[] Dendrochronology Program Library Run JUVI Program COF 15:50 Mon 17 Sep 2018 Page 1

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[] P R O G R A M C O F E C H A Version 6.06P 30577

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QUALITY CONTROL AND DATING CHECK OF TREE-RING MEASUREMENTS

Title of run: TNCBH\_JUVI\_CORR1-50

File of DATED series: TNCBH\_JUVI\_CORR1.rwl

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 1930 to 2018 89 years

Continuous time span is 1930 to 2018 89 years

Portion with two or more series is 1930 to 2018 89 years

>> 7B 2018 absent in 1 of 31 series, but is not usually narrow: master index is -.347

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

\*C\* Number of dated series 31 \*C\*

\*O\* Master series 1930 2018 89 yrs \*O\*

\*F\* Total rings in all series 2398 \*F\*

\*E\* Total dated rings checked 2398 \*E\*

\*C\* Series intercorrelation .536 \*C\*

\*H\* Average mean sensitivity .206 \*H\*

\*A\* Segments, possible problems 4 \*A\*

\*\*\* Mean length of series 77.4 \*\*\*

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

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

2A 1 absent rings: 2014

2B 1 absent rings: 2014

7B 2 absent rings: 2014 2018

4 absent rings .167%

1950 -.488 29 2000 .645 31

1951 .212 30 2001 .229 31

1952 -.265 30 2002 1.320 31

1953 .589 30 2003 -.005 31

1954 .152 30 2004 .587 31

1955 1.623 30 2005 .447 31

1956 -.244 30 2006 .564 31

1957 .293 30 2007 -.494 31

1958 2.354 30 2008 1.096 31

1959 .554 30 2009 1.220 31

1960 -.873 30 2010 .748 31

1961 -.058 31 2011 -2.552 31

1962 .450 31 2012 .979 31

1963 -2.143 31 2013 .800 31

1964 .161 31 2014 -1.733 31 3

1965 -.208 31 2015 -.228 31

1966 -.787 31 2016 .603 31

1967 -.027 31 2017 .157 31

1968 -.097 31 2018 -.347 31 1<<

1969 -1.605 31

1970 -.779 31

1971 -1.092 31

1972 -.462 31

1973 .515 31

1974 2.476 31

1975 -.481 31

1976 .000 31

1977 1.079 31

1978 -.045 31

1979 .148 31

1930 -2.295 2 1980 1.398 31

1931 -1.349 2 1981 .473 31

1932 .640 2 1982 .701 31

1933 -1.643 3 1983 .686 31

1934 -.366 3 1984 1.074 31

1935 .129 4 1985 .756 31

1936 -.136 5 1986 .574 31

1937 .977 6 1987 -.920 31

1938 1.672 7 1988 -.806 31

1939 1.768 9 1989 -1.779 31

1940 -.168 18 1990 -1.034 31

1941 .171 20 1991 -1.761 31

1942 1.392 20 1992 -1.577 31

1943 -.462 21 1993 -.222 31

1944 -1.603 22 1994 -.710 31

1945 .278 23 1995 .314 31

1946 -1.043 24 1996 -.521 31

1947 .071 26 1997 -.288 31

1948 .535 27 1998 1.004 31

1949 -.863 27 1999 -.056 31

PART 5: CORRELATION OF SERIES BY SEGMENTS: TNCBH\_JUVI\_CORR1-50 15:50 Mon 17 Sep 2018 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 1925 1950 1975

