 1991> -.058 1988< -.020 1974> -.015 1995> -.014 1981> -.013 Higher 2016 .071 2003 .044

1110A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1939 53

1940 56 32 45 33 25 26 6 27 12 28

1950 25 228 248 287 380 468 352 422 310 313

1960 387 370 300 393 379 266 274 265 250 185

1970 180 149 106 142 156 131 153 120 149 165

1980 156 181 163 151 249 173 188 161 131 119

1990 139 176 178 87 167 127 124 111 142 115

2000 157 110 130 54 93 82 82 98 87 107

2010 130 88 111 115 146 144 81

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

1111A 1945 to 2016 72 years Series 6

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

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

1945 1994 3 .11 .02 -.11 -.19 -.14 -.20 -.05 -.11 .09 -.09 .13| .06 .15 .23\* .06 -.09 -.02 -.16 -.16 -.08 .17

1950 1999 3 .14 .10 -.08 -.16 -.19 -.12 -.05 -.29 .03 -.01 .06| .13 .20 .24\* .08 -.15 .01 -.09 -.29 -.02 .13

1967 2016 0 -.05 -.01 .05 -.32 -.07 .13 -.18 -.23 -.07 -.17 .26\* - - - - - - - - - -

[B] Entire series, effect on correlation ( .252) is:

Lower 1955< -.040 1982< -.032 2010< -.024 2003> -.021 1969> -.019 1950< -.019 Higher 2016 .097 2009 .031

1945 to 1994 segment:

Lower 1955< -.058 1982< -.045 1950< -.027 1969> -.026 1990< -.021 1980< -.015 Higher 1948 .055 1971 .038

1950 to 1999 segment:

Lower 1955< -.061 1982< -.048 1950< -.024 1969> -.024 1990< -.022 1995> -.018 Higher 1971 .054 1979 .031

1967 to 2016 segment:

Lower 1982< -.045 2010< -.034 2003> -.029 1969> -.029 1990< -.021 1967< -.021 Higher 2016 .137 2009 .045

1111A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1945 137 137 237 123 118

1950 73 226 273 243 322 179 122 150 249 159

1960 205 289 264 253 270 229 213 135 166 201

1970 236 170 214 199 211 179 224 314 328 368

1980 194 158 97 89 88 79 67 69 120 93

1990 82 109 131 130 186 171 140 200 195 177

2000 194 188 209 213 200 186 162 173 177 243

2010 149 121 122 155 159 211 103

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1111B 1941 to 2016 76 years Series 7

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

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

1950 1999 0 .00 -.26 -.21 -.07 -.24 -.11 -.01 .16 .03 .06 .32\* .00 .19 -.03 .00 .14 -.05 .06 .07 -.12 -.05

[B] Entire series, effect on correlation ( .504) is:

Lower 1995> -.032 1974> -.029 1991> -.027 1984< -.015 1981> -.013 1983> -.011 Higher 1945 .033 2016 .024

1950 to 1999 segment:

Lower 1995> -.050 1974> -.045 1991> -.039 1981> -.021 1984< -.020 1963< -.015 Higher 1969 .191 1982 .035

1111B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1941 156 208 196 241 118 106 222 62 115

1950 122 208 263 231 403 540 423 425 377 305

1960 397 268 225 171 252 186 176 190 224 70

1970 73 63 69 77 125 134 143 120 113 116

1980 130 151 205 162 76 75 40 41 47 29

1990 47 86 78 131 162 190 180 247 182 188

2000 170 110 78 62 67 65 91 96 100 193

2010 136 82 93 148 186 187 123

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

1110C 1934 to 2016 83 years Series 8

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

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

1950 1999 -2 -.14 -.01 -.15 -.19 .00 -.04 -.02 -.05 .52\*-.07 .21| .07 .33 .06 -.18 -.02 .08 -.30 .04 .18 .08

[B] Entire series, effect on correlation ( .282) is:

Lower 1935> -.053 1993< -.051 1991> -.039 1995> -.031 2014< -.025 1944< -.015 Higher 2011 .033 2003 .026

