Orcas Island Orcas Island Climate

The information for this page is derived from the weather station data accumulated by the John Willis family over the last 122 years. You can read a story regarding the Willis family in the Islands' Sounder. http://www.islandssounder.com/news/willis-sets-the-record-with-weather-keeping/

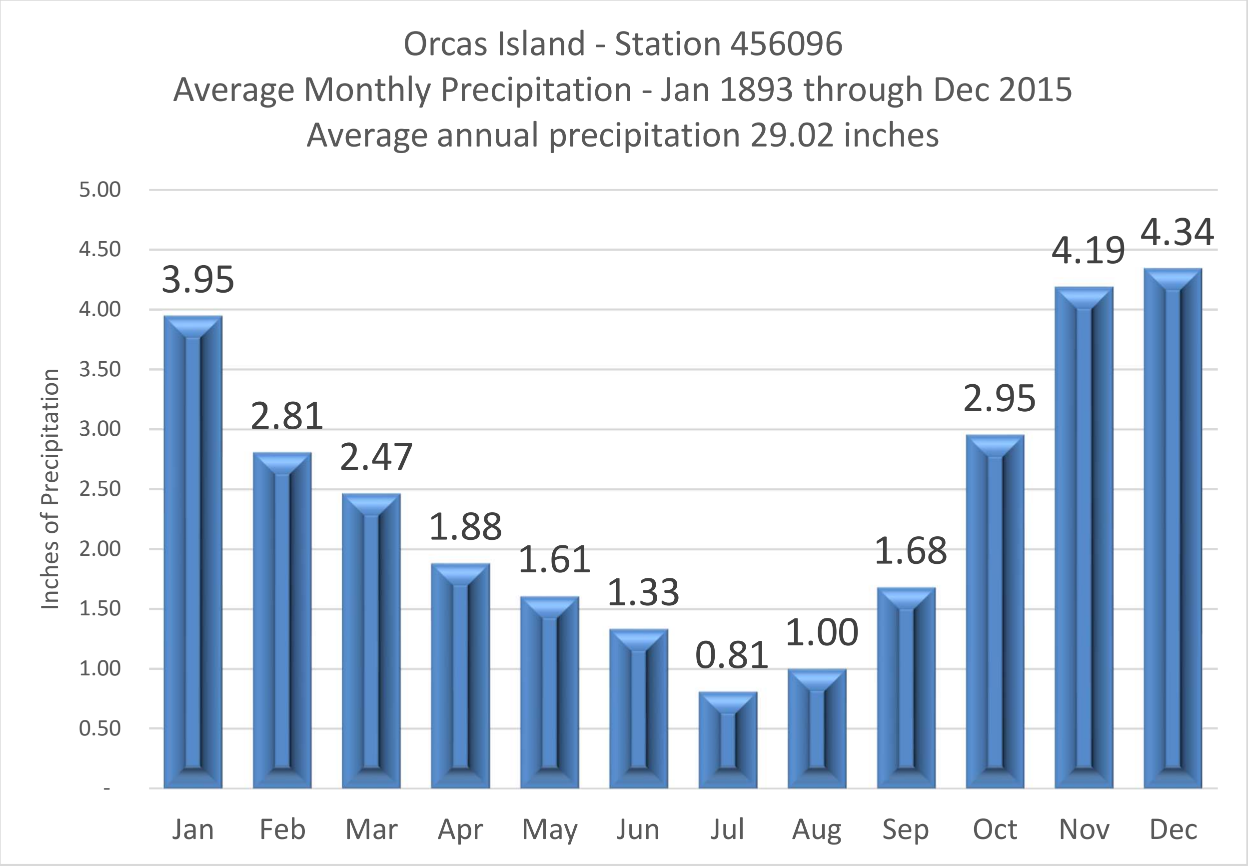
Unfortunately, John stopped collecting weather data in April 2015 and he passed away in 2019. His family contributed a very valuable set of data over the decades. I hope we will be able to resume data collection at the same site in the future.

Temperature		Avg/Year	Occurrences in 122 years
Typical days in year equal or over	100	0	0
Typical days in year equal or over	90	0	4
Typical days in year equal or over	80	3	475
Typical days in year equal or over	70	50	6,135
Typical days in year equal or below	32	21	2,606
Typical days in year equal or below	0	0	6

High Temperatures		
Temperature Range	% of Days	Historical Occurancess
100+	0%	-
90-99	0%	4
80-89	1%	471
70-79	13%	5,660
60-69	30%	13,390
50-59	31%	13,672
40-49	22%	9,850
30-39	3%	1,455
20-29	0%	221
Less than 20	0%	35
		44,758

Low Temperatures		
Temperature Range	% of Days	Historical Occurancess
70+	0%	5
60-69	0%	91
50-59	18%	8,050
40-49	49%	22,155
30-39	28%	12,488
20-29	4%	1,642
10-19	1%	294
0-9	0%	27
-10 to -1	0%	6
Below -11	0%	-
		44,758

Precipitation data --- Average number of days each year	Avg Days per year	Frequency
Days per year with no precipitation	232	64%
Days with trace to 0.25" precipitation	108	30%
Days per year with more than 0.25" precipitation	25	7%
Days per year with more than 1.00" precipitation	0	0%



First complete year of usable record.	1893
Years of data used in analysis.	122
Years ignored since first year used.	0
Percentage of years used since first year used.	100%
Percentage of years missing since first year used.	0%
Total days in the years that were used.	44,165
Number of Days with missing temperature data.	199
Percentage of days missing temp data.	0.45%
Number of days with missing precipitation data.	1,047
Percentage of days missing precipitation data.	2.37%
Period of analysis 1893 - 2015	

Analysis of weather data for weather station 456096, which is located on John Willis' property on the southwest side of Orcas Island. It has the distinction of being the longest continuous set of weather records maintained by a private family in the United States. For this reason, it is one of the more valuable sets of data in the nation.

The weather records were pulled from http://www.ncdc.noaa.gov/ which maintains a continuous set of error-corrected data for many of the stations in the nation. The data was converted from Celsius to Fahrenheit. Days without temperature records were either ignored or set as the average between the two most recent records to allow for nonparametric trend analysis. Days without precipitation data were ignored. So, if it precipitated on a day without a record, then the total precipitation for that year would be under-reported. Out of the nearly 45,000 days in the period of record, there are only 199 days without temperature records. There are 1,047 without precipitation data.

The most notable point of interest is the significant jump in the high temperatures beginning in 1925. Beginning in 1925, all subsequent high temperatures are about two degrees higher on average than all average temperatures prior to that date. The reason for the difference is found in the weather records maintained at the University of Washington.

History summary, see document at: http://www.atmos.washington.edu/marka/olga.gif

Site homesteaded in 1886, weather observations began Jan 1890

Apr 1897 temperature was measured on veranda on N side of house.
time of obs 7am, 2pm, 9pm

Feb 1906 temperature was measured N side of house under open porch

Aug 1917 temperature still measured N side of house under open porch
even though shelter had been sent "long ago"

Apr 1925 Since December temperature measured under roof of S porch of house
after shelter blown over by storm. New shelter planned in a
few weeks.

Jul 1927 Obs time 7 PM, Culver Willis became observer after death of father
Cecil Willis, who was killed in logging accident

Oct 1928 Exposure of temperature equipment is not creditable, as
thermometers are mounted under a porch on S side of residence.
For 3 years shelter has sat out on lawn unused.

Sep 1936 Main purpose of visit was to survey site on summit of Mt Constitution
for possible fire weather station.

Jul 1974 Obs time 7 PM, CRS mx/mn and unshielded SRG

Jul 1985 John Willis becomes observer after death of his father,
Culver Willis (~age 87), who took observations for almost 60 years

Apr 2015 John Will stopped collecting weather data. John died in 2019.

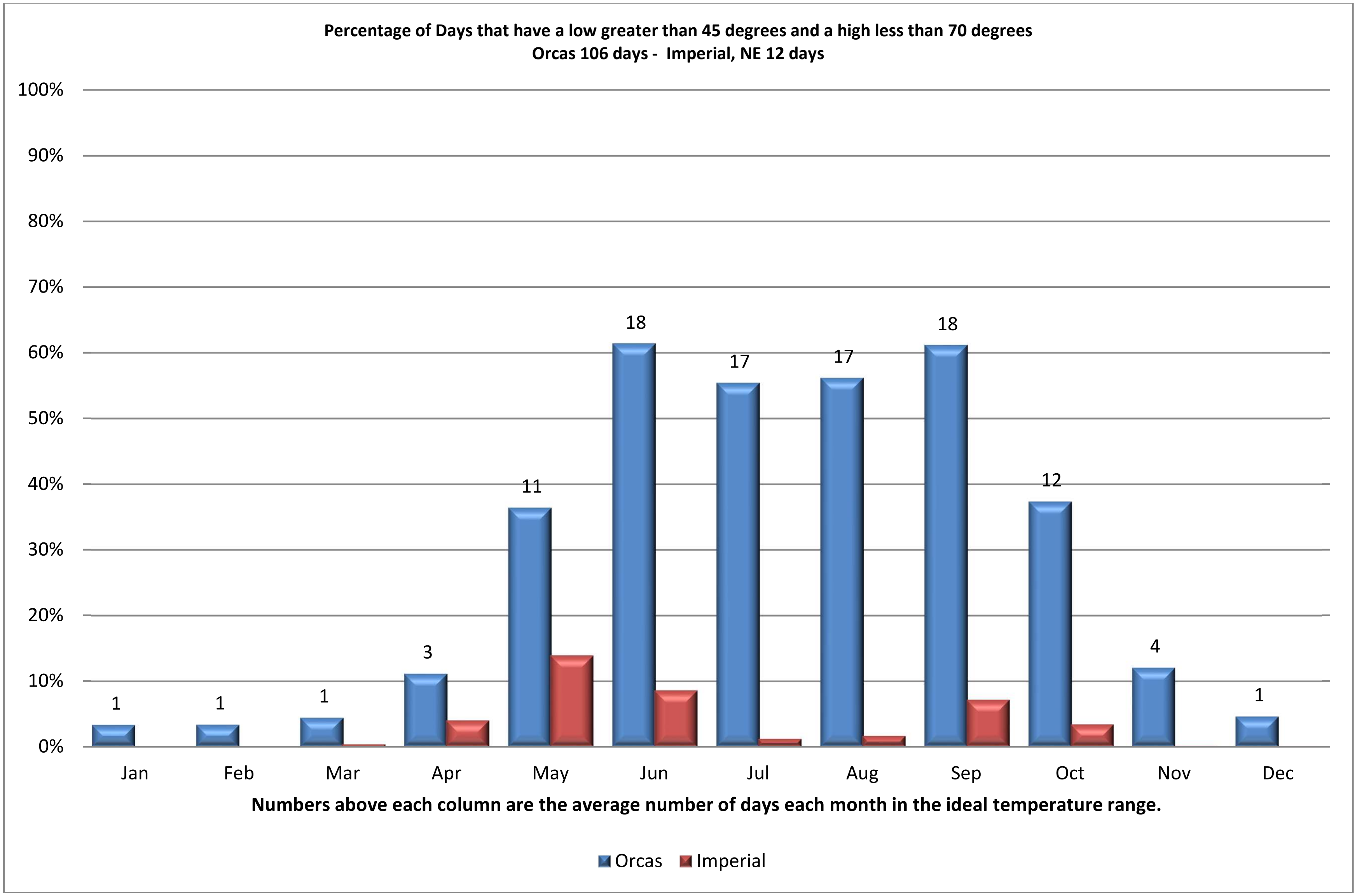
The reason for the jump temperatures in 1925 was due to a move in the location of the gauge from the north side of the house to the south side of the house under the porch. The affect of this was an approximate change in all temperature readings by 2 degrees. Any trend line analysis needs to account for this move.