1974 1999 2024

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

1 1A 1961 2018 .45 .50

2 1B 1941 2018 .51 .53 .58

3 2A 1935 2018 .57 .68 .60

4 2B 1938 2018 .43 .47 .41

5 3A 1940 2018 .48 .55 .51

6 3B 1940 2018 .46 .51 .57

7 4A 1950 2018 .55 .57

8 5A 1946 2018 .60 .60 .64

9 5B 1950 2018 .61 .63

10 6A 1945 2018 .38 .38 .42

11 6B 1940 2018 .42 .40 .47

12 7A 1947 2018 .51 .49 .45

13 7B 1947 2018 .47 .50 .65

14 8A 1944 2018 .63 .64 .63

15 8B 1940 2018 .64 .60 .63

16 9A 1943 2018 .51 .52 .57

17 9B 1933 2018 .65 .64 .65

18 10A 1940 2018 .47 .45 .60

19 10B 1937 2018 .66 .48 .49

20 11A 1936 2018 .39 .43 .53

21 11B 1939 2018 .29A .26A .27A

22 12A 1939 2018 .62 .60 .57

23 12B 1941 2018 .65 .69 .46

24 13A 1930 2018 .59 .60 .72

25 13B 1930 2018 .70 .62 .62

26 14A 1940 2018 .70 .71 .53

27 14B 1940 2018 .55 .51 .53

28 15A 1951 2018 .54 .26A

29 15B 1948 2018 .56 .58 .48

30 16A 1940 2018 .47 .48 .60

31 16B 1940 2018 .59 .56 .62

Av segment correlation .54 .54 .54

PART 6: POTENTIAL PROBLEMS: TNCBH\_JUVI\_CORR1-50 15:50 Mon 17 Sep 2018 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

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

1A 1961 to 2018 58 years Series 1

[B] Entire series, effect on correlation ( .469) is:

Lower 2014> -.031 1999< -.022 2013< -.022 1987> -.019 1963> -.016 1994> -.015 Higher 2011 .040 1975 .035

1A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1961 271 267 212 242 274 230 179 176 101

1970 110 127 158 195 189 90 71 100 91 132

1980 172 136 185 177 125 129 151 131 112 84

1990 94 55 54 63 90 94 67 62 79 45

2000 40 50 76 102 91 116 104 96 130 147

2010 108 63 162 111 65 124 139 98 80

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

1B 1941 to 2018 78 years Series 2

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

Lower 1963> -.024 1956> -.023 2017< -.012 2007> -.011 1950> -.010 1946> -.009 Higher 1975 .021 1969 .020

1B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1941 197 243 222 169 236 261 304 299 231

1950 308 346 253 262 219 224 294 249 301 194

1960 133 117 157 166 156 149 133 232 232 102

1970 126 154 181 241 258 127 165 172 158 163

1980 151 112 104 87 96 126 157 108 83 70

1990 67 30 33 57 58 75 58 56 61 36

2000 39 53 86 109 168 131 95 108 97 147

2010 126 59 89 68 46 58 101 61 57

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

2A 1935 to 2018 84 years Series 3

[B] Entire series, effect on correlation ( .593) is:

Lower 1935< -.048 1943> -.029 1952< -.017 1987> -.010 1996> -.010 2003> -.008 Higher 2014 .047 1963 .026

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

2014 -1.733 31 3

2A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1935 37 119 161 306 325

1940 251 271 382 378 283 317 247 292 254 221

1950 249 248 184 204 178 206 184 209 300 188

1960 150 157 161 101 122 124 83 124 111 58

1970 64 53 69 66 104 62 103 93 68 86

1980 94 96 128 173 133 142 126 113 118 76

1990 96 66 67 80 70 85 94 69 100 76

2000 71 90 89 86 61 74 81 54 52 66

2010 42 22 41 32 0 9 29 30 19

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2B 1938 to 2018 81 years Series 4

[B] Entire series, effect on correlation ( .460) is:

Lower 1994> -.025 2004< -.018 1940< -.017 1986< -.014 1972< -.013 2018> -.012 Higher 2014 .049 1974 .016

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

2014 -1.733 31 3

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

1994 +3.1 SD

2B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1938 280 259

1940 176 292 245 228 199 257 169 169 269 175

1950 198 226 190 173 216 244 166 225 230 229

1960 168 168 235 173 246 281 246 209 174 155

1970 157 139 121 150 259 167 224 218 185 210

1980 223 300 226 264 209 185 148 167 169 155

1990 186 152 172 229 319 243 186 221 311 164

2000 183 226 199 171 121 128 133 150 123 93

2010 111 54 97 56 0 21 40 49 37

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3A 1940 to 2018 79 years Series 5

[B] Entire series, effect on correlation ( .458) is:

Lower 1940< -.024 2011> -.023 1943> -.016 1944> -.015 2000< -.014 1941< -.014 Higher 1974 .025 1958 .019

