[] Dendrochronology Program Library Run RNM Program COF 16:37 Thu 03 Aug 2017 Page 1

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[] P R O G R A M C O F E C H A Version 6.06P 30167

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QUALITY CONTROL AND DATING CHECK OF TREE-RING MEASUREMENTS

File of DATED series: rnm.txt

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 N

8 Parts printed 1234567

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

Time span of Master dating series is 1854 to 2016 163 years

Continuous time span is 1854 to 2016 163 years

Portion with two or more series is 1861 to 2015 155 years

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

\*C\* Number of dated series 20 \*C\*

\*O\* Master series 1854 2016 163 yrs \*O\*

\*F\* Total rings in all series 2306 \*F\*

\*E\* Total dated rings checked 2298 \*E\*

\*C\* Series intercorrelation .635 \*C\*

\*H\* Average mean sensitivity .214 \*H\*

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

\*\*\* Mean length of series 115.3 \*\*\*

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

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

No ring measurements of zero value

PART 2: TIME PLOT OF TREE-RING SERIES: 16:37 Thu 03 Aug 2017 Page 2

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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

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

. . . . . . . . . . . . . . . . . .<=========> . RNM01A 1 1918 2016 99

. . . . . . . . . . . . . . . . . . <========> . RNM01B 2 1928 2015 88

. . . . . . . . . . . . . . . . . . <=======> . RNM02A 3 1937 2015 79

. . . . . . . . . . . . . . . . . <==========> . RNM02B 4 1902 2015 114

. . . . . . . . . . . . . . . . . .<=========> . RNM03A 5 1919 2015 97

. . . . . . . . . . . . . . . . . <=============> . RNM03B 6 1877 2015 139

. . . . . . . . . . . . . . . . . <==========> . RNM04A 7 1900 2015 116

. . . . . . . . . . . . . . . . . <==========> . RNM04B 8 1906 2015 110

. . . . . . . . . . . . . . . . . <==========> . RNM05A 9 1904 2015 112

. . . . . . . . . . . . . . . . . . <=======> . RNM05B 10 1939 2015 77

. . . . . . . . . . . . . . . . . <===========> . RNM06A 11 1899 2015 117

. . . . . . . . . . . . . . . . . <============> . RNM06B 12 1882 2015 134

. . . . . . . . . . . . . . . . .<==============> . RNM07A 13 1869 2015 147

. . . . . . . . . . . . . . . . .<==============> . RNM07B 14 1862 2015 154

. . . . . . . . . . . . . . . . . <=============> . RNM08A 15 1872 2015 144

. . . . . . . . . . . . . . . . <===============> . RNM08B 16 1854 2015 162

. . . . . . . . . . . . . . . . .<==============> . RNM09A 17 1861 2015 155

. . . . . . . . . . . . . . . . . <==========> . RNM09B 18 1900 2015 116

. . . . . . . . . . . . . . . . . . <=====> . RNM010A 19 1950 2015 66

. . . . . . . . . . . . . . . . . . <=======> . RNM10B 20 1936 2015 80

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

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

PART 3: Master Dating Series: 16:37 Thu 03 Aug 2017 Page 3

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Year Value No Ab Year Value No Ab Year Value No Ab Year Value No Ab Year Value No Ab Year Value No Ab

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1900 -.739 10 1950 1.233 20 2000 .553 20