In most other locations that have been analyzed across the nation, the trend is for the high temperatures to be trending lower and for the low temperatures to be trending higher. Note that this is significantly different than what is reported by the press. In other words, in most locations, the reality is that there is a moderation of temperatures -- with highs not being quite as high as they used to be and for lows to be a bit warmer than they used to be.

On Orcas, we see the same pattern. A decline or no change in high temperatures and a warming trend in the low temperatures. Regarding the high temperatures, the trend depends on where you start the trend line. If you go from 1893 to 2015, then the trend is significantly warmer for the highs. But, this is due to the jump in 1925. If you trend from 1925 to 2015, then the trend is cooler.

If you consider temperatures between 45 and 75 to be an ideal range for a day, then Orcas Island is one of the most ideal in the nation. Approximately, 37% of the days in the year see some precipitation but the vast majority of that is measured between a trace and a quarter of an inch. On average, thirteen days a year show more than a half inch of precipitation.

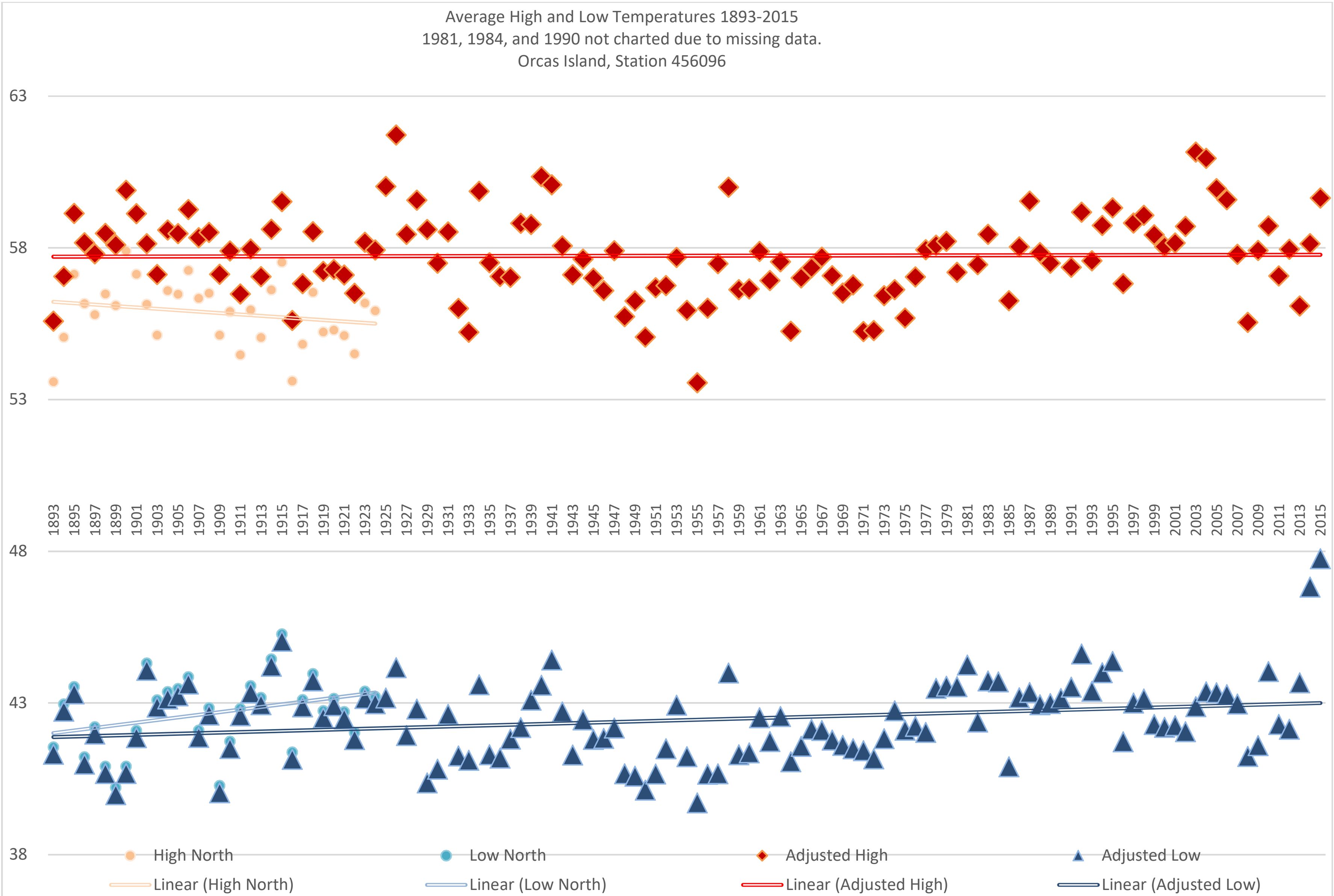
Data compiled by Steve Smith. You are welcome to a copy of the analysis worksheet or the summary information. Just ask. Orcas.Art@gmail.com