1950 to 1999 segment:

Lower 1993< -.088 1991> -.076 1995> -.059 1982< -.023 1978< -.016 1956> -.015 Higher 1969 .065 1974 .064

1110C Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1934 49 122 91 89 77 60

1940 60 41 57 31 23 24 6 22 11 31

1950 29 162 246 243 392 584 601 455 436 382

1960 415 362 332 301 306 245 273 237 190 148

1970 150 123 160 138 99 110 160 165 131 174

1980 175 160 134 108 169 137 113 127 148 122

1990 124 150 151 92 93 131 138 102 140 158

2000 108 105 77 38 85 79 147 130 83 154

2010 112 55 105 91 55 141 99

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1112A 1918 to 2016 99 years Series 9

[\*] Early part of series cannot be checked from 1918 to 1918 -- not matched by another series

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

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

1919 1968 10 - - - - - - - - - .12 .27|-.07 -.15 -.21 -.28 -.22 -.08 -.06 .12 .28 .33\*

1925 1974 -2 - - - .07 .09 -.05 .00 .06 .43\* .18 .42|-.05 .01 -.05 -.27 -.13 -.10 -.18 .03 .14 .23

[B] Entire series, effect on correlation ( .413) is:

Lower 1919> -.154 1963< -.020 1974> -.013 2002> -.010 1945> -.008 1960< -.006 Higher 1991 .016 2011 .013

1919 to 1968 segment:

Lower 1919> -.135 1963< -.048 1960< -.013 1925< -.011 1953< -.011 1930> -.011 Higher 1948 .026 1946 .025

1925 to 1974 segment:

Lower 1963< -.054 1974> -.046 1945> -.042 1930> -.018 1960< -.016 1959> -.014 Higher 1971 .069 1955 .034

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

1919 1920 -5.8 SD

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

1919 +4.2 SD

1112A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1918 56 83

1920 114 147 167 170 158 110 119 195 243 226

1930 239 241 171 160 186 97 73 61 85 93

1940 123 174 223 184 215 142 75 73 46 67

1950 71 103 91 54 66 138 103 129 77 86

1960 66 75 72 55 83 93 104 91 107 86

1970 120 68 63 89 143 235 159 133 197 237

1980 167 134 196 125 153 174 167 165 229 204

1990 219 128 196 141 176 115 93 127 154 155

2000 105 129 169 73 92 49 51 76 41 99

2010 104 48 82 131 131 181 126

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

1112B 1919 to 2016 98 years Series 10

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

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

1919 1968 -1 - - - - - - - - - .63\* .45|-.04 -.27 -.22 -.22 -.16 -.08 -.05 .12 -.03 .34

[B] Entire series, effect on correlation ( .465) is:

Lower 1960< -.045 1919< -.041 1969> -.019 1974> -.016 1945> -.014 2002> -.008 Higher 1995 .021 2005 .017

1919 to 1968 segment:

Lower 1960< -.068 1945> -.036 1919< -.032 1925> -.015 1967> -.008 1921< -.006 Higher 1948 .025 1955 .025

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

1919 1920 4.4 SD

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

1960 .206 24 1 >> WARNING: Ring is not usually narrow

1112B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1919 69

1920 158 160 176 167 157 158 119 172 214 205

1930 168 191 156 140 139 47 56 59 75 124

1940 143 109 125 126 129 88 49 117 49 52

1950 59 104 107 64 51 106 69 67 48 40

1960 0 20 35 45 65 76 94 93 85 91

1970 62 75 58 62 127 206 194 193 198 195

1980 175 138 175 103 144 164 124 126 142 176

1990 133 112 197 178 121 71 114 116 102 122

2000 85 106 116 46 112 46 72 91 45 84

2010 70 46 65 136 100 164 68

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1114A 1952 to 2016 65 years Series 11

[B] Entire series, effect on correlation ( .495) is:

Lower 1983> -.078 1969> -.032 1975< -.019 1977< -.013 2005> -.013 2013< -.010 Higher 1991 .045 2016 .034

1114A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1952 113 49 75 83 79 50 9 7