1901 .140 10 1951 1.679 20 2001 1.058 20

1902 1.341 11 1952 .095 20 2002 .972 20

1903 1.365 11 1953 -.198 20 2003 .980 20

1854 .854 1 1904 .944 12 1954 -1.166 20 2004 1.536 20

1855 .608 1 1905 .374 12 1955 -.389 20 2005 .058 20

1856 -.856 1 1906 .492 13 1956 .639 20 2006 -.636 20

1857 -1.213 1 1907 1.212 13 1957 .405 20 2007 -1.196 20

1858 -1.146 1 1908 .345 13 1958 1.447 20 2008 .665 20

1859 -2.362 1 1909 .115 13 1959 -.998 20 2009 .100 20

1860 -1.387 1 1910 -.503 13 1960 -.442 20 2010 .150 20

1861 1.320 2 1911 -1.498 13 1961 .582 20 2011 .413 20

1862 .513 3 1912 -.013 13 1962 -1.362 20 2012 -1.332 20

1863 .564 3 1913 .421 13 1963 -.244 20 2013 .688 20

1864 -1.241 3 1914 -1.221 13 1964 -.238 20 2014 -.988 20

1865 1.155 3 1915 -.187 13 1965 -.970 20 2015 .381 20

1866 1.279 3 1916 1.217 13 1966 -1.309 20 2016 1.049 1

1867 .347 3 1917 .477 13 1967 -.270 20

1868 .589 3 1918 -1.162 14 1968 .445 20

1869 .889 4 1919 -.945 15 1969 .447 20

1870 .198 4 1920 .221 15 1970 .542 20

1871 -.897 4 1921 -.334 15 1971 1.559 20

1872 -.372 5 1922 .010 15 1972 -.398 20

1873 -1.458 5 1923 .827 15 1973 .806 20

1874 -2.632 5 1924 1.050 15 1974 1.113 20

1875 .181 5 1925 -.586 15 1975 .763 20

1876 1.433 5 1926 .419 15 1976 -.166 20

1877 2.068 6 1927 1.355 15 1977 -2.337 20

1878 1.023 6 1928 1.041 16 1978 .207 20

1879 .005 6 1929 -.498 16 1979 -.506 20

1880 -.717 6 1930 -.870 16 1980 1.764 20

1881 -.678 6 1931 -1.416 16 1981 .255 20

1882 .785 7 1932 .817 16 1982 .286 20

1883 1.331 7 1933 .150 16 1983 .614 20

1884 .298 7 1934 -1.495 16 1984 -1.040 20

1885 -.927 7 1935 .395 16 1985 .575 20

1886 .427 7 1936 -1.808 17 1986 -.380 20

1887 -.541 7 1937 .779 18 1987 .012 20

1888 -.634 7 1938 1.548 18 1988 -2.197 20

1889 .865 7 1939 .029 19 1989 .101 20

1890 .075 7 1940 .106 19 1990 .985 20

1891 .735 7 1941 .594 19 1991 -.677 20

1892 .981 7 1942 .264 19 1992 .552 20

1893 -.128 7 1943 1.052 19 1993 .612 20

1894 -.945 7 1944 -.694 19 1994 -.055 20

1895 -2.331 7 1945 .466 19 1995 .806 20

1896 -2.570 7 1946 -.009 19 1996 .553 20

1897 -.522 7 1947 -.527 19 1997 -.516 20

1898 -1.712 7 1948 -2.507 19 1998 -.796 20

1899 -1.055 8 1949 .689 19 1999 -2.321 20

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PART 4: Master Bar Plot: 16:37 Thu 03 Aug 2017 Page 4

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Year Rel value Year Rel value Year Rel value Year Rel value Year Rel value Year Rel value Year Rel value Year Rel value