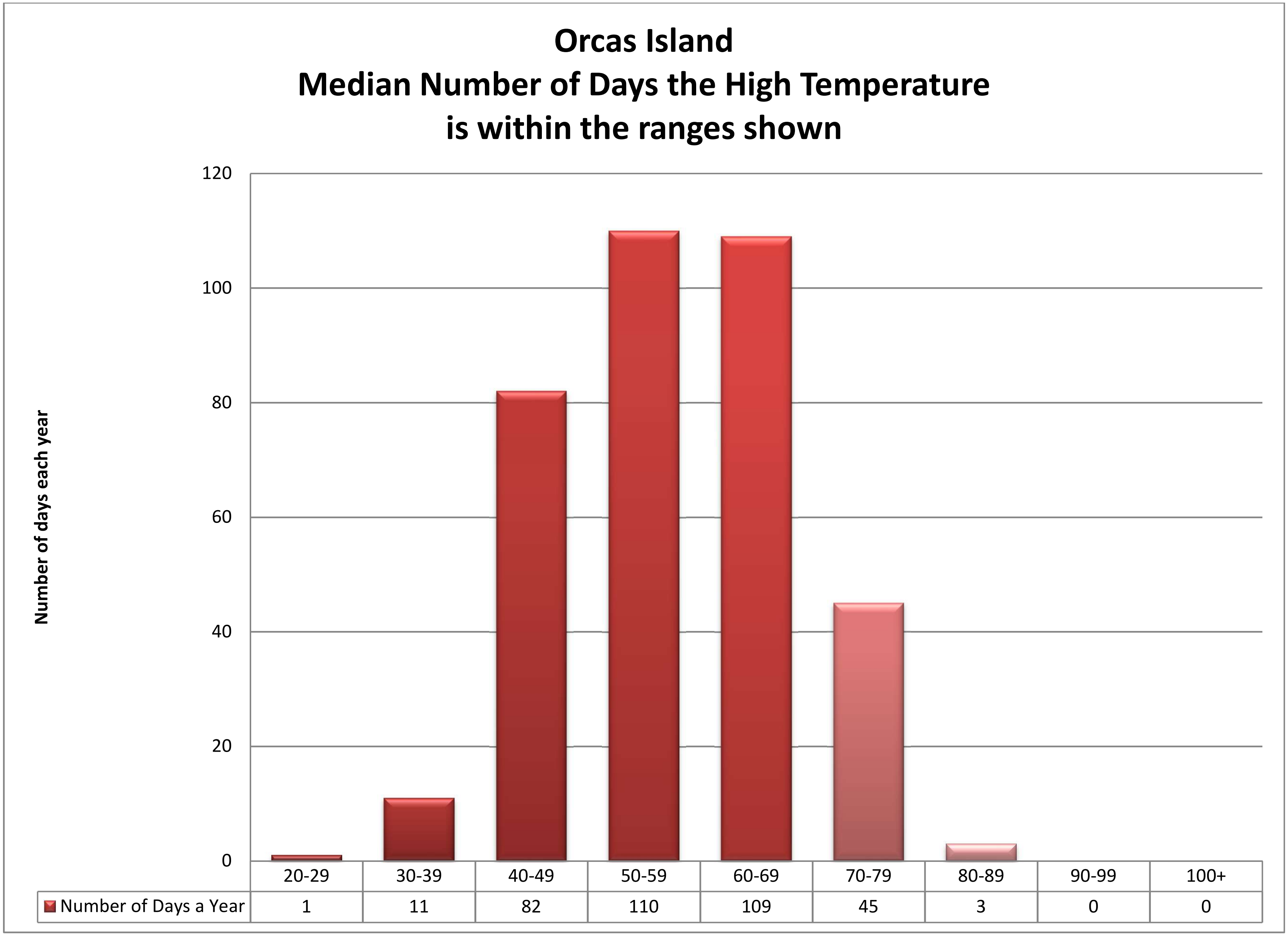


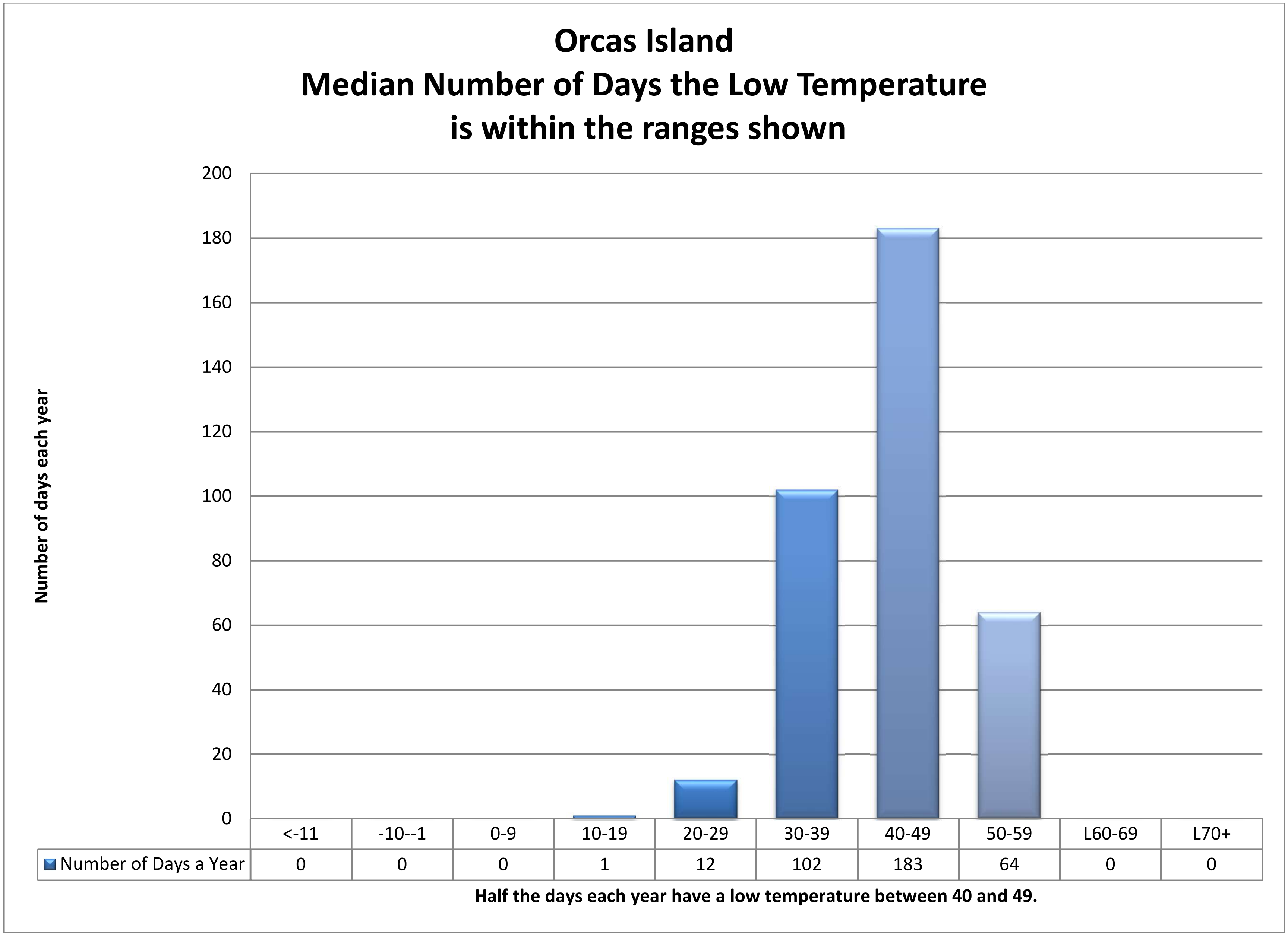
The 45 and 70 degrees are arbitrary and what I like for weather. Before moving to Orcas, I lived in Imperial, NE so show the climate there for comparison. Orcas has a climate much more to my liking.

The Willis family charted high and low temperatures for decades. However, in 1925, the temperature station shelter was blown over. From 1893 through 1925, the temperature was measured on the north side of the house under an open porch. After the storm, the gauge was moved to the south side of the house and still under a porch. The average temperature from 1893 through 1925 was exactly 2 degrees cooler than the average temperature between 1926 and 2015. The high temperature portion of the chart shows the unadjusted temperature prior to 1925 as smaller circles. The red diamonds prior to 1925 depict the adjusted temperature to match the warmer location the temperatures began to be measured from. The low temperatures were barely affected. The south side of the house was actually slightly cooler; 0.24 cooler. The small circle prior to 1925 reflect the unadjusted temperatures. Trend lines are shown for both high and low. The low temperatures are getting warmer over the last 122 years. The high temperatures show virtually no trend. The low temperature in 2014 (3 degrees) and 2015 (4 degrees) saw a very large jump. Enough of a jump that I suspect that something changed. There was an abnormally warm patch of warm water in the Pacific Ocean that existed for several years. The high temperatures did not see a matching jump. Only the low temperatures.

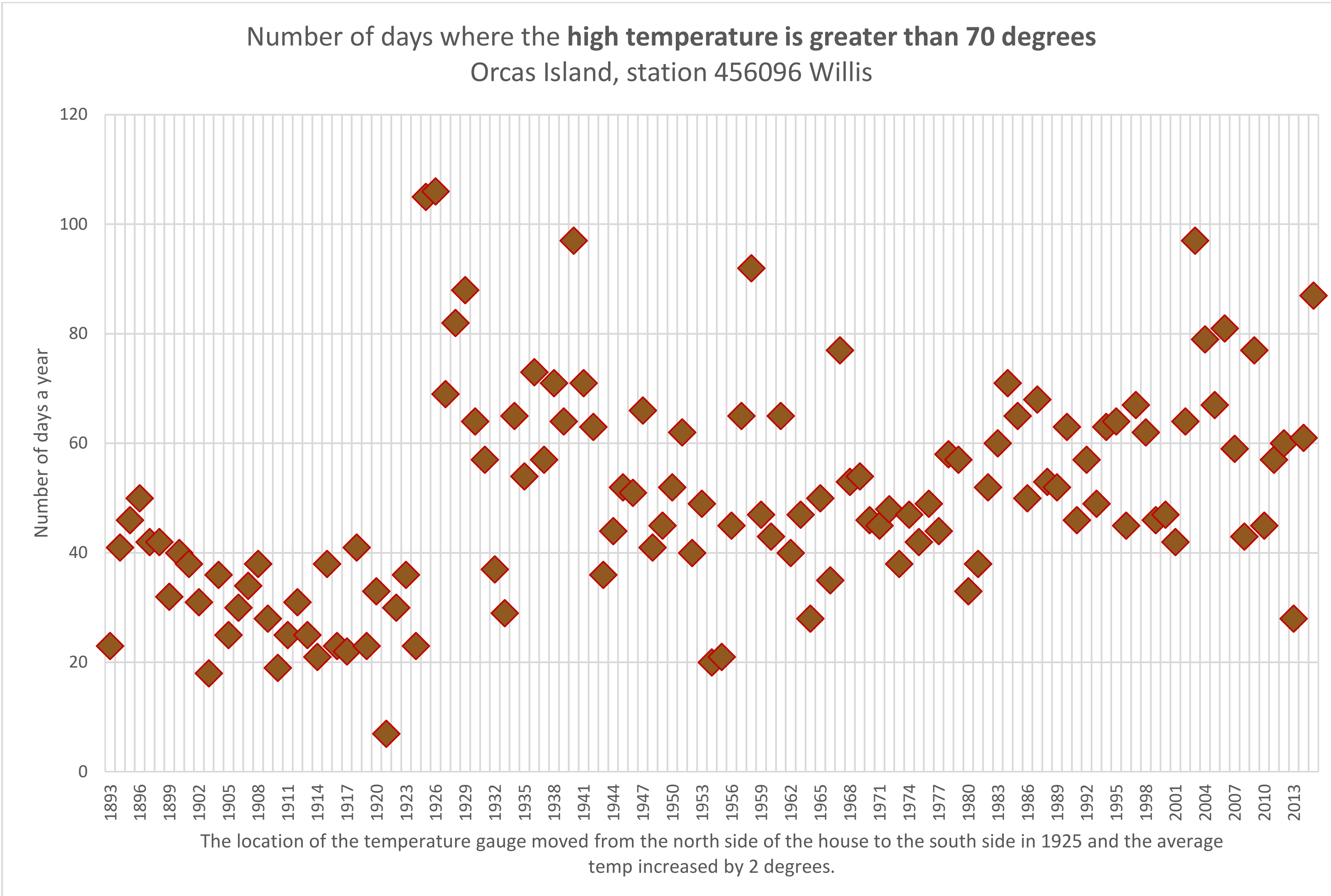
It is getting warmer or colder? One must consider the movement of the gauge in 1925 in any analysis. In the following graphs you have the data presented in a variety of ways.

