[] Dendrochronology Program Library Run MWS Program COF 18:38 Tue 17 Oct 2017 Page 1

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[] P R O G R A M C O F E C H A Version 6.06P 30242

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QUALITY CONTROL AND DATING CHECK OF TREE-RING MEASUREMENTS

File of DATED series: mws\_final.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 1917 to 2016 100 years

Continuous time span is 1917 to 2016 100 years

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

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

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

\*O\* Master series 1917 2016 100 yrs \*O\*

\*F\* Total rings in all series 1548 \*F\*

\*E\* Total dated rings checked 1546 \*E\*

\*C\* Series intercorrelation .584 \*C\*

\*H\* Average mean sensitivity .365 \*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)

MWS12A 1 absent rings: 1970

1 absent rings .065%

PART 2: TIME PLOT OF TREE-RING SERIES: 18:38 Tue 17 Oct 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

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

. . . . . . . . . . . . . . . . . .<=========> . MWS01A 1 1919 2016 98

. . . . . . . . . . . . . . . . . . <======> . MWS01B 2 1940 2016 77

. . . . . . . . . . . . . . . . . .<=========> . MWS02A 3 1917 2016 100

. . . . . . . . . . . . . . . . . . <========> . MWS02B 4 1927 2016 90

. . . . . . . . . . . . . . . . . . <=====> . MWS03A 5 1956 2016 61

. . . . . . . . . . . . . . . . . . <========> . MWS03B 6 1929 2016 88

. . . . . . . . . . . . . . . . . . <=======> . MWS04A 7 1936 2016 81

. . . . . . . . . . . . . . . . . . <=======> . MWS04B 8 1939 2016 78

. . . . . . . . . . . . . . . . . . <========> . MWS06A 9 1925 2016 92

. . . . . . . . . . . . . . . . . . <======> . MWS06B 10 1949 2011 63

. . . . . . . . . . . . . . . . . . <=====> . MWS07A 11 1954 2016 63

. . . . . . . . . . . . . . . . . . <=====> . MWS08A 12 1959 2016 58

. . . . . . . . . . . . . . . . . . .<====> . MWS08B 13 1961 2016 56

. . . . . . . . . . . . . . . . . . <======> . MWS09A 14 1943 2016 74

. . . . . . . . . . . . . . . . . . <=====> . MWS09B 15 1954 2016 63

. . . . . . . . . . . . . . . . . . <=======> . MWS10A 16 1934 2016 83

. . . . . . . . . . . . . . . . . . <======> . MWS10B 17 1940 2016 77

. . . . . . . . . . . . . . . . . . <========> . MWS11A 18 1925 2015 91

. . . . . . . . . . . . . . . . . . <=======> . MWS11B 19 1937 2015 79

. . . . . . . . . . . . . . . . . . <======> . MWS12A 20 1940 2015 76

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

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: 18:38 Tue 17 Oct 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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1950 .351 15 2000 .683 20

1951 -.459 15 2001 1.015 20

1952 -.623 15 2002 -.631 20

1953 -.823 15 2003 .358 20

1954 -1.457 17 2004 .695 20

1955 .503 17 2005 .342 20

1956 .876 18 2006 .143 20

1957 1.081 18 2007 -3.355 20

1958 .157 18 2008 -1.287 20

1959 -1.435 19 2009 .021 20

1960 .569 19 2010 1.189 20

1961 .228 20 2011 -.866 20

1962 .487 20 2012 -1.545 19

1963 .185 20 2013 -.108 19

1964 -.686 20 2014 .651 19

1965 .621 20 2015 1.573 19

1966 .172 20 2016 .378 16

1917 .266 1 1967 -.153 20

1918 1.419 1 1968 .387 20

1919 1.391 2 1969 -.068 20

1920 1.008 2 1970 -4.040 20 1

1921 -.644 2 1971 -.054 20

1922 -1.305 2 1972 -.146 20

1923 .002 2 1973 .337 20

1924 1.257 2 1974 .677 20

1925 .593 4 1975 .244 20

1926 -1.339 4 1976 .772 20

1927 -.467 5 1977 -.742 20

1928 .033 5 1978 -.337 20

1929 -1.641 6 1979 .218 20

1930 .125 6 1980 .384 20

1931 .156 6 1981 .398 20

1932 .206 6 1982 .249 20

1933 -.478 6 1983 -.471 20

1934 .688 7 1984 .128 20

1935 -.717 7 1985 .863 20

1936 1.309 8 1986 -.004 20

1937 .103 9 1987 -.075 20

1938 1.380 9 1988 -4.649 20

1939 .684 10 1989 .421 20

1940 .129 13 1990 .880 20

1941 -.389 13 1991 -1.063 20

1942 -.554 13 1992 .810 20

1943 -.683 14 1993 .151 20

1944 -.594 14 1994 .627 20

1945 -.103 14 1995 .425 20

1946 .341 14 1996 -.337 20

1947 .406 14 1997 .699 20

1948 .498 14 1998 .888 20

1949 .572 15 1999 -.075 20

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PART 4: Master Bar Plot: 18:38 Tue 17 Oct 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