3A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1940 192 223 291 324 329 363 297 344 413 343

1950 328 384 394 378 389 405 305 281 416 311

1960 197 234 318 244 218 280 199 200 235 173

1970 182 162 203 279 336 236 212 211 162 183

1980 205 144 145 168 167 143 134 123 121 100

1990 78 83 76 104 114 112 69 91 94 77

2000 67 91 132 75 84 89 66 67 81 90

2010 95 67 76 62 39 48 62 47 36

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

3B 1940 to 2018 79 years Series 6

[B] Entire series, effect on correlation ( .475) is:

Lower 1944> -.026 1940< -.023 1943> -.016 2007> -.015 1975> -.013 2012< -.011 Higher 1974 .032 2011 .020

3B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1940 155 273 296 326 361 299 226 286 400 319

1950 408 338 397 358 330 289 235 232 292 220

1960 176 191 230 182 205 227 164 162 178 149

1970 150 118 145 183 320 215 154 230 158 183

1980 185 172 158 165 187 157 180 139 154 100

1990 134 132 139 167 168 170 102 115 124 133

2000 159 135 190 112 144 168 200 209 189 170

2010 150 86 99 97 71 102 121 95 65

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4A 1950 to 2018 69 years Series 7

[B] Entire series, effect on correlation ( .522) is:

Lower 2011> -.057 1963> -.023 1958< -.021 1987> -.013 1971> -.013 2015< -.008 Higher 2014 .061 1975 .026

4A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1950 213 205 205 191 178 193 110 95 103 84

1960 75 79 74 81 145 126 98 113 102 70

1970 80 123 122 178 217 103 92 125 104 128

1980 159 122 150 123 143 190 168 155 156 123

1990 91 86 64 80 84 95 86 123 219 122

2000 119 90 123 79 131 89 103 89 90 94

2010 112 92 92 86 27 38 77 95 97

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5A 1946 to 2018 73 years Series 8

[B] Entire series, effect on correlation ( .627) is:

Lower 2000< -.026 1966> -.018 1957< -.016 1980< -.014 1979< -.012 2016< -.011 Higher 2014 .037 1963 .035

5A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1946 283 300 270 266

1950 309 337 378 393 325 396 269 203 294 246

1960 204 177 189 128 171 194 226 225 165 145

1970 143 156 159 179 198 141 155 148 95 73

1980 79 71 81 87 114 101 118 74 82 56

1990 78 46 46 72 57 72 54 53 78 86

2000 57 59 92 72 106 81 87 92 118 106

2010 91 49 68 74 25 46 37 45 36

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5B 1950 to 2018 69 years Series 9

[B] Entire series, effect on correlation ( .668) is:

Lower 1969> -.037 1973< -.025 1975> -.021 1997< -.011 1950> -.011 1972< -.011 Higher 1963 .047 1958 .020

5B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1950 433 367 338 361 311 357 257 237 391 232

1960 201 183 197 137 185 205 196 232 178 186

1970 164 145 119 113 191 145 146 158 128 100

1980 116 105 98 107 130 128 90 62 60 40

1990 50 41 34 47 34 43 42 30 39 30

2000 37 39 74 51 48 37 45 32 58 45

2010 44 26 52 47 24 28 41 27 25

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6A 1945 to 2018 74 years Series 10

[B] Entire series, effect on correlation ( .386) is:

Lower 2010< -.041 1963> -.039 1987> -.022 2004< -.018 1959< -.017 1980< -.015 Higher 1975 .034 2014 .030

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

1963 +3.2 SD

6A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1945 359 307 244 246 211

1950 287 272 277 302 271 432 337 282 381 225

1960 176 251 394 343 352 307 183 114 160 146

1970 183 126 109 94 146 78 89 86 58 63

1980 59 46 51 70 163 178 154 138 77 71

1990 86 58 68 95 64 66 85 97 115 99

2000 80 78 74 59 43 53 54 52 63 69

2010 38 25 57 71 41 29 27 31 35

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6B 1940 to 2018 79 years Series 11

[B] Entire series, effect on correlation ( .449) is:

Lower 1963> -.035 1992> -.021 1987> -.016 1956> -.013 2018> -.012 2007< -.012 Higher 2011 .062 1975 .027

