NEW YORK STATE | Department of Environmental Conservation

Cattaraugus Creek
Integrated Watershed Action Plan
APPENDIX 1. ECOSYSTEM ASSESSMENT

Land Cover Change within the Cattaraugus Creek Watershed, 2001-2019

Year	Land Cover Type (acres)									
	Open Water	Developed, Open Space	Developed (High, Medium, and Low Intensity)	Barren	Forest	Shrubland	Planted/ Cultivated	Herbaceous	Wetland	Total (Watershed)
2001	2,346	17,724	5,414	438	201,667	823	115,763	443	13,996	358,614
2004	2,158	17,845	5,494	440	200,879	969	115,238	1531	14,059	358,613
2008	2,318	17,846	5,875	424	201,139	1,991	114,329	795	13,896	358,613
2011	2,349	18,022	6,117	458	201,369	2,461	113,037	883	13,918	358,614
2013	2,308	17,697	6,463	457	202,215	1,762	113,067	712	13,932	358,613
2016	2,201	17,638	6,745	463	201,931	1,548	112,810	1263	14,016	358,615
2019	2,142	17,541	6,873	551	202,308	1,349	112,864	921	14,064	358,613
Median cover (2001 to 2019, %)	1	5	2	0.1	56	0	32	0.2	4	100
Overall Trend	**None**	**None**	**Increasing (≈81 acres/year)**	**Increasing (≈6 acres/year)**	**Increasing (≈36 acres/year)**	**None**	**Decreasing (≈161 acres/year)**	**None**	**None**	**None**

Table A1.1 Description: Land cover change data are from the USGS National Land Cover Database (NLCD) for years 2001-2019. Years with missing rows from the table indicate gaps within the dataset, e.g., 2002, 2005-2007, 2018. The table shows the number of acres of various land types present in the watershed for each available year. The trends listed in the table were determined using a Spearman-Rank Correlation.

Key Points:

- Forested land is the main cover type (56% of the watershed) with agricultural lands second at 32%. Wetlands comprise a relatively small percentage of the watershed at 4%
- Developed (high, medium, and low intensity), barren, and forest land types were increasing 81 acres/year, 6 acres/year, and 36 acres/year, respectively
- Planted/cultivated land type was decreasing at approximately 161 acres/year

Updated July 2022

Land Cover Change within Potential Environmental Justice Areas, 2001-2019

Year	Land Cover Type (acres)									
	Open Water	Developed, Open Space	Developed (High, Medium, and Low Intensity)	Barren	Forest	Shrubland	Planted/ Cultivated	Herbaceous	Wetland	Total (Potential Environmental Justice Areas)
2001	374	1,134	970	38	12,732	78	3,502	20	1,796	20,644
2004	380	1,137	979	37	12,728	78	3,491	21	1,794	20,645
2008	408	1,145	1,022	30	12,729	77	3,431	22	1,780	20,644
2011	384	1,165	1,037	54	12,721	77	3,393	23	1,789	20,643
2013	378	1,151	1,051	54	12,720	78	3,392	31	1,789	20,644
2016	378	1,151	1,079	56	12,698	77	3,361	43	1,801	20,644
2019	375	1,150	1,083	60	12,706	56	3,363	46	1,806	20,645
Median cover (2001 to 2019, %)	2	6	5	0.3	62	0	16	0.1	9	100
Overall Trend	**None**	**None**	**Increasing (≈6 acres/year)**	**Increasing (≈1 acres/year)**	**Decreasing (≈1 acres/year)**	**Decreasing (≈1 acres/year)**	**Decreasing (≈8 acres/year)**	**Increasing (≈1 acres/year)**	**None**	**None**

Table A1.2 Description: Land cover change within potential environmental justice areas (PEJA are from DEC Commissioner's Policy #29, Environmental Justice and Permitting) are from the USGS National Land Cover Database (NLCD) for years 2001-2019. The table shows the number of acres of various land types present in the PEJAs for each available year. The trends listed in the table were determined using a Spearman-Rank Correlation.

Key Points:

- Potential environmental justice areas are largely forested (62%) with agricultural lands comprising the next most extensive land cover (16%)
- Developed (high, medium, and low intensity), barren, and herbaceous land types were increasing 6 acres/year, 1 acres/year, and 1 acres/year, respectively
- Forest, shrubland, and planted/cultivated land types were decreasing 1 acres/year, 1 acres/year, and 8 acres/year, respectively
- While for the total watershed, the decline of agricultural lands was associated with some increases in forested areas; within potential environmental justice areas similar increases in forest area have not occurred

Updated July 2022

Land Cover Change within Riparian Buffers, 2001-2019

Year	Land Cover Type (acres)									
	Open Water	**Developed, Open Space**	**Developed (High, Medium, and Low Intensity)**	**Barren**	**Forest**	**Shrubland**	**Planted/ Cultivated**	**Herbaceous**	**Wetland**	**Total (NYNHP Riparian Buffers)**
2001	1,669	2,683	1,106	204	28,747	93	14,956	73	10,072	59,603
2004	1,585	2,704	1,120	206	28,727	106	14,881	149	10,123	59,601
2008	1,739	2,692	1,170	191	28,695	191	14,822	112	9,990	59,602
2011	1,695	2,731	1,209	229	28,717	243	14,649	121	10,008	59,602
2013	1,681	2,679	1,264	222	28,788	175	14,665	107	10,022	59,603
2016	1,645	2,669	1,295	227	28,779	129	14,617	153	10,089	59,603
2019	1,595	2,657	1,312	229	28,775	139	14,624	143	10,129	59,603
Median cover (2001 to 2019, %)	3	5	2	0.4	48	0.2	25	0.2	17	100
Overall Trend	**None**	**None**	**Increasing (≈11 acres/year)**	**None**	**None**	**None**	**Decreasing (≈18 acres/year)**	**None**	**None**	**None**

Table A1.3 Description: Land cover change within the NY Natural Heritage Program riparian buffers are from the USGS National Land Cover Database (NLCD) for years 2001-2019. Years with missing rows from the table indicate gaps within the dataset, e.g., 2002, 2005-2007, 2018. The table shows the number of acres of various land types present in riparian buffers for each available year. The trends listed in the table were determined using a Spearman-Rank Correlation.

Key Points:
- Riparian buffers in the watershed are largely forested (48%) with agricultural lands comprising the next most extensive cover type at 25%
- Developed (high, medium, and low intensity) land type was increasing 11 acres/year which may lead to reduced ecological functions and values with riparian buffers as well as an increase in built assets in areas that are potentially exposed to flooding
- Planted/cultivated land types was decreasing 18 acres/year

Updated July 2022

Median Wind Speed, 1984-2022

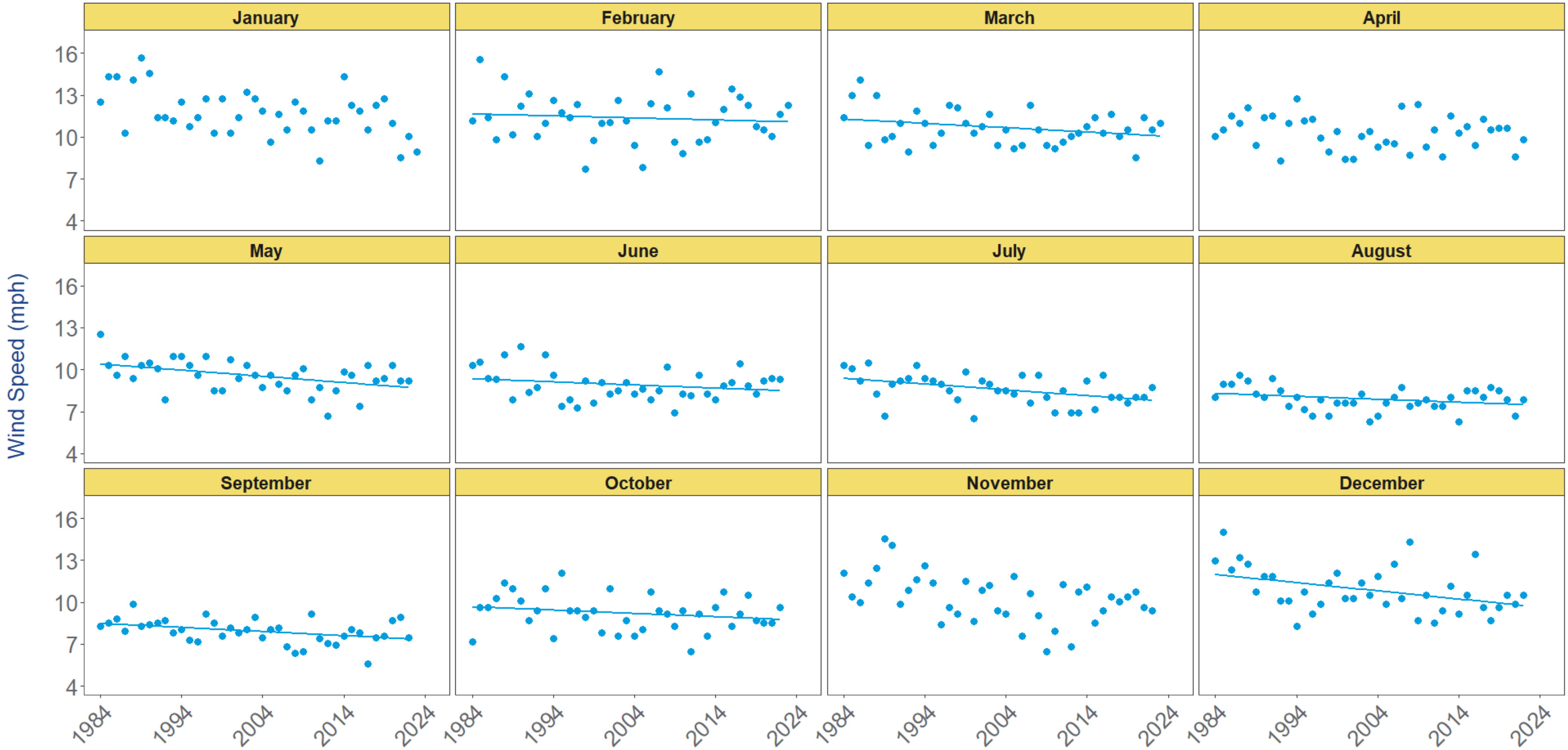

Figure A1.1 Description: Median monthly wind data are from the Buffalo Niagara International Station, NY (Source: NOAA National Centers for Environmental Information) for years 1984-2022. The Buffalo Niagara International Station is located 30 miles north of the Village of Springville, i.e., the station is not located within the watershed. This figure depicts median winds speeds by month, with trend lines if the change in wind speed was found to be statistically significant.

Key Points:

- February, March, May, June, July, August, September, October, and December have decreasing median wind speeds over the 38-year timeframe, indicated by the statistically significant trendline
- The statistically significant trends should be interpreted cautiously due to the relatively short timeframe of the data set

Updated July 2022

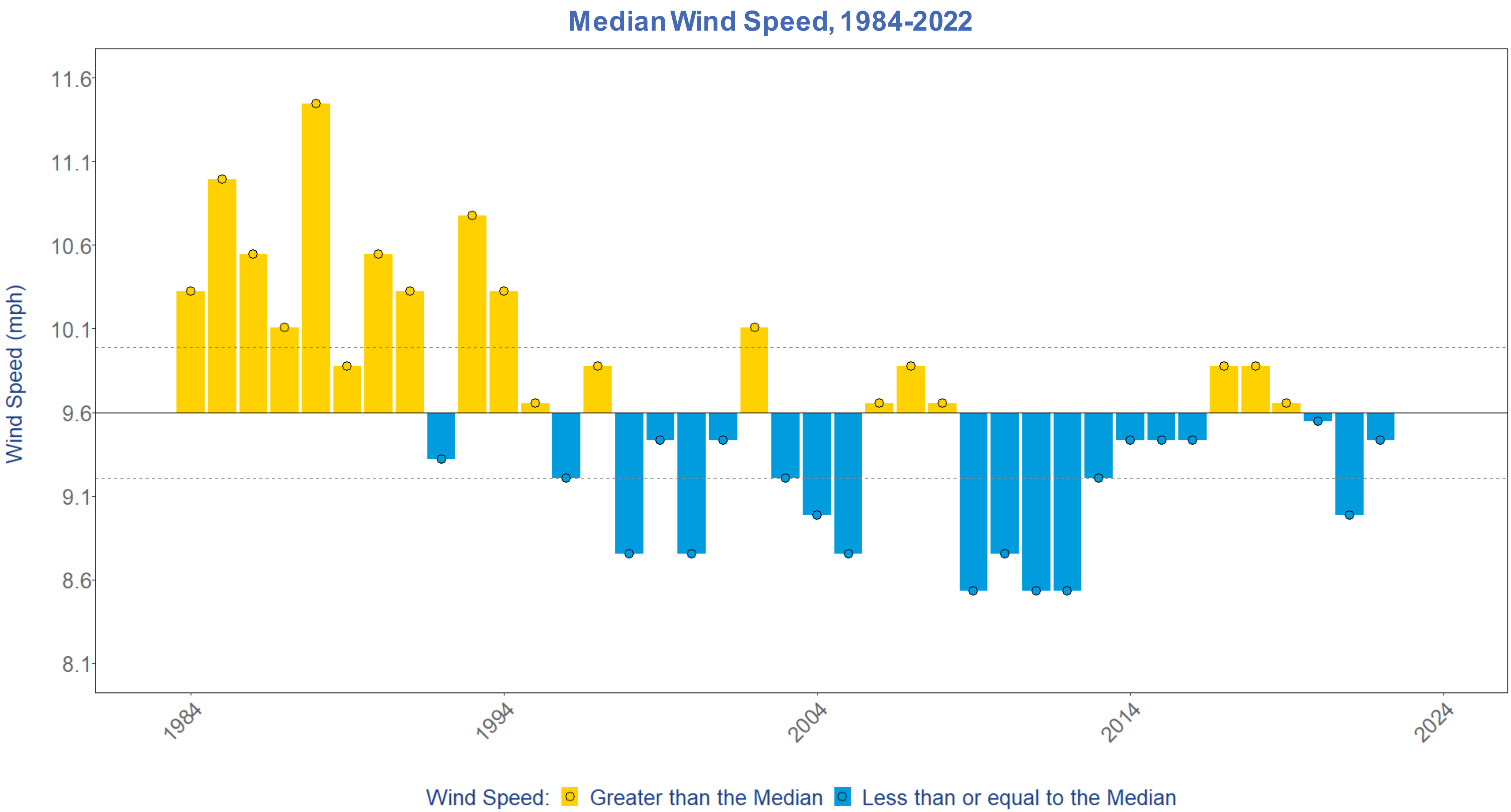

Figure A1.2 Description: Median annual wind speed data are from the Buffalo Niagara International Station, NY (Source: NOAA National Centers for Environmental Information) for years 1984-2022. The Buffalo Niagara International Station is located 30 miles north of the Village of Springville, i.e., the station is not located within the watershed. This graph uses the 1984-2022 median as a baseline (solid gray line) for depicting change; the dotted gray lines indicate the 25th and 75th percentiles, i.e., the normal range of values.

Key Points:

- During the 38-year timeframe, median wind speed has been below the long-term median of 9.6 mph 20 out of 38 years
- Wind speed patterns may be related to broader meteorological patterns evident in the precipitation data (i.e., Figure A1.3)

Updated July 2022

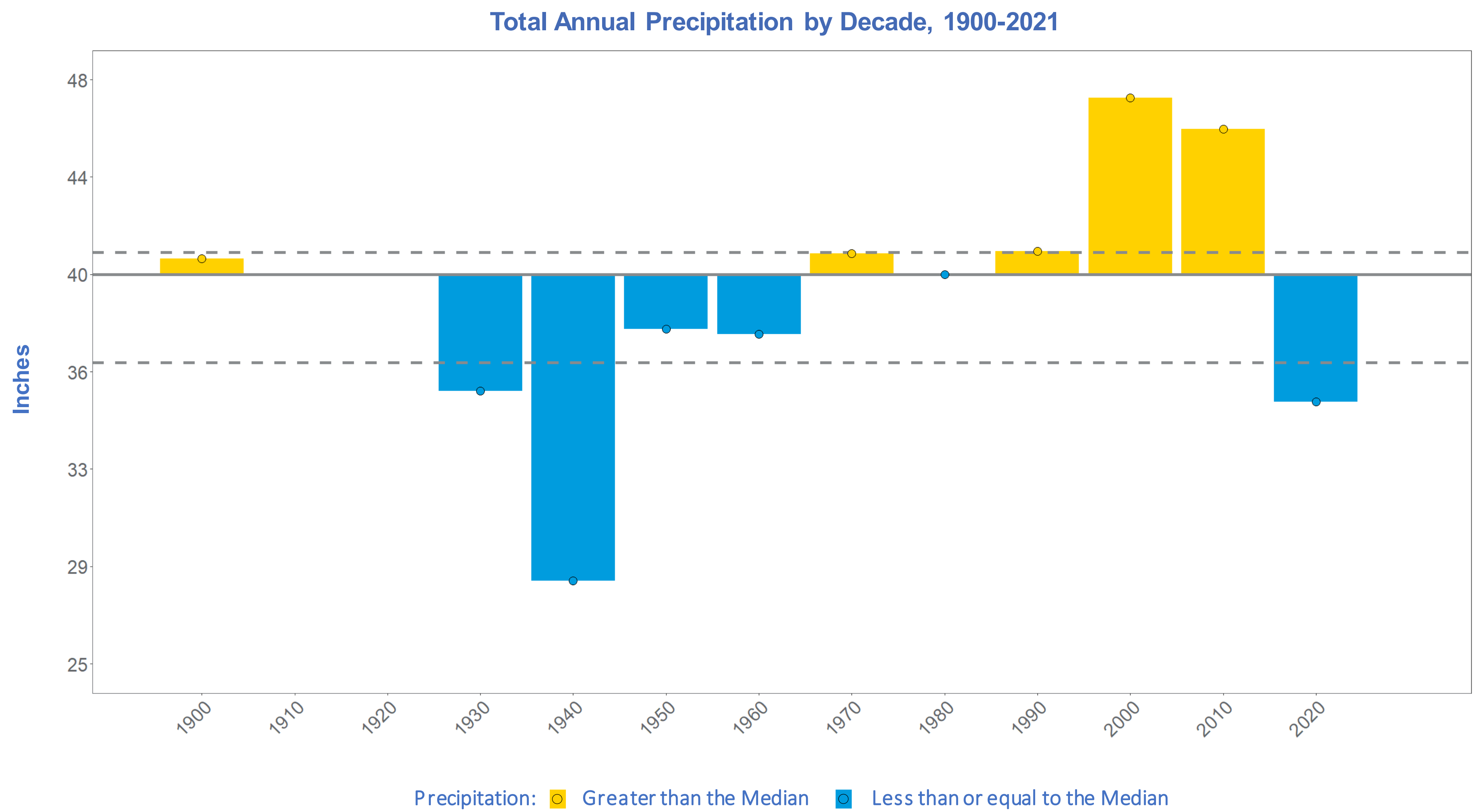

Figure A1.3 Description: Annual precipitation data are from the Franklinville Station (Source: NOAA National Centers for Environmental Information) for years 1900-2021. Decades with missing values from the graph indicate gaps within the dataset, e.g., 1910 and 1920. Each bar represents a median annual precipitation value for the decade. This graph uses the 1900-2021 median as a baseline (solid gray line) for depicting change; the dotted gray lines indicate the 25th and 75th percentiles, i.e., the normal range of values.

Key Points:

- Median annual precipitation has been below the median of 40 inches in the decades of 1930, 1940, 1950, 1960, and 2020
- Precipitation varies by 20-40 year cycles in the Great Lakes region, driven by processes such as ocean oscillations

Updated July 2022

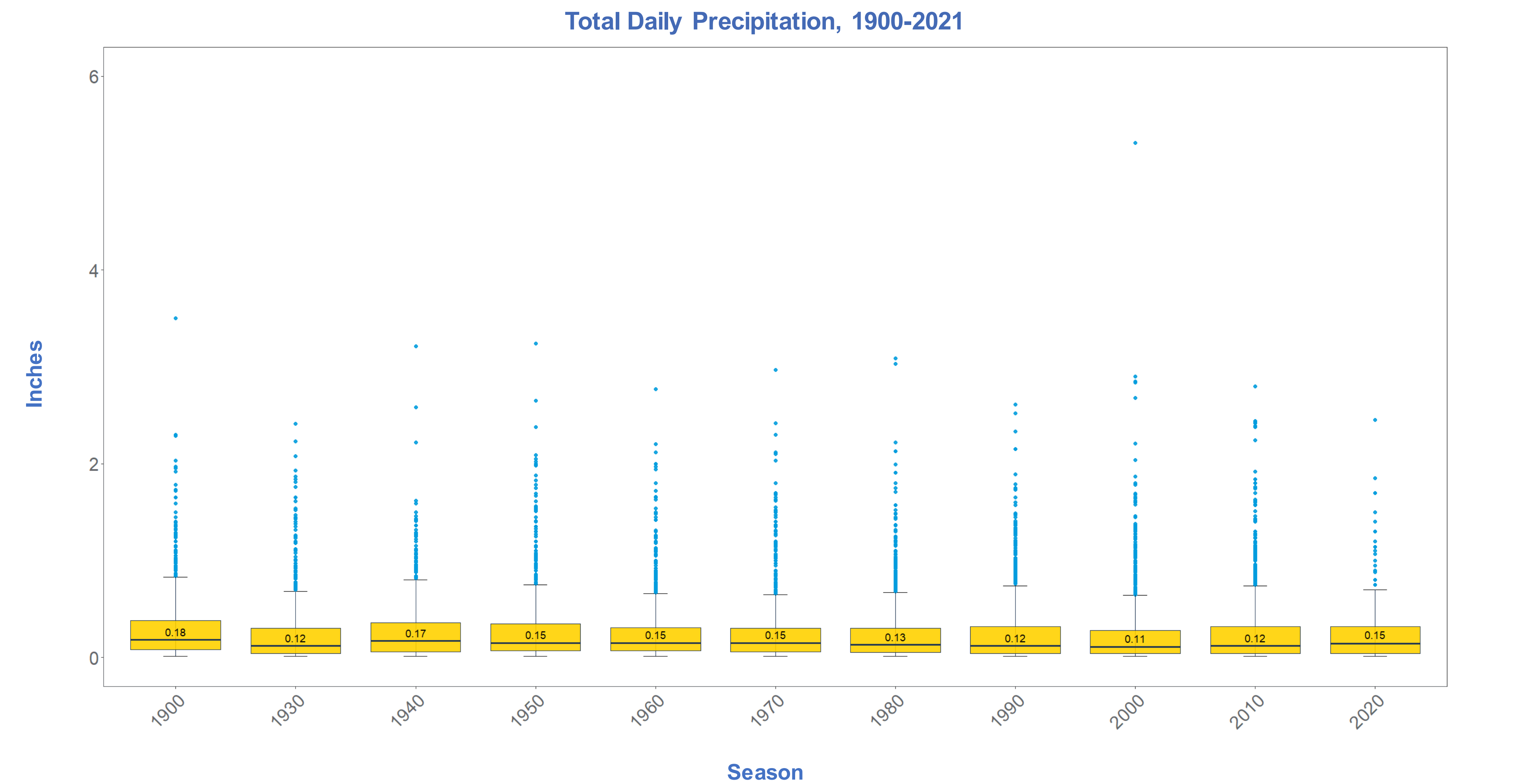

Figure A1.4 Description: Total daily precipitation data are from the Franklinville Station (Source: NOAA National Centers for Environmental Information) for years 1900-2021. Decades with missing values from the graph indicate gaps within the dataset, e.g., 1910 and 1920. This graph uses a boxplot for each decade, indicating the median (dark grey lines labeled in each yellow box), 25th percentile (lower line of yellow boxes), 75th percentile (upper line of yellow boxes), and outliers (blue dots).