1900--c 1950---------E 2000-------B

1901-----A 1951----------G 2001---------D

1902----------E 1952-----@ 2002---------D

1903----------E 1953----a 2003---------D

1854--------C 1904---------D 1954-e 2004----------F

1855-------B 1905------A 1955---b 2005----@

1856--c 1906------B 1956-------C 2006--c

1857-e 1907---------E 1957------B 2007-e

1858-e 1908------A 1958----------F 2008-------C

1859i 1909-----@ 1959-d 2009-----@

1860-f 1910---b 1960---b 2010-----A

1861----------E 1911-f 1961-------B 2011------B

1862-------B 1912----@ 1962-e 2012-e

1863-------B 1913------B 1963---a 2013-------C

1864-e 1914-e 1964---a 2014-d

1865---------E 1915----a 1965-d 2015------B

1866----------E 1916---------E 1966-e 2016---------D

1867------A 1917------B 1967---a

1868-------B 1918-e 1968------B

1869--------D 1919--d 1969------B

1870-----A 1920-----A 1970-------B

1871--d 1921---a 1971----------F

1872---a 1922----@ 1972---b

1873-f 1923--------C 1973--------C

1874k 1924---------D 1974---------D

1875-----A 1925---b 1975--------C

1876----------F 1926------B 1976----a

1877----------H 1927----------E 1977i

1878---------D 1928---------D 1978-----A

1879----@ 1929---b 1979---b

1880--c 1930--c 1980----------G

1881--c 1931-f 1981-----A

1882--------C 1932--------C 1982------A

1883----------E 1933-----A 1983-------B

1884------A 1934-f 1984-d

1885--d 1935------B 1985-------B

1886------B 1936g 1986---b

1887---b 1937--------C 1987----@

1888--c 1938----------F 1988i

1889--------C 1939----@ 1989-----@

1890-----@ 1940-----@ 1990---------D

1891--------C 1941-------B 1991--c

1892---------D 1942-----A 1992-------B

1893----a 1943---------D 1993-------B

1894--d 1944--c 1994----@

1895i 1945------B 1995--------C

1896j 1946----@ 1996-------B

1897---b 1947---b 1997---b

1898g 1948j 1998--c

1899-d 1949-------C 1999i

PART 5: CORRELATION OF SERIES BY SEGMENTS: 16:37 Thu 03 Aug 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 1850 1875 1900 1925 1950 1975

1899 1924 1949 1974 1999 2024

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

1 RNM01A 1918 2016 .65 .63 .76 .78

2 RNM01B 1928 2015 .73 .69 .80

3 RNM02A 1937 2015 .57 .56 .55

4 RNM02B 1902 2015 .61 .66 .41 .42

5 RNM03A 1919 2015 .62 .58 .32A .30A

6 RNM03B 1877 2015 .42 .52 .64 .54 .48

7 RNM04A 1900 2015 .64 .72 .70 .70

8 RNM04B 1906 2015 .33A .38 .25A .45

9 RNM05A 1904 2015 .71 .68 .70 .69

10 RNM05B 1939 2015 .71 .70 .58

11 RNM06A 1899 2015 .68 .69 .64 .70 .73

12 RNM06B 1882 2015 .71 .79 .71 .72 .68

13 RNM07A 1869 2015 .50 .48 .37 .61 .64 .50

14 RNM07B 1862 2015 .54 .54 .36 .38 .50 .40

15 RNM08A 1872 2015 .61 .66 .68 .74 .82 .78

16 RNM08B 1854 2015 .82 .80 .69 .71 .85 .84

17 RNM09A 1861 2015 .73 .79 .87 .83 .73 .76

18 RNM09B 1900 2015 .78 .82 .82 .80

19 RNM010A 1950 2015 .76 .77

20 RNM10B 1936 2015 .76 .76 .70

Av segment correlation .64 .64 .62 .66 .65 .64

PART 6: POTENTIAL PROBLEMS: 16:37 Thu 03 Aug 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

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RNM01A 1918 to 2016 99 years Series 1

[\*] Later part of series cannot be checked from 2016 to 2016 -- not matched by another series

[B] Entire series, effect on correlation ( .720) is:

Lower 1948> -.026 1950< -.014 1970< -.013 2015< -.008 1958< -.008 1944> -.007 Higher 1977 .032 1999 .018

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

1949 +3.2 SD

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

RNM01B 1928 to 2015 88 years Series 2

[B] Entire series, effect on correlation ( .759) is:

Lower 1953< -.053 1984> -.006 1959> -.006 1986< -.006 1964< -.005 1977> -.005 Higher 1988 .019 1948 .009

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RNM02A 1937 to 2015 79 years Series 3

[B] Entire series, effect on correlation ( .565) is:

Lower 1977> -.021 2006> -.016 1944< -.014 1996< -.011 1983< -.010 1955> -.010 Higher 1980 .015 1959 .014

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RNM02B 1902 to 2015 114 years Series 4

[B] Entire series, effect on correlation ( .516) is:

Lower 1977> -.028 1990< -.022 1907< -.011 1908< -.010 1941< -.010 1974< -.009 Higher 1936 .020 1980 .014

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RNM03A 1919 to 2015 97 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 0 -.01 -.11 -.13 .13 -.04 .05 .05 -.27 .09 -.26 .32\*-.01 -.19 .27 -.11 .10 -.18 .29 -.07 -.06 .20

1966 2015 0 -.06 -.09 -.02 .19 -.05 .01 .08 -.23 .15 -.22 .30\* .07 - - - - - - - - -

[B] Entire series, effect on correlation ( .445) is:

Lower 1977> -.051 1981< -.036 1974< -.025 1996< -.020 1965> -.020 1931> -.016 Higher 1948 .032 1936 .022

1950 to 1999 segment:

Lower 1977> -.084 1981< -.043 1974< -.037 1965> -.031 1996< -.029 1988> -.022 Higher 1959 .042 1951 .029