6B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1940 258 281 284 241 244 241 214 209 249 255

1950 224 216 189 246 201 322 265 225 246 187

1960 149 157 192 177 198 125 120 106 132 114

1970 165 125 171 147 169 91 95 100 73 92

1980 99 91 98 115 110 120 92 112 111 90

1990 82 73 127 138 118 117 90 80 87 53

2000 58 93 140 105 120 72 85 37 57 55

2010 45 25 54 32 27 24 31 24 25

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7A 1947 to 2018 72 years Series 12

[B] Entire series, effect on correlation ( .472) is:

Lower 2011> -.070 1951< -.018 1989> -.015 1988> -.014 2008< -.013 1985< -.009 Higher 2014 .061 1974 .022

7A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1947 220 232 181

1950 220 158 154 167 176 207 146 156 190 185

1960 134 188 154 128 141 119 118 140 135 121

1970 142 129 146 181 182 108 133 118 85 89

1980 141 107 91 85 99 73 81 51 88 76

1990 69 54 51 45 51 77 66 39 59 61

2000 104 66 57 44 42 31 23 11 19 21

2010 24 24 31 35 8 9 13 10 6

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7B 1947 to 2018 72 years Series 13

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

Lower 2011> -.051 1953< -.044 1950< -.027 1949> -.023 1966< -.013 1968< -.012 Higher 2014 .045 1974 .021

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

2014 -1.733 31 3

2018 -.347 31 1 >> WARNING: Ring is not usually narrow

>> WARNING: Last ring in series is ABSENT

7B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1947 292 285 306

1950 231 295 271 203 226 225 184 178 234 199

1960 183 172 160 139 191 143 98 110 96 105

1970 140 133 133 154 190 127 120 146 139 124

1980 155 120 112 133 115 117 98 66 63 40

1990 45 33 34 41 34 35 28 25 28 15

2000 22 29 22 21 24 17 15 6 19 15

2010 10 8 17 14 0 5 11 5 0

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8A 1944 to 2018 75 years Series 14

[B] Entire series, effect on correlation ( .633) is:

Lower 2014> -.030 1944> -.018 1977< -.014 1955< -.009 2007> -.009 1993< -.008 Higher 2011 .068 1963 .022

8A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1944 218 242 160 187 203 162

1950 159 175 212 264 257 214 176 186 222 170

1960 139 161 131 105 143 121 121 106 117 93

1970 108 98 100 99 126 98 109 93 117 121

1980 134 104 109 117 105 128 102 88 70 57

1990 54 57 54 46 48 49 51 56 56 50

2000 60 43 54 52 55 45 51 50 63 43

2010 56 14 42 37 33 33 28 20 19

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8B 1940 to 2018 79 years Series 15

[B] Entire series, effect on correlation ( .679) is:

Lower 2017< -.035 1966> -.022 1984< -.011 1969> -.011 1974< -.011 1999> -.009 Higher 2011 .059 1963 .039

8B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1940 344 397 384 268 227 298 251 261 268 230

1950 214 200 195 230 237 271 209 212 287 217

1960 198 197 165 118 170 173 210 187 197 163

1970 123 136 114 115 133 105 98 128 126 169

1980 171 155 132 140 96 110 81 63 49 52

1990 56 45 50 45 45 51 38 41 58 59

2000 62 41 50 40 53 57 47 41 43 40

2010 36 19 33 30 18 19 17 10 13

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9A 1943 to 2018 76 years Series 16

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

Lower 2014> -.037 1943> -.028 2006< -.023 1999> -.022 1944> -.019 1998< -.019 Higher 2011 .115 1958 .019

9A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1943 272 256 241 186 166 186 138

1950 172 162 182 278 247 279 271 380 406 308

1960 223 260 281 252 317 226 254 270 238 218

1970 226 258 203 265 298 218 195 239 219 164

1980 204 182 233 193 187 144 108 91 59 34

1990 47 37 41 40 39 48 22 33 24 46

2000 36 29 30 26 29 34 20 40 49 47

2010 57 19 40 46 45 57 44 35 35

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9B 1933 to 2018 86 years Series 17