Key Points:

- Total daily precipitation data show no clear trends, typically around 0.15 inches per day
- Maximum daily precipitation values also show no clear trends over time with values typically ranging from 2 to 3 inches per day

Updated July 2022

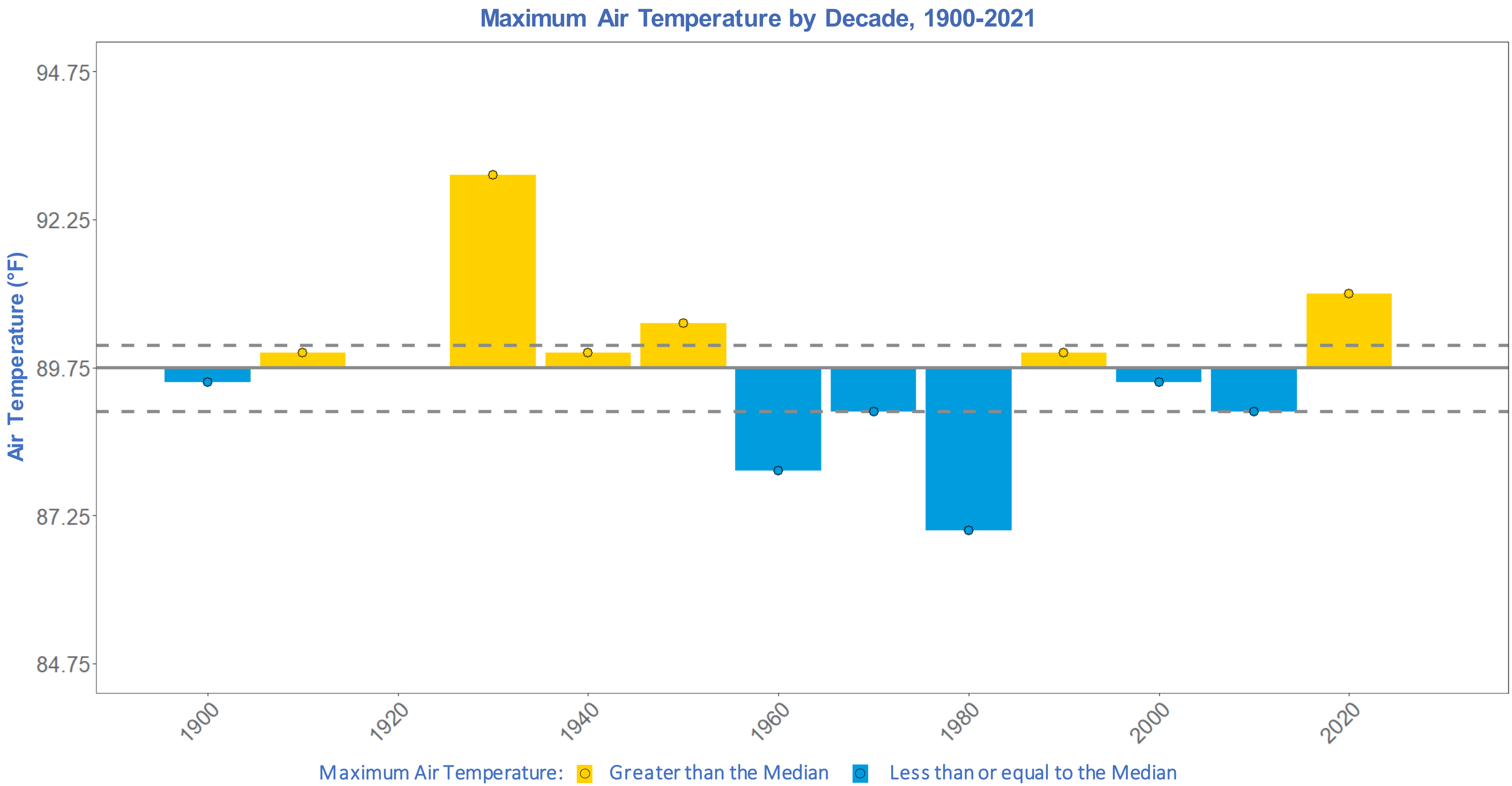

Figure A1.5 Description: Maximum air temperature data are from the Franklinville Station (Source: NOAA National Centers for Environmental Information) for the years 1900-2021. Each bar represents the median of the maximum annual air temperatures across each decade. Decades with missing values from the graph indicate gaps within the dataset, e.g., 1910 and 1920. This graph uses the 1900-2021 median as a baseline (solid gray line) for depicting change; the dotted gray lines indicate the 25th and 75th percentiles, i.e., the normal range of values.

Key Points:

- Patterns of maximum annual air temperature somewhat mirror those of annual precipitation rates over this timeframe
- These data demonstrate the important role that Lake Erie plays in providing a temperature buffer as maximum air temperature values above 100°F have been noted further inland from Lake Erie, within the Finger Lakes region

Updated July 2022

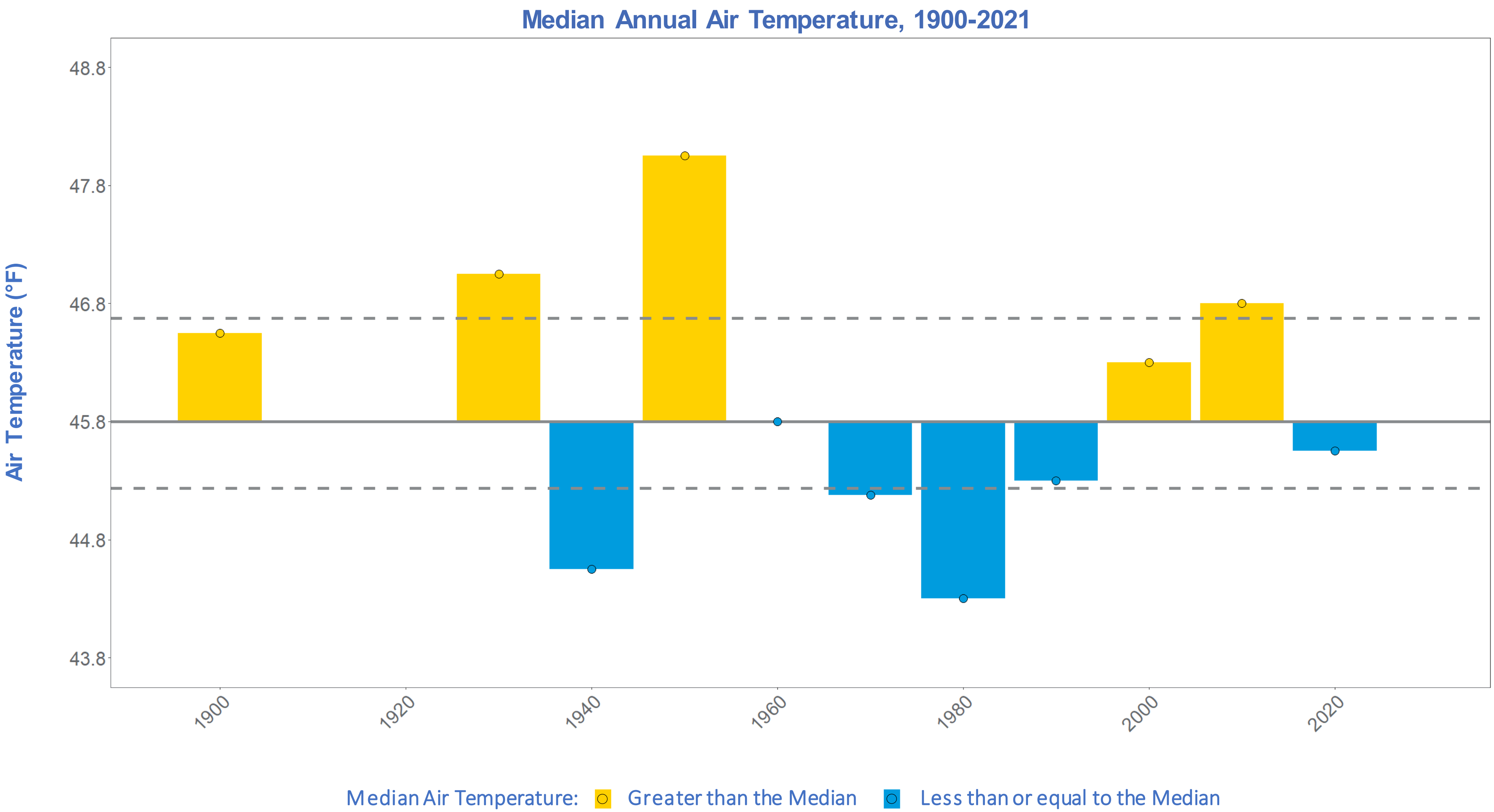

Figure A1.6 Description: Annual air temperature data are from the Franklinville Station (Source: NOAA National Centers for Environmental Information) for years 1900-2021. Decades with missing values from the graph indicate gaps within the dataset, e.g., 1910 and 1920. Each bar represents the median of annual air temperature values for each decade. This graph uses the 1900-2021 median as a baseline (solid gray line) for depicting change; the dotted gray lines indicate the 25th and 75th percentiles, i.e., the normal range of values.

Key Points:

- The long-term median air temperature from 1900-2021 was 45.8 °F
- An apparent cool period during the 1970's through 1990's correspond with a similar timeframe of elevated precipitation rates

Updated July 2022

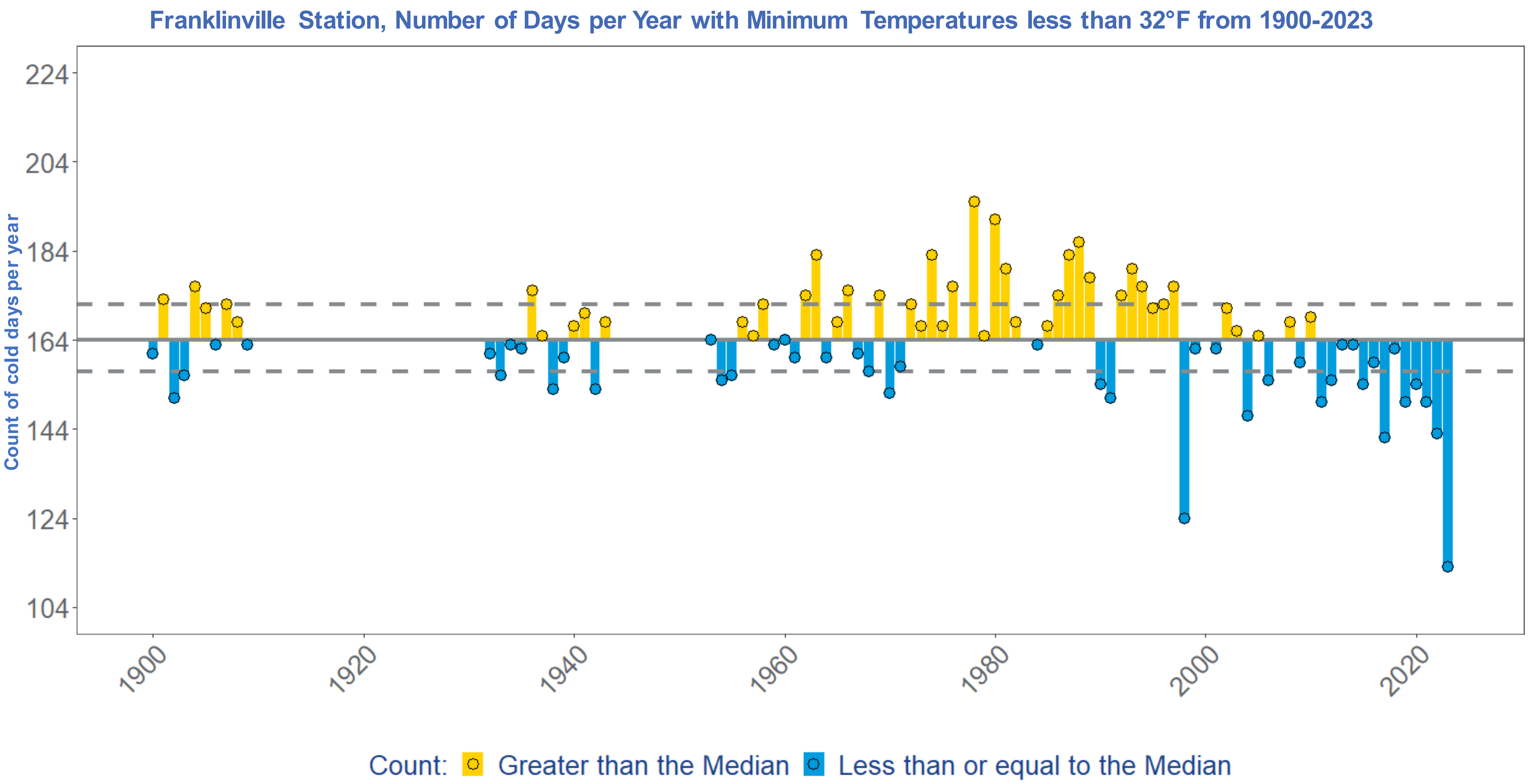

Figure A1.7 Description: Count of days per year with freezing temperatures (< 32° F) from the Franklinville Station (Source: NOAA National Centers for Environmental Information) for years 1900-2023. Years with missing values from the graph indicate gaps within the dataset, e.g., 1910s – 1920s. This graph uses the 1900-2023 median as a baseline (solid gray line) for depicting change; the dotted gray lines indicate the 25th and 75th percentiles, i.e., the normal range of values.

Key Points:

- The long-term trend follows a cyclical pattern, similar to the pattern seen in median air temperature and precipitation
- However, there is an apparent decreasing trend in the number of freezing days per year. The year 2023 had the lowest count of freezing days ever recorded with 51 days lower than the median (164)

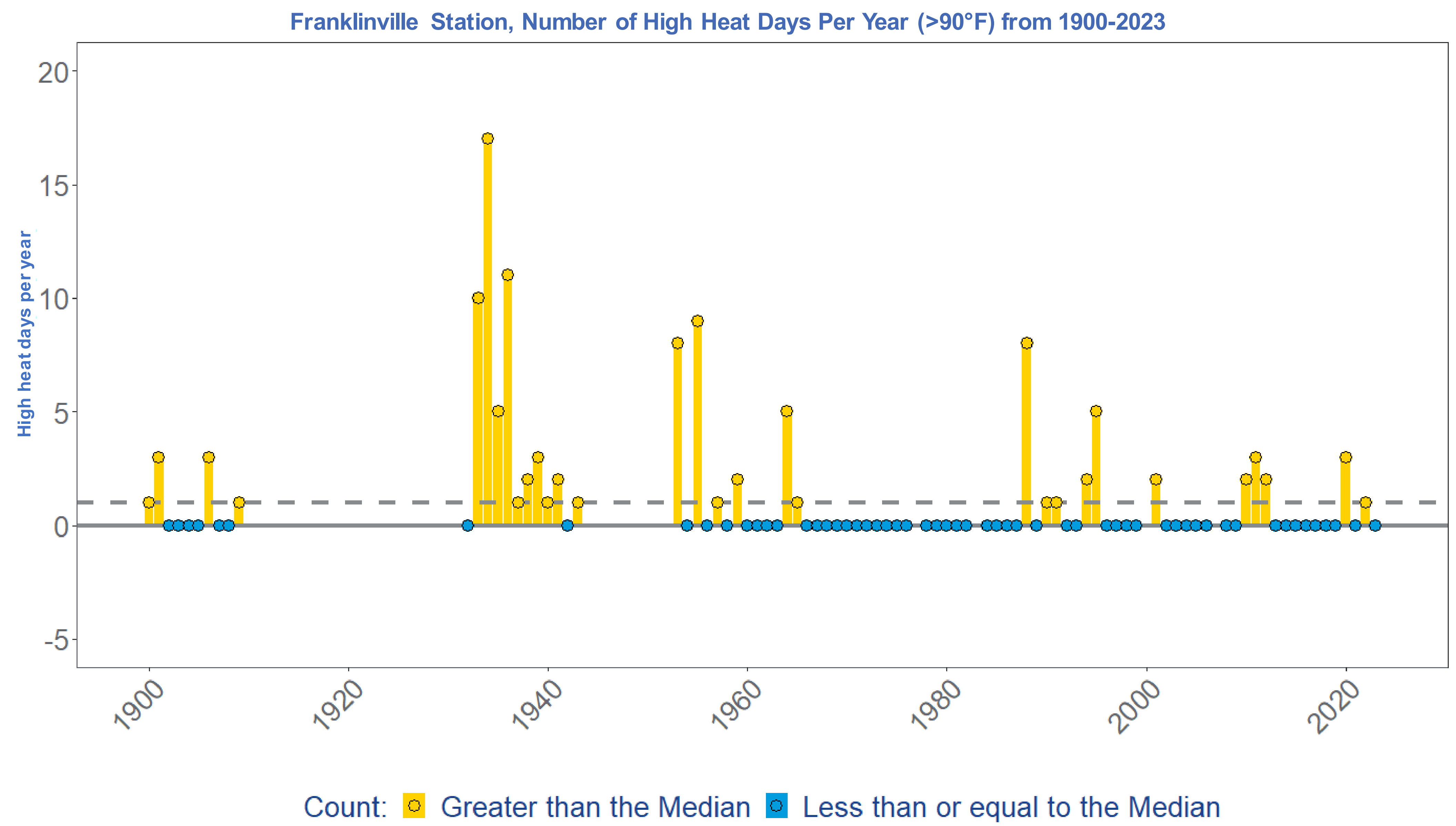

Figure A1.8 Description: Count of high heat days (> 90° F) per year from the Franklinville Station (Source: NOAA National Centers for Environmental Information) for years 1900-2023. Years with missing values from the graph indicate gaps within the dataset, e.g., 1910s – 1920s. This graph uses the 1900-2023 median as a baseline (solid gray line) for depicting change; the dotted gray lines indicate the 25th and 75th percentiles, i.e., the normal range of values.

Key Points:

- The median number of high heat days per year is zero
- There are no apparent significant or emerging trends in maximum air temperature, with annual maximum values typically around 90 °F

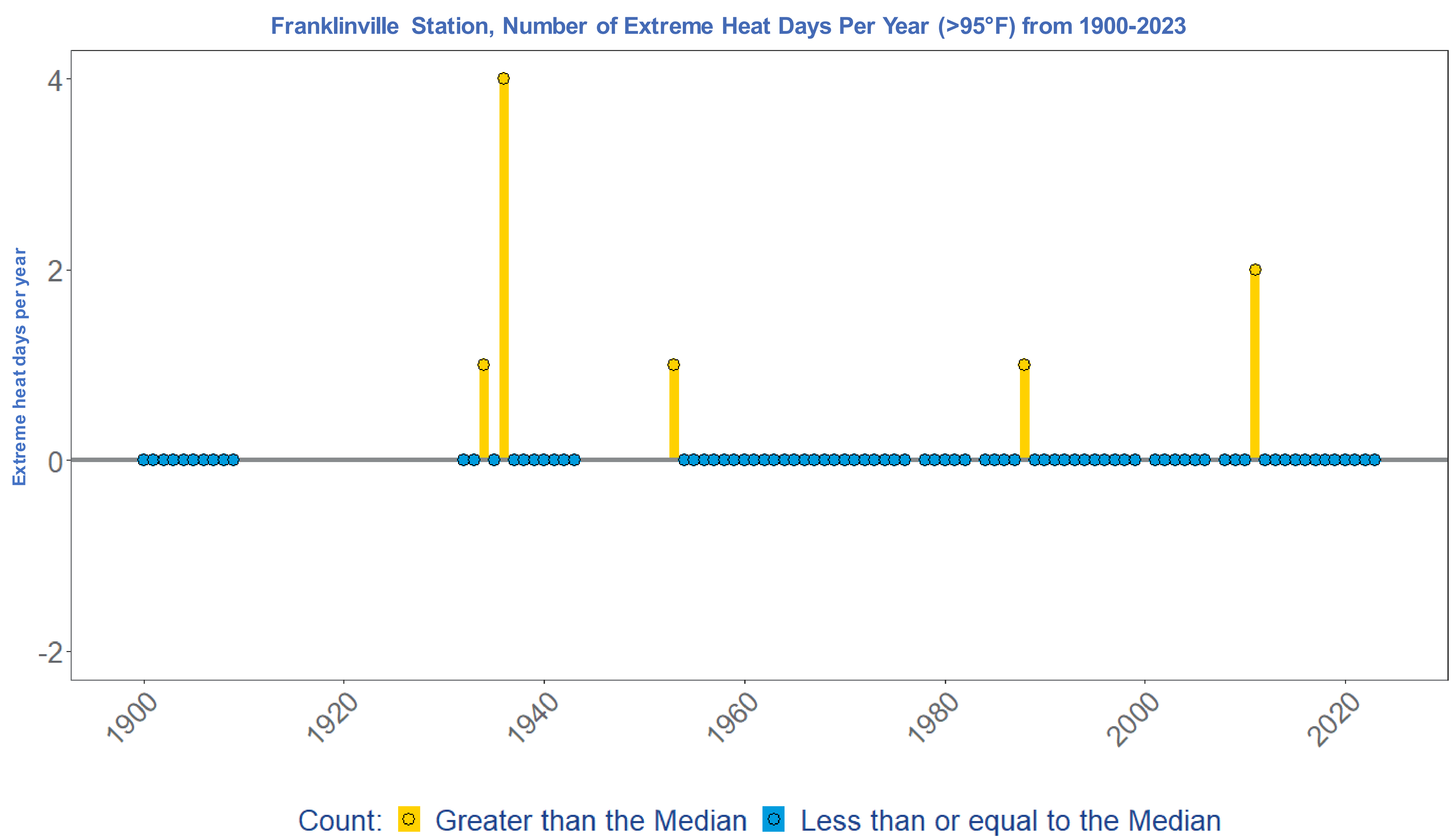

Figure A1.9 Description: Extreme heat days (> 95° F) per year from the Franklinville Station (Source: NOAA National Centers for Environmental Information) for years 1900-2023. Years with missing values from the graph indicate gaps within the dataset, e.g., 1910s – 1920s. This graph uses the 1900-2023 median as a baseline (solid gray line) for depicting change; the dotted gray lines indicate the 25th and 75th percentiles, i.e., the normal range of values.

Key Points:

- The median number of extreme heat days per year is zero

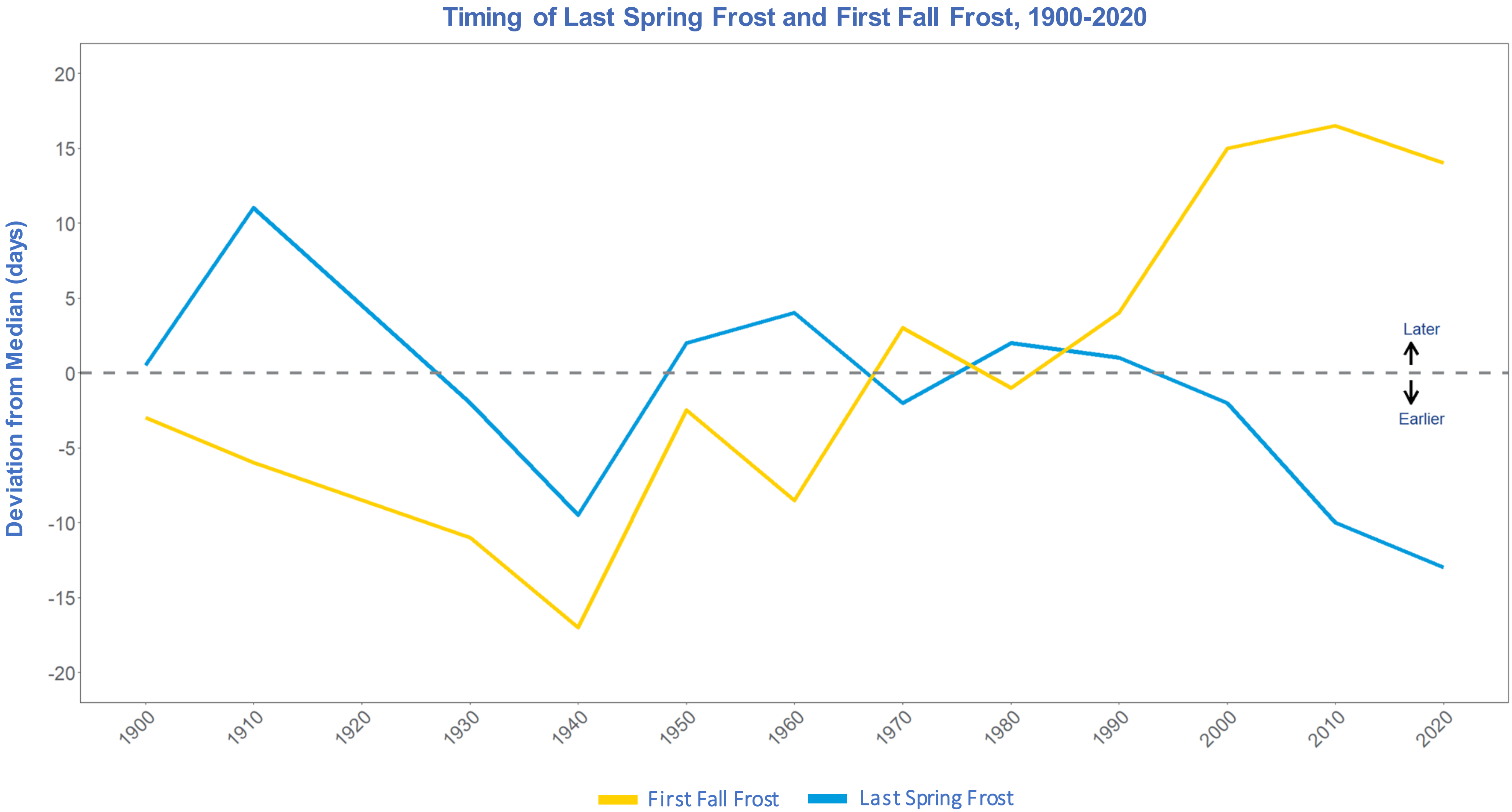

Figure A1.10 Description: Annual first and last frost data are from the Franklinville Station (Source: NOAA National Centers for Environmental Information) for years 1900-2020. The grey dotted line indicates no annual deviation from the long-term median. Data above the dotted line represent frost dates that are later in the year (relative to the median), while data below the dotted line represent frost dates that are earlier in the year (relative to the median). The blue line represents the last spring frost, and the yellow line represents the first fall frost.