1966 to 2015 segment:

Lower 1977> -.087 1981< -.051 1974< -.042 1996< -.033 1988> -.019 2006> -.009 Higher 1984 .031 1999 .025

[E] Outliers 3 3.0 SD above or -4.5 SD below mean for year

1965 +3.4 SD; 1977 +4.0 SD; 1981 -4.7 SD

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RNM03B 1877 to 2015 139 years Series 6

[B] Entire series, effect on correlation ( .513) is:

Lower 1924< -.017 1914> -.012 2011< -.012 1931> -.009 1896> -.009 1919> -.009 Higher 1948 .033 1936 .012

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RNM04A 1900 to 2015 116 years Series 7

[B] Entire series, effect on correlation ( .684) is:

Lower 1923< -.014 1997< -.013 1944> -.009 1986> -.009 1928< -.008 1971< -.008 Higher 1936 .017 1988 .012

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RNM04B 1906 to 2015 110 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

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

1906 1955 0 -.27 -.01 -.10 .02 -.04 -.08 .14 .00 .01 .10 .33\*-.15 -.11 -.16 -.07 -.14 .22 -.01 -.03 -.05 -.23

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

1950 1999 0 -.16 .09 -.23 .16 .14 -.04 .08 -.04 -.15 -.04 .25\*-.18 -.15 -.12 -.09 .21 .15 .13 .18 -.14 -.07

[B] Entire series, effect on correlation ( .361) is:

Lower 1912< -.050 1914> -.022 1971< -.020 1929> -.015 1954> -.014 1965> -.011 Higher 1948 .078 2012 .021

1906 to 1955 segment:

Lower 1912< -.093 1914> -.044 1929> -.028 1954> -.026 1931> -.016 1910> -.014 Higher 1948 .208 1936 .019

1950 to 1999 segment:

Lower 1971< -.053 1954> -.030 1969< -.024 1965> -.024 1992< -.017 1952> -.015 Higher 1977 .049 1999 .040

[E] Outliers 5 3.0 SD above or -4.5 SD below mean for year

1912 -5.1 SD; 1914 +3.4 SD; 1929 +3.6 SD; 1954 +3.1 SD; 1996 +3.2 SD

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RNM05A 1904 to 2015 112 years Series 9

[B] Entire series, effect on correlation ( .698) is:

Lower 1936> -.014 1942< -.011 2013< -.010 1910< -.010 1959> -.009 1926< -.008 Higher 1948 .027 1977 .026

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RNM05B 1939 to 2015 77 years Series 10

[B] Entire series, effect on correlation ( .606) is:

Lower 2011< -.081 1959> -.022 2013< -.018 1998> -.018 1982< -.014 1942< -.011 Higher 1977 .057 1948 .045

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RNM06A 1899 to 2015 117 years Series 11

[B] Entire series, effect on correlation ( .693) is:

Lower 1961< -.021 1930> -.021 1997> -.017 1941< -.010 1910< -.007 2011> -.006 Higher 1977 .025 1931 .007

[E] Outliers 3 3.0 SD above or -4.5 SD below mean for year

1930 +3.7 SD; 1950 +3.1 SD; 1997 +3.2 SD

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RNM06B 1882 to 2015 134 years Series 12

[B] Entire series, effect on correlation ( .709) is:

Lower 2010< -.015 1931< -.013 1961< -.010 1949< -.010 1990< -.009 1944> -.007 Higher 1948 .020 1977 .019

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RNM07A 1869 to 2015 147 years Series 13

[B] Entire series, effect on correlation ( .513) is:

Lower 1948> -.017 1977> -.013 1983< -.012 2014> -.011 2008< -.009 1887> -.009 Higher 1988 .026 1999 .018

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RNM07B 1862 to 2015 154 years Series 14

[B] Entire series, effect on correlation ( .444) is:

Lower 2011< -.017 1948> -.015 2008< -.014 1862< -.013 1956< -.011 1938< -.011 Higher 1936 .023 1895 .019

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

1981 +3.6 SD

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RNM08A 1872 to 2015 144 years Series 15

[B] Entire series, effect on correlation ( .708) is:

Lower 1883< -.027 1874> -.018 1931< -.014 1936> -.012 1916< -.008 2001< -.008 Higher 1977 .017 1999 .012