1960 38 79 52 148 185 157 187 141 202 165

1970 142 120 209 211 121 105 125 87 126 210

1980 214 220 333 449 277 178 251 259 244 270

1990 297 123 227 246 267 143 112 158 238 159

2000 124 156 119 88 207 161 179 156 158 203

2010 181 87 162 81 83 163 47

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1114B 1958 to 2016 59 years Series 12

[B] Entire series, effect on correlation ( .397) is:

Lower 1996< -.060 2016> -.045 1973> -.023 1983> -.019 2009< -.016 1995> -.016 Higher 1991 .041 2011 .040

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

2011 -1.050 28 1

2013 .304 28 1 >> WARNING: Ring is not usually narrow

2016 -1.008 28 3

>> WARNING: Last ring in series is ABSENT

1114B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1958 99 124

1960 253 250 181 203 189 182 162 128 239 166

1970 234 196 279 359 171 211 184 143 207 261

1980 231 136 226 208 196 156 182 200 186 246

1990 278 108 179 142 156 126 65 84 97 76

2000 88 79 60 45 77 39 72 66 31 27

2010 37 0 23 0 16 19 0

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1115A 1947 to 2016 70 years Series 13

[B] Entire series, effect on correlation ( .338) is:

Lower 1984< -.068 2016> -.048 1955< -.028 1979< -.021 2003> -.019 2015< -.016 Higher 1991 .063 2011 .031

1115A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1947 116 75 176

1950 202 182 149 109 137 112 113 121 162 146

1960 232 228 237 271 218 255 210 213 199 153

1970 214 174 189 163 119 192 208 270 194 144

1980 187 215 224 154 88 151 137 143 167 161

1990 213 108 178 155 153 114 109 149 148 192

2000 148 165 97 182 216 203 222 280 286 347

2010 285 92 93 116 228 139 212

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1116A 1953 to 2016 64 years Series 14

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

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

1967 2016 0 .05 -.01 -.23 .05 -.14 .25 .02 .01 .21 -.15 .28\* - - - - - - - - - -

[B] Entire series, effect on correlation ( .263) is:

Lower 2003> -.064 2015< -.033 2016> -.030 1967> -.022 1954< -.021 1992< -.020 Higher 1995 .065 1974 .028

1967 to 2016 segment:

Lower 2003> -.071 2015< -.040 2016> -.036 1976< -.026 1992< -.025 1967> -.023 Higher 1995 .065 1974 .029

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

2003 +4.1 SD

1116A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1953 267 158 209 182 185 193 236

1960 262 246 267 239 252 270 309 363 269 219

1970 288 255 274 293 231 267 227 275 315 404

1980 351 268 336 256 281 270 219 280 290 325

1990 270 198 202 254 237 163 203 237 241 243

2000 218 218 261 348 214 159 234 212 120 176

2010 173 164 149 133 207 131 125

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1116B 1955 to 2016 62 years Series 15

[B] Entire series, effect on correlation ( .443) is:

Lower 2003> -.051 1957< -.019 2008> -.016 1992< -.014 1977< -.014 1960< -.012 Higher 1969 .060 1991 .047

1116B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1955 250 237 192 219 224

1960 222 313 297 345 360 375 325 314 357 247

1970 315 308 320 348 317 348 295 263 314 423

1980 359 331 333 305 420 360 304 375 395 364

1990 374 222 279 325 371 308 316 298 283 351

2000 443 364 381 492 358 266 358 419 394 342

2010 204 171 166 159 210 170 84

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1117A 1943 to 2016 74 years Series 16

[B] Entire series, effect on correlation ( .537) is:

Lower 2009< -.037 2011> -.026 2014< -.015 1970< -.013 1958> -.011 1963< -.011 Higher 1971 .024 1969 .024

1117A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1943 174 305 190 135 152 75 105

1950 173 321 357 373 311 424 380 322 393 330

1960 448 378 274 229 320 229 281 288 295 188

1970 142 108 172 157 159 162 166 129 198 155

1980 168 156 185 124 199 121 94 114 145 262

1990 374 176 160 144 112 79 79 96 164 128

2000 154 148 135 123 155 86 117 119 91 85

2010 113 141 253 211 135 150 103

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1117B 1941 to 2016 76 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