1950------A 2000--------C

1951--b 2001---------D

1952-b 2002-c

1953-c 2003------A

1954f 2004--------C

1955-------B 2005------A

1956---------D 2006----A

1957---------D 2007m

1958-----A 2008e

1959f 2009----@

1960--------B 2010----------E

1961-----A 2011-c

1962-------B 2012f

1963-----A 2013---@

1964-c 2014--------C

1965--------B 2015----------F

1966-----A 2016------B

1917------A 1967---a

1918----------F 1968-------B

1919----------F 1969---@

1920---------D 1970p

1921-c 1971---@

1922e 1972---a

1923----@ 1973------A

1924----------E 1974--------C

1925--------B 1975-----A

1926e 1976---------C

1927--b 1977-c

1928----@ 1978--a

1929g 1979-----A

1930----A 1980-------B

1931-----A 1981-------B

1932-----A 1982-----A

1933--b 1983--b

1934--------C 1984----A

1935-c 1985---------C

1936----------E 1986---@

1937----@ 1987---@

1938----------F 1988s

1939--------C 1989-------B

1940----A 1990---------D

1941--b 1991-d

1942--b 1992---------C

1943-c 1993-----A

1944-b 1994--------C

1945---@ 1995-------B

1946------A 1996--a

1947-------B 1997--------C

1948-------B 1998---------D

1949--------B 1999---@

PART 5: CORRELATION OF SERIES BY SEGMENTS: 18:38 Tue 17 Oct 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 MWS01A 1919 2016 .29A .48 .74 .73

2 MWS01B 1940 2016 .60 .66 .76

3 MWS02A 1917 2016 .35 .36 .48 .57

4 MWS02B 1927 2016 .27A .52 .60

5 MWS03A 1956 2016 .43 .59

6 MWS03B 1929 2016 .45 .57 .68

7 MWS04A 1936 2016 .24B .50 .69

8 MWS04B 1939 2016 .40 .41 .56

9 MWS06A 1925 2016 .65 .75 .76

10 MWS06B 1949 2011 .51 .51 .58

11 MWS07A 1954 2016 .61 .65

12 MWS08A 1959 2016 .75 .76

13 MWS08B 1961 2016 .84 .85

14 MWS09A 1943 2016 .68 .71 .84

15 MWS09B 1954 2016 .67 .87

16 MWS10A 1934 2016 .36 .57 .63

17 MWS10B 1940 2016 .52 .68 .78

18 MWS11A 1925 2015 .41 .59 .63

19 MWS11B 1937 2015 .54 .68 .61

20 MWS12A 1940 2015 .25A .40 .47

Av segment correlation .32 .45 .60 .68

PART 6: POTENTIAL PROBLEMS: 18:38 Tue 17 Oct 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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MWS01A 1919 to 2016 98 years Series 1

[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 0 - - - - - - - - -.02 .03 .29\* .09 -.05 -.19 -.05 .05 .10 -.10 .01 .04 -.08

[B] Entire series, effect on correlation ( .557) is:

Lower 1941< -.029 1924< -.026 1935> -.022 1920< -.022 2001< -.015 1973< -.013 Higher 1988 .094 1970 .043

1919 to 1968 segment:

Lower 1924< -.051 1935> -.048 1920< -.046 1941< -.029 1961< -.017 1945> -.014 Higher 1959 .054 1929 .047

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

MWS01B 1940 to 2016 77 years Series 2

[B] Entire series, effect on correlation ( .641) is:

Lower 2014< -.022 1961< -.022 1994< -.017 1942> -.010 1940< -.010 1951> -.008 Higher 2007 .044 1970 .041

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

MWS02A 1917 to 2016 100 years Series 3

[\*] Early part of series cannot be checked from 1917 to 1918 -- not matched by another series