[B] Entire series, effect on correlation ( .686) is:

Lower 1969> -.018 1970> -.013 1945< -.010 1942< -.010 1996> -.007 1994> -.007 Higher 2011 .033 1963 .026

9B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1933 74 199 250 291 384 449 433

1940 306 246 224 197 163 169 173 204 249 188

1950 169 232 214 245 188 216 168 261 281 234

1960 176 174 245 132 196 192 198 228 207 214

1970 276 221 183 236 245 184 162 178 189 155

1980 200 211 190 147 185 130 138 92 87 48

1990 66 55 69 67 77 74 73 57 70 68

2000 57 49 56 58 65 63 57 51 64 74

2010 66 35 43 53 33 38 40 42 32

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10A 1940 to 2018 79 years Series 18

[B] Entire series, effect on correlation ( .551) is:

Lower 1940> -.020 1946> -.017 1960> -.017 1975> -.011 2003> -.011 1999> -.009 Higher 2014 .043 2011 .034

10A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1940 343 283 298 199 129 183 212 193 185 168

1950 158 158 164 174 154 184 159 221 248 139

1960 169 179 114 79 83 65 68 63 51 28

1970 26 20 24 30 68 68 87 123 121 112

1980 105 128 126 142 132 146 99 85 84 80

1990 66 69 74 70 56 74 53 65 73 85

2000 89 74 73 89 117 82 71 61 76 69

2010 69 38 73 59 21 24 37 37 37

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10B 1937 to 2018 82 years Series 19

[B] Entire series, effect on correlation ( .551) is:

Lower 2011> -.036 1994< -.026 1991> -.021 1962< -.014 1999< -.014 1960> -.012 Higher 2014 .043 1958 .020

10B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1937 359 382 416

1940 260 264 355 208 174 205 209 225 174 156

1950 152 157 143 175 150 133 117 156 199 121

1960 125 118 71 51 86 69 70 95 83 53

1970 50 41 45 48 109 78 106 137 116 119

1980 143 138 115 106 115 101 106 93 87 83

1990 103 97 85 92 63 85 72 75 67 46

2000 48 43 44 37 36 36 40 35 43 43

2010 35 29 43 45 21 22 30 26 19

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11A 1936 to 2018 83 years Series 20

[B] Entire series, effect on correlation ( .473) is:

Lower 1936< -.033 2014> -.024 2008< -.020 1985< -.018 1954< -.018 1956> -.013 Higher 2011 .103 1963 .061

11A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1936 91 227 249 217

1940 185 227 182 155 129 162 169 200 200 125

1950 107 121 108 93 72 117 137 102 144 123

1960 132 129 137 74 109 140 119 125 120 112

1970 95 77 143 110 148 97 137 113 91 82

1980 88 101 103 90 82 52 62 54 51 46

1990 49 55 31 62 42 41 51 59 55 43

2000 63 61 71 45 73 77 69 49 37 41

2010 44 24 46 50 41 40 35 36 34

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11B 1939 to 2018 80 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

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1939 1988 0 - -.11 -.17 -.06 .07 -.05 -.11 .16 .26 -.22 .29\* .03 -.07 .15 .10 -.20 .22 .13 -.14 -.06 .12

1950 1999 0 -.14 -.08 -.10 -.17 .05 -.06 -.12 .18 .15 -.04 .26\*-.09 .12 -.01 .21 -.09 .19 .17 -.11 -.08 .16

1969 2018 0 -.06 -.22 .02 .00 .09 -.28 .20 -.08 -.07 -.03 .27\* - - - - - - - - - -

[B] Entire series, effect on correlation ( .287) is:

Lower 2014> -.050 1982< -.035 1996> -.022 1956> -.019 1983< -.017 2003< -.016 Higher 2011 .047 1974 .033

1939 to 1988 segment:

Lower 1982< -.063 1956> -.036 1983< -.030 1975> -.025 1948< -.025 1960> -.023 Higher 1974 .057 1943 .040

1950 to 1999 segment:

Lower 1982< -.068 1996> -.038 1956> -.034 1983< -.033 1975> -.023 1958< -.022 Higher 1974 .063 1955 .037

1969 to 2018 segment:

Lower 2014> -.077 1982< -.055 1996> -.033 1983< -.027 2003< -.025 1975> -.021 Higher 2011 .081 1974 .052

11B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1939 331

1940 249 306 257 166 225 230 165 190 153 160

1950 197 267 189 157 158 239 227 180 156 158

1960 180 148 145 120 156 105 101 138 95 95

1970 143 117 119 139 192 137 121 99 124 119

1980 158 105 64 60 94 93 86 71 86 72

1990 57 48 45 62 66 64 90 54 70 38

2000 46 54 45 28 56 47 67 59 55 52

2010 57 37 55 53 57 40 49 40 35

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12A 1939 to 2018 80 years Series 22

[B] Entire series, effect on correlation ( .579) is:

Lower 2014> -.060 2016< -.024 1941< -.015 1975> -.012 1985< -.012 1964< -.012 Higher 2011 .079 1969 .016

12A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1939 257

1940 231 191 332 246 218 326 217 265 279 228

1950 216 200 190 232 215 202 154 213 239 194

1960 148 180 202 123 113 111 110 127 88 70

1970 85 91 111 112 150 111 117 157 131 89

1980 102 90 99 106 87 59 63 44 40 49

1990 42 42 45 53 40 37 41 49 53 35

2000 48 47 52 44 43 42 32 23 34 37

2010 35 19 33 25 31 35 21 20 23

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12B 1941 to 2018 78 years Series 23

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

Lower 2014> -.050 2002< -.037 1943> -.031 1969> -.015 1999> -.012 1945< -.010 Higher 1963 .045 1975 .019

12B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1941 305 354 354 258 236 243 320 292 230

1950 217 232 235 272 287 269 199 244 269 217

1960 188 232 232 166 186 182 148 170 176 165

1970 164 145 138 157 209 148 145 214 178 156

1980 160 136 161 172 133 132 133 103 65 61

1990 58 55 54 56 54 65 52 67 78 77

2000 61 74 64 62 64 78 78 60 76 76

2010 63 54 66 72 72 94 85 58 45

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13A 1930 to 2018 89 years Series 24

[B] Entire series, effect on correlation ( .640) is:

Lower 1959> -.014 1966> -.014 1935> -.011 1963> -.011 1947< -.010 1964< -.010 Higher 2011 .021 1974 .016

13A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1930 90 145 239 157 199 325 289 336 326 335

1940 302 263 276 209 179 193 196 177 219 221

1950 180 192 181 206 213 250 182 203 249 252

1960 193 196 225 189 180 178 211 188 183 156

1970 184 187 190 212 242 181 162 191 178 153

1980 186 156 160 140 194 167 150 115 114 118

1990 128 109 124 146 129 140 131 116 122 142

2000 190 132 165 134 148 114 129 130 154 162

2010 117 84 103 101 64 91 84 78 64

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

13B 1930 to 2018 89 years Series 25

[B] Entire series, effect on correlation ( .636) is:

Lower 1991> -.015 1936> -.013 2003< -.012 1966> -.012 1995< -.009 1983< -.008 Higher 1963 .025 2014 .016

13B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1930 94 130 235 178 228 313 358 307 294 390

1940 299 274 263 170 161 228 210 209 225 195

1950 182 203 240 254 214 291 210 202 278 237

1960 232 233 270 189 223 214 243 229 227 192

1970 210 194 203 236 251 165 165 202 140 182

1980 268 188 180 139 157 144 172 119 121 123

1990 122 135 136 145 96 100 102 107 124 125

2000 160 110 116 71 93 104 116 103 133 138

2010 118 76 93 91 49 83 74 77 67

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14A 1940 to 2018 79 years Series 26

[B] Entire series, effect on correlation ( .548) is:

Lower 2018< -.092 2014> -.043 1956> -.011 1946> -.010 2009< -.009 1963> -.009 Higher 2011 .033 1974 .017

14A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1940 337 288 351 255 206 313 301 363 335 265