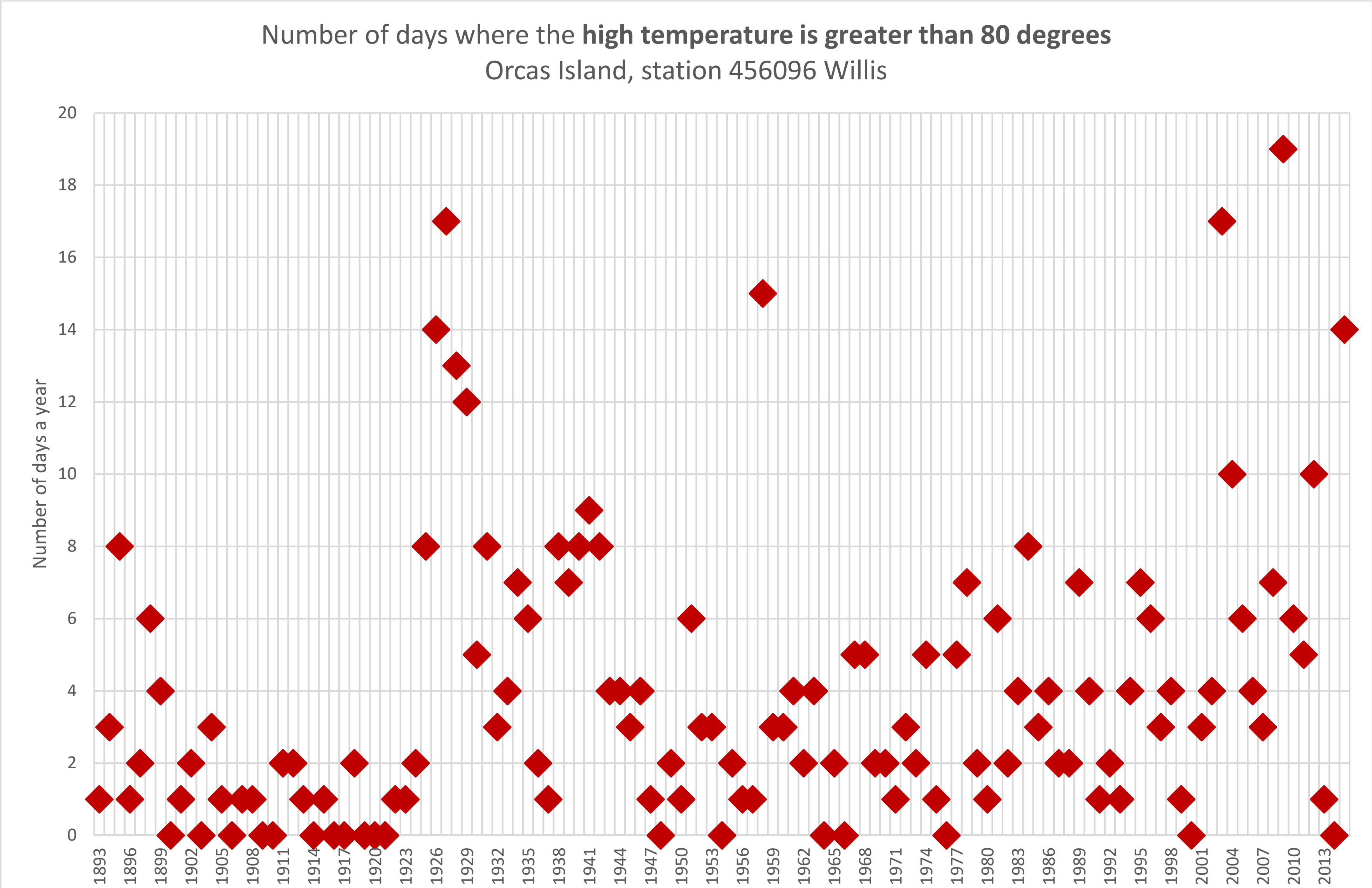

Average High and Low Temperatures 1893-2015
1981, 1984, and 1990 not charted due to missing data.
Orcas Island, Station 456096
63
58
53
48
43
38
High North
Low North
Adjusted High
Adjusted Low
Linear (High North)
Linear (Low North)
Linear (Adjusted High)
Linear (Adjusted Low)


Orcas Island
Median Number of Days the High Temperature
is within the ranges shown
Number of days each year
120
100
80
60
40
20
0
20-29
30-39
40-49
50-59
60-69
70-79
80-89
90-99
100+
Number of Days a Year
1
11
82
110
109
45
3
0
0

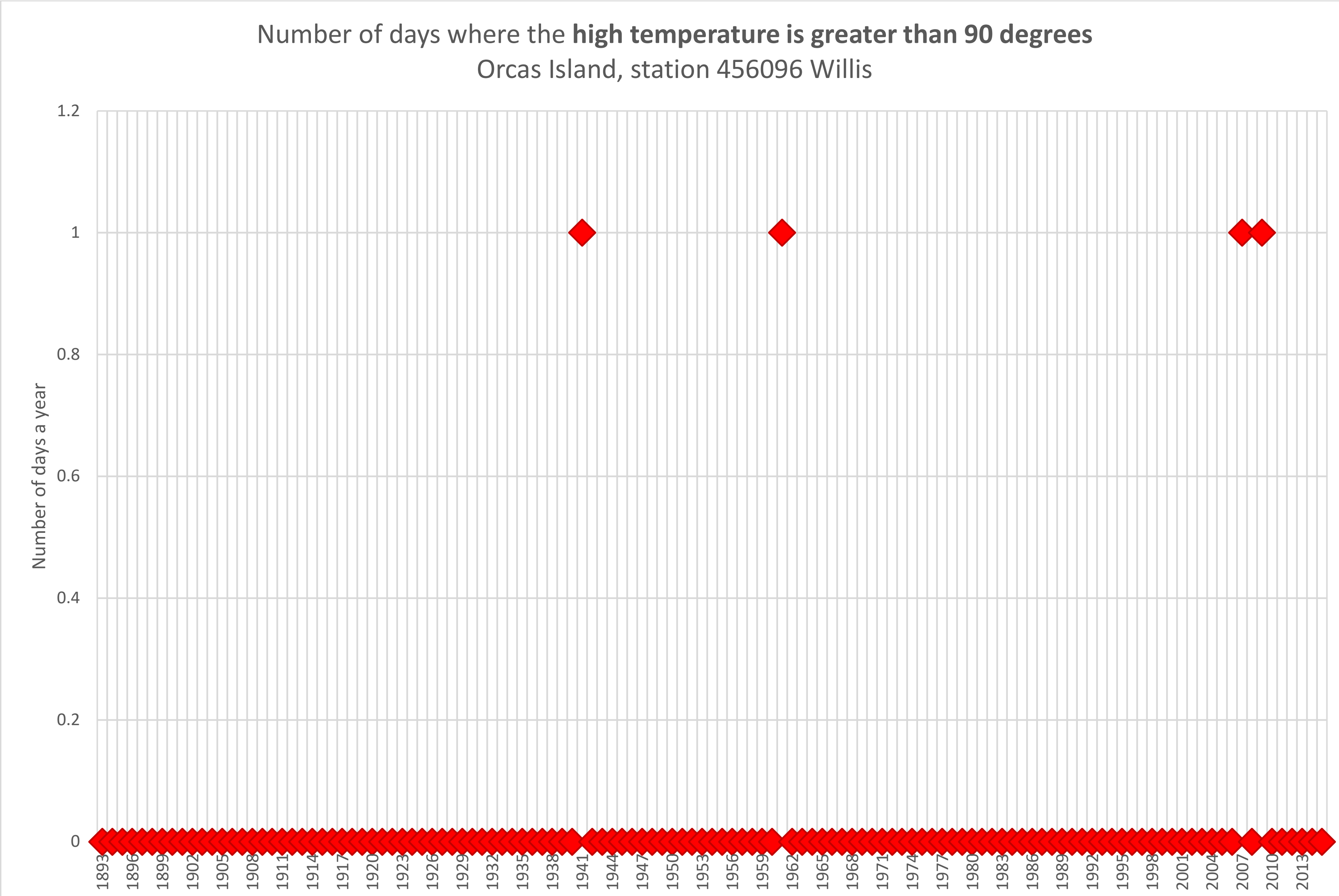

Orcas Island
Median Number of Days the Low Temperature
is within the ranges shown
Number of days each year
200
180
160
140
120
100
80
60
40
20
0
<-11
-10--1
0-9
10-19
20-29
30-39
40-49
50-59
L60-69
L70+
Number of Days a Year
0
0
0
1
12
102
183
64
0
0
Half the days each year have a low temperature between 40 and 49.

Another way to look at the data is to count the number of days in a year that exceed a certain temperature.