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

Lower 1969< -.027 1971< -.024 1941> -.022 1920> -.017 1919< -.014 1924> -.013 Higher 1988 .088 2007 .068

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

1969 1970 4.1 SD

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

MWS02B 1927 to 2016 90 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

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

1927 1976 0 .11 -.07 .05 .15 .04 -.05 -.34 -.26 .04 .06 .27\* .24 .13 .01 -.17 -.19 .22 -.08 .02 .14 -.07

[B] Entire series, effect on correlation ( .549) is:

Lower 1970> -.048 1987< -.042 1971< -.018 1961< -.015 1969< -.013 1976< -.013 Higher 1988 .145 2007 .021

1927 to 1976 segment:

Lower 1970> -.058 1971< -.033 1961< -.024 1941> -.024 1976< -.024 1969< -.018 Higher 1936 .038 1929 .037

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MWS03A 1956 to 2016 61 years Series 5

[B] Entire series, effect on correlation ( .556) is:

Lower 1992< -.034 2008> -.033 1970> -.028 1959> -.015 1965< -.013 1968< -.011 Higher 2007 .116 2012 .010

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MWS03B 1929 to 2016 88 years Series 6

[B] Entire series, effect on correlation ( .600) is:

Lower 1992< -.026 1931< -.020 1959> -.015 1943> -.015 1968< -.010 1937< -.010 Higher 2007 .078 1988 .048

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

MWS04A 1936 to 2016 81 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

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

1936 1985 -2 -.14 .03 .15 -.05 -.12 -.07 -.03 .03 .24\* .21 .24|-.12 -.01 -.19 -.06 .02 -.11 -.11 -.16 -.05 .19

[B] Entire series, effect on correlation ( .577) is:

Lower 1955< -.024 1937< -.020 1970> -.016 1993< -.015 1973< -.013 1943> -.012 Higher 1988 .110 2007 .069

1936 to 1985 segment:

Lower 1955< -.046 1937< -.026 1973< -.023 1943> -.022 1974< -.021 1968< -.016 Higher 1970 .083 1938 .037

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MWS04B 1939 to 2016 78 years Series 8

[B] Entire series, effect on correlation ( .415) is:

Lower 1955< -.030 1991> -.020 1943> -.016 1960< -.014 2005< -.014 1998< -.014 Higher 1988 .220 2007 .027

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MWS06A 1925 to 2016 92 years Series 9

[B] Entire series, effect on correlation ( .658) is:

Lower 1938< -.017 1939< -.016 1997< -.013 1942< -.009 1941> -.009 1964> -.009 Higher 1970 .080 1988 .057

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

MWS06B 1949 to 2011 63 years Series 10

[B] Entire series, effect on correlation ( .549) is:

Lower 1955< -.056 1988> -.044 1997< -.025 1980< -.021 1981< -.016 1989< -.012 Higher 1970 .149 2007 .016

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MWS07A 1954 to 2016 63 years Series 11

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

Lower 1954< -.095 1959> -.018 2008> -.016 2002> -.014 2011> -.012 2009< -.011 Higher 1970 .116 1988 .008

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

1954 -6.1 SD

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MWS08A 1959 to 2016 58 years Series 12

[B] Entire series, effect on correlation ( .766) is:

Lower 1988> -.036 1974< -.009 1982< -.009 2008> -.007 1975< -.006 1990< -.006 Higher 1970 .050 2007 .025

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MWS08B 1961 to 2016 56 years Series 13

[B] Entire series, effect on correlation ( .826) is:

Lower 1997< -.019 2002> -.015 1965< -.013 2011> -.012 1987> -.012 2000< -.010 Higher 1988 .056 1970 .054

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MWS09A 1943 to 2016 74 years Series 14

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

Lower 1954> -.030 1944> -.021 1982< -.019 1952> -.017 1958< -.014 1964> -.009 Higher 1988 .102 1970 .049

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MWS09B 1954 to 2016 63 years Series 15

[B] Entire series, effect on correlation ( .734) is:

Lower 1959> -.034 1954> -.029 1957< -.015 1958< -.014 1961< -.013 1986< -.010 Higher 1988 .095 2007 .047

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MWS10A 1934 to 2016 83 years Series 16

[B] Entire series, effect on correlation ( .455) is:

Lower 1944< -.064 1936< -.014 1963< -.010 1966< -.010 1972> -.010 2016> -.010 Higher 1970 .044 2007 .023

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

1944 -5.9 SD

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MWS10B 1940 to 2016 77 years Series 17