1950 274 235 192 231 209 256 238 229 252 171

1960 153 125 119 110 126 121 95 109 110 79

1970 97 80 112 121 151 94 98 133 115 102

1980 137 98 107 112 87 75 68 50 44 43

1990 49 48 41 52 48 55 58 59 67 62

2000 72 59 77 71 65 82 112 90 94 72

2010 61 45 64 58 60 59 50 49 31

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14B 1940 to 2018 79 years Series 27

[B] Entire series, effect on correlation ( .543) is:

Lower 1988< -.041 2014> -.029 2009< -.014 1992> -.011 1999> -.011 1996> -.011 Higher 2011 .058 1975 .017

14B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1940 248 210 256 166 190 228 213 314 312 253

1950 251 223 213 257 227 263 224 221 216 171

1960 166 173 156 121 174 137 93 97 117 101

1970 112 110 148 146 182 107 135 146 120 124

1980 152 98 100 97 113 86 73 78 47 59

1990 60 68 84 83 71 76 88 93 108 105

2000 94 78 74 62 58 65 58 44 66 49

2010 47 27 66 63 54 61 65 47 28

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

15A 1951 to 2018 68 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

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

1969 2018 0 -.08 -.24 -.04 -.24 -.06 .00 -.12 .02 -.13 -.06 .26\* - - - - - - - - - -

[B] Entire series, effect on correlation ( .322) is:

Lower 2004< -.113 2018> -.024 2014> -.024 2011> -.021 1986< -.015 1953< -.011 Higher 1963 .042 1975 .029

1969 to 2018 segment:

Lower 2004< -.136 2018> -.027 2014> -.025 2011> -.019 1986< -.018 1993< -.012 Higher 1975 .041 1987 .029

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

1987 1988 4.1 SD

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

1987 -4.9 SD

15A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1951 429 293 235 250 246 239 240 317 251

1960 207 294 217 151 201 167 144 174 178 150

1970 152 195 232 229 250 174 198 224 192 197

1980 200 160 152 129 132 145 103 70 107 97

1990 84 88 77 67 71 83 85 84 95 82

2000 99 83 91 82 42 49 46 23 34 29

2010 16 10 15 17 12 11 12 11 14

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

15B 1948 to 2018 71 years Series 29

[B] Entire series, effect on correlation ( .536) is:

Lower 2014> -.034 1959> -.014 2018> -.012 1994> -.012 2001< -.012 2012< -.012 Higher 1963 .072 2011 .035

15B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1948 254 246

1950 250 342 290 278 271 311 286 262 320 326

1960 279 269 269 192 230 225 243 237 267 228

1970 220 195 228 249 234 167 182 203 213 196

1980 189 179 167 144 141 137 149 111 118 115

1990 137 131 125 141 147 141 124 124 151 119

2000 119 69 110 71 79 52 61 42 71 82

2010 53 32 43 53 50 52 58 50 57

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16A 1940 to 2018 79 years Series 30

[B] Entire series, effect on correlation ( .596) is:

Lower 1940> -.024 1975> -.020 1988> -.016 2013< -.015 1984< -.013 1987> -.012 Higher 2011 .090 1958 .019

16A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1940 393 286 366 314 253 276 205 218 215 194

1950 207 215 202 226 207 280 219 184 283 167

1960 79 84 87 43 56 46 28 33 39 20

1970 20 26 22 21 27 28 31 35 24 37

1980 38 40 71 44 38 46 56 58 73 49

1990 66 58 50 58 54 91 56 60 66 86

2000 113 100 92 75 74 66 62 53 68 70

2010 72 33 59 42 35 51 55 58 44

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16B 1940 to 2018 79 years Series 31

[B] Entire series, effect on correlation ( .642) is:

Lower 1975> -.018 2018> -.017 1989> -.014 1940> -.012 1970< -.012 1958< -.009 Higher 2011 .062 1963 .044

16B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1940 477 455 476 361 260 294 265 292 254 245

1950 207 258 244 281 240 239 166 177 180 184

1960 148 181 162 101 132 134 108 149 150 121

1970 79 77 63 75 120 109 94 122 88 89

1980 106 124 116 129 97 73 43 34 14 31

1990 26 20 17 20 23 25 25 26 27 33

2000 48 44 38 33 30 28 24 14 17 21

2010 22 12 24 24 16 19 19 21 25

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PART 7: DESCRIPTIVE STATISTICS: TNCBH\_JUVI\_CORR1-50 15:50 Mon 17 Sep 2018 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 ()