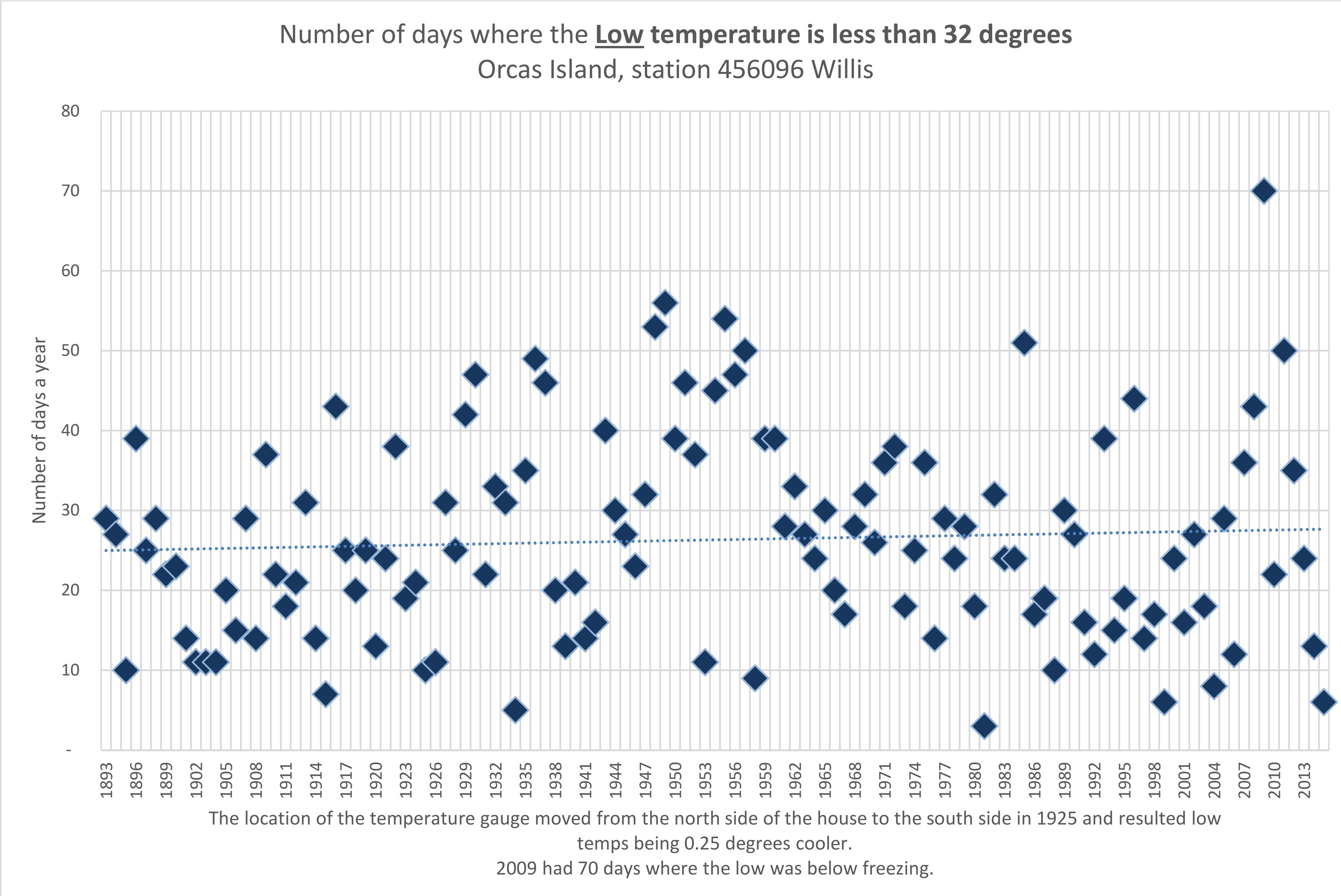




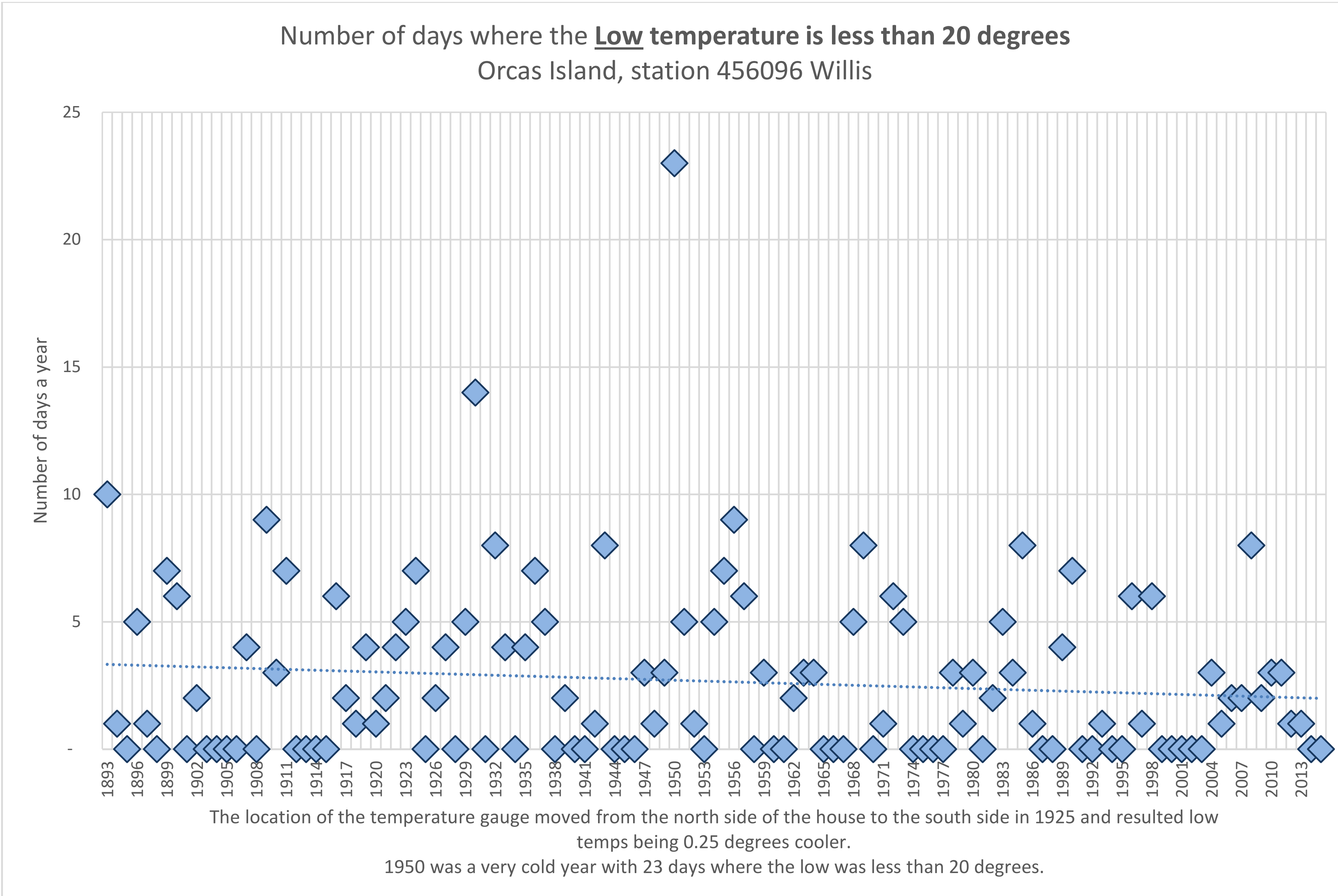
The location of the temperature gauge moved from the north side of the house to the south side in 1925 and the average temp increased by 2 degrees.



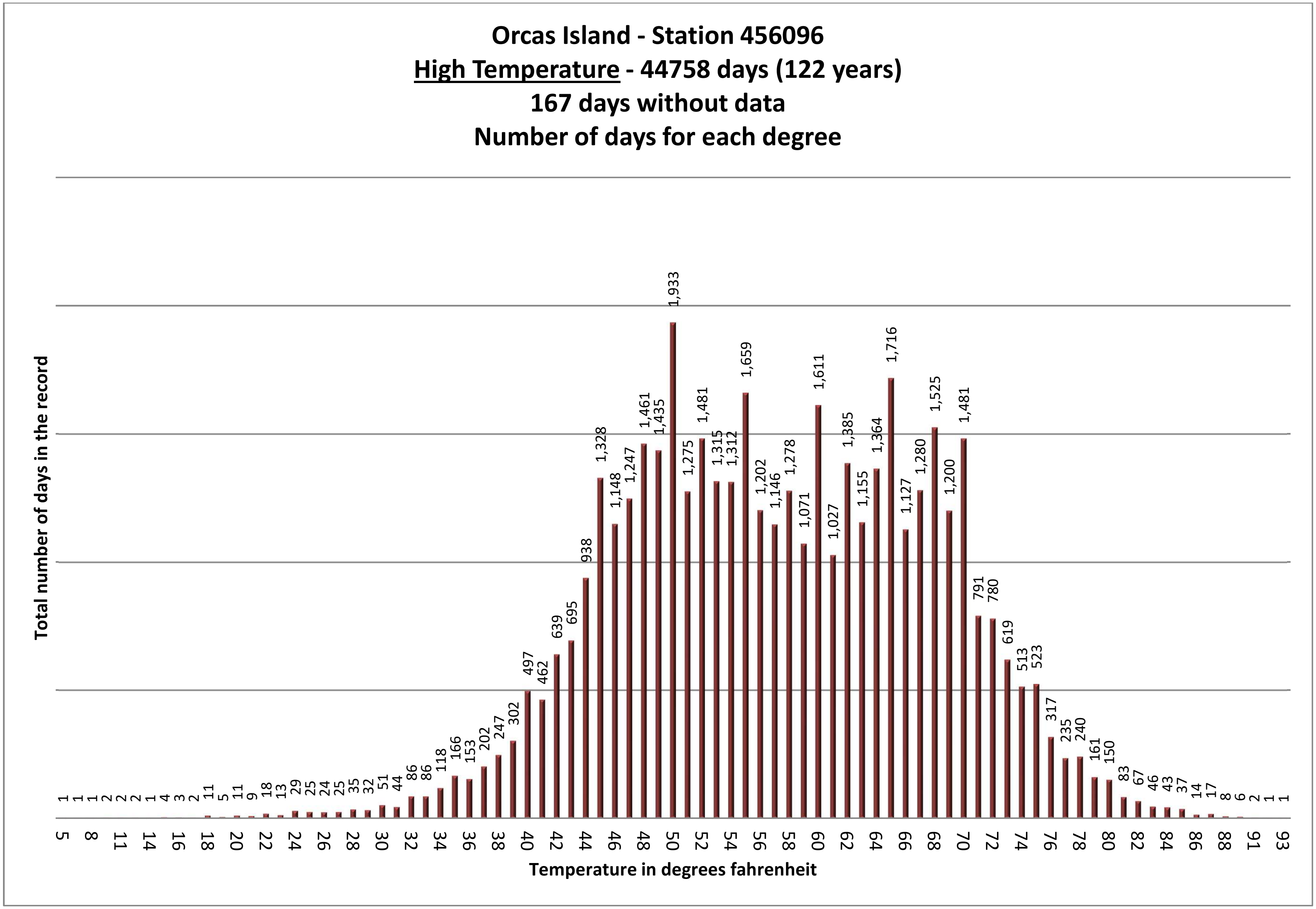
Number of days where the **high temperature is greater than 90 degrees**
Orcas Island, station 456096 Willis
Number of days a year
1.2
1
0.8
0.6
0.4
0.2
0
1893
1896
1899
1902
1905
1908
1911
1914
1917
1920
1923
1926
1929
1932
1935
1938
1941
1944
1947
1950
1953
1956
1959
1962
1965
1968
1971
1974
1977
1980
1983
1986
1989
1992
1995
1998
2001
2004
2007
2010
2013