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

1967 2016 -2 -.09 -.28 .20 -.12 .04 -.17 .21 -.28 .41\*-.18 .36| - - - - - - - - - -

[B] Entire series, effect on correlation ( .343) is:

Lower 1966< -.070 2016> -.049 1999< -.030 2007< -.025 2005> -.011 1959> -.011 Higher 1945 .040 1969 .027

1967 to 2016 segment:

Lower 2016> -.077 1999< -.058 2007< -.045 2005> -.017 2006> -.015 2000> -.015 Higher 1969 .042 1995 .027

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

1999 2000 4.1 SD

1117B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1941 239 191 198 239 106 116 106 99 93

1950 137 281 279 305 502 616 335 369 375 418

1960 400 412 398 255 231 273 114 102 159 102

1970 218 148 216 136 108 139 177 184 194 242

1980 373 353 359 230 299 161 189 244 364 444

1990 454 267 213 167 164 113 171 123 134 82

2000 184 147 106 96 103 99 124 83 69 75

2010 68 52 51 52 71 65 60

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

1118B 1937 to 2016 80 years Series 18

[B] Entire series, effect on correlation ( .442) is:

Lower 1952< -.044 2015< -.035 1969> -.020 1995> -.014 1948> -.014 1981> -.011 Higher 1991 .037 1945 .036

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

1991 -4.6 SD

1118B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1937 396 297 272

1940 298 412 361 268 318 199 194 192 203 168

1950 222 179 140 161 197 211 160 182 166 156

1960 154 148 130 157 230 222 218 215 205 168

1970 167 112 92 116 95 87 80 53 124 180

1980 286 224 230 98 123 88 107 107 149 97

1990 95 39 131 136 125 105 76 106 79 90

2000 69 120 63 53 74 44 52 103 50 96

2010 110 73 184 181 129 14 7

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

1119A 1937 to 2016 80 years Series 19

[B] Entire series, effect on correlation ( .511) is:

Lower 1951< -.051 1937< -.020 1948> -.018 2015< -.017 1983> -.011 2011> -.011 Higher 2016 .028 1982 .020

1119A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1937 128 192 152

1940 197 209 198 184 207 100 72 93 94 115

1950 146 63 182 143 181 200 103 99 76 57

1960 52 32 27 32 58 40 86 35 73 24

1970 25 19 66 62 44 62 64 85 111 115

1980 87 38 215 98 163 98 45 36 82 79

1990 115 72 213 203 174 137 190 193 257 195

2000 181 158 72 32 75 71 149 119 87 152

2010 117 124 192 190 183 103 36

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

1119B 1921 to 2016 96 years Series 20

[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 - - - -.13 -.06 -.19 .11 .17 .19 .03 .32\*-.04 .03 -.07 -.09 .07 -.21 -.02 .02 -.07 .04

[B] Entire series, effect on correlation ( .503) is:

Lower 1935> -.028 1930< -.023 1928< -.022 1960< -.021 1933> -.014 1980< -.012 Higher 2016 .048 1969 .034

1925 to 1974 segment:

Lower 1935> -.048 1930< -.040 1960< -.037 1928< -.033 1933> -.024 1937> -.017 Higher 1969 .114 1948 .043

1119B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1921 185 126 86 49 61 65 65 64 94

1930 37 102 123 270 240 297 232 310 277 240

1940 256 183 180 201 192 118 91 104 52 50

1950 85 89 149 126 113 122 93 76 65 55

1960 35 36 53 82 87 67 78 81 138 61

1970 94 49 110 56 91 127 167 142 162 170

1980 101 123 219 93 86 85 120 158 223 257

1990 276 79 168 90 77 47 45 61 59 76

2000 77 71 88 81 121 75 82 146 118 133

2010 104 120 183 205 242 239 55

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

1120A 1937 to 2016 80 years Series 21

[B] Entire series, effect on correlation ( .465) is:

Lower 1991> -.023 1959< -.014 1973> -.013 1998< -.011 2001< -.011 1995> -.011 Higher 1969 .040 1946 .031

1120A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1937 53 69 78

1940 71 55 68 37 61 35 10 66 41 25

1950 44 58 46 39 46 46 45 49 41 21

1960 43 46 54 67 85 80 91 85 184 70

1970 78 68 228 315 196 228 230 321 239 260

1980 251 227 367 325 448 400 380 348 337 353

1990 387 355 416 424 344 289 312 302 189 178

2000 160 142 117 126 260 206 279 256 250 308

2010 220 235 237 252 266 471 261

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

1120B 1937 to 2016 80 years Series 22

[B] Entire series, effect on correlation ( .434) is:

Lower 1942< -.041 1940< -.036 2011> -.015 1989< -.014 1986> -.014 1979< -.013 Higher 1991 .040 1946 .035

1120B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1937 67 62 65

1940 42 59 38 52 66 43 28 77 66 81

1950 90 123 97 61 74 95 78 93 63 47

1960 65 57 51 88 109 99 106 49 123 85

1970 95 60 37 26 33 73 66 216 162 108

1980 144 107 219 189 255 255 327 237 200 116

1990 174 65 142 207 133 96 151 195 197 193

2000 136 101 121 82 142 41 83 71 96 358

2010 264 191 155 131 119 140 102

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

1121A 1974 to 2016 43 years Series 23

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

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

1974 2016 -10 .39\* .06 .08 -.02 -.10 -.07 -.22 -.06 .13 -.25 .28| - - - - - - - - - -

[B] Entire series, effect on correlation ( .281) is:

Lower 1991> -.072 1974> -.060 2013< -.035 1981< -.028 2001< -.009 1996> -.008 Higher 2005 .042 2009 .031

1974 to 2016 segment:

Lower 1991> -.072 1974> -.060 2013< -.035 1981< -.028 2001< -.009 1996> -.008 Higher 2005 .042 2009 .031

1121A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1974 362 342 268 300 275 298

1980 277 174 251 205 206 235 210 205 252 280

1990 365 353 292 228 242 201 290 251 274 237

2000 158 140 177 149 152 108 121 141 144 186

2010 164 136 191 111 122 180 131

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

1121B 1975 to 2016 42 years Series 24

[B] Entire series, effect on correlation ( .400) is:

Lower 1980< -.093 2016> -.066 1991> -.056 2008> -.016 2013< -.016 1979< -.014 Higher 1983 .047 2003 .043

1121B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1975 378 316 320 319 288

1980 247 241 327 251 308 283 298 257 283 289

1990 306 299 304 258 317 245 269 254 306 273

2000 276 240 163 97 174 130 130 234 210 259

2010 165 104 166 108 165 180 149

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

1122A 1927 to 2016 90 years Series 25

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

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

1927 1976 1 - -.05 -.04 -.10 -.42 -.19 -.21 .08 .12 .04 .35| .44\*-.11 .13 -.15 -.17 -.11 -.31 .00 .15 .03

1950 1999 0 -.04 -.20 -.17 -.01 -.28 -.13 -.07 .11 .18 -.01 .28\* .03 -.05 -.02 -.02 -.05 -.02 -.09 .19 -.11 .15

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

Lower 1969> -.026 1968< -.021 1946> -.017 1974> -.013 1967> -.013 1961< -.011 Higher 2016 .065 1945 .043

1927 to 1976 segment:

Lower 1969> -.044 1968< -.039 1946> -.025 1967> -.024 1974> -.022 1961< -.021 Higher 1945 .124 1955 .030

1950 to 1999 segment:

Lower 1968< -.048 1969> -.043 1967> -.027 1961< -.026 1981> -.022 1974> -.021 Higher 1982 .058 1991 .049