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1 1A 1961 2018 58 2 0 .469 1.24 2.74 .583 .802 .250 2.78 .626 -.022 4

2 1B 1941 2018 78 3 0 .524 1.47 3.46 .800 .852 .239 2.63 .529 -.012 2

3 2A 1935 2018 84 3 0 .593 1.30 3.82 .890 .899 .288 2.93 .503 -.038 1

4 2B 1938 2018 81 3 0 .460 1.84 3.19 .669 .694 .270 2.82 .562 -.007 1

5 3A 1940 2018 79 3 0 .458 1.88 4.16 1.111 .919 .180 2.74 .531 .018 4

6 3B 1940 2018 79 3 0 .475 1.94 4.08 .811 .824 .195 2.80 .444 -.036 1

7 4A 1950 2018 69 2 0 .522 1.17 2.19 .430 .662 .224 2.70 .385 .032 1

8 5A 1946 2018 73 3 0 .627 1.42 3.96 .956 .934 .215 2.47 .413 -.068 1

9 5B 1950 2018 69 2 0 .668 1.26 4.33 1.044 .928 .228 2.83 .514 .011 1

10 6A 1945 2018 74 3 0 .386 1.45 4.32 1.088 .893 .238 2.78 .587 -.074 2

11 6B 1940 2018 79 3 0 .449 1.34 3.22 .744 .905 .205 2.85 .572 -.049 1

12 7A 1947 2018 72 3 0 .472 .99 2.32 .614 .909 .231 2.83 .563 -.055 1

13 7B 1947 2018 72 3 0 .503 1.05 3.06 .862 .957 .303 2.67 .588 .000 1

14 8A 1944 2018 75 3 0 .633 1.05 2.64 .620 .932 .173 2.38 .315 -.071 2

15 8B 1940 2018 79 3 0 .679 1.32 3.97 .947 .951 .174 2.75 .490 -.041 1

16 9A 1943 2018 76 3 0 .504 1.51 4.06 1.059 .937 .222 2.51 .407 -.111 1

17 9B 1933 2018 86 3 0 .686 1.57 4.49 .928 .900 .190 2.48 .388 -.062 1

18 10A 1940 2018 79 3 0 .551 1.08 3.43 .669 .903 .197 2.55 .376 .013 1

19 10B 1937 2018 82 3 0 .551 1.11 4.16 .835 .916 .183 2.75 .529 -.021 1

20 11A 1936 2018 83 3 0 .473 .97 2.49 .525 .848 .215 2.49 .456 -.059 1

21 11B 1939 2018 80 3 3 .287 1.17 3.31 .697 .879 .218 2.70 .520 .025 1

22 12A 1939 2018 80 3 0 .579 1.14 3.32 .827 .911 .195 2.63 .488 -.007 1

23 12B 1941 2018 78 3 0 .524 1.50 3.54 .839 .936 .142 2.75 .701 .017 3

24 13A 1930 2018 89 3 0 .640 1.75 3.36 .601 .831 .154 2.57 .377 -.036 1

25 13B 1930 2018 89 3 0 .636 1.79 3.90 .716 .829 .174 2.63 .378 -.040 1

26 14A 1940 2018 79 3 0 .548 1.29 3.63 .882 .938 .165 2.65 .400 -.051 1

27 14B 1940 2018 79 3 0 .543 1.29 3.14 .719 .917 .176 2.62 .497 -.048 1

28 15A 1951 2018 68 2 1 .322 1.36 4.29 .914 .926 .189 2.65 .430 -.044 1

29 15B 1948 2018 71 3 0 .536 1.68 3.42 .851 .947 .147 2.47 .400 -.015 1

30 16A 1940 2018 79 3 0 .596 1.02 3.92 .910 .931 .219 2.74 .388 -.093 1

31 16B 1940 2018 79 3 0 .642 1.18 4.77 1.126 .969 .197 2.52 .467 -.058 1

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Total or mean: 2398 89 4 .536 1.37 4.77 .815 .890 .206 2.93 .476 -.033

- = [ COFECHA JUVI COF ] = -