Key Points:

- The growing season (days between last spring and first fall frost) has increased substantially. The long-term median of growing season length (from 1900-2020) was 117 days.
- The last spring frost is 13 days earlier now than it was in 1900. The first fall frost is 17 days later than in 1900
- These changes in the growing season may have broad-reaching implications for agricultural practices and natural ecological processes

Updated July 2022

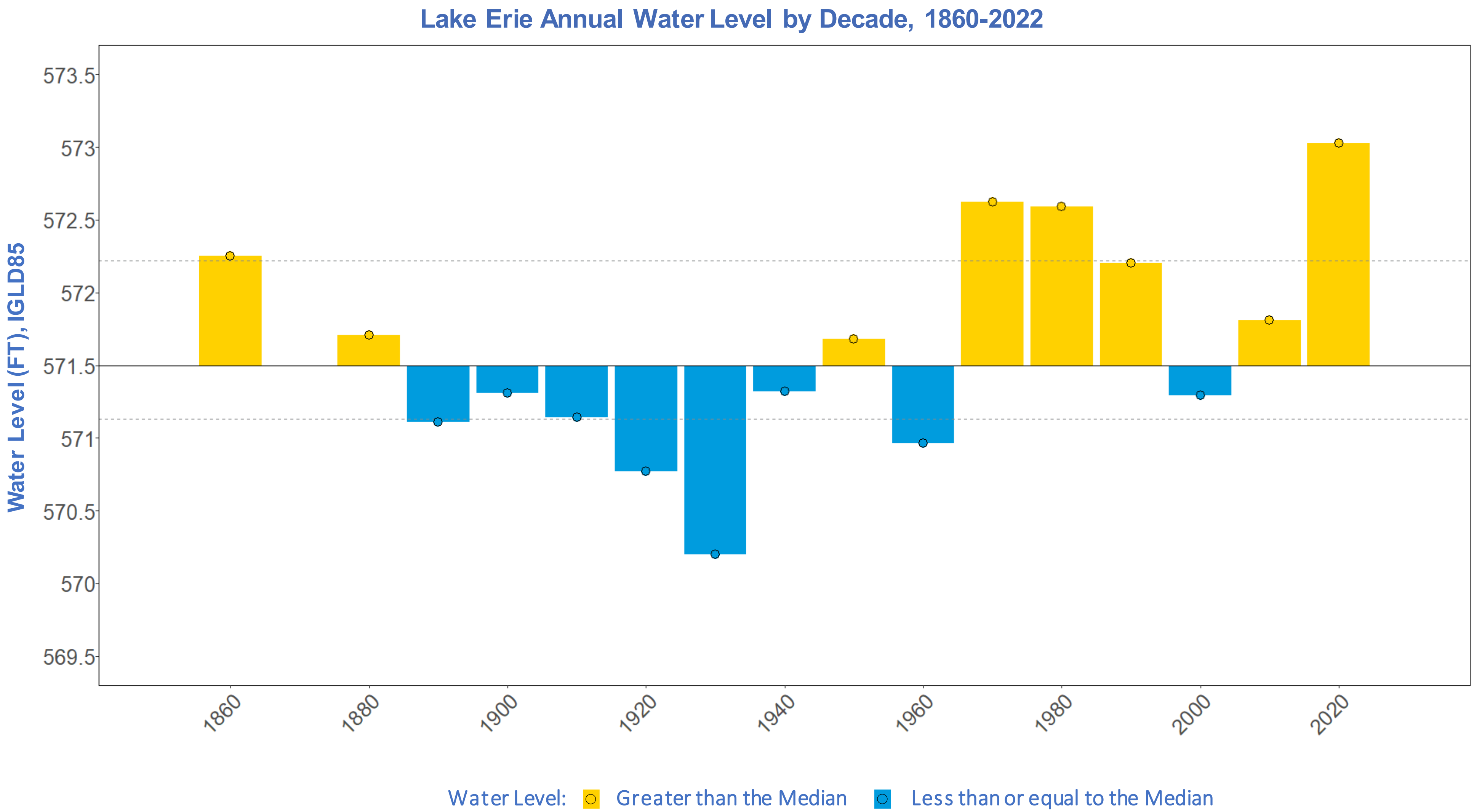

Figure A1.11 Description: Lake Erie water level data are from the Buffalo Station, 9063020 (Source: NOAA National Centers for Environmental Information) for years 1860-2022. Decades with missing values from the graph indicate gaps within the dataset, e.g., 1870. Each bar represents the median by decade of median annual water levels. This graph uses the 1860-2022 median as a baseline (solid gray line) for depicting change; the dotted gray lines indicate the 25th and 75th percentiles, i.e., the normal range of values.

Key Points:

- Lake Erie water levels follow a 20-40 year pattern like the local precipitation and temperature data, however recent water level medians are above any in the data set

Updated July 2022

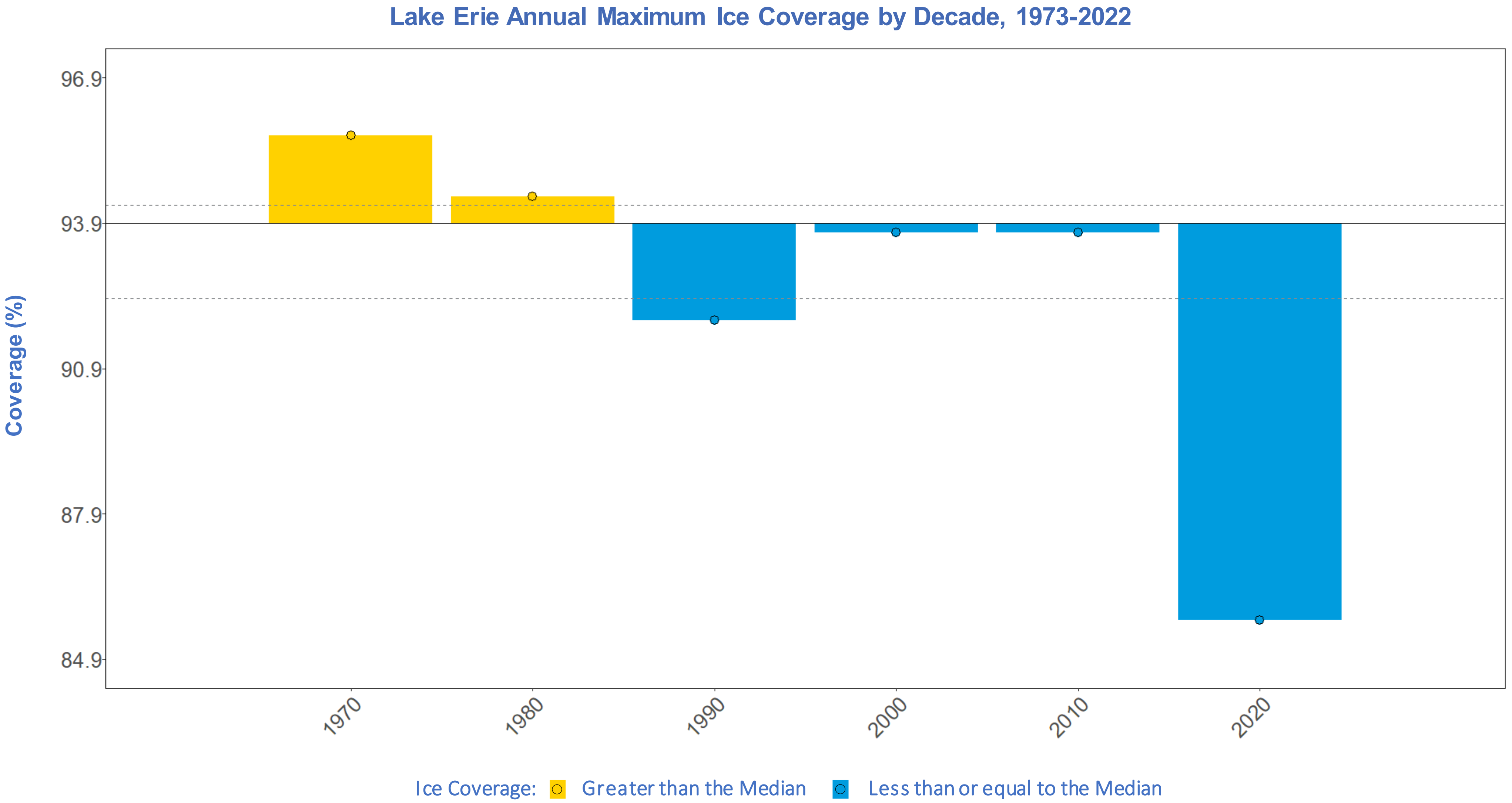

Figure A1.12 Description: Lake Erie maximum ice coverage data are from NOAA's Great Lakes Environmental Research Laboratory (GLERL) (Source: Ice Cover: NOAA Great Lakes Environmental Research Laboratory - Ann Arbor, MI, USA) for years 1973-2022. Each bar represents the median by decade of annual maximum ice. This graph uses the 1973-2020 median as a baseline (solid gray line) for depicting change; the dotted gray lines indicate the 25th and 75th percentiles, i.e., the normal range of values.

Key Points:

- Ice coverage in Lake Erie has decreased from approximately 95% in 1973 to 86% in 2021
- As a result of a warming climate, Lake Erie ice coverage has steadily declined. In the last 50 years, Lake Erie maximum ice coverage below 50% occurred 8 times, with 6 happening in the last 25 years
- Reduced ice coverage, and later onset of ice development, will likely increase shoreline exposure to and potential for erosion from severe winter storm events

Updated July 2022

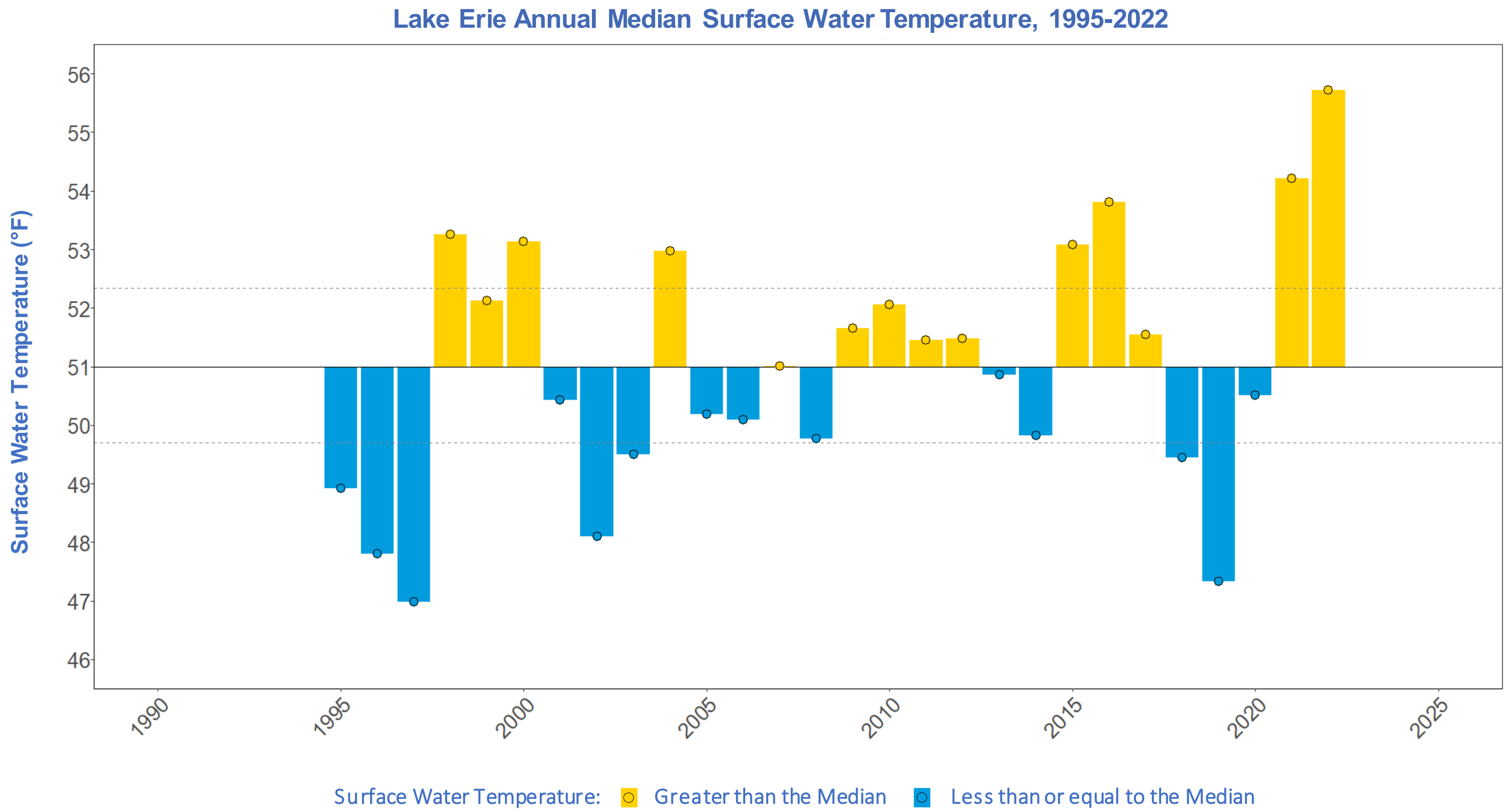

Figure A.13 Description: Lake Erie annual median surface water temperature data are from the Great Lakes Surface Environmental Analysis (GLSEA) (Source: NOAA National Centers for Environmental Information) for years 1995-2022. This graph uses the 1995-2022 median as a baseline (solid gray line) for depicting change; the dotted gray lines indicate the 25th and 75th percentiles, i.e., the normal range of values.

Key Points:

- Lake Erie had the highest median surface water temperatures in 2021 and 2022 of 54 °F and 56 °F, respectively, greater than the long-term median surface water temperature of 51 °F

Updated July 2022

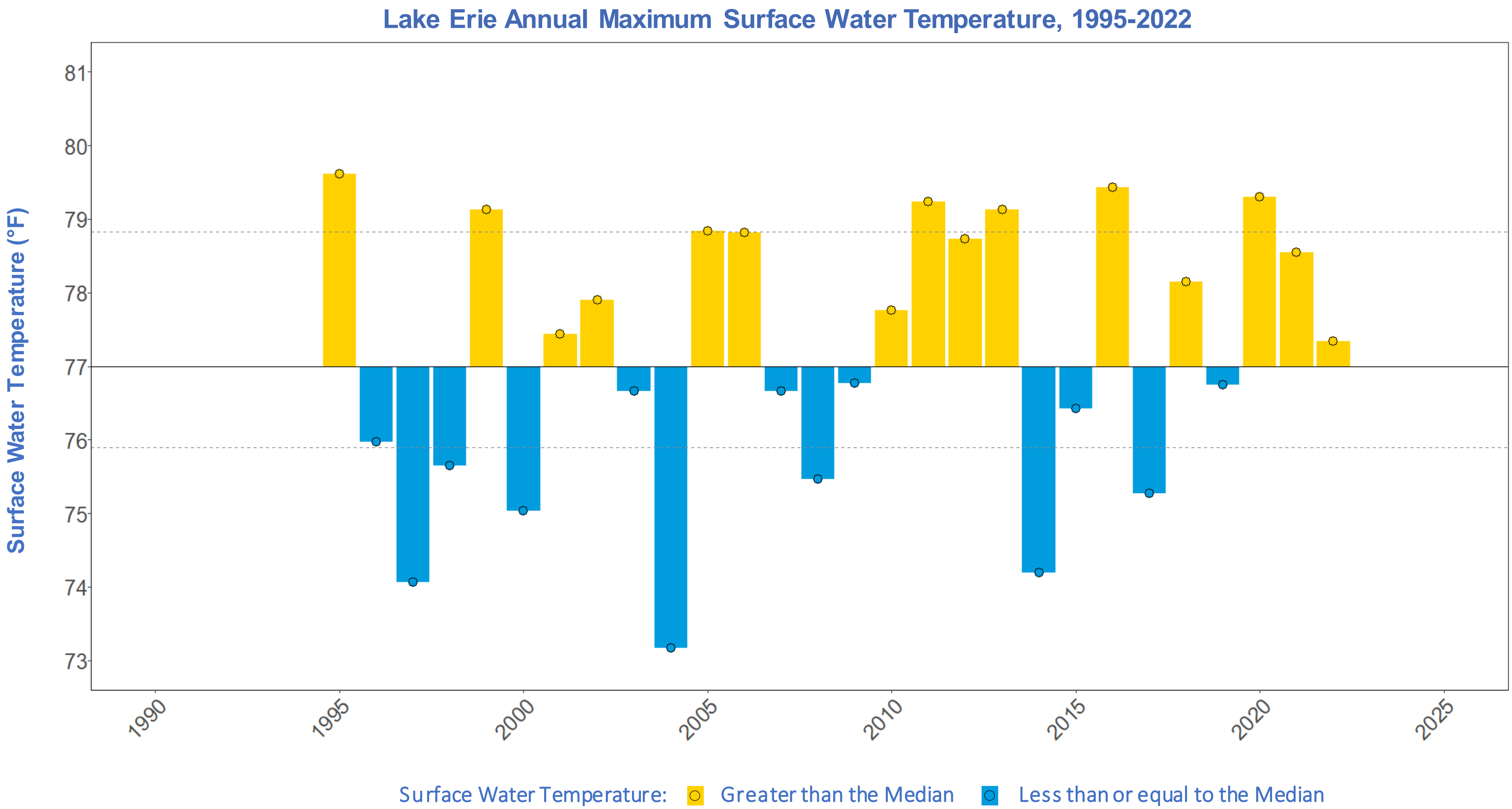

Figure A1.14 Description: Lake Erie maximum surface water temperature data are from the Great Lakes Surface Environmental Analysis (GLSEA) (Source: NOAA National Centers for Environmental Information) for years 1995-2022. This graph uses the 1995-2022 median as a baseline (solid gray line) for depicting change; the dotted gray lines indicate the 25th and 75th percentiles, i.e., the normal range of values.

Key Points:

- There's no apparent trend in Lake Erie maximum surface water temperatures since 1995
- The median value of 77 °F is an important ecological threshold as cyanobacteria (harmful algal blooms) tend to have a competitive advantage over other phytoplankton at and above this temperature (Paerl and Huisman 2008*)

*Hans W. Paerl, Jef Huisman ,Blooms Like It Hot.Science320,57-58(2008).DOI:10.1126/science.1155398

Updated July 2022

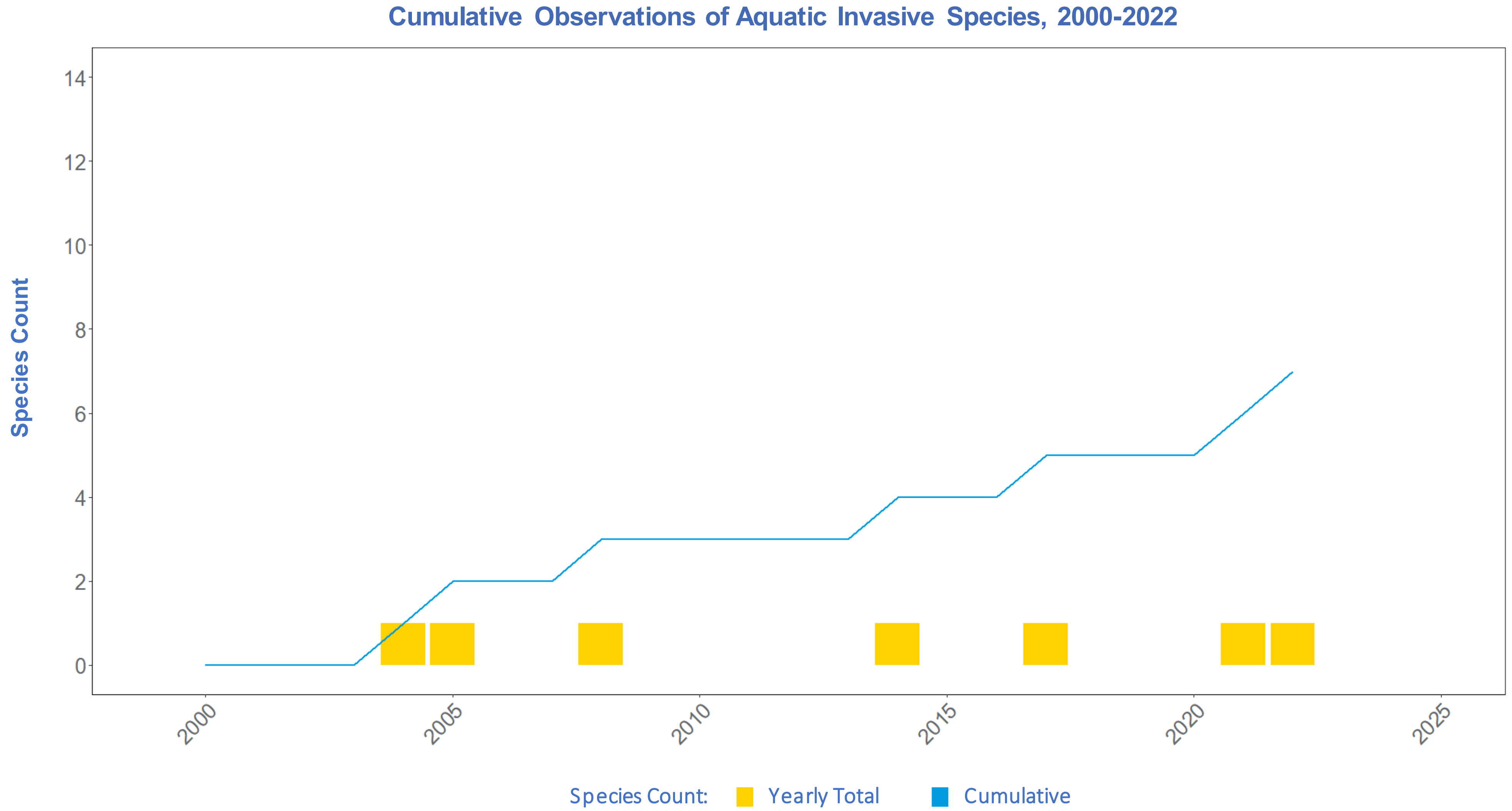

Figure A1.15 Description: Aquatic invasive species observation data are from New York's iMapInvasives (Source USGS-NAS and NY Natural Heritage Program) for years 2000-2022. Years with missing yearly total bars (yellow) indicate no new invasive species were observed. The blue line indicates the cumulative number of aquatic invasive species during the 2000-2022 time period.

Key Points:

- As of 2022, there were 12 confirmed aquatic invasive species within the watershed
- Brittle Naiad and Water Chestnut were first observed in 2021 and 2022, respectively

Updated July 2022

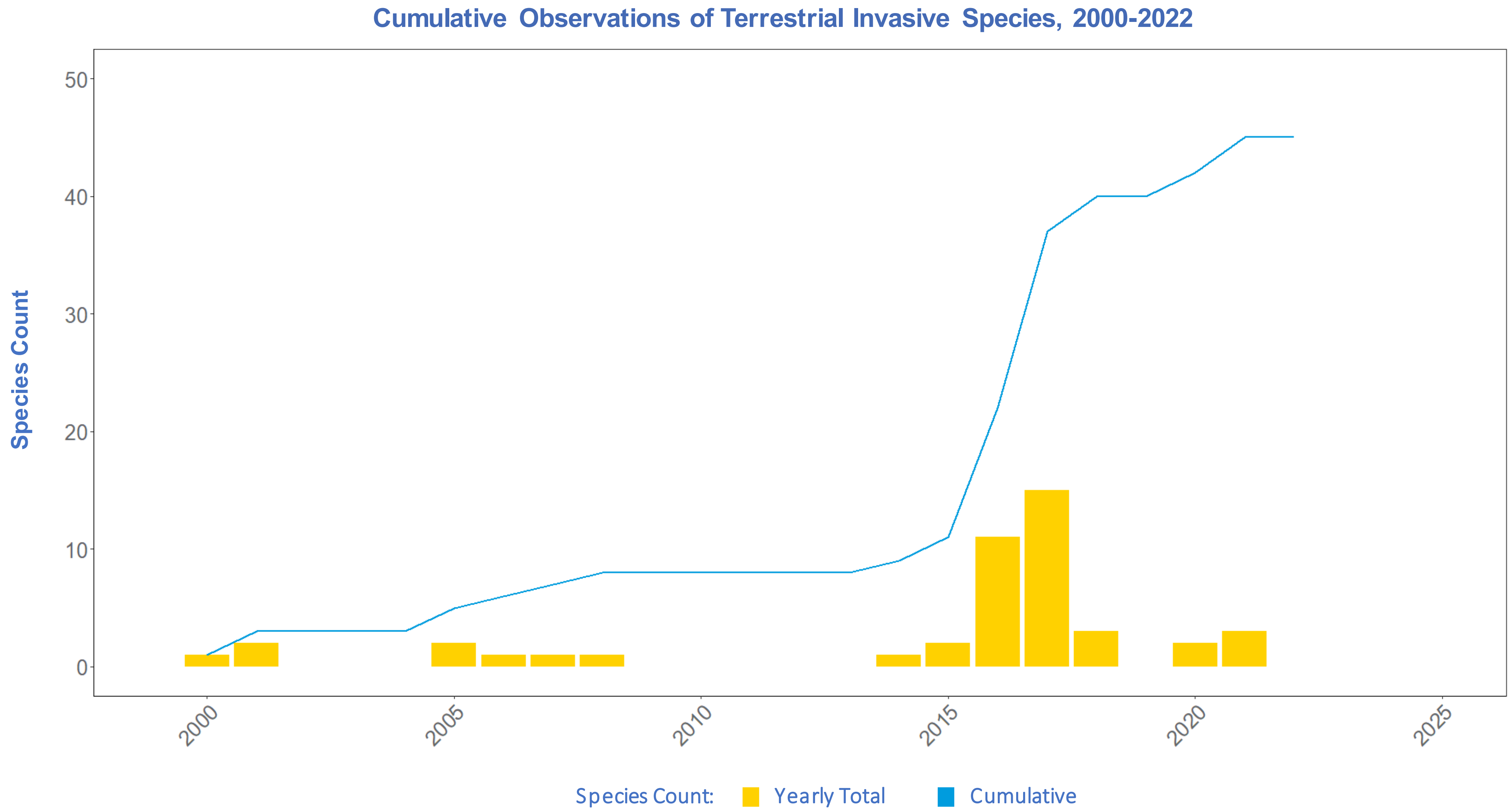

Figure A1.16 Description: Confirmed terrestrial invasive species observation data are from New York's iMapInvasives (Source: USGS-NAS and NY Natural Heritage Program) for years 2000-2022. Years with missing yearly total bars (yellow) indicate no new invasive species were observed. The blue line indicates the cumulative number of terrestrial invasive species during the 2000-2022 time period.