1122A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1927 185 268 185

1930 209 308 275 159 137 109 86 77 154 156

1940 180 135 205 186 183 71 112 115 113 126

1950 147 155 165 117 172 201 182 147 128 117

1960 108 96 130 143 160 131 132 164 103 123

1970 107 102 102 106 124 205 146 119 104 110

1980 176 169 236 121 93 92 81 81 85 86

1990 117 86 99 118 161 128 208 178 135 174

2000 197 148 146 127 187 153 218 264 202 258

2010 184 181 178 157 175 193 109

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

1122B 1990 to 2016 27 years Series 26

[B] Entire series, effect on correlation ( .703) is:

Lower 1992< -.030 2000> -.023 1996> -.022 1999> -.017 2010< -.016 2003> -.013 Higher 2016 .090 1991 .045

1122B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1990 327 130 157 196 211 172 377 333 289 467

2000 497 373 247 211 234 181 142 160 153 226

2010 155 130 168 208 201 269 129

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

1115B 1947 to 2016 70 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

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

1947 1996 2 .11 -.07 .18 .05 -.03 .11 -.17 .13 -.09 -.03 .16|-.04 .21\*-.07 -.05 .07 -.18 .20 -.25 -.05 -.25

1950 1999 7 .08 -.06 .20 .11 -.06 .11 -.07 .13 -.20 .02 .09|-.06 .22 -.07 .02 .06 -.19 .32\*-.31 -.04 -.24

1967 2016 0 .03 -.04 .08 .06 -.13 .16 -.16 .17 -.22 -.02 .21\* - - - - - - - - - -

[B] Entire series, effect on correlation ( .196) is:

Lower 1984< -.061 2016> -.042 1954< -.038 1979< -.026 2003> -.019 1971> -.018 Higher 2011 .060 1974 .043

1947 to 1996 segment:

Lower 1984< -.090 1954< -.057 1979< -.039 1971> -.025 1991> -.023 1959> -.023 Higher 1974 .073 1948 .060

1950 to 1999 segment:

Lower 1984< -.075 1954< -.053 1979< -.038 1959> -.025 1971> -.024 1991> -.022 Higher 1974 .090 1969 .052

1967 to 2016 segment:

Lower 1984< -.089 2016> -.053 1979< -.035 2003> -.024 1971> -.023 1991> -.022 Higher 2011 .068 1974 .047

1115B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1947 118 80 149

1950 159 155 127 133 86 200 150 214 159 247

1960 220 261 261 238 171 195 158 155 166 139

1970 187 188 186 181 118 169 162 182 185 138

1980 239 203 176 151 98 161 188 223 243 205

1990 203 212 278 260 260 200 197 231 155 146

2000 124 192 121 192 195 176 162 209 155 254

2010 146 42 84 101 157 134 151

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

1118A 1933 to 2016 84 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

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

1933 1982 -6 .11 .09 .00 -.09 .33\* .09 -.27 .19 .09 -.04 .13| .07 .12 .13 -.18 .05 -.23 -.07 .05 -.45 -.03

1950 1999 -6 .02 .00 -.06 -.15 .34\*-.03 .06 .24 .19 -.17 .09| .05 .08 -.09 -.13 .04 -.02 -.11 .18 -.30 -.17

[B] Entire series, effect on correlation ( .171) is:

Lower 1951< -.078 1955< -.032 2015< -.026 1991> -.025 1974> -.018 1938< -.014 Higher 1945 .033 1995 .025

1933 to 1982 segment:

Lower 1951< -.117 1955< -.049 1974> -.030 1936> -.023 1954< -.019 1938< -.019 Higher 1945 .059 1982 .029

1950 to 1999 segment:

Lower 1951< -.118 1955< -.052 1991> -.043 1974> -.032 1954< -.020 1968< -.015 Higher 1995 .052 1992 .038

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

2015 1.335 28 2 >> WARNING: Ring is not usually narrow

2016 -1.008 28 3

>> WARNING: Last ring in series is ABSENT

1118A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1933 215 234 173 245 258 166 308