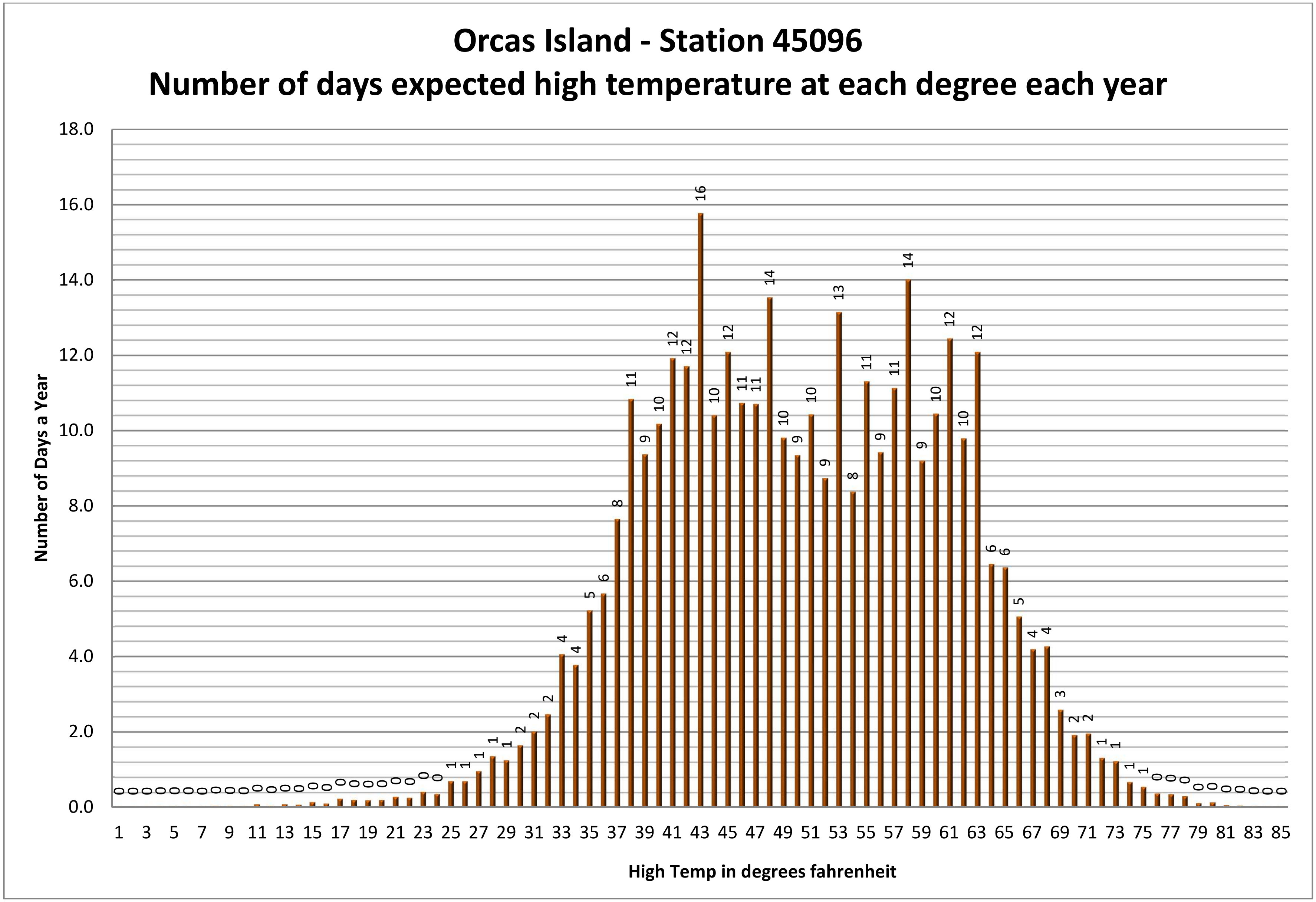


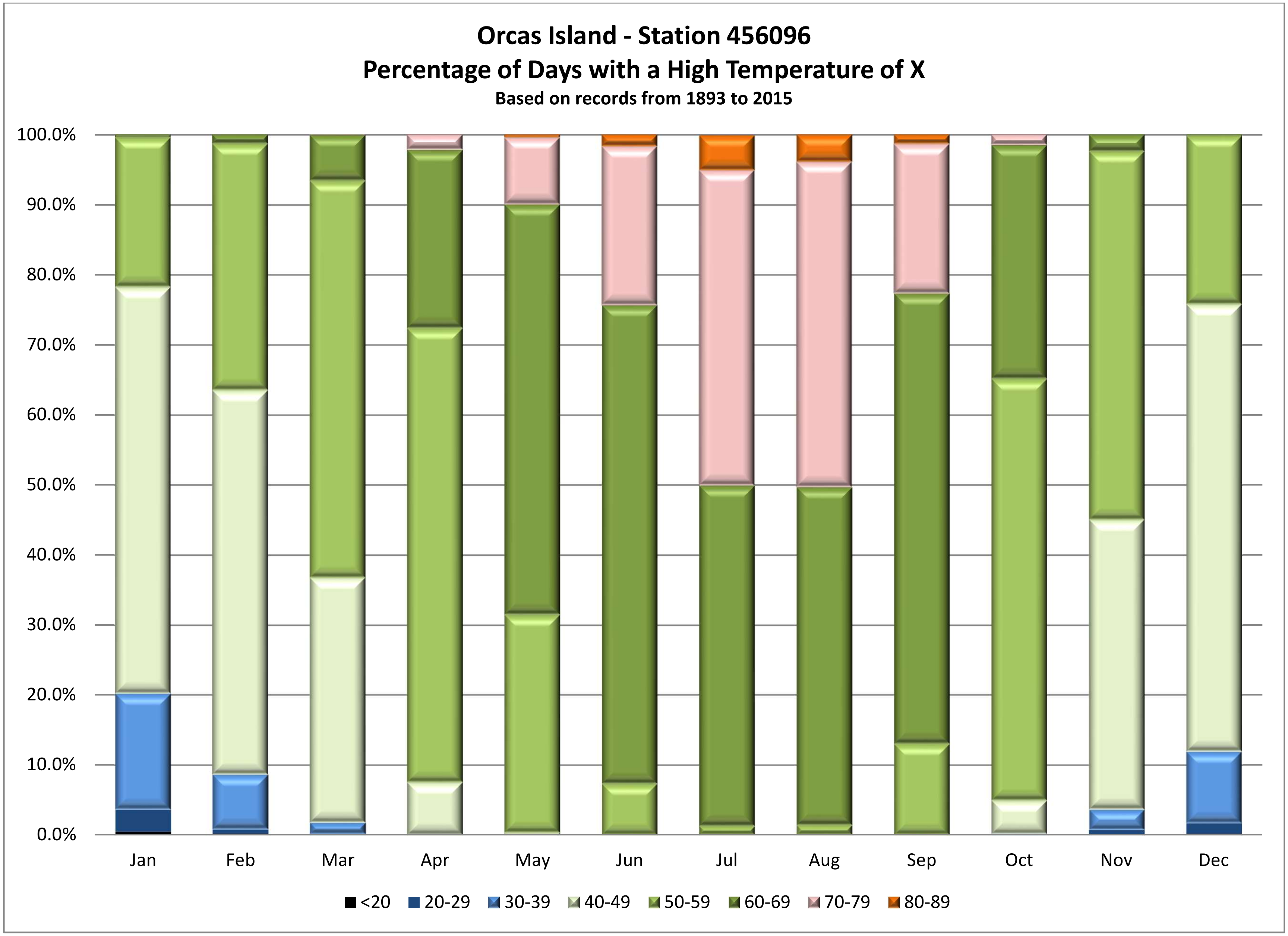
A simple linear trend line shows there to be more days where it freezes, than there uses to be. In other words, it is getting colder.

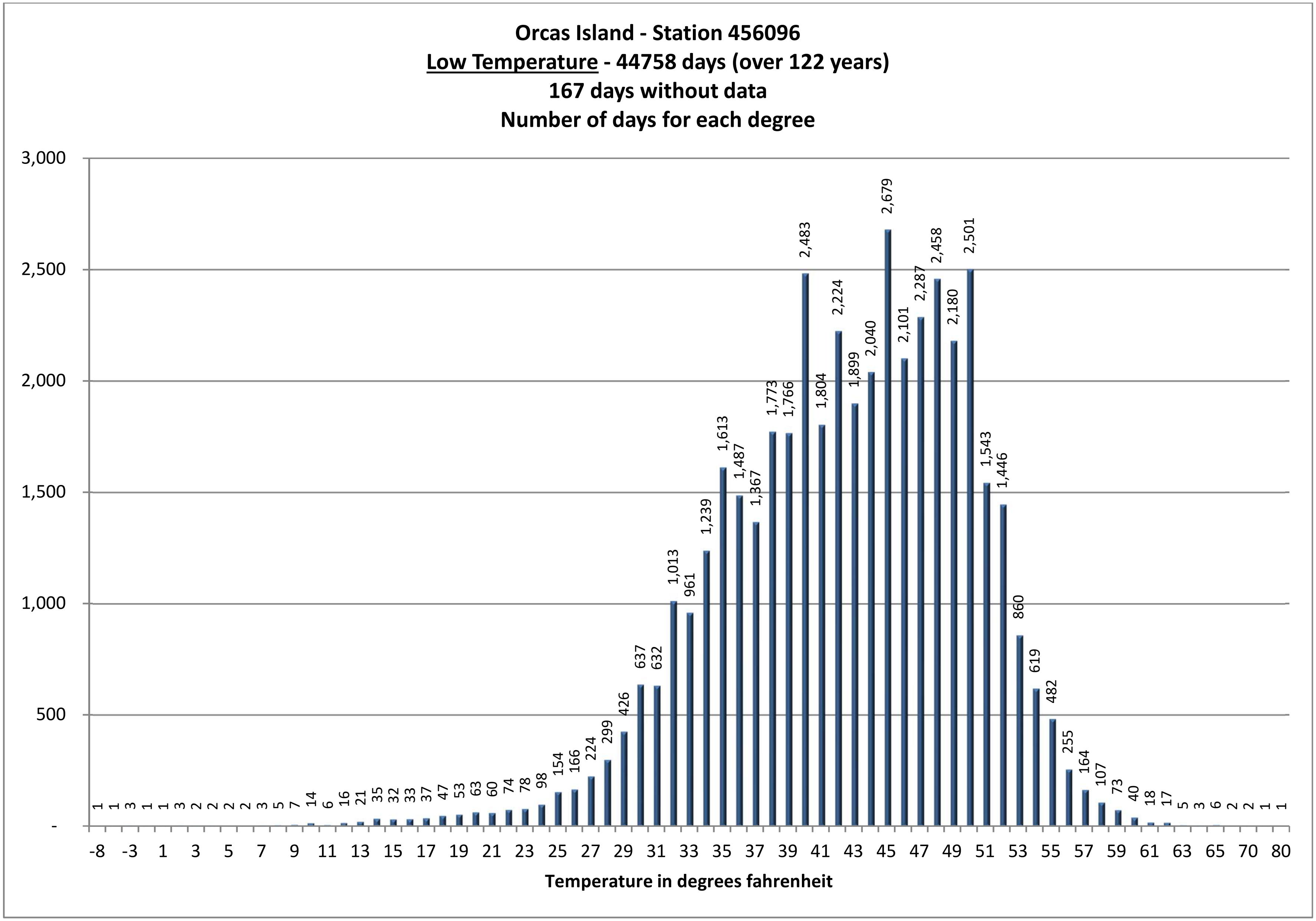


A simple linear trend line shows there to be fewer days where it is very cold, than there uses to be. In other words, it is getting warmer.