Key Points:

- As of 2022, there were 46 confirmed terrestrial invasive species within the watershed
- Hemlock Woolly Adelgid, Emerald Ash Borer and Beech Leaf Disease were first observed in 2014, 2017 and 2021, respectively

Updated July 2022

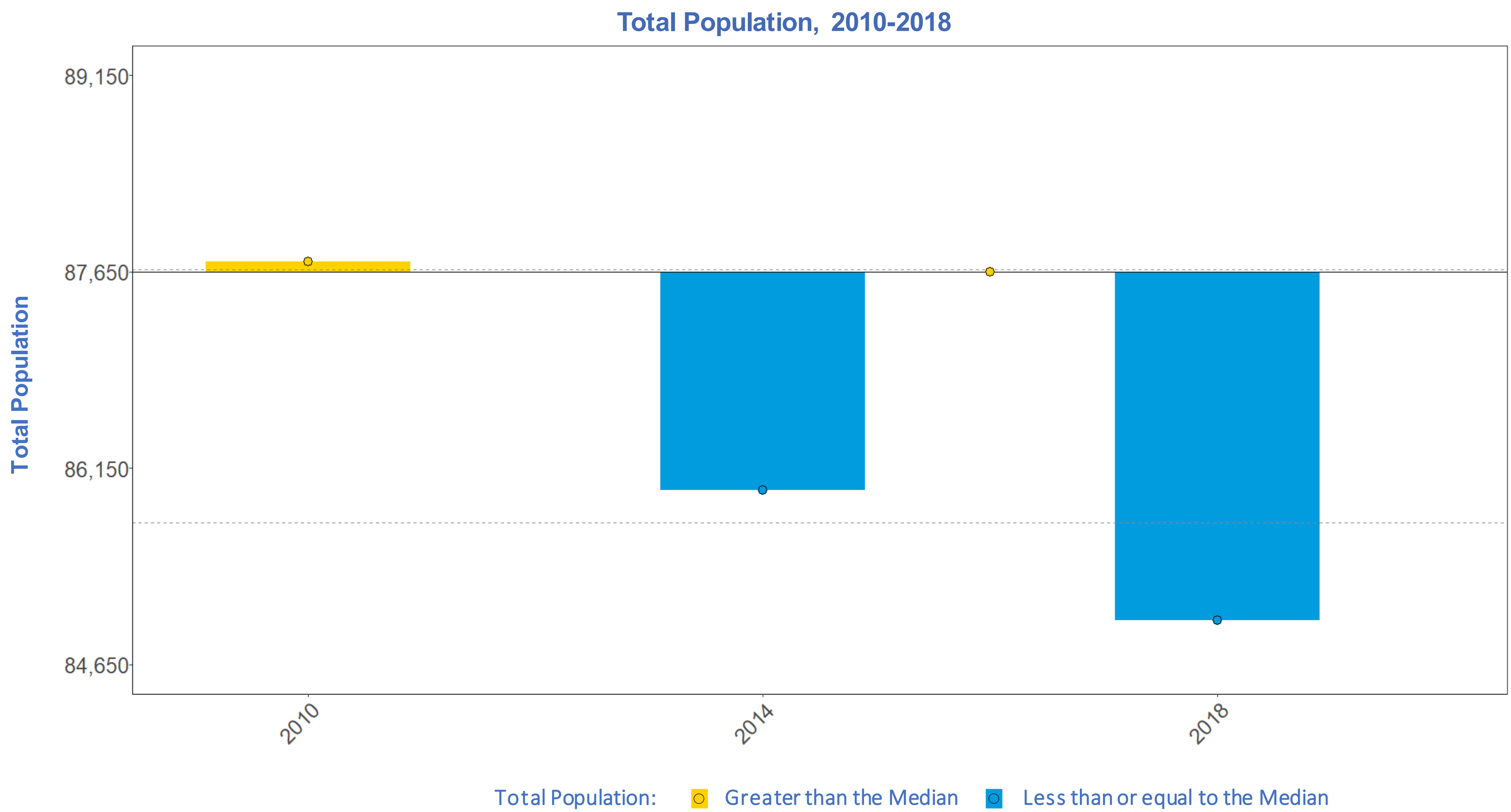

Figure A1.17 Description: Total watershed population are based on census tracts within the watershed and are from the Geospatial Research, Analysis, and Services Program (GRASP) (Source: Agency for Toxic Substances and Disease Registry (ATSDR), Centers for Disease Control and Prevention (CDC)) for years 2010-2018. Years with missing values from the graph indicate gaps within the dataset, e.g., 2012. This graph uses the 2010-2018 median as a baseline (solid gray line) for depicting change; the dotted gray lines indicate the 25th and 75th percentiles, i.e., the normal range of values.

Key Points:

- The total population in the watershed decreased from 87,729 in 2010 to 84,989 in 2018

Updated July 2022

Social Vulnerability Index, 2010-2018

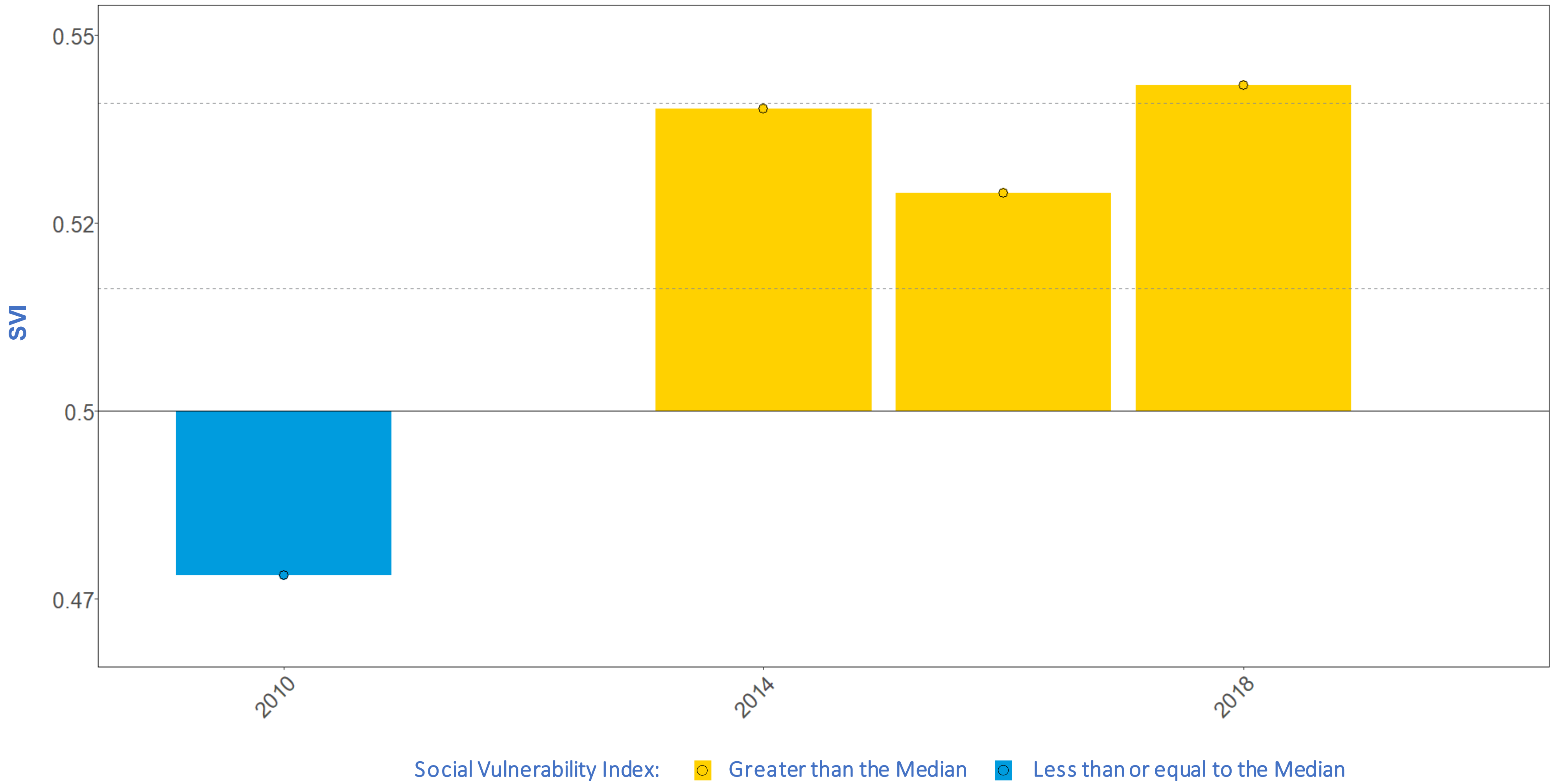

Figure A1.18 Description: Social Vulnerability Index (SVI) data are based on census tracts within the watershed and are from the Geospatial Research, Analysis, and Services Program (GRASP) (Source: Agency for Toxic Substances and Disease Registry (ATSDR), Centers for Disease Control and Prevention (CDC)) for years 2010-2018. Years with missing values from the graph indicate gaps within the dataset, e.g., 2012. This graph uses the 2010-2018 median as a baseline (solid gray line) for depicting change; the dotted gray lines indicate the 25th and 75th percentiles, i.e., the normal range of values.

Key Points:

- Social Vulnerability Index has been higher than 0.5 (considered vulnerable) in 2014, 2016, and 2018

Updated July 2022

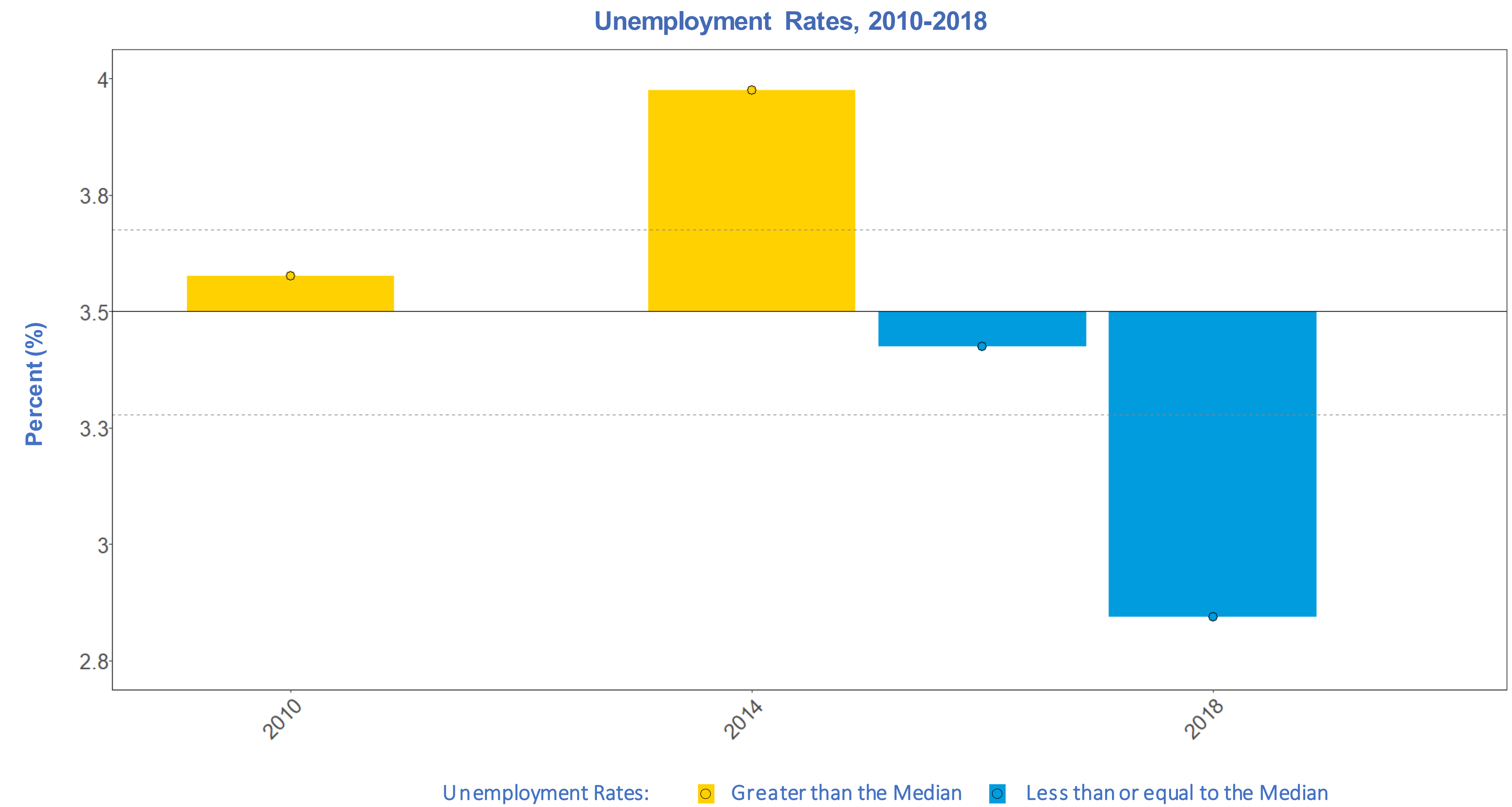

Figure A1.19 Description: Unemployment rate data are based on census tracts within the watershed and are from the Geospatial Research, Analysis, and Services Program (GRASP) (Source: Agency for Toxic Substances and Disease Registry (ATSDR), Centers for Disease Control and Prevention (CDC)) for years 2010-2018. The data was collected based on census tracts. Years with missing values from the graph indicate gaps within the dataset, e.g., 2012. This graph uses the 2010-2018 median as a baseline (solid gray line) for depicting change; the dotted gray lines indicate the 25th and 75th percentiles, i.e., the normal range of values.

Key Points:

- The unemployment rate decreased from 3.6 in 2010 to 2.9 in 2018

Updated July 2022

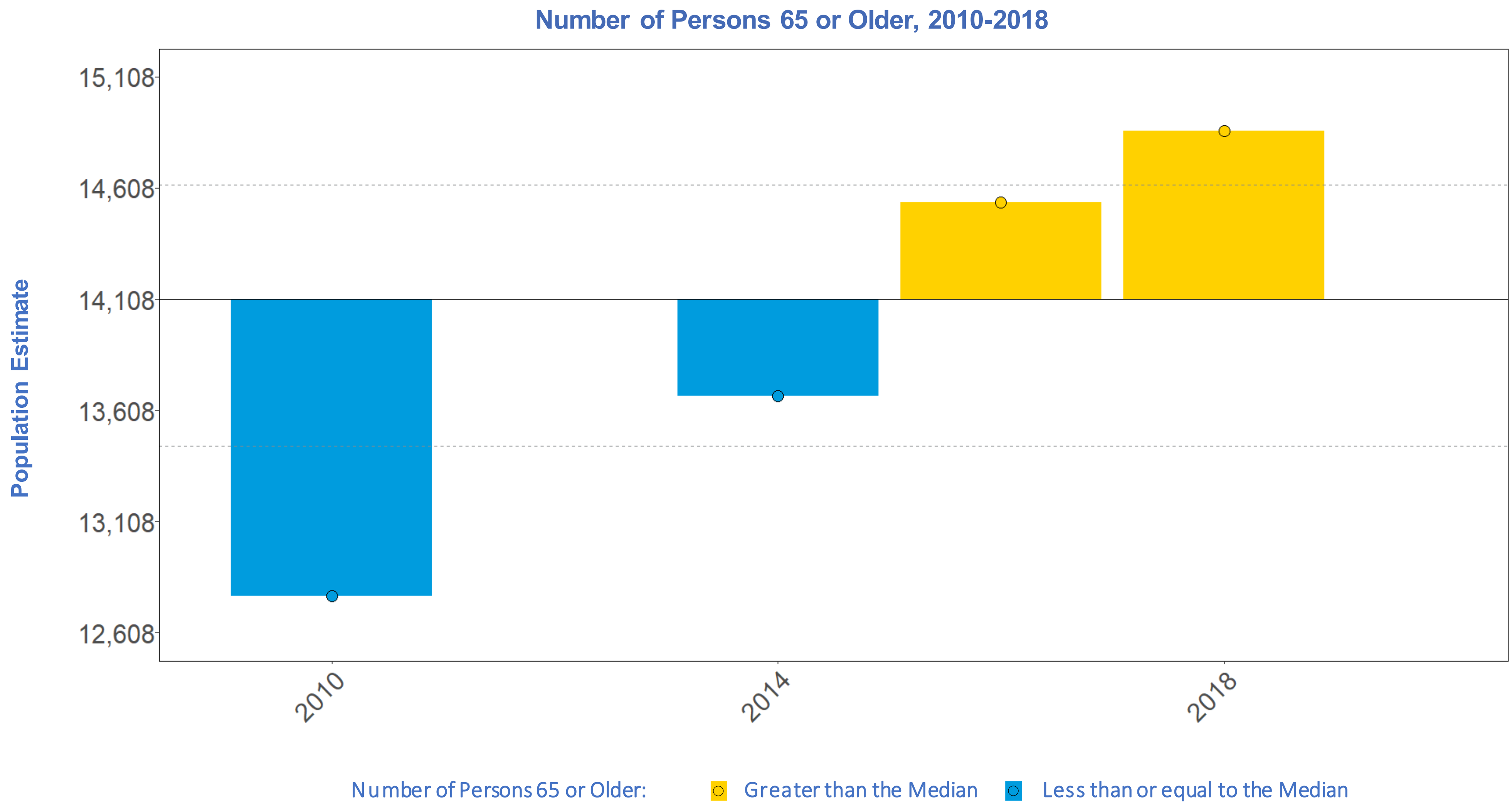

Figure A1.20 Description: Data are based on census tracts within the watershed and are from the Geospatial Research, Analysis, and Services Program (GRASP) (Source: Agency for Toxic Substances and Disease Registry (ATSDR), Centers for Disease Control and Prevention (CDC)) for years 2010-2018. Years with missing values from the graph indicate gaps within the dataset, e.g., 2012. This graph uses the 2010-2018 median as a baseline (solid gray line) for depicting change; the dotted gray lines indicate the 25th and 75th percentiles, i.e., the normal range of values.

Key Points:
- The number of persons aged 65 or older in the watershed has increased from 12,776 in 2010 to 14,864 in 2018

Updated July 2022

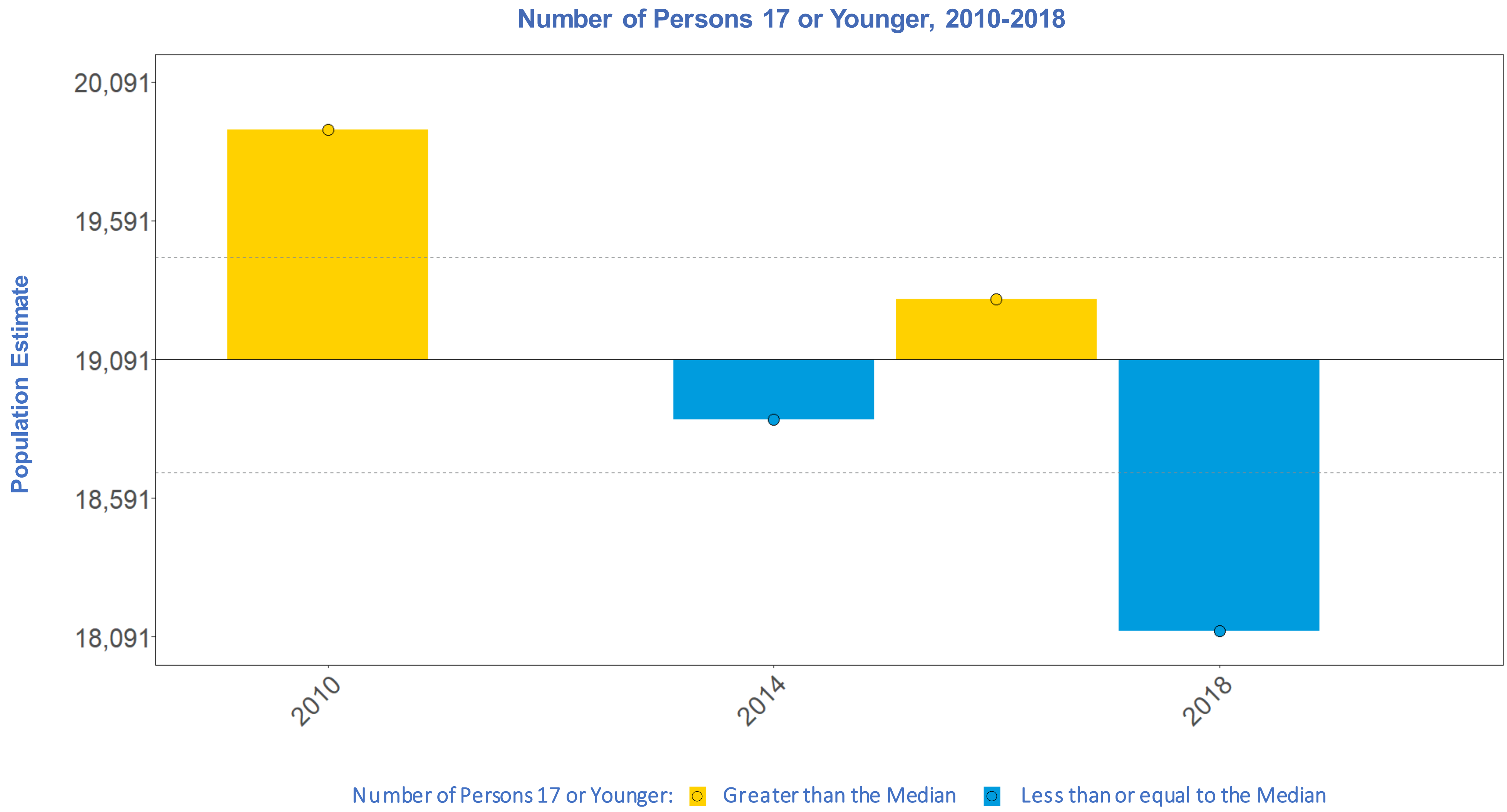

Figure A1.21 Description: Data are based on census tracts within the watershed and are from the Geospatial Research, Analysis, and Services Program (GRASP) (Source: Agency for Toxic Substances and Disease Registry (ATSDR), Centers for Disease Control and Prevention (CDC)) for years 2010-2018. Years with missing values from the graph indicate gaps within the dataset, e.g., 2012. This graph uses the 2010-2018 median as a baseline (solid gray line) for depicting change; the dotted gray lines indicate the 25th and 75th percentiles, i.e., the normal range of values.

Key Points:
- The population of people aged 17 and younger in the watershed has decreased between 2010 and 2018

Updated July 2022

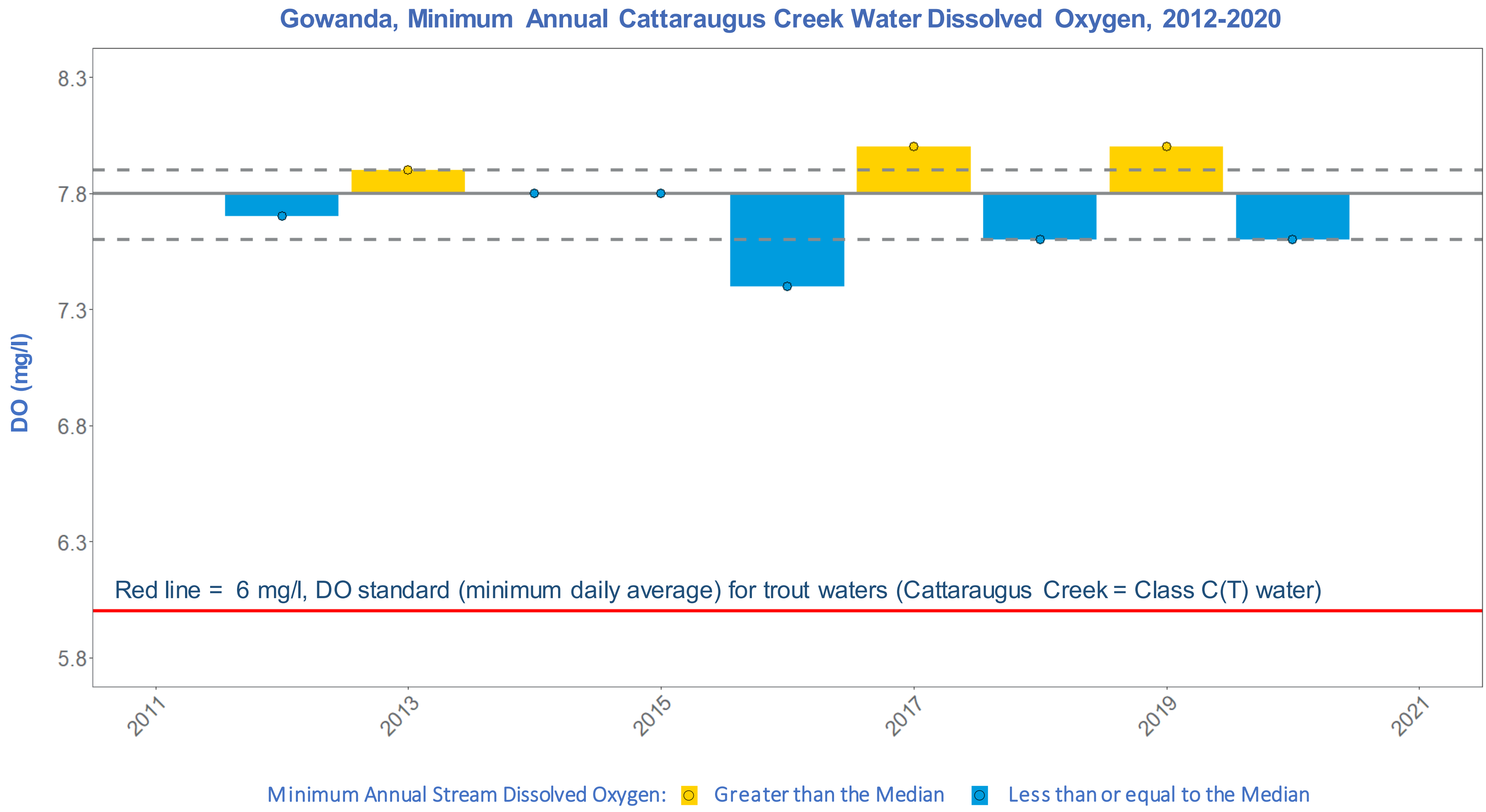

Figure A1.22 Description: Minimum annual surface water dissolved oxygen (DO) data are from the Gowanda Station, monitoring location #04213500 (Source: United States Geological Survey (USGS)) in Cattaraugus Creek for years 2012-2020. This graph uses the 2012-2020 median as a baseline (solid gray line) for depicting change; the dotted gray lines indicate the 25th and 75th percentiles, i.e., the normal range of values. The red line indicates the minimum DO standard (6 mg/l) for New York State waters designated as supporting trout.