1940 269 292 222 160 229 120 85 101 107 164

1950 289 88 73 115 62 21 56 187 121 167

1960 237 326 241 221 238 239 179 196 95 73

1970 107 72 42 51 115 127 96 85 118 171

1980 204 184 216 148 186 146 143 140 149 125

1990 167 210 338 384 254 140 236 152 122 79

2000 65 86 90 51 58 37 17 41 40 49

2010 62 52 162 150 68 0 0

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PART 7: DESCRIPTIVE STATISTICS: GOSH2\_BEAL\_Corr4-50 11:26 Fri 05 May 2017 Page 6

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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 1108A 1958 2016 59 2 0 .608 2.19 3.69 .856 .617 .296 2.49 .414 -.063 1

2 1108B 1947 2016 70 3 1 .344 1.89 3.55 .751 .608 .290 2.63 .505 .001 1

3 1109A 1961 2016 56 2 0 .571 1.52 4.34 .960 .819 .346 2.54 .481 -.039 1

4 1109B 1960 2016 57 2 2 .114 1.35 3.70 .721 .828 .261 2.63 .464 -.084 1

5 1110A 1939 2016 78 3 2 .293 1.63 4.68 1.069 .888 .274 2.67 .420 -.073 2

6 1111A 1945 2016 72 3 3 .252 1.80 3.67 .658 .637 .225 2.66 .507 .006 1

7 1111B 1941 2016 76 3 1 .504 1.62 5.40 1.014 .824 .272 2.48 .371 -.006 1

8 1110C 1934 2016 83 3 1 .282 1.55 6.01 1.211 .917 .303 2.68 .503 .006 1

9 1112A 1918 2016 99 4 2 .413 1.27 2.42 .543 .704 .282 2.72 .540 -.013 1

10 1112B 1919 2016 98 4 1 .465 1.10 2.13 .503 .712 .331 2.53 .389 -.034 1

11 1114A 1952 2016 65 2 0 .495 1.58 4.49 .808 .673 .367 2.70 .483 .002 1

12 1114B 1958 2016 59 2 0 .397 1.42 3.59 .848 .774 .436 2.77 .560 -.082 1

13 1115A 1947 2016 70 3 0 .338 1.76 3.47 .554 .537 .246 2.56 .507 -.066 1

14 1116A 1953 2016 64 2 1 .263 2.39 4.04 .599 .612 .179 2.80 .519 -.035 2

15 1116B 1955 2016 62 2 0 .443 3.09 4.92 .780 .668 .162 2.54 .417 .009 1

16 1117A 1943 2016 74 3 0 .537 1.94 4.47 .957 .772 .261 2.90 .580 .043 1

17 1117B 1941 2016 76 3 1 .343 2.06 6.16 1.246 .818 .248 2.69 .503 -.062 1

18 1118B 1937 2016 80 3 0 .442 1.53 4.12 .829 .818 .286 2.59 .436 -.061 1

19 1119A 1937 2016 80 3 0 .511 1.13 2.57 .612 .642 .382 3.08 .665 .005 4

20 1119B 1921 2016 96 4 1 .503 1.23 3.10 .687 .723 .304 2.65 .472 -.058 3

21 1120A 1937 2016 80 3 0 .465 1.84 4.71 1.297 .889 .267 2.72 .492 .058 1

22 1120B 1937 2016 80 3 0 .434 1.15 3.58 .693 .677 .353 2.91 .522 -.035 1

23 1121A 1974 2016 43 1 1 .281 2.18 3.65 .721 .783 .185 2.50 .457 -.069 1

24 1121B 1975 2016 42 1 0 .400 2.42 3.78 .713 .748 .197 2.53 .649 .077 1

25 1122A 1927 2016 90 3 2 .464 1.50 3.08 .489 .596 .211 2.57 .394 -.042 1

26 1122B 1990 2016 27 1 0 .703 2.35 4.97 1.013 .619 .274 2.63 .603 -.119 1

27 1115B 1947 2016 70 3 3 .196 1.75 2.78 .488 .508 .239 2.55 .479 .002 1

28 1118A 1933 2016 84 3 2 .171 1.46 3.84 .845 .729 .362 2.66 .443 -.041 1

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Total or mean: 1990 74 24 .398 1.67 6.16 .794 .722 .283 3.08 .486 -.026

- = [ COFECHA BEAL COF ] = -