Orcas Island - Station 456096
High Temperature - 44758 days (122 years)
167 days without data
Number of days for each degree
Total number of days in the record
Temperature in degrees fahrenheit

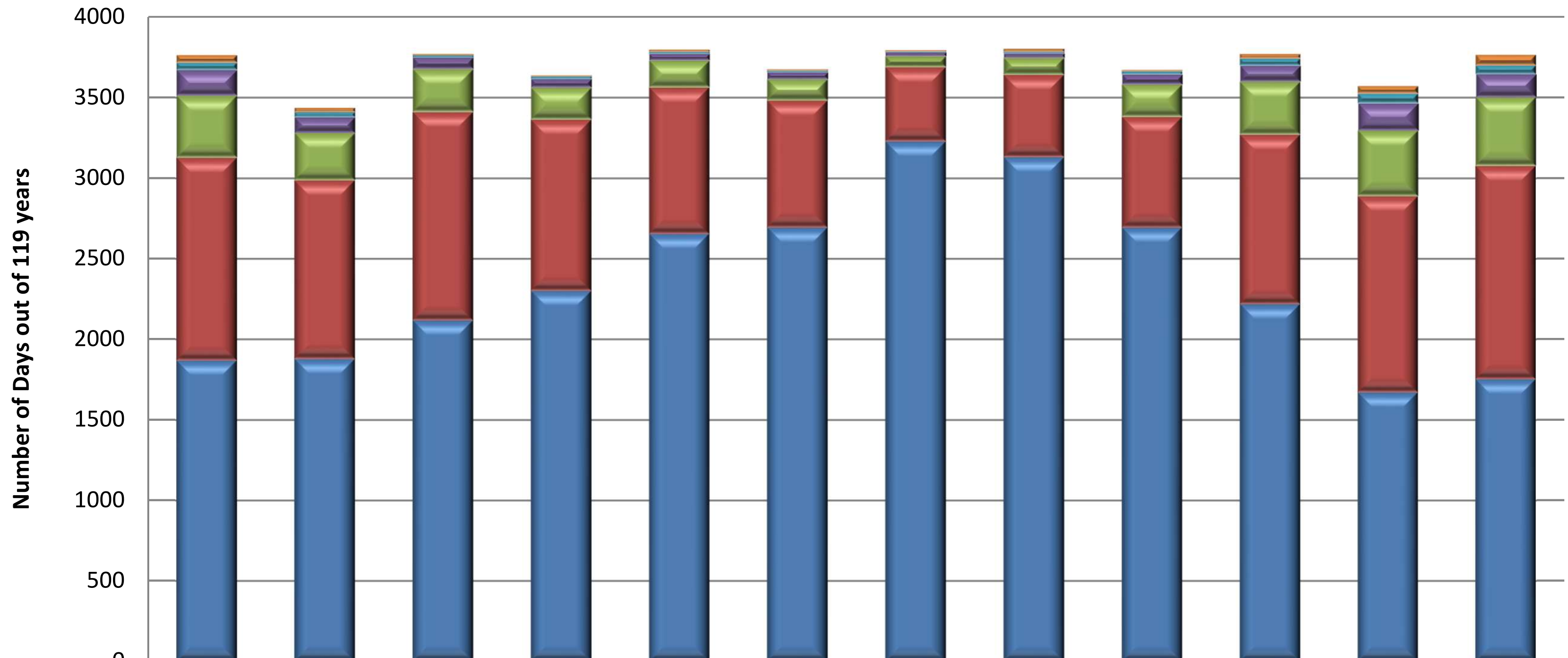

Orcas Island - Station 45096
Number of days expected high temperature at each degree each year
Number of Days a Year
High Temp in degrees fahrenheit


Orcas Island - Station 456096
Percentage of Days with a High Temperature of X
Based on records from 1893 to 2015
100.0%
90.0%
80.0%
70.0%
60.0%
50.0%
40.0%
30.0%
20.0%
10.0%
0.0%
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
<20
20-29
30-39
40-49
50-59
60-69
70-79
80-89



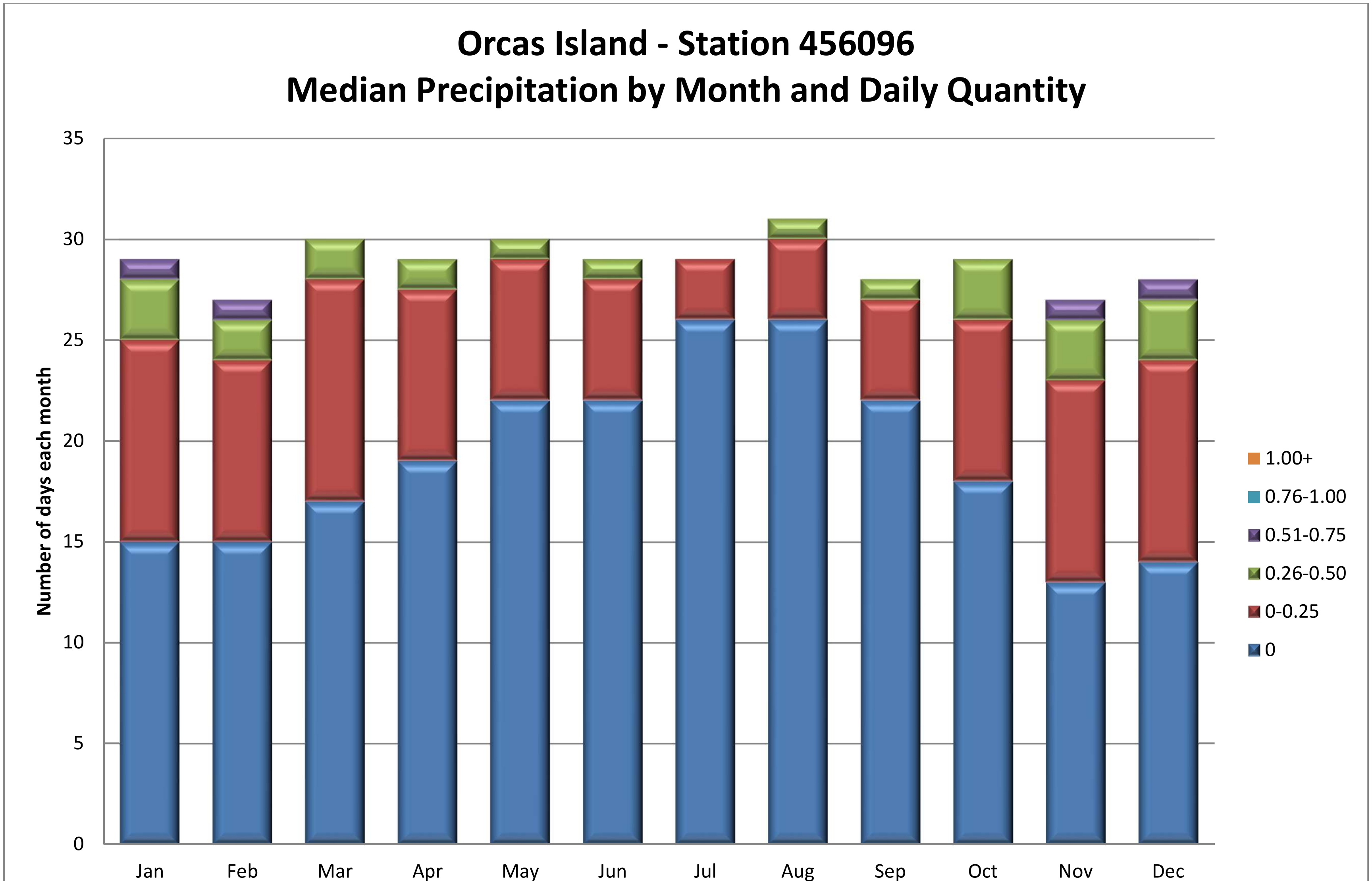
Orcas Island - Station 456096
Low Temperature - 44758 days (over 122 years)
167 days without data
Number of days for each degree
3,000
2,500
2,000
1,500
1,000
500
-
1
1
3
1
1
3
2
2
2
2
3
5
7
14
6
16
21
35
32
33
37
47
53
63
60
74
78
98
154
166
224
299
426
637
632
1,013
961
1,239
1,613
1,487
1,367
1,773
1,766
2,483
1,804
2,224
1,899
2,040
2,679
2,101
2,287
2,458
2,180
2,501
1,543
1,446
860
619
482
255
164
107
73
40
18
17
5
3
6
2
2
1
1
-8 -3 1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31 33 35 37 39 41 43 45 47 49 51 53 55 57 59 61 63 65 70 80
Temperature in degrees fahrenheit

Orcas Island - Station 456096
Quantitative Daily Precipitation Events over 122 years

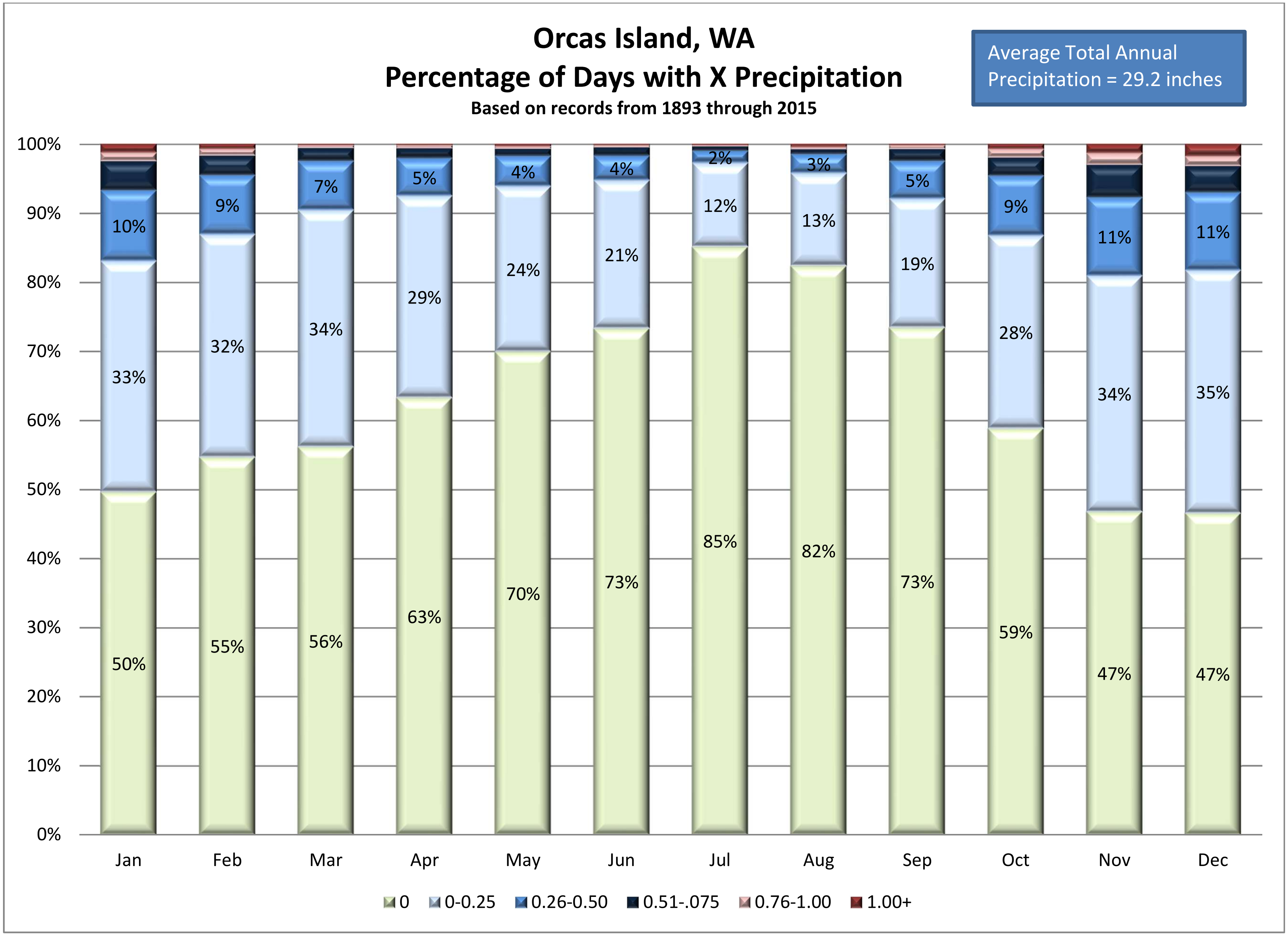


	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.00+	47	25	7	6	13	7	7	18	7	28	47	66
0.76-1.00	46	32	15	17	13	11	6	11	20	45	59	53
0.51-.075	158	98	71	52	40	44	25	26	63	99	168	143
0.26-0.50	384	293	266	198	166	131	66	106	200	327	406	424
0-0.25	1259	1108	1293	1062	908	787	460	510	685	1052	1219	1324
0	1867	1878	2116	2300	2653	2692	3226	3128	2693	2217	1670	1752