Key Points:

- There appears to be no clear or significant trend in minimum annual surface dissolved oxygen from 2012 to 2020
- Dissolved oxygen levels are much higher than the minimum average dissolved oxygen standard for trout-supporting waters

Updated July 2022

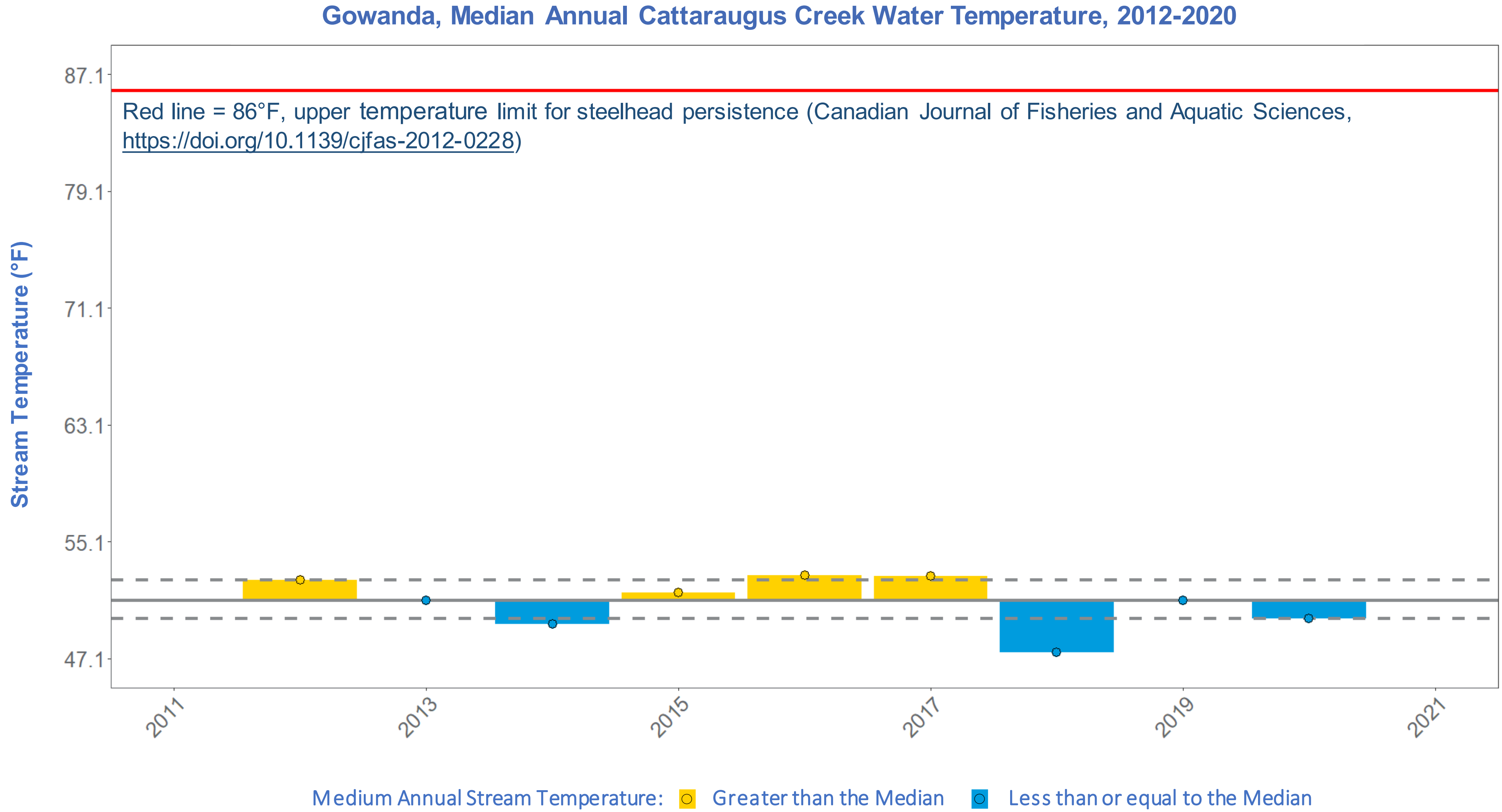

Figure A1.23 Description: Median annual stream temperature data are from the Gowanda Station, monitoring location #04213500 (Source: United States Geological Survey (USGS)) for years 2012-2020. This graph uses the 2012-2020 median as a baseline (solid gray line) for depicting change; the dotted gray lines indicate the 25th and 75th percentiles, i.e., the normal range of values. The red line indicates the upper temperature limit for steelhead persistence (86°F), based on the Canadian Journal of Fisheries and Aquatic Sciences, https://doi.org/10.1139/cjfas-2012-0228.

Key Points:

- The median annual stream temperature stays well below the upper temperature limit for steelhead persistence and is very stable over time

Updated July 2022

Gowanda, Maximum Annual Cattaraugus Creek Water Temperature, 2012-2020

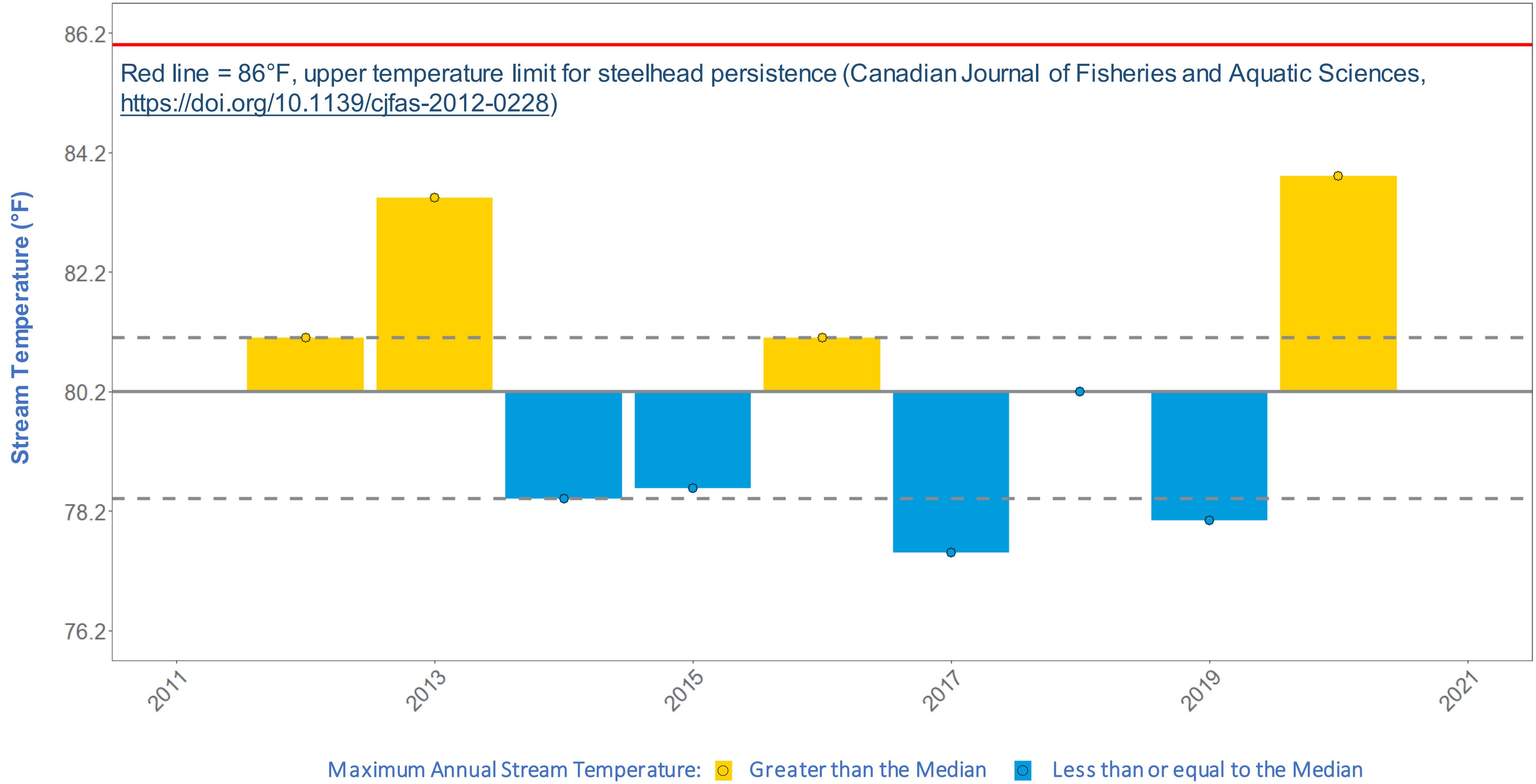

Figure A1.24 Description: Maximum annual stream temperature data are from the Gowanda Station, monitoring location #04213500 (Source: United States Geological Survey (USGS)) for years 2012-2020. This graph uses the 2012-2020 median as a baseline (solid gray line) for depicting change; the dotted gray lines indicate the 25th and 75th percentiles, i.e., the normal range of values. The red line indicates the upper temperature limit for steelhead persistence (86°F), based on the Canadian Journal of Fisheries and Aquatic Sciences, https://doi.org/10.1139/cjfas-2012-0228.

Key Points:

- There is no clear trend in maximum annual stream temperature from 2012 to 2020
- The maximum annual stream temperature has stayed below the upper temperature limit for steelhead activity and persistence

Updated July 2022

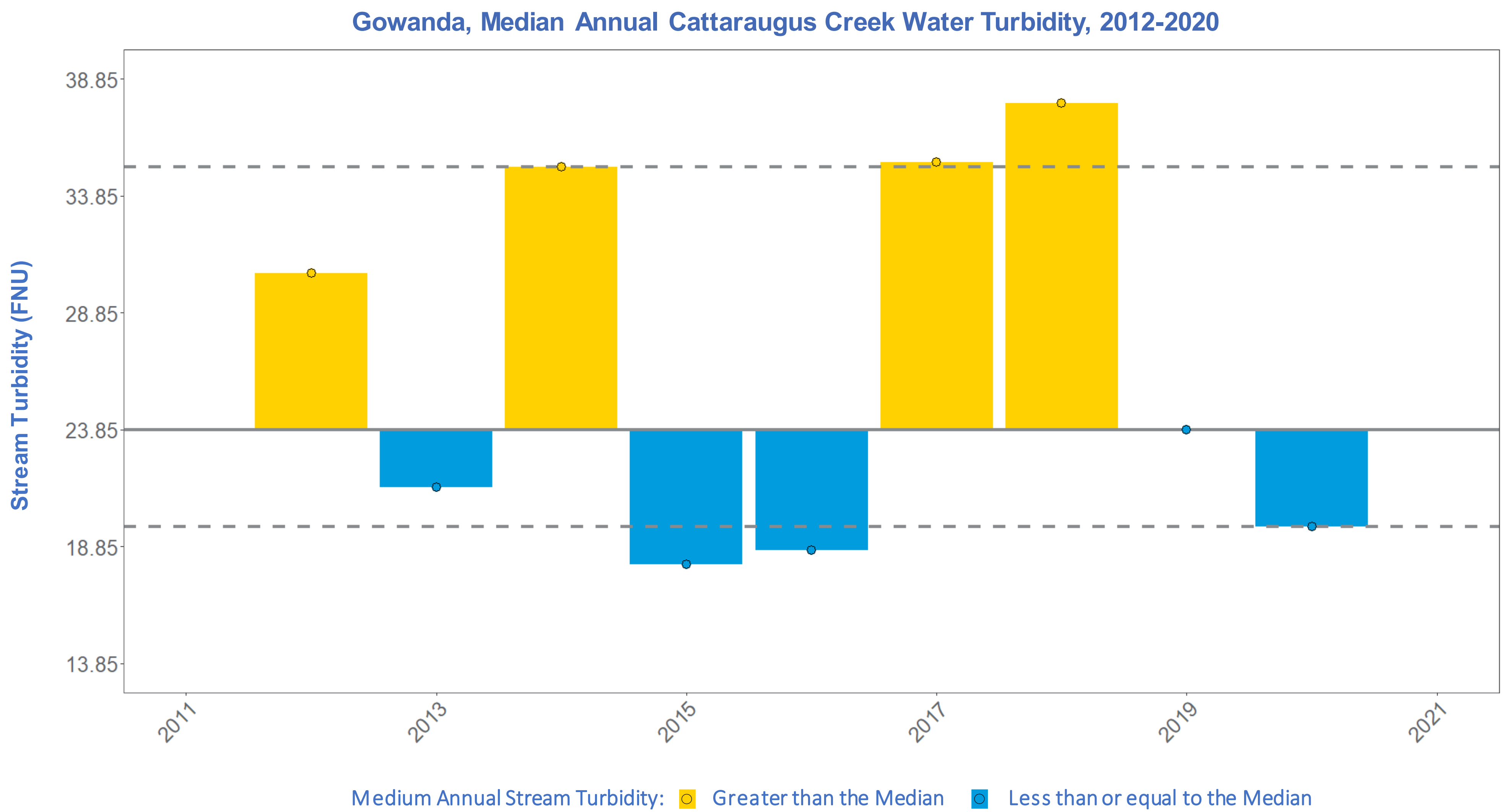

Figure A1.25 Description: Median annual stream turbidity data are from the Gowanda Station, monitoring location #04213500 (Source: United States Geological Survey (USGS), raw data format: daily means) for years 2012-2020. This graph uses the 2012-2020 median as a baseline (solid gray line) for depicting change; the dotted gray lines indicate the 25th and 75th percentiles, i.e., the normal range of values.

Key Points:

- Cattaraugus Creek is known to have high turbidity due to its headwaters flowing through erodible glacial deposits of silts and clays
- Variation in turbidity levels tend to follow annual precipitation amounts

Updated July 2022

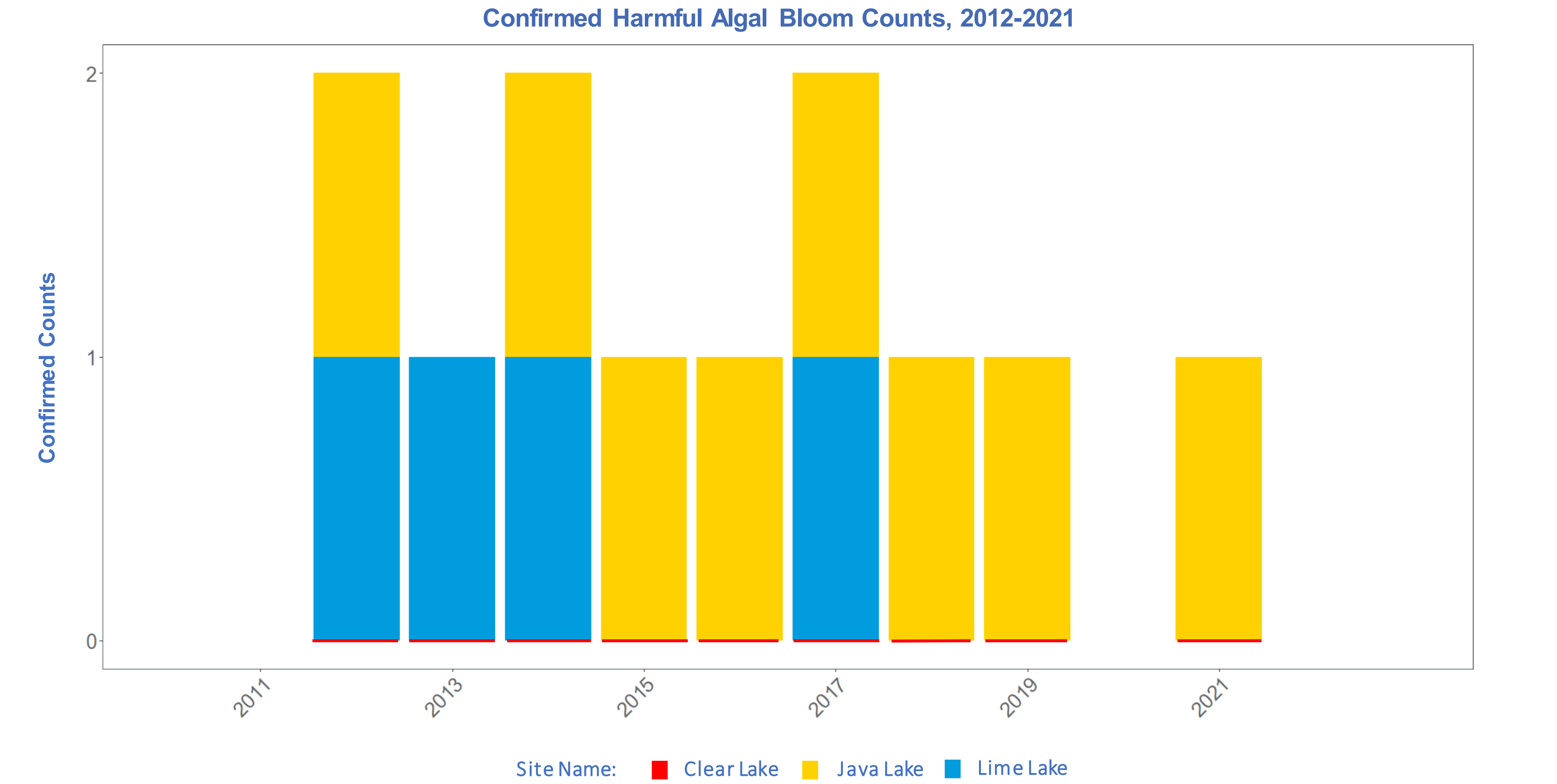

Figure A1.26 Description: Confirmed harmful algal bloom data are from the NYSDEC Harmful Algal Blooms (HABs) Notifications and Archive Pages (Source: Harmful Algal Blooms (HABs) - NYS Dept. of Environmental Conservation) for years 2012-2021. This graph displays the count of confirmed HABs for three lakes tracked by NYSDEC in the watershed: Clear Lake, Java Lake, and Lime Lake.

Key Points:

- Clear Lake has had 0 confirmed harmful algal bloom reports from 2012 to 2021
- Java Lake is subject to recurrent harmful algal blooms (confirmed harmful algal blooms in 2012, 2014, 2015, 2016, 2017, 2018, 2019, and 2021)

Updated July 2022

Figure A1.27A Description: Withdrawal rate data (groundwater and surface water) are from facilities that report annually to NYSDEC (Source: NYSDEC Water Withdrawal Annual Reports, DECinfo Locator (ny.gov)) for years 2009-2020. Years with missing values from the graph indicate gaps within the dataset, e.g., 2012-2015 for State Farm. This graph displays average withdrawals for facilities. The blue numbers located above each point are the number of wells used that year, while the red lines indicate the permitted water withdrawal limit.

Key Points:

- All listed facilities in this figure have not exceeded their permitted water withdrawal limit (Concord Crest Golf Course, Emmco Golfing Rose Brook, State Farm, and Edelweiss).

Updated July 2022

Water Withdrawal Rates, 2009-2021

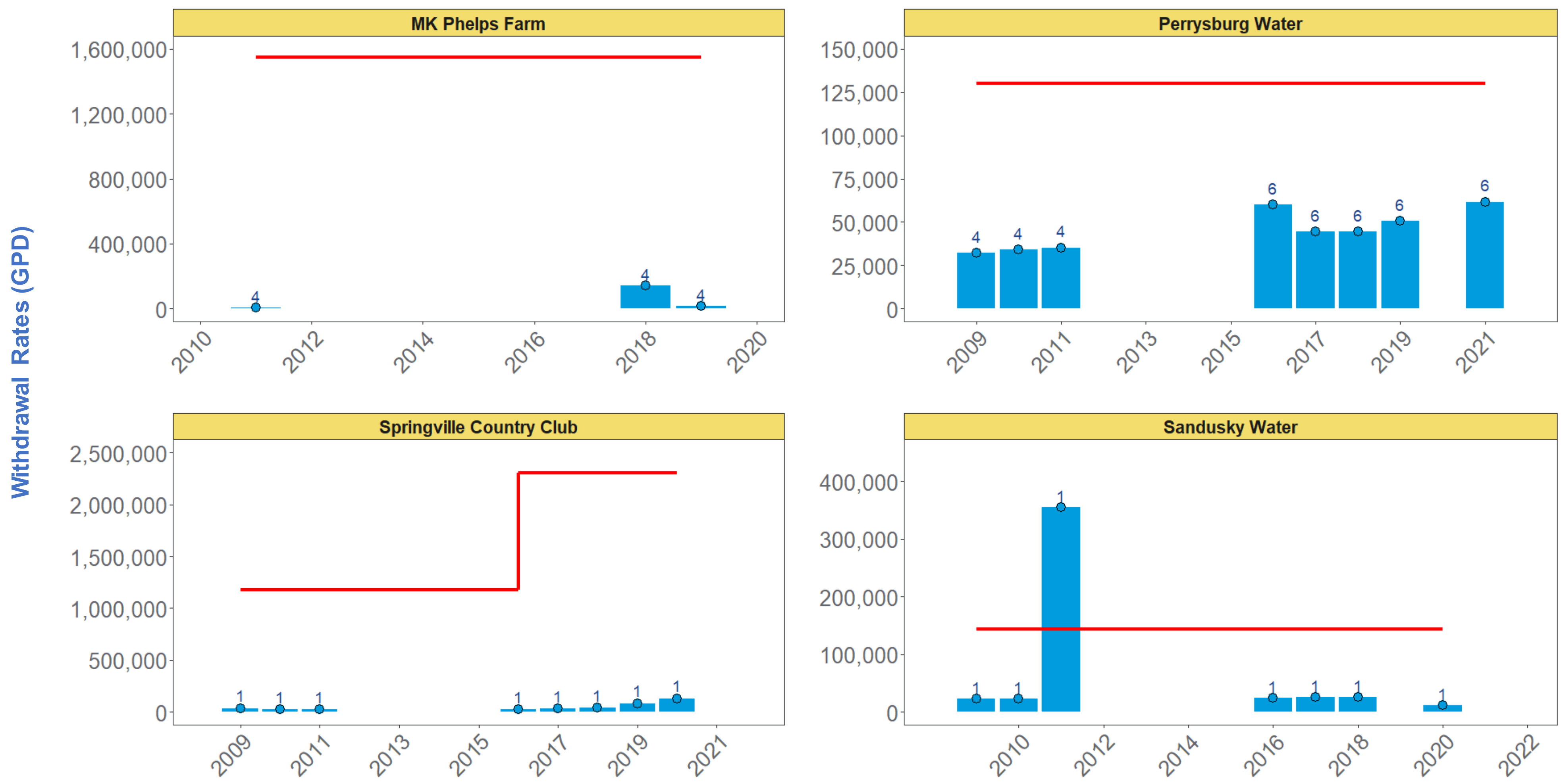

Figure A1.27B Description: Withdrawal rate data (groundwater and surface water) rate data are from facilities that report annually to NYSDEC (Source: NYSDEC Water Withdrawal Annual Reports, DECinfo Locator (ny.gov)) for years 2009-2021. Years with missing values from the graph indicate gaps within the dataset, e.g., 2012-2015 for Sandusky Water. This graph displays average withdrawals for facilities. The blue numbers located above each point are the number of wells used that year. The red lines indicate the permitted water withdrawal limit.

Key Points:

- Sandusky Water had one instance in 2011 where their water withdrawal exceeded their permitted water withdrawal limit. In all other years, the facility remained below their permitted water withdrawal limit

Updated July 2022

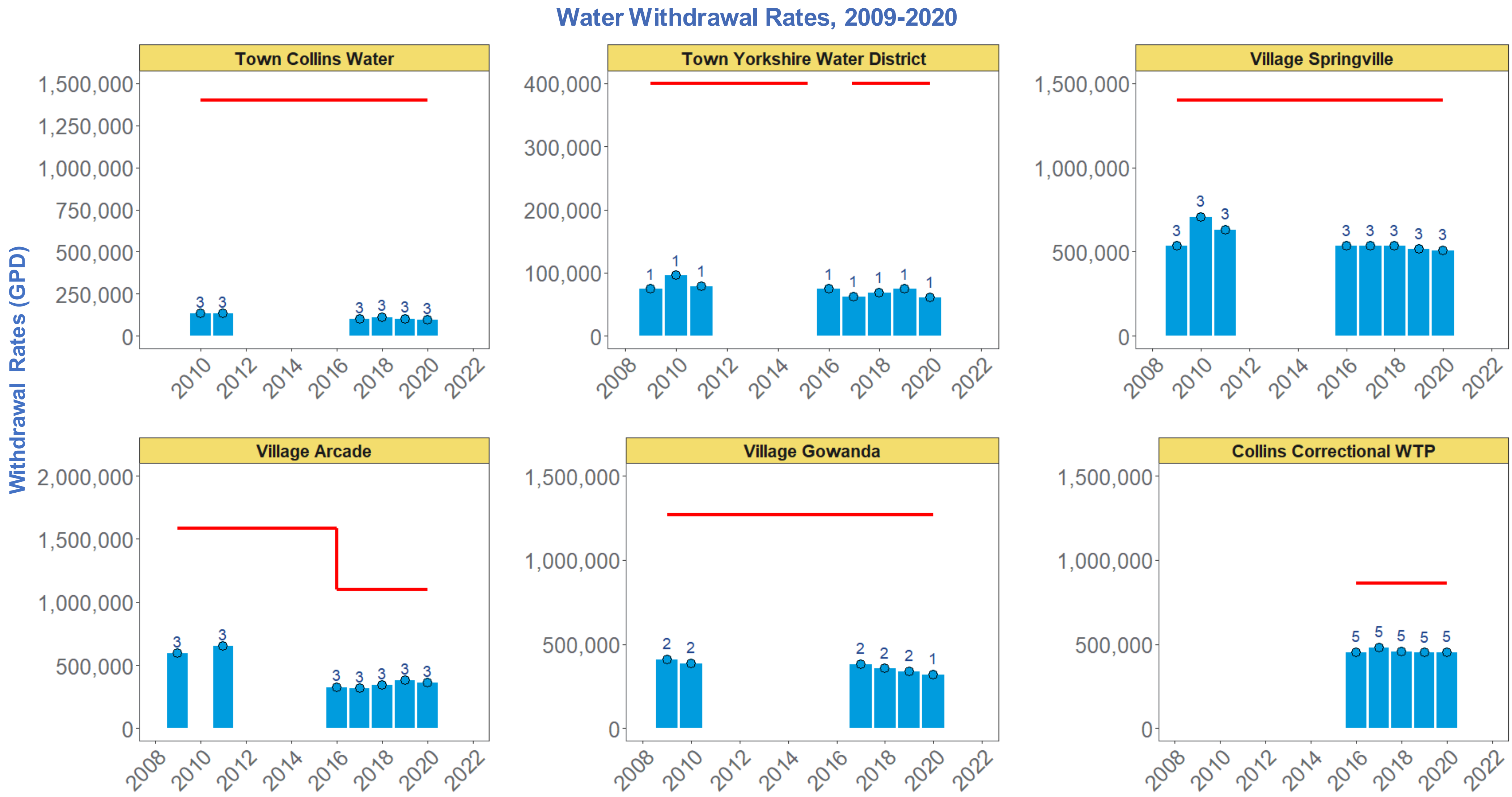

Figure A1.27C Description: Withdrawal rate data (groundwater and surface water) rate data are from facilities that report annually to NYSDEC (Source: NYSDEC Water Withdrawal Annual Reports, DECinfo Locator (ny.gov)) for years 2009-2020. Years with missing values from the graph indicate gaps within the dataset, e.g., 2012-2015 for Village Arcade. This graph displays average withdrawals for facilities. The blue numbers located above each point are the number of wells used that year. The red lines indicate the permitted water withdrawal limit; gaps in the red line indicate years the permitted water withdrawal limit was not listed on the report.