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RNM08B 1854 to 2015 162 years Series 16

[\*] Early part of series cannot be checked from 1854 to 1860 -- not matched by another series

[B] Entire series, effect on correlation ( .770) is:

Lower 1944< -.034 1998> -.007 1923< -.007 1864> -.006 2006< -.005 1972> -.005 Higher 1977 .015 1988 .011

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RNM09A 1861 to 2015 155 years Series 17

[B] Entire series, effect on correlation ( .769) is:

Lower 1977> -.030 1896> -.007 1880> -.007 1866< -.005 1981< -.005 1957< -.004 Higher 1999 .010 1874 .007

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RNM09B 1900 to 2015 116 years Series 18

[B] Entire series, effect on correlation ( .804) is:

Lower 1977> -.020 1970< -.013 1900< -.009 1905< -.008 1910> -.004 1948> -.003 Higher 1999 .011 1988 .009

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

RNM010A 1950 to 2015 66 years Series 19

[B] Entire series, effect on correlation ( .764) is:

Lower 1998> -.027 1972> -.018 1963< -.009 1980< -.008 2006> -.007 1960> -.006 Higher 1977 .042 1988 .016

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RNM10B 1936 to 2015 80 years Series 20

[B] Entire series, effect on correlation ( .698) is:

Lower 2003< -.023 1962> -.016 1998> -.015 2006> -.014 2001< -.012 2008< -.007 Higher 1977 .019 1999 .017

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PART 7: DESCRIPTIVE STATISTICS: 16:37 Thu 03 Aug 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 RNM01A 1918 2016 99 4 0 .720 2.15 5.75 .864 .470 .278 2.92 .501 -.004 1

2 RNM01B 1928 2015 88 3 0 .759 2.29 5.03 .811 .342 .306 2.63 .557 .020 1

3 RNM02A 1937 2015 79 3 0 .565 4.42 9.34 1.678 .454 .291 2.70 .492 -.044 1

4 RNM02B 1902 2015 114 4 0 .516 2.62 5.32 .962 .435 .273 2.98 .581 -.052 1

5 RNM03A 1919 2015 97 4 2 .445 1.62 2.90 .420 .423 .224 2.69 .488 -.059 1

6 RNM03B 1877 2015 139 5 0 .513 1.89 3.33 .609 .623 .219 2.48 .320 .013 1

7 RNM04A 1900 2015 116 4 0 .684 2.50 4.42 .822 .558 .244 2.83 .533 -.096 1

8 RNM04B 1906 2015 110 4 2 .361 2.80 5.84 .914 .767 .167 2.58 .361 -.013 1

9 RNM05A 1904 2015 112 4 0 .698 1.58 3.49 .485 .669 .194 2.48 .375 -.017 1

10 RNM05B 1939 2015 77 3 0 .606 1.69 2.48 .383 .481 .183 2.70 .534 -.016 1

11 RNM06A 1899 2015 117 5 0 .693 1.62 3.85 .435 .589 .178 2.71 .360 -.022 1

12 RNM06B 1882 2015 134 5 0 .709 1.38 3.58 .437 .765 .160 2.69 .463 -.004 1

13 RNM07A 1869 2015 147 6 0 .513 1.21 2.03 .426 .799 .171 2.48 .364 .016 1

14 RNM07B 1862 2015 154 6 0 .444 1.34 4.27 .587 .750 .188 2.91 .526 -.042 2

15 RNM08A 1872 2015 144 6 0 .708 1.71 3.15 .624 .758 .200 2.67 .457 -.062 1

16 RNM08B 1854 2015 162 6 0 .770 1.63 2.99 .540 .634 .234 2.63 .407 -.023 1

17 RNM09A 1861 2015 155 6 0 .769 1.77 3.56 .565 .663 .205 2.52 .399 -.018 1

18 RNM09B 1900 2015 116 4 0 .804 2.47 4.48 .765 .591 .231 2.67 .457 -.038 1

19 RNM010A 1950 2015 66 2 0 .764 2.01 3.67 .521 .517 .200 2.69 .551 -.061 3

20 RNM10B 1936 2015 80 3 0 .698 2.15 3.90 .489 .347 .198 2.56 .354 -.025 1

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Total or mean: 2306 87 4 .635 1.96 9.34 .648 .607 .214 2.98 .447 -.026

- = [ COFECHA RNM COF ] = -