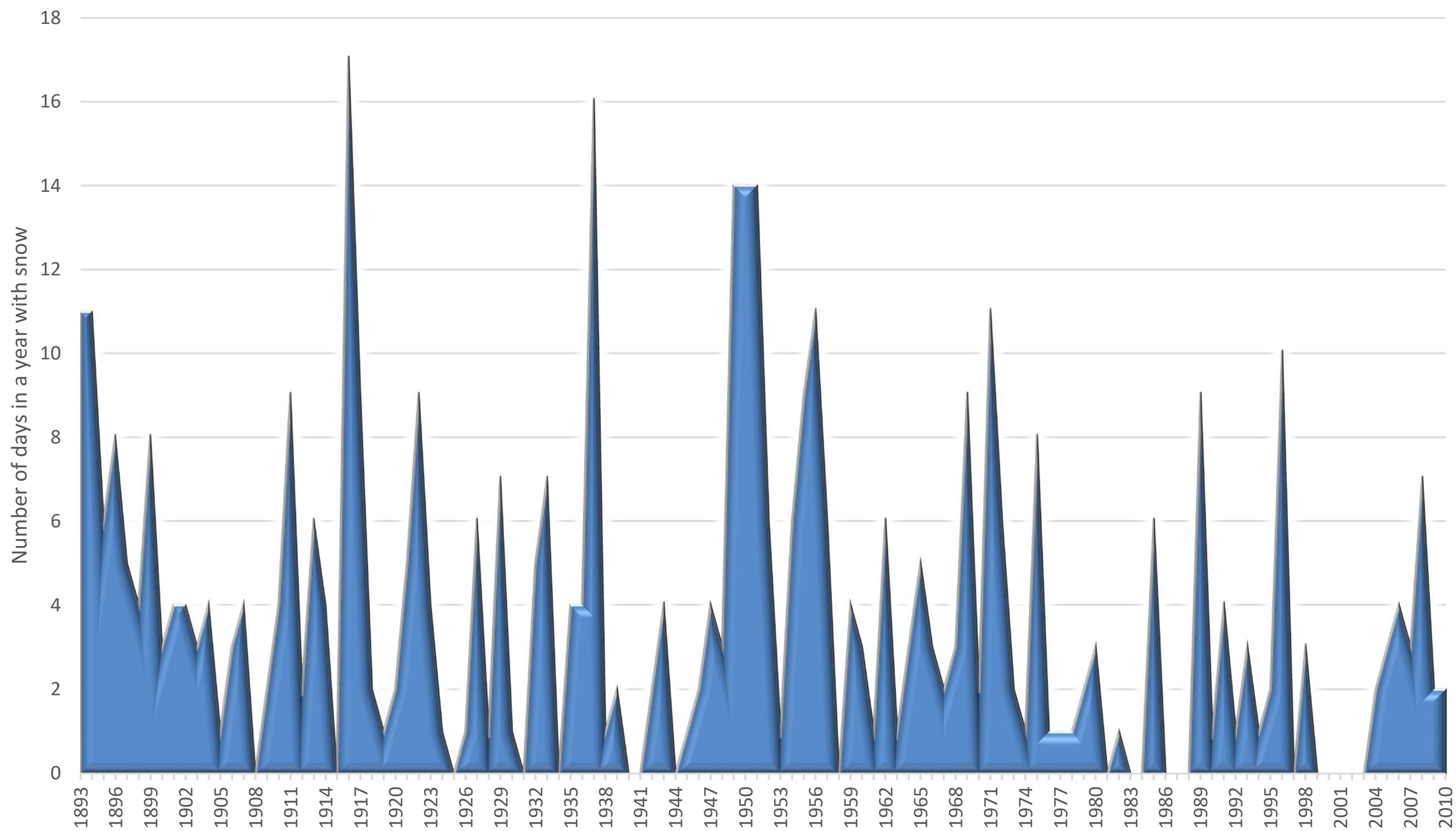
Even though on average no days each year see more than 0.75 inches of precipitation, there have been 66 days in history in December which have seen more than 1 inch of precipitation.



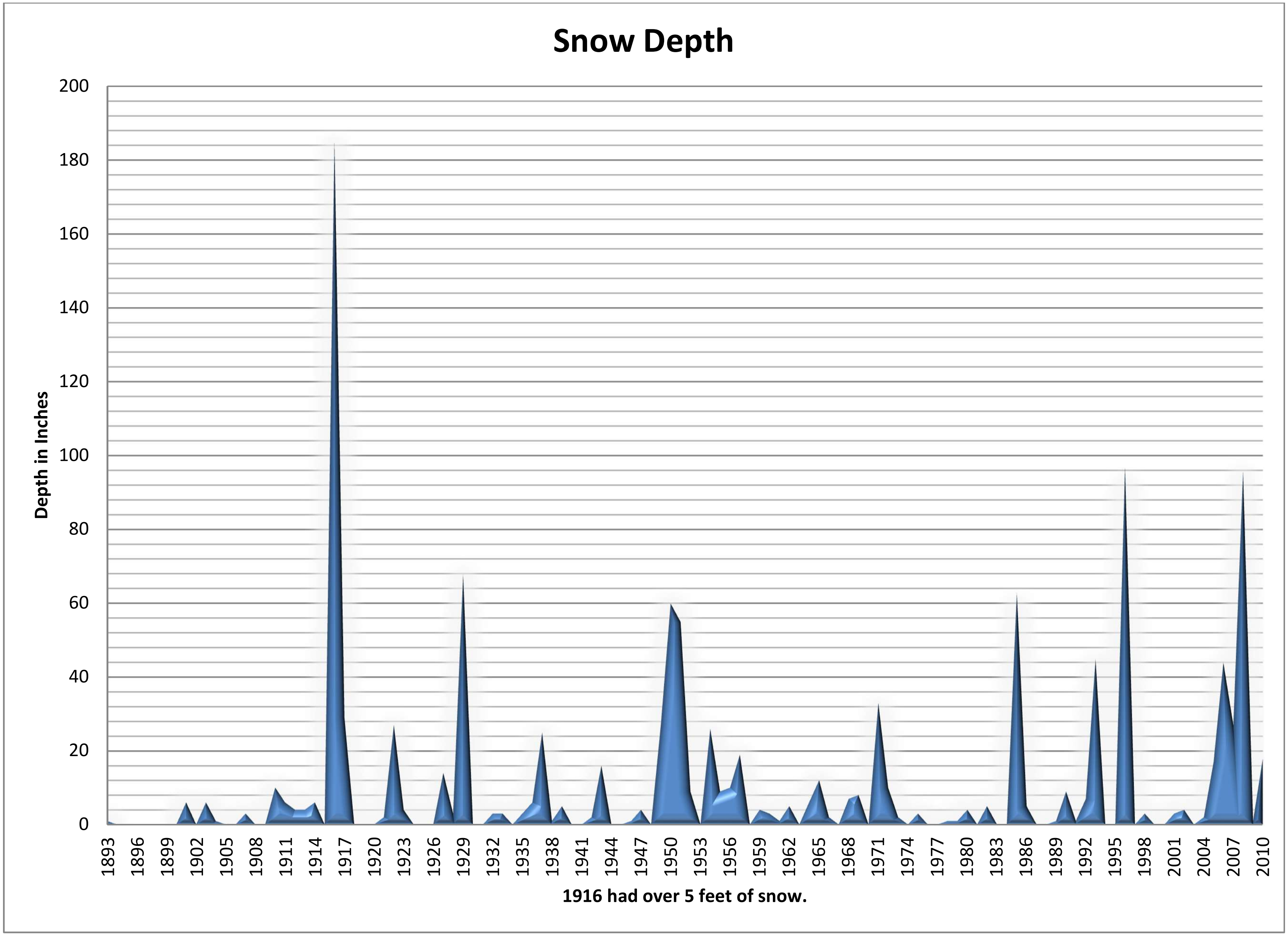
Typcially is about one day a year that sees more than 0.75 of an inch of precipitation.
More than 0.75 has fallen on 606 days in 122 years.
More than half of the days each November and December have precipitation


Orcas Island, WA
Percentage of Days with X Precipitation
Based on records from 1893 through 2015
Average Total Annual Precipitation = 29.2 inches
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
50% 33% 10%
55% 32% 9%
56% 34% 7%
63% 29% 5%
70% 24% 4%
73% 21% 4%
85% 12% 2%
82% 13% 3%
73% 19% 5%
59% 28% 9%
47% 34% 11%
47% 35% 11%
0
0-0.25
0.26-0.50
0.51-.075
0.76-1.00
1.00+

Number of days each year with snow
Data exists from 1893 through 2010



The snowiest year was 2016 with 17 days of snow.
The average is 3.81 days of snow in a year.
There were 21 years with no recorded snow between 1893 and 2010
however most of the missing weather data occurs in the winter months.


Snow Depth
Depth in Inches
200
180
160
140
120
100
80
60
40
20
0
1893
1896
1899
1902
1905
1908
1911
1914
1917
1920
1923
1926
1929
1932
1935
1938
1941
1944
1947
1950
1953
1956
1959
1962
1965
1968
1971
1974
1977
1980
1983
1986
1989
1992
1995
1998
2001
2004
2007
2010
1916 had over 5 feet of snow.