Key Points:

- All listed facilities in this figure have not exceeded their permitted water withdrawal limit (Town of Collins Water, Town of Yorkshire, Village of Springville, Village of Arcade, Village of Gowanda, and Collins Correctional Facility).

Updated July 2022

Water Withdrawal Rates, 2009-2020

Figure A1.27D Description: Withdrawal rate data (groundwater and surface water) rate data are from facilities that report annually to NYSDEC (Source: NYSDEC Water Withdrawal Annual Reports, [DECinfo Locator (ny.gov)]) for years 2009-2020. Years with missing values from the graph indicate gaps within the dataset, e.g., 2012-2015 for Village Arcade. This graph displays average withdrawals for facilities. The blue numbers located above each point are the number of wells used that year, while the red lines indicate the permitted water withdrawal limit.

Key Points:

- All listed facilities in this figure have not exceeded their permitted water withdrawal limit (Gernatt facilities located in Hanover, Vogtli, Springville, Chaffee, Freedom, and Collins).

Updated July 2022

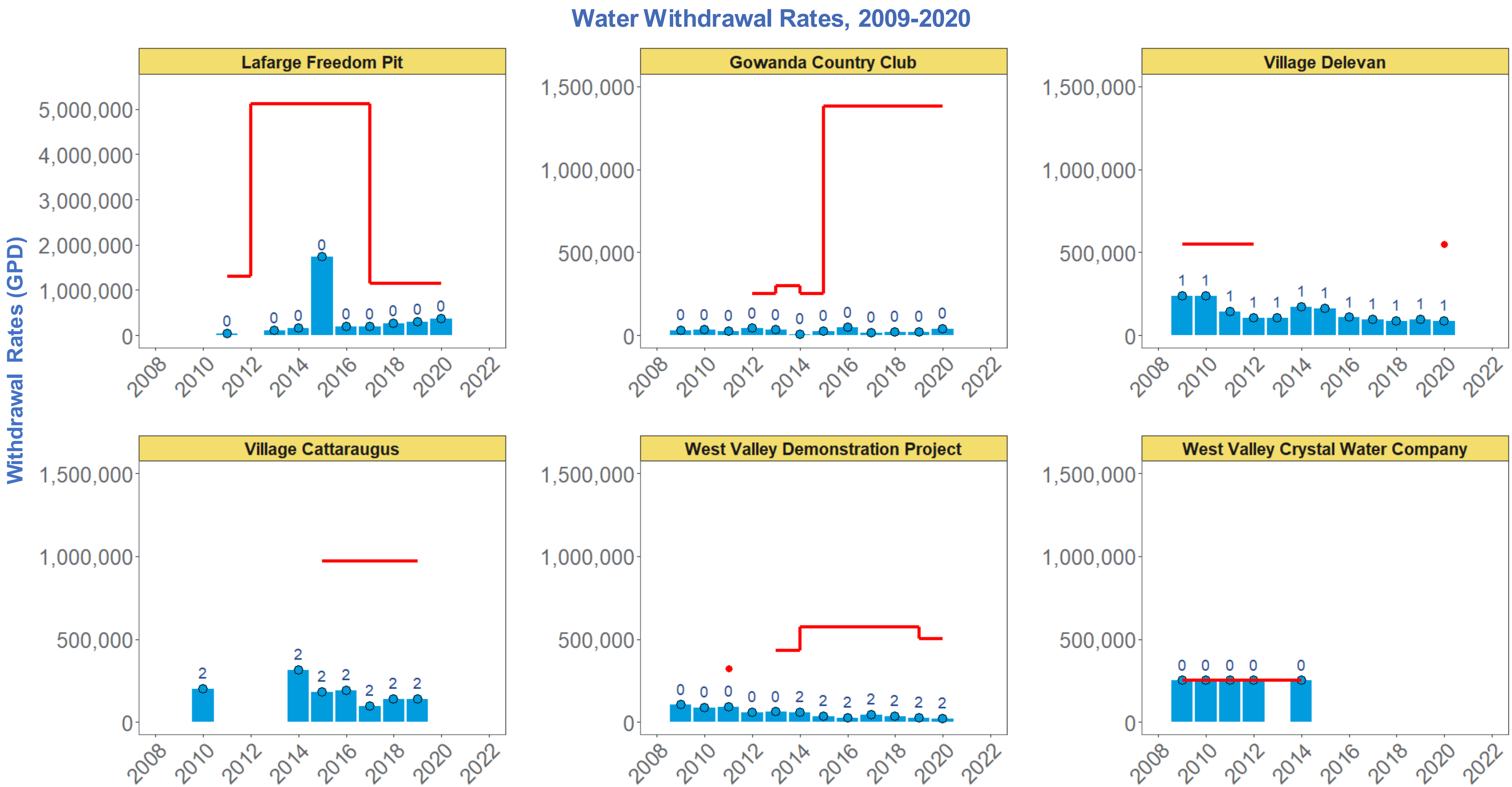

Figure A1.27E Description: Withdrawal rate data (groundwater and surface water) rate data are from facilities that report annually to NYSDEC (Source: NYSDEC Water Withdrawal Annual Reports, DECinfo Locator (ny.gov)) for years 2009-2020. Years with missing values from the graph indicate gaps within the dataset, e.g., 2012-2015 for Village Arcade. This graph displays average withdrawals for facilities. The blue numbers located above each point are the number of wells used that year. The red lines indicate the permitted water withdrawal limit. Gaps in the red line indicate years the permitted water withdrawal limit was not listed on the report, while red dots indicate the permitted water withdrawal limit for that single year.

Key Points:

- All listed facilities in this figure have not exceeded their permitted water withdrawal limit (Lafarge Freedom Pit, Gowanda Country Club, Village of Delevan, Village of Cattaraugus, West Valley Demonstration Project, and West Valley Crystal Water Company).

Updated July 2022

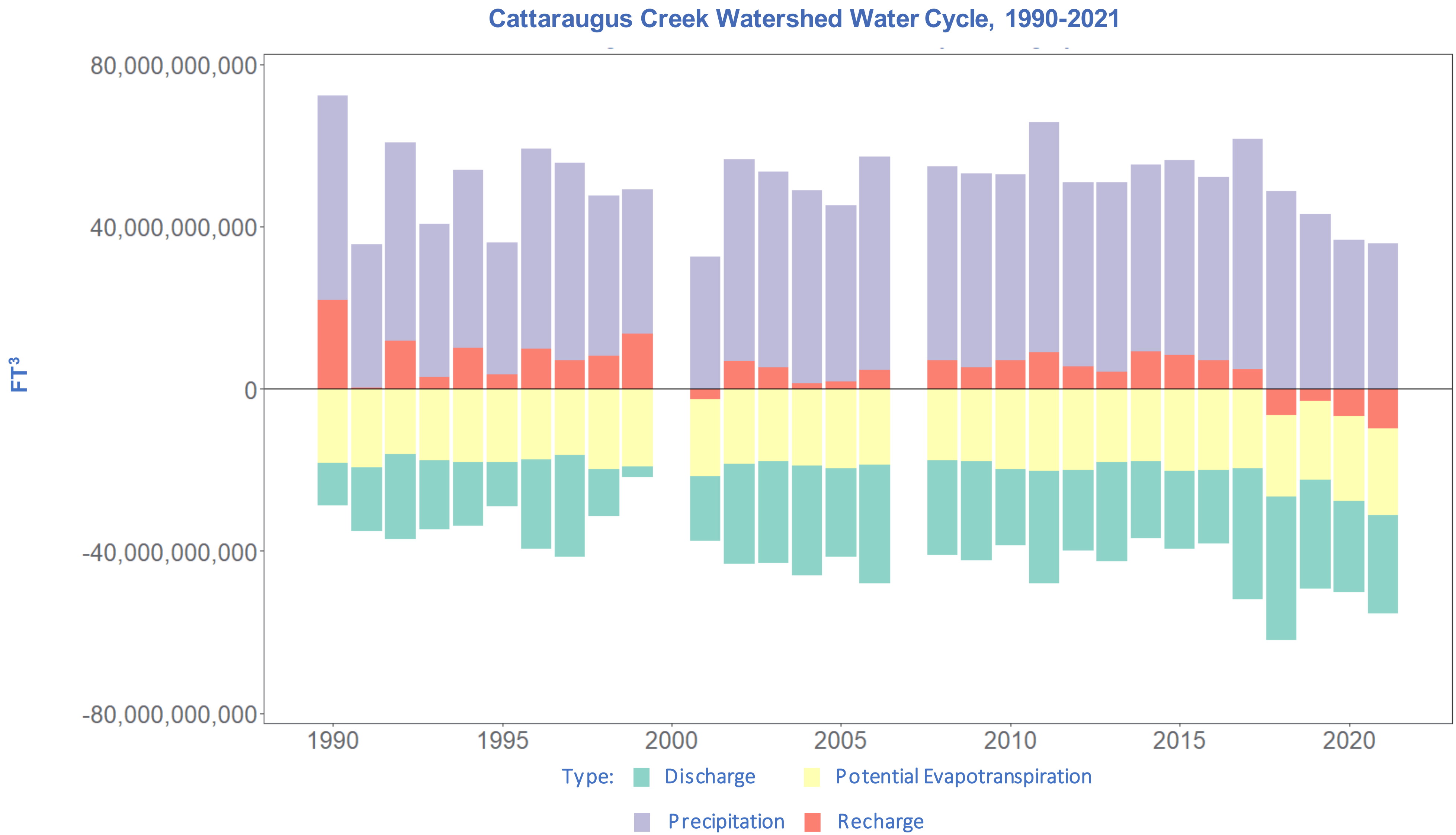

Figure A1.28 Description: Water cycle data are from the Franklinville Station (Source: NOAA National Centers for Environmental Information) and Gowanda Station (Source: United States Geological Survey (USGS)) for years 1990-2021. This figure shows the four major components of the watershed water cycle: streamflow (discharge), precipitation, potential evapotranspiration, and soil/groundwater recharge. Stream flow and precipitation were measured; potential evapotranspiration was calculated based on temperature data; recharge was estimated by subtracting stream discharge and potential evapotranspiration from precipitation. Years with missing values from the graph indicate gaps within the dataset, e.g., 2000 & 2007.

Key Points:

- There were estimated deficits in water recharge in the last four years, i.e., 2018-2021

Updated July 2022

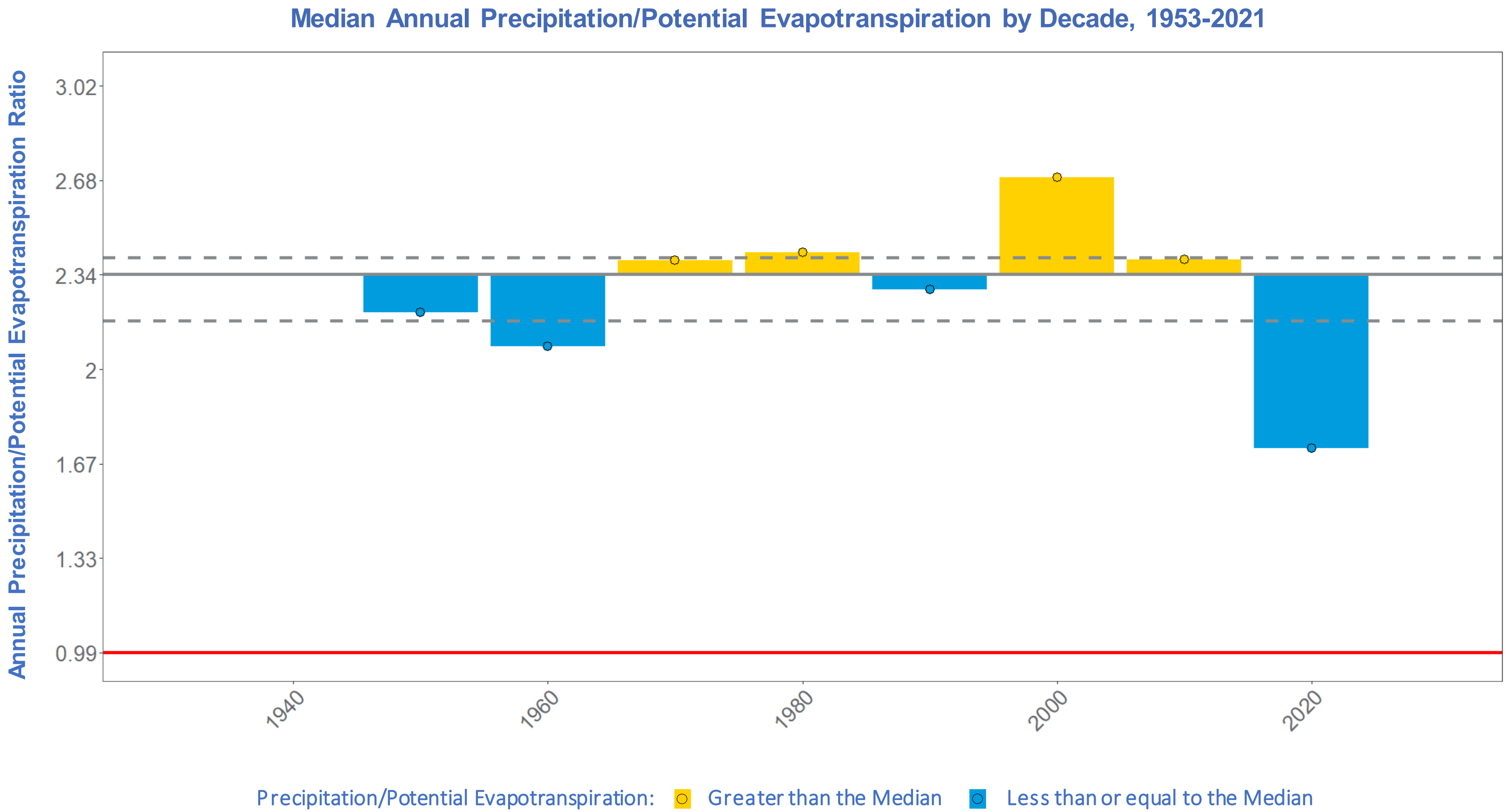

Figure A1.29 Description: Total annual precipitation and potential evapotranspiration ratio data are from the Franklinville Station (Source: NOAA National Centers for Environmental Information) for years 1953-2021. This graph uses the 1953-2021 median as a baseline (solid gray line) for depicting change; the dotted gray lines indicate the 25th and 75th percentiles, i.e., the normal range of values. The red line indicates a total precipitation/potential evapotranspiration ratio of 1; values above this line indicate precipitation in excess of potential evapotranspiration.

Key Points:

- The long-term median P:ET ratio is ~2.3, meaning that about 2.3x more precipitation falls than potential for evaporation
- Similar to the precipitation, temperature and Lake Erie water level data, the P:ET ratio shows a cyclical pattern with more arid conditions in the 1950s and 60s, followed by a wet period culminating in the 2000's
- The 2020's appear to be starting off with the driest conditions on record

Updated July 2022

Cattaraugus Creek Watershed (HUC8) Forest Regeneration Resiliency Against Deer Browse

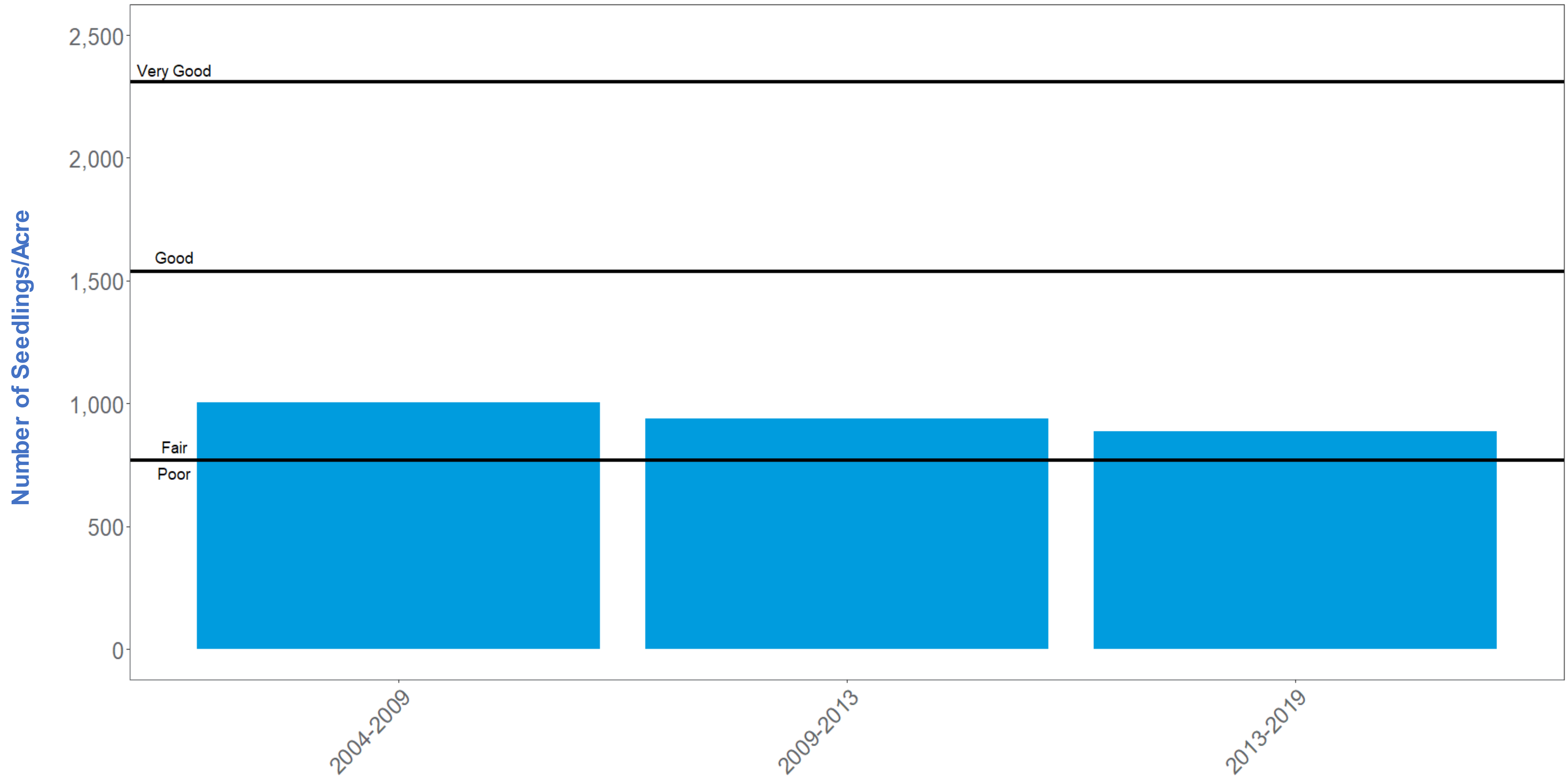

Figure A1.30 Description: Cattaraugus Creek watershed tree seedling data are from the USDA Forest Service Forest Inventory and Analysis (Source: USDA Forest Service Analysis Tool for Inventory and Monitoring (ATIM) ATIM Home (usda.gov)) for years 2004-2019. This graph displays average number of tree seedlings per acre for segments of years. Based on Marquis's *Prescribing Silvicultural Treatments in Hardwood Stands of the Alleghenies,* the overall regenerative ability of a forest (poor, fair, good, very good) to survive under deer browse pressure can be estimated based on the number of seedlings (Marquis, D.A.; Ernst, R.L.; Stout, S.L. 1992. Prescribing silvicultural treatments in hardwood stands of the Alleghenies (Revised). Gen. Tech. Rep. NE-96. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 101 p.)

Key Points:

- The regenerative health of the Cattaraugus Creek forests has decreased from 1,005 seedlings per acre in 2004 to 886 seedlings per acre in 2019
- Regeneration capacity of trees is at the low end of Fair and trending towards Poor conditions

Updated February 2023

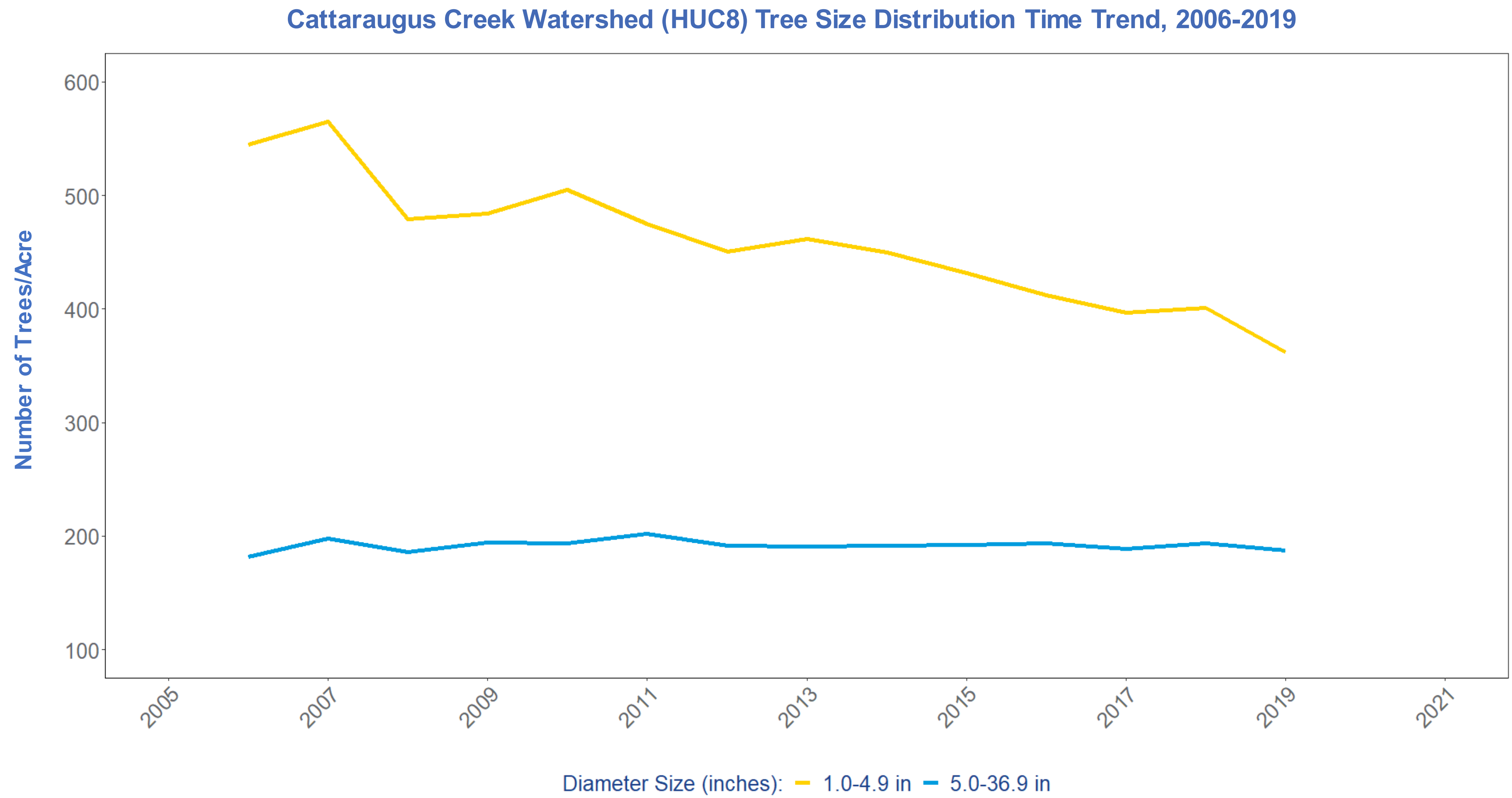

Figure A1.31 Description: Cattaraugus Creek watershed tree size class distribution data are from the USDA Forest Service Forest Inventory and Analysis (Source: USDA Forest Service Analysis Tool for Inventory and Monitoring (ATIM) ATIM Home (usda.gov)) for years 2006-2019. This graph displays a time trend of the relative density of small diameter trees (1.0-4.9 in, yellow line) and large diameter trees (5.0-36.9 in, blue line).

Key Points:

- The number of small diameter trees (1.0-4.9 in) has decreased from 545 trees per acre in 2006 to 362 trees per acre in 2019
- The number of large diameter trees (5.0-36.9 in) has remained relatively stable, with slight natural variability.