[B] Entire series, effect on correlation ( .569) is:

Lower 1943< -.083 1956< -.017 1944> -.016 1980< -.013 1966< -.010 1951> -.008 Higher 1988 .068 1970 .049

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

1943 -5.5 SD

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MWS11A 1925 to 2015 91 years Series 18

[B] Entire series, effect on correlation ( .500) is:

Lower 1977< -.059 1929> -.030 1954> -.025 1944> -.014 1932< -.010 1950< -.010 Higher 1988 .097 1970 .059

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

1977 -6.4 SD

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MWS11B 1937 to 2015 79 years Series 19

[B] Entire series, effect on correlation ( .591) is:

Lower 2008< -.059 1981< -.027 1954> -.017 1943> -.015 2010< -.011 1947< -.008 Higher 1988 .093 1970 .022

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

2007 2008 -4.3 SD

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

2008 -5.8 SD

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MWS12A 1940 to 2015 76 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

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

1940 1989 0 .11 .20 .00 .10 .08 .12 -.05 -.21 -.12 -.20 .25\* .14 -.13 -.05 -.14 .13 -.07 .01 .20 .07 -.02

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

Lower 1988> -.047 1953> -.023 1942> -.016 2005< -.010 1944< -.009 1979< -.009 Higher 1970 .162 2015 .012

1940 to 1989 segment:

Lower 1988> -.098 1953> -.032 1942> -.021 1979< -.011 1944< -.010 1976< -.010 Higher 1970 .282 1957 .011

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

1970 -4.040 20 1

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PART 7: DESCRIPTIVE STATISTICS: 18:38 Tue 17 Oct 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 MWS01A 1919 2016 98 4 1 .557 2.66 7.58 1.771 .622 .490 2.60 .479 -.036 1

2 MWS01B 1940 2016 77 3 0 .641 3.01 6.69 1.702 .525 .455 2.57 .555 -.070 1

3 MWS02A 1917 2016 100 4 0 .504 1.83 5.51 1.188 .739 .399 2.75 .536 .128 1

4 MWS02B 1927 2016 90 3 1 .549 2.71 6.41 1.752 .804 .367 2.50 .394 .099 1

5 MWS03A 1956 2016 61 2 0 .556 3.27 6.22 1.475 .699 .237 2.41 .361 -.076 1

6 MWS03B 1929 2016 88 3 0 .600 2.87 5.88 1.521 .770 .313 2.56 .415 -.045 1

7 MWS04A 1936 2016 81 3 1 .577 2.48 4.32 .815 .560 .251 2.62 .497 .024 1

8 MWS04B 1939 2016 78 3 0 .415 2.67 6.60 1.194 .662 .260 2.58 .388 -.034 1

9 MWS06A 1925 2016 92 3 0 .658 2.14 4.28 .929 .478 .400 2.52 .409 -.040 2

10 MWS06B 1949 2011 63 3 0 .549 1.63 4.72 .803 .230 .467 2.53 .404 -.023 1

11 MWS07A 1954 2016 63 2 0 .548 2.52 6.24 1.051 .581 .326 2.43 .376 -.085 1

12 MWS08A 1959 2016 58 2 0 .766 2.72 4.72 .833 .023 .358 2.39 .359 -.072 1

13 MWS08B 1961 2016 56 2 0 .826 2.67 4.66 .749 .101 .313 2.58 .460 -.049 1

14 MWS09A 1943 2016 74 3 0 .708 2.58 5.35 1.315 .763 .336 2.39 .436 .000 1

15 MWS09B 1954 2016 63 2 0 .734 2.91 7.34 1.400 .710 .332 2.47 .475 -.027 1

16 MWS10A 1934 2016 83 3 0 .455 1.61 5.68 1.017 .682 .356 2.68 .420 -.033 1

17 MWS10B 1940 2016 77 3 0 .569 2.18 7.23 1.432 .667 .443 2.66 .444 -.061 1

18 MWS11A 1925 2015 91 3 0 .500 2.40 5.90 1.365 .740 .361 2.45 .384 -.022 1

19 MWS11B 1937 2015 79 3 0 .591 2.58 6.56 1.319 .670 .373 2.51 .440 -.008 1

20 MWS12A 1940 2015 76 3 1 .554 1.86 5.08 1.058 .608 .378 2.41 .334 -.050 1

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Total or mean: 1548 57 4 .584 2.44 7.58 1.257 .603 .365 2.75 .431 -.019

- = [ COFECHA MWS COF ] = -