Updated February 2023

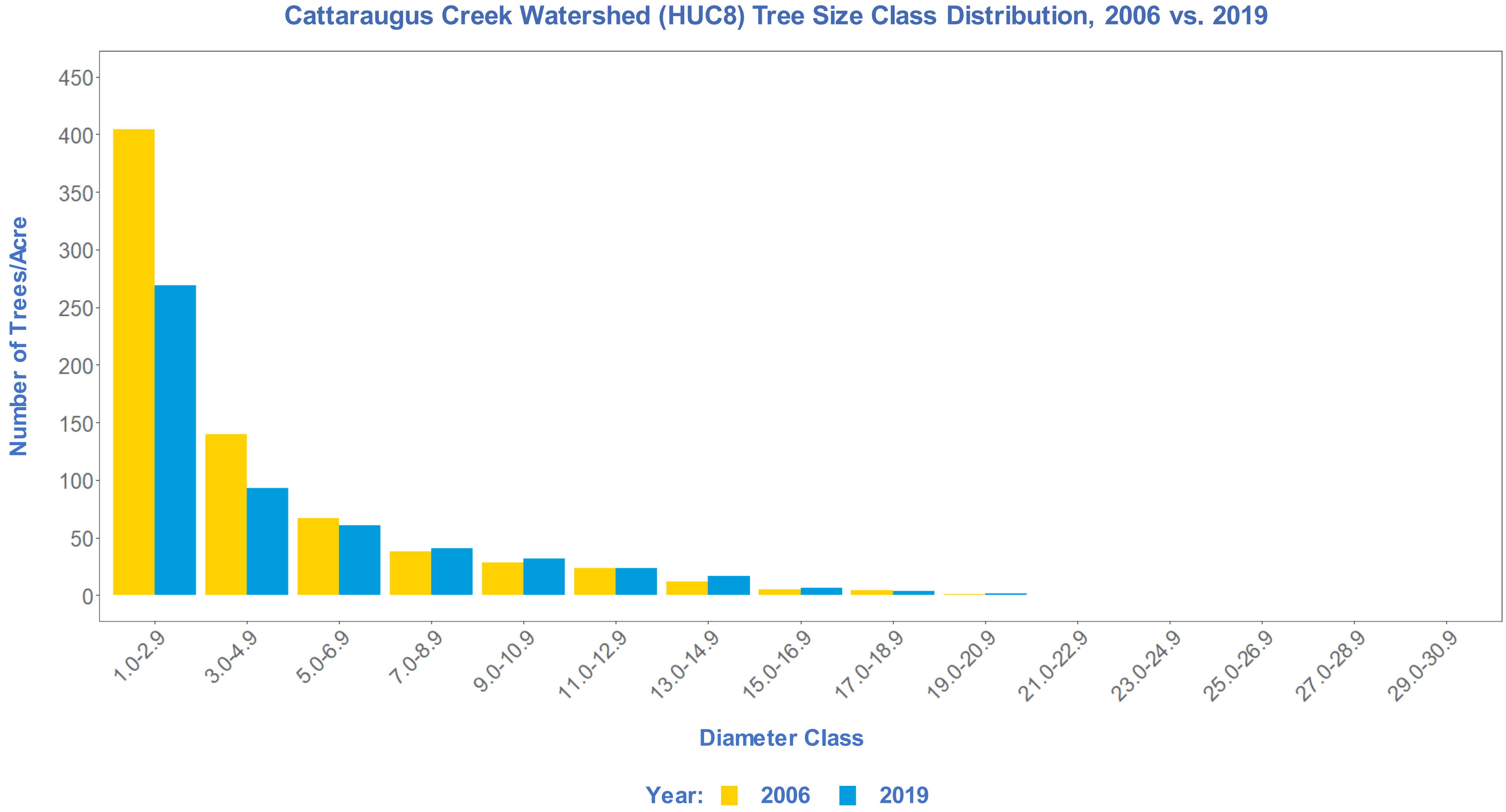

Figure A1.32 Description: Cattaraugus Creek watershed tree size class distribution data are from the USDA Forest Service Forest Inventory and Analysis (Source: USDA Forest Service Analysis Tool for Inventory and Monitoring (ATIM) [ATIM Home (usda.gov)]) for years 2006-2019. This graph displays the number of trees per acre based on tree diameters in 2006 (yellow) and 2019 (blue). Note that larger diameter trees (21.0-30.9 in) were present, but the small number of those trees resulted in less than 1 tree per acre.

Key Points:

- The number of small diameter trees per acre has decreased from 404 trees per acre in 2006 to 269 trees per acre in 2019
- The number of 13.0-14.9 in diameter trees per acre has increased from 12 trees per acre in 2006 to 17 trees per acre in 2019
- The data suggest a typical mixed-age forest stand structure and the stand is aggrading as smaller trees are entering larger size classes

Updated February 2023

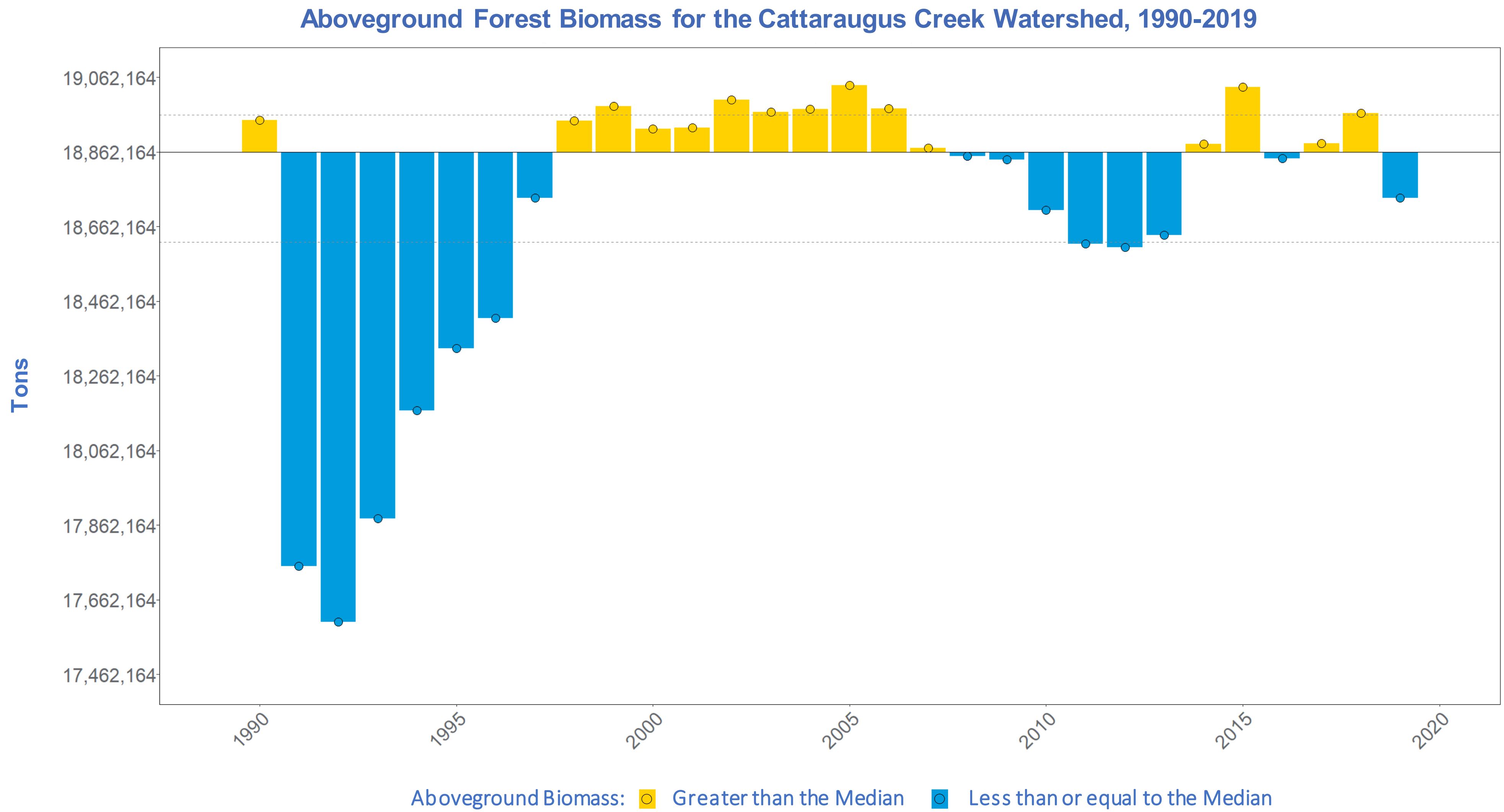

Figure A1.33 Description: Aboveground forest biomass stock data are based on a 30-year (1990-2019) time series of 30 m resolution predictions for the watershed for years 1990-2019 (Source: SUNY ESF). This graph uses the 1990-2019 median as a baseline (solid gray line) for depicting change; the dotted gray lines indicate the 25th and 75th percentiles, i.e., the normal range of values.

Key Points:

- Aboveground forest biomass stock estimates in the Cattaraugus Creek watershed increased from approximately 17,600,000 tons in 1992 to 18,965,000 tons in 2018.

Updated July 2022

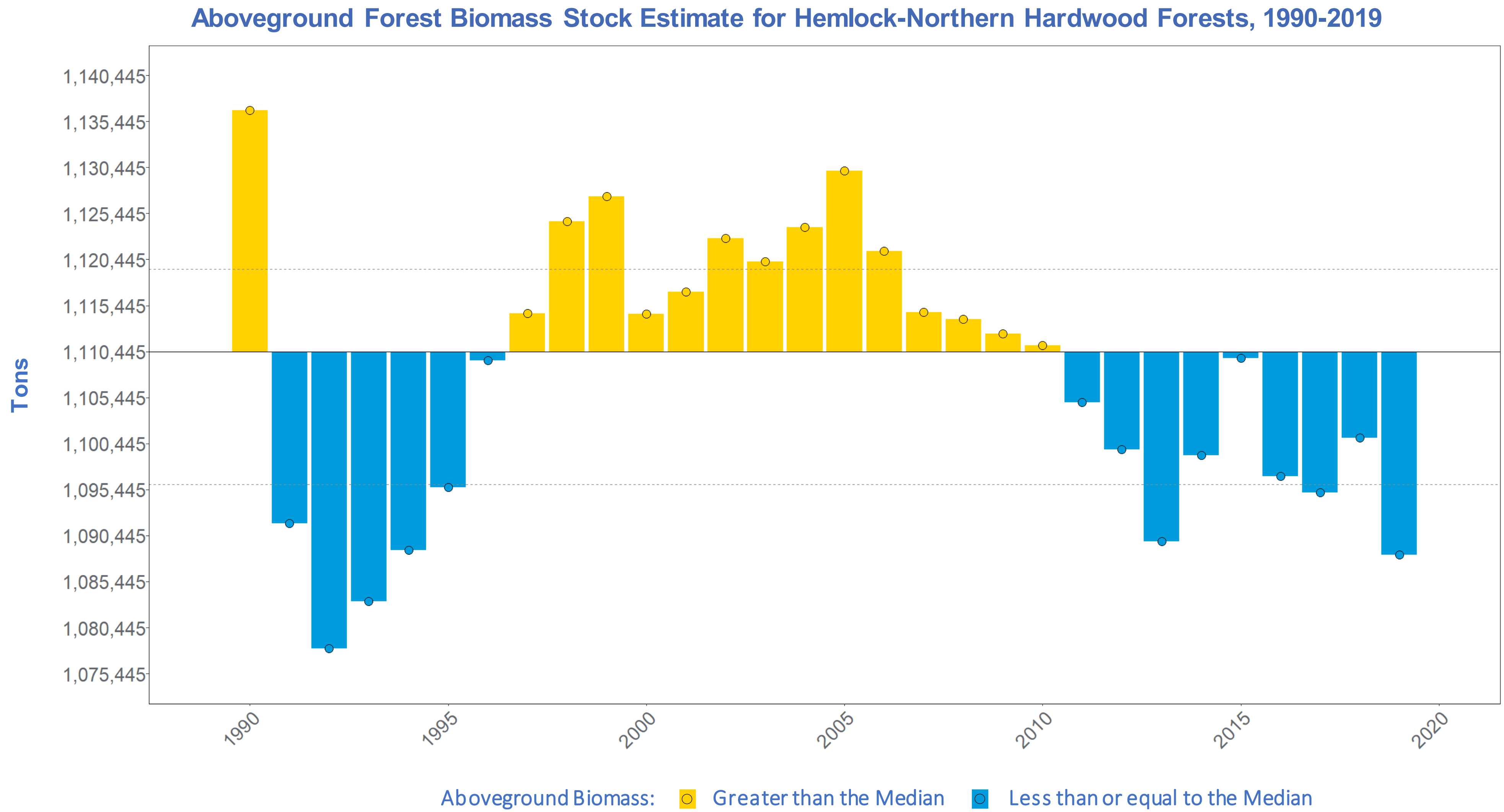

Figure A1.34 Description: Aboveground biomass stock estimate for Hemlock-northern hardwood forests data are based on a 30-year (1990-2019) time series of 30 m resolution predictions for the watershed (Source: SUNY ESF) for years 1990-2019. Biomass estimates were restricted to Hemlock-northern hardwood forest extents from New York Natural Heritage. This graph uses the 1990-2019 median as a baseline (solid gray line) for depicting change; the dotted gray lines indicate the 25th and 75th percentiles, i.e., the normal range of values.

Key Points:

- Aboveground biomass stock estimates for Hemlock-northern hardwood forests decreased from 1,130,000 tons in 2005 to 1,088,371 tons in 2019

Updated July 2022

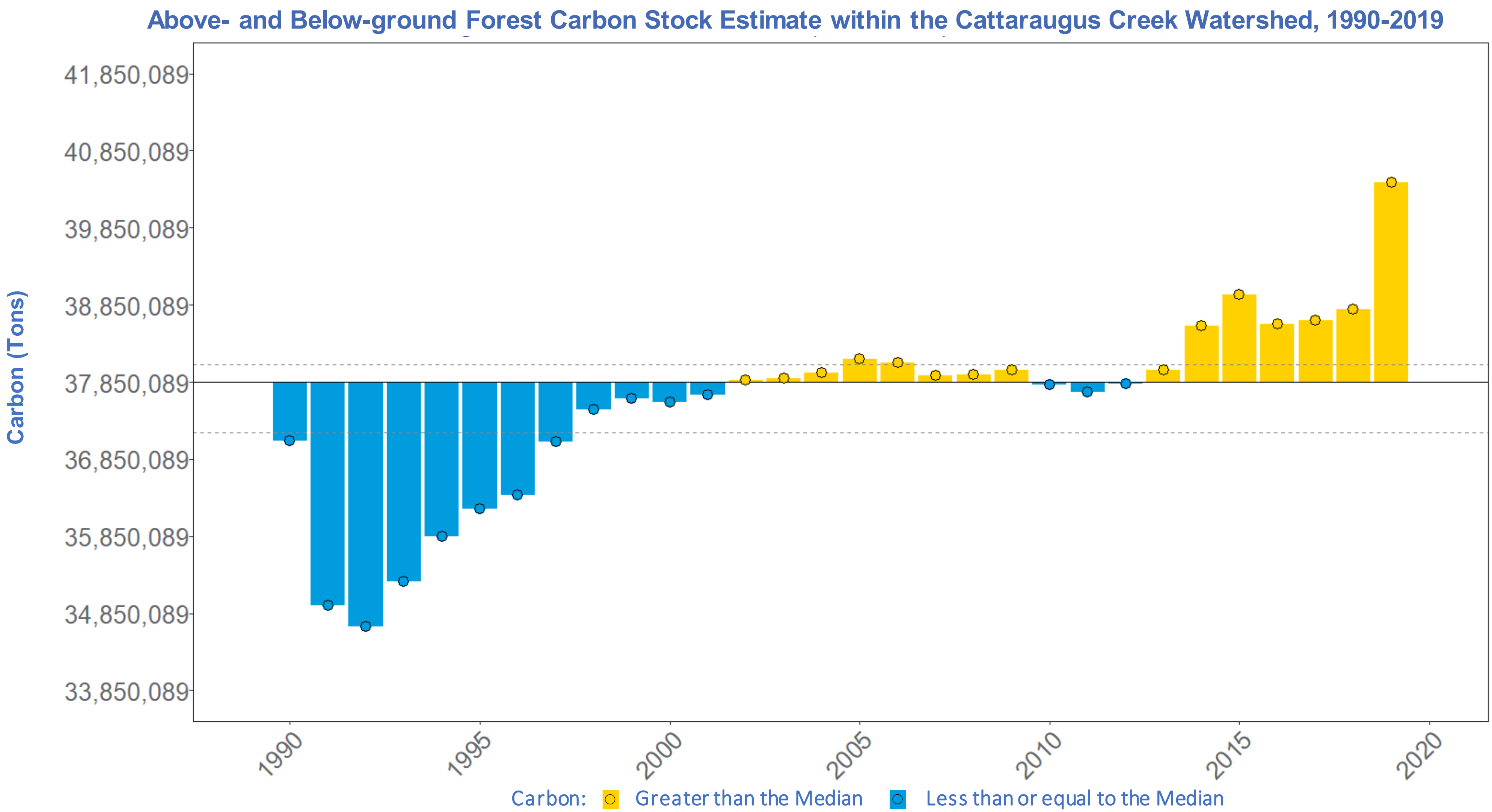

Figure A1.35 Description: Above- and below-ground forest carbon stock estimate data are based on a 30-year (1990-2019) time series of 30 m resolution predictions for the watershed (Source: SUNY ESF) for years 1990-2019. "Tree cover" classification is based on the annual Land Change Monitoring, Assessment, and Projection Primary Land Cover. This graph uses the 1990-2019 median as a baseline (solid gray line) for depicting change; the dotted gray lines indicate the 25th and 75th percentiles, i.e., the normal range of values.

Key Points:

- Above- and below-ground carbon stock estimates has increased from 34,681,398 tons in 1992 to 40,440,992 tons in 2019
- On average, the sequestered above- and below-ground carbon stock is about 213,000 tons of carbon per year, or the total annual emissions from 190,000 vehicles.

Updated July 2022

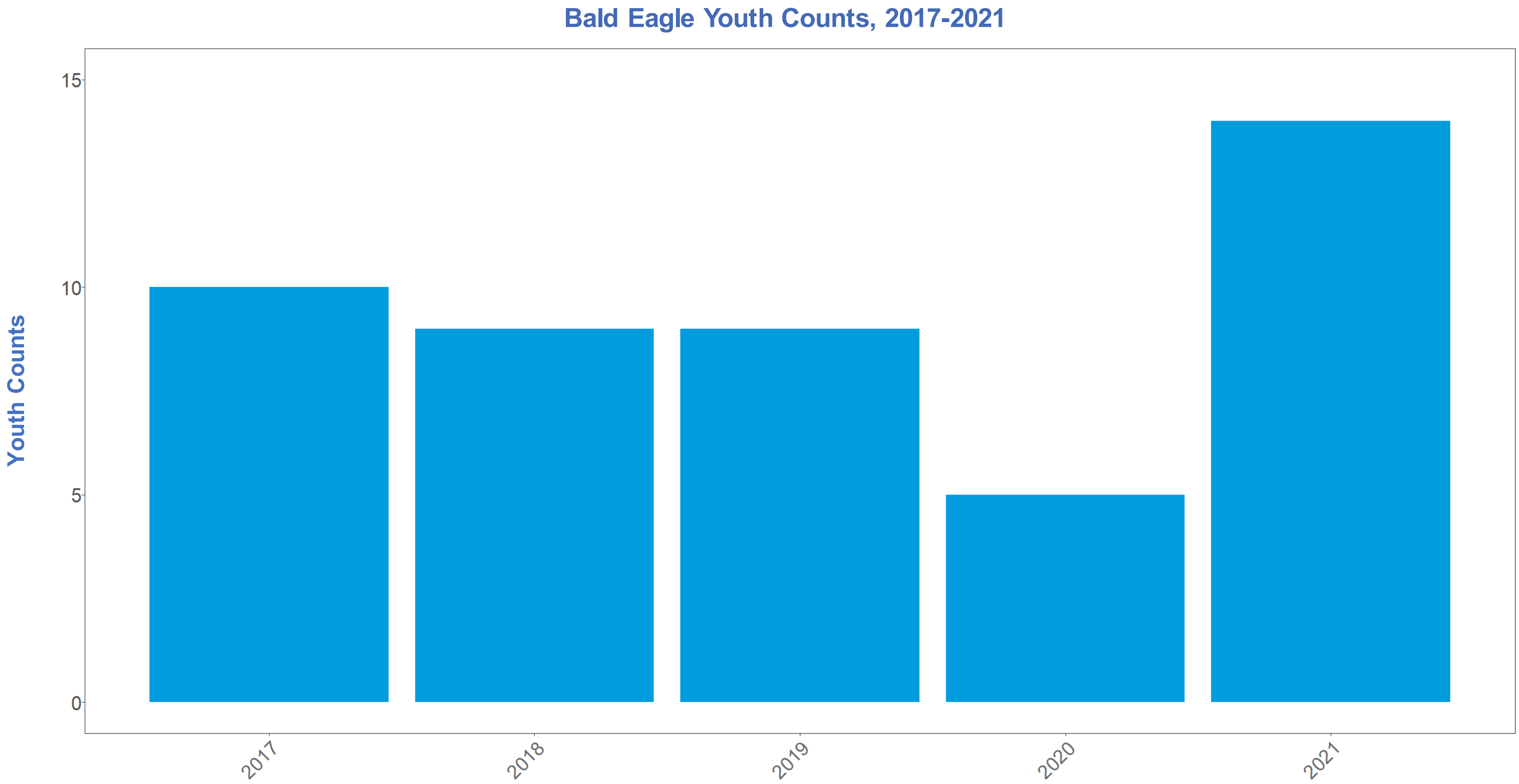

Figure A1.36 Description: Bald eagle youth count data are from sites throughout the Cattaraugus Creek watershed (Source: NYSDEC and NY Natural Heritage Program) for years 2017-2021. This graph displays the number of bald eagle youth seen each year during surveys conducted by NYSDEC and the NY Natural Heritage Program.

Key Points:
- Bald eagle youth counts have increased from 10 in 2017 to 14 in 2021

Updated July 2022

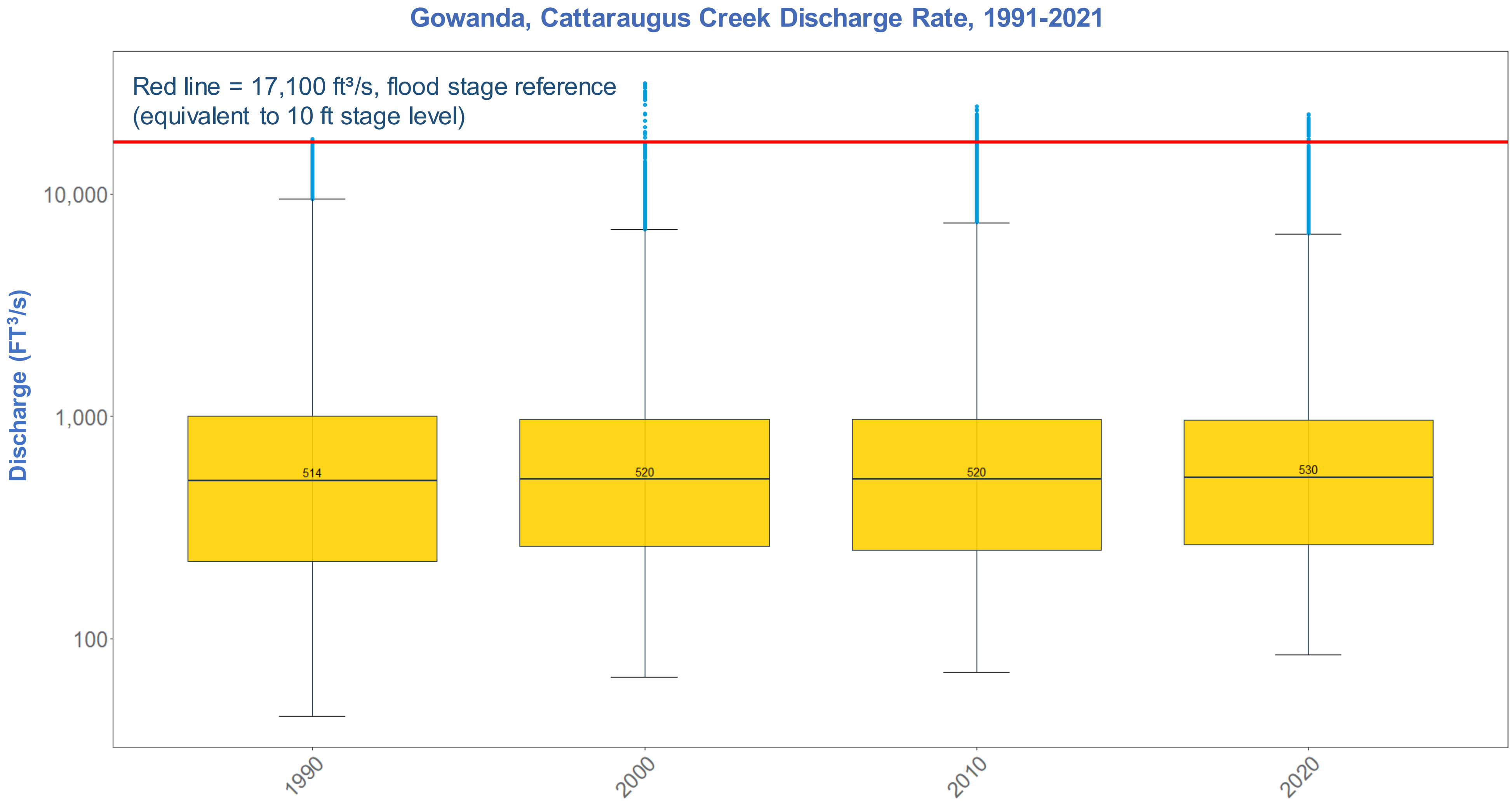

Figure A1.37 Description: Instantaneous 15-minute interval discharge rate data are from the Gowanda Station, monitoring location #04213500 (Source: United States Geological Survey (USGS)) for years 1991-2021. This graph uses a boxplot for each decade, indicating the median (dark grey lines labeled in each yellow box), 25^{th} percentile (lower line of yellow boxes), 75^{th} percentile (upper line of yellow boxes), and outliers (blue dots) of Cattaraugus Creek discharge. The red line marks the flood stage reference, 17,100 ft^3/s.

Key Points:

- Data from the Gowanda station has observed a slight increase in median discharge rate (514 ft^3/s in the 1990s to 530 ft^3/s in the 2020s)

Updated July 2022

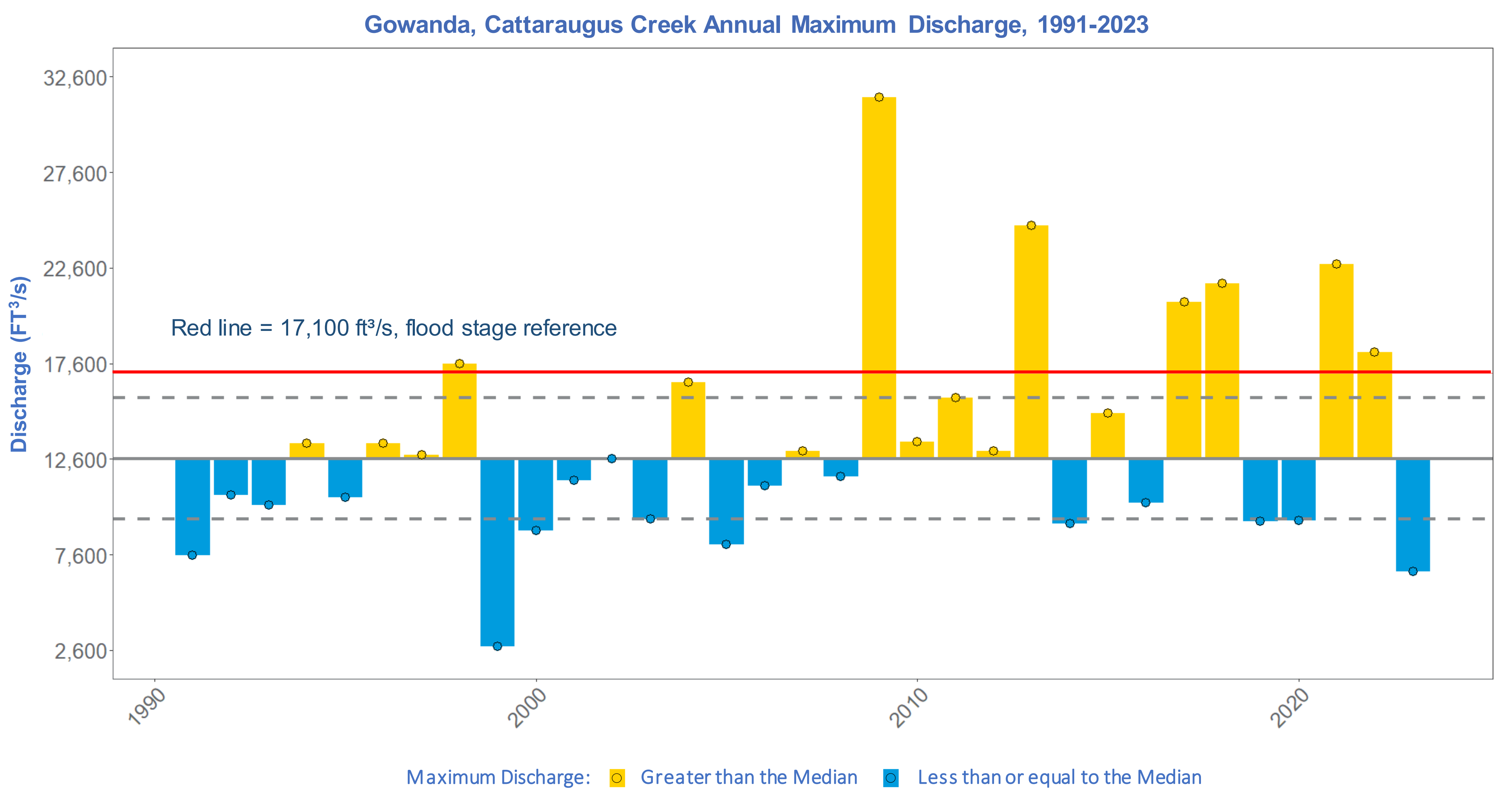

Figure A1.38 Description: Annual maximum discharge data are from the Gowanda Station, monitoring location #04213500 (Source: United States Geological Survey (USGS)) for years 1991-2023. This graph uses the 1991-2023 median as a baseline (solid gray line) for depicting change; the dotted gray lines indicate the 25th and 75th percentiles, i.e., the normal range of values. The red line marks the flood stage reference, 17,100 ft³/s.

Key Points:

- Data from the Gowanda monitoring location has observed seven instances where annual maximum discharge rate exceeded the flood stage reference (1999, 2009, 2013, 2017, 2018, 2021, 2022)

Updated July 2022

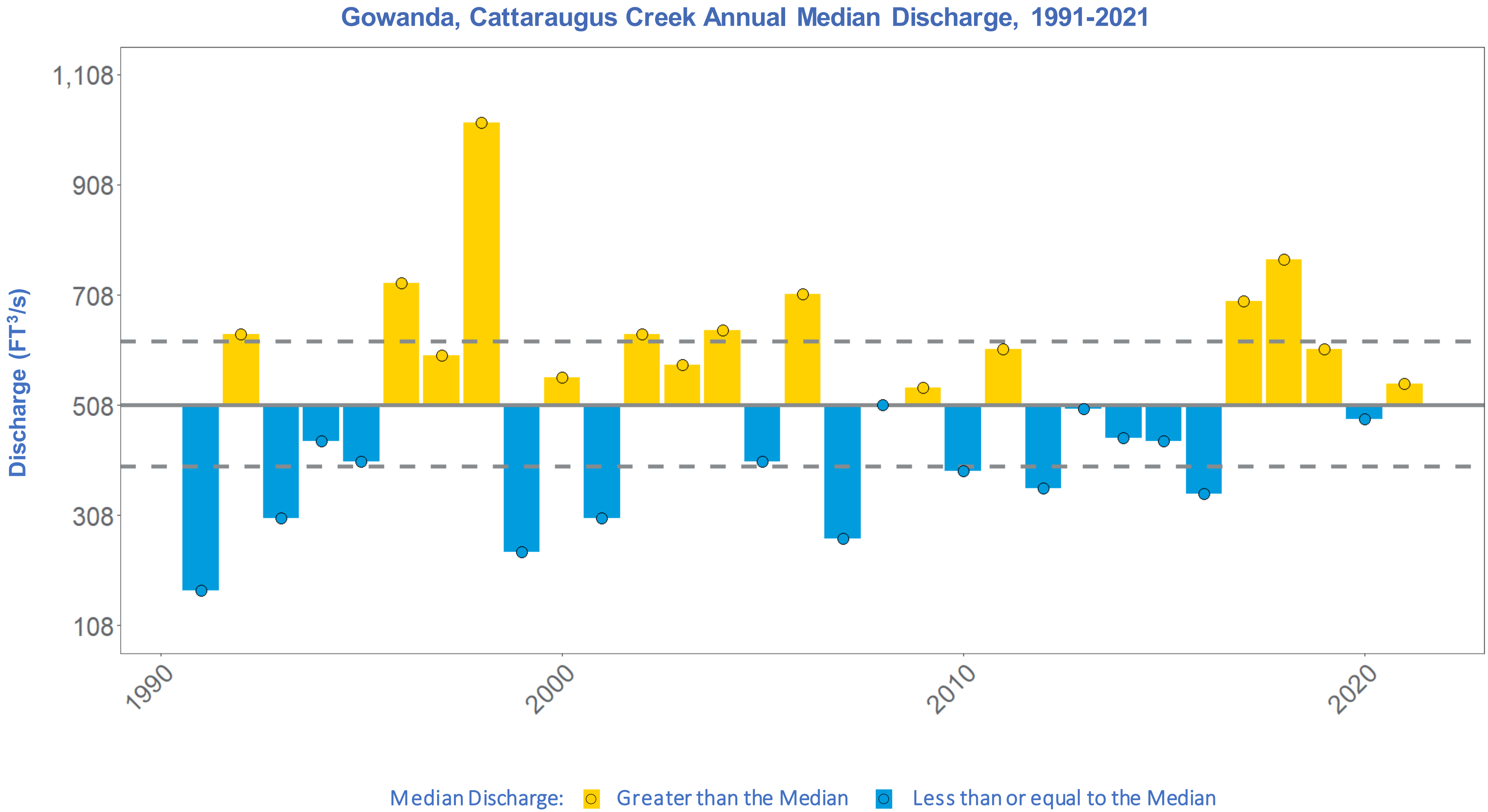

Figure A1.39 Description: Annual median discharge data are from the Gowanda Station, monitoring location #04213500 (Source: United States Geological Survey (USGS)) for years 1991-2021. This graph uses the 1991-2021 median as a baseline (solid gray line) for depicting change; the dotted gray lines indicate the 25th and 75th percentiles, i.e., the normal range of values.

Key Points:

- There are no obvious or strong trends in annual median discharge data at Gowanda from 1991 to 2021
- During the 30-year time period, annual median discharge at Gowanda has exceeded the long-term median of 508 ft^3/s in 15 years
- Higher rates of discharge are associated with elevated precipitation and creek turbidity levels

Updated July 2022

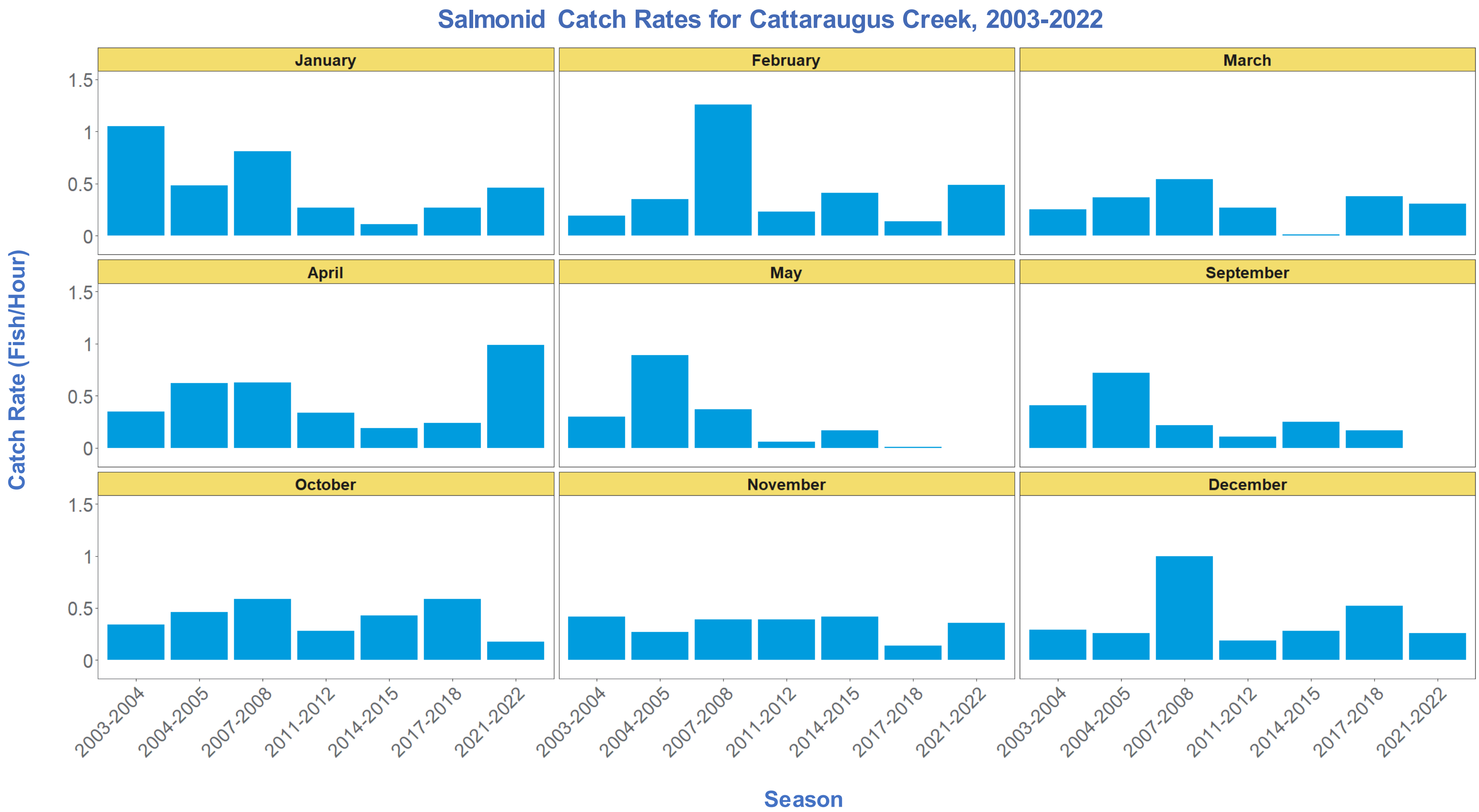

Figure A1.40 Description: Salmonid catch rate data for Cattaraugus Creek are from the Lake Erie Fisheries Research Unit for years 2003-2022. Years with missing values from the graph indicate gaps within the dataset, e.g., May and September were not surveyed for the 2021-2022 season. This graph displays the monthly mean catch rate (fish per hour) for each season the surveys were conducted by the Lake Erie Fisheries Research Unit.

Key Points:

- Salmonid catch rates for Cattaraugus Creek in January decreased from 1.1 fish per hour in 2003-2004 to 0.5 fish per hour in 2021-2022
- Salmonid catch rates for Cattaraugus Creek in September decreased from 0.4 fish per hour in 2003-2004 to 0.17 fish per hour in 2017-2018
- Lower catch rates in 2017-2018 may have been associated with elevated turbidity levels during these years

Updated July 2022

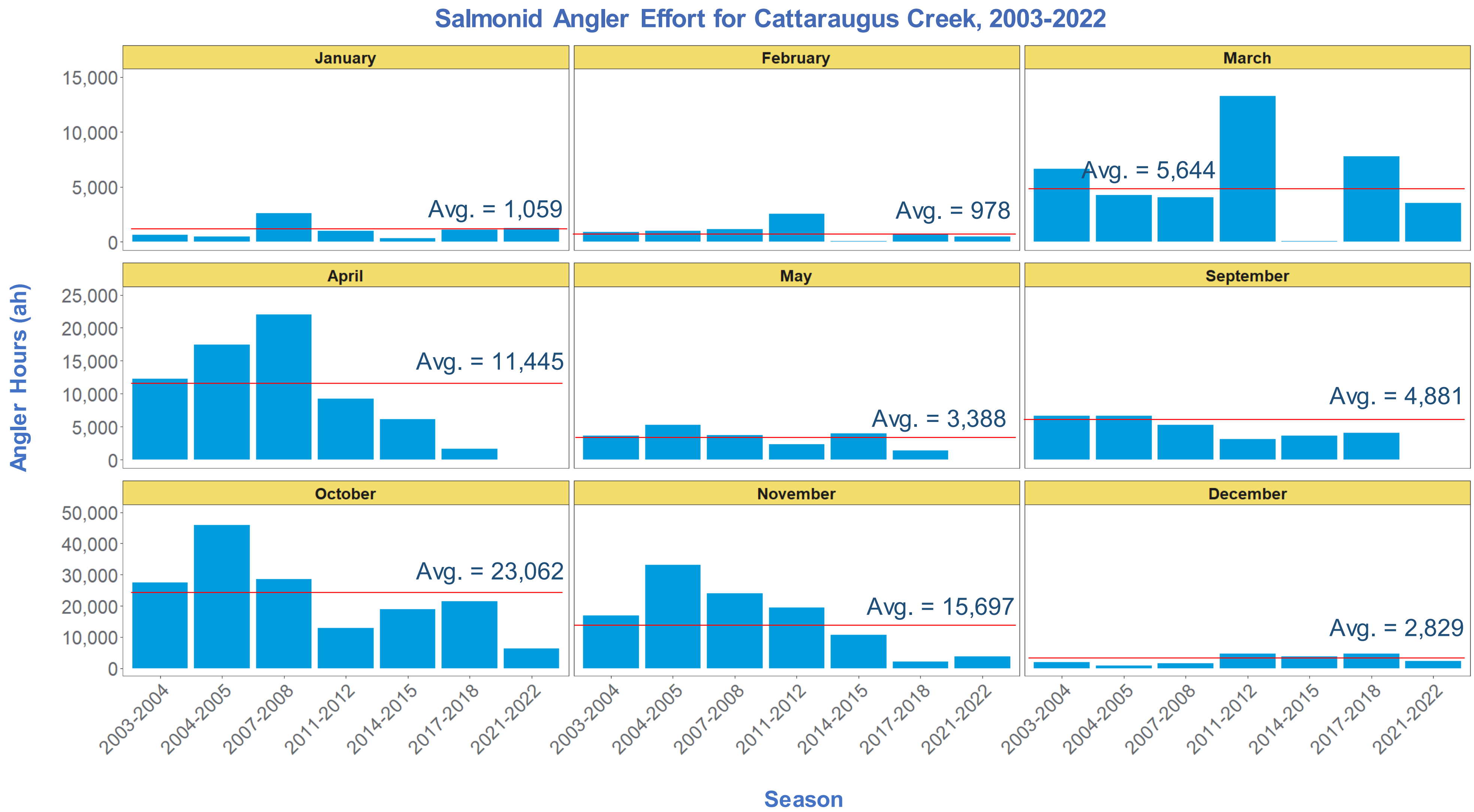

Figure A1.41 Description: Angler effort data for Cattaraugus Creek are from the Lake Erie Fisheries Research Unit for years 2003-2022. Years with missing values from the graph indicate gaps within the dataset, e.g., April, May and September were not surveyed for the 2021-2022 season. This graph displays the monthly total angler hours for each season the surveys were conducted by the Lake Erie Fisheries Research Unit; the red line indicates the monthly average angler-hours for all years surveyed.

Key Points:

- Cattaraugus Creek is the most-fished Lake Erie tributary in New York for steelhead.
- Salmonid angler effort in April has decreased from 12,225 angler hours in 2003-2004 to 1,646 angler hours in 2017-2018
- Salmonid angler effort in October has decreased from a peak of 45,918 angler hours in 2004-2005 to 6,294 angler hours in 2021-2022

Updated July 2022

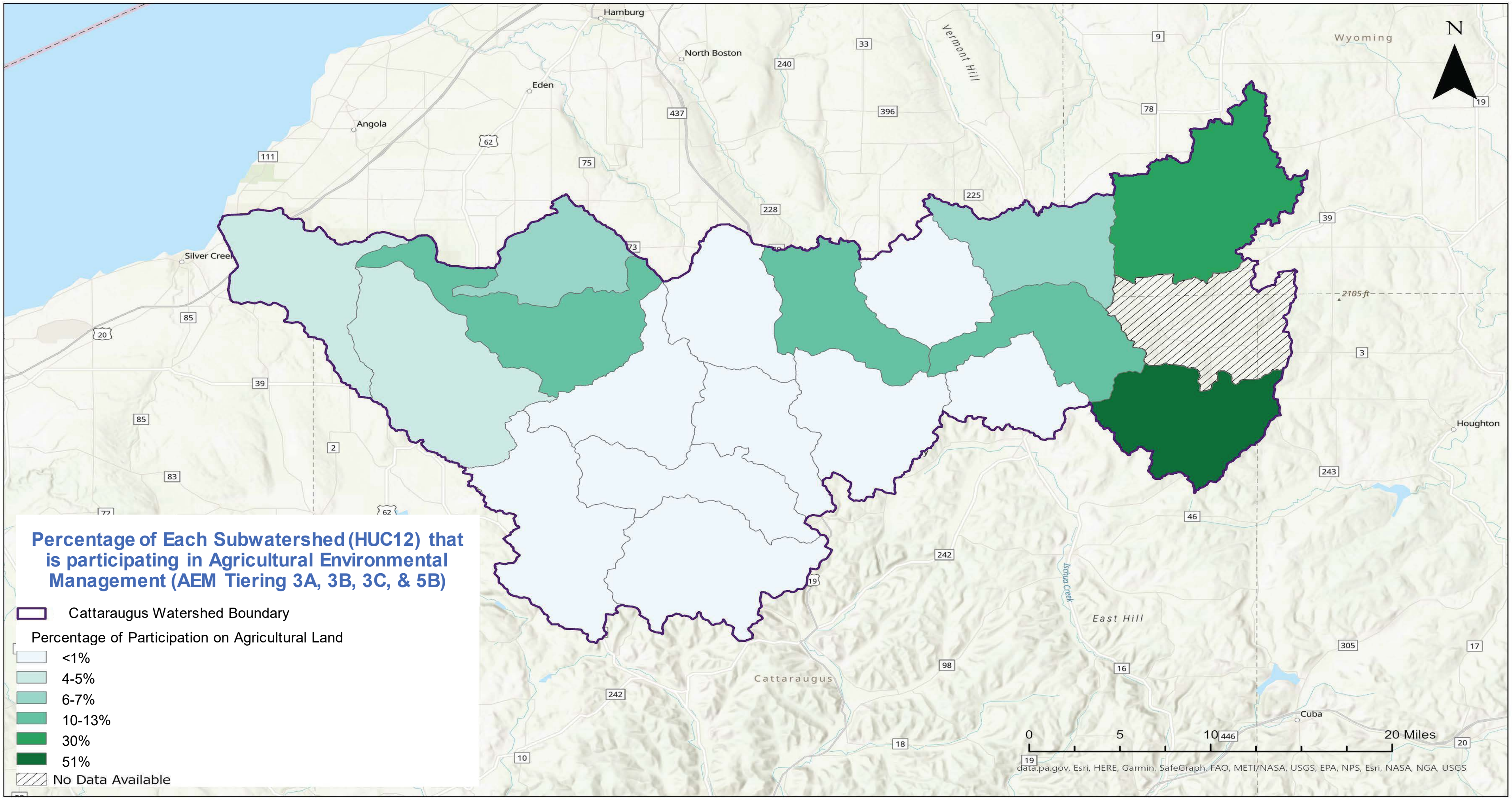

Figure A1.42 Description: Agricultural Environmental Management (AEM) participation data are from New York State Department of Agriculture and Markets. Subwatersheds (HUC12s) with cross hatching indicate where data were not available. This map displays the percentage of each subwatershed that is participating in AEM, with dark green indicating the highest percentage and light green the lowest.

Key Points:

- While some portions of the watershed have AEM participation on over 50% of agricultural lands, significant opportunities exist to increase participation in this program

Table A1.4. Top 10 Agricultural Land Types within the Watershed Counties, 2008 & 2021

Agricultural Land Type	2008	2021	Difference
	Total Acreage		
Other Hay/Non Alfalfa	234,067	193,276	-40,791
Corn	214,778	161,937	-52,841
Alfalfa	74,608	97,227	22,619
Soybeans	10,313	27,012	16,699
Grapes	25,950	24,928	-1,022
Winter Wheat	8,805	11,942	3,137
Dry Beans	7,026	7,419	393
Potatoes	3,013	6,375	3,361
Oats	5,639	3,817	-1,822
Fallow/Idle Cropland	24,106	3,308	-20,799

Table A1.5. Corn Production (Bushels) within the Watershed Counties, 2008-2021

Year	Allegany	Cattaraugus	Chautauqua	Erie	Wyoming	Total
	Bushels					
2008	794,100	594,800	1,572,500	NA	2,695,100	5,656,500
2009	NA	NA	1,520,100	1,665,000	2,800,900	5,986,000
2010	1,073,000	1,290,000	1,383,000	1,510,000	2,973,000	8,229,000
2011	1,021,000	1,511,000	1,256,000	1,584,000	2,860,000	8,232,000
2012	1,202,983	1,184,702	1,771,515	1,718,000	3,082,296	8,959,496
2013	1,223,000	1,785,000	2,633,000	1,598,000	4,095,000	11,334,000
2014	NA	NA	NA	NA	NA	NA
2015	NA	1,549,000	NA	1,970,000	3,601,000	7,120,000
2016	881,000	1,847,000	1,330,000	1,377,000	2,214,000	7,649,000
2017	1,362,695	1,341,000	2,340,163	1,491,257	2,921,000	9,456,115
2018	1,237,000	1,622,000	1,785,000	2,178,000	3,813,000	10,635,000
2019	NA	NA	2,650,000	1,341,000	3,209,000	7,200,000
2021	NA	1,389,000	2,365,000	2,278,000	4,207,000	10,239,000

Table A1.4 and A1.5 Descriptions: Top Agricultural Land Types (Table A1.4) and County Level Production of Corn (Table A1.5) are from the USDA Cropland CROS and USDA Quick Stats for years 2008-2021. Years with missing values from the tables indicate gaps within the dataset, e.g., 2014 and 2015.

Key Points:

- Consistent with the watershed land cover data (Table A1.1), agricultural land area is in counties that are within the Cattaraugus watershed. The total decline of agricultural lands county-wide is over 71,000 acres from 2008 to 2021 (Table A1.4), which is a significantly greater rate of decline than within the Cattaraugus watershed (Table A1.1).
- Corn production has generally increased in the five counties that are within the watershed (Allegany, Cattaraugus, Chautauqua, Erie, and Wyoming) from approximately 5.7 million bushels in 2008 to nearly 10.2 million bushels in 2021. This increase in production has occurred while acreage of corn has decreased by approximately 52,841 acres over this timeframe (Table A1.5).

Updated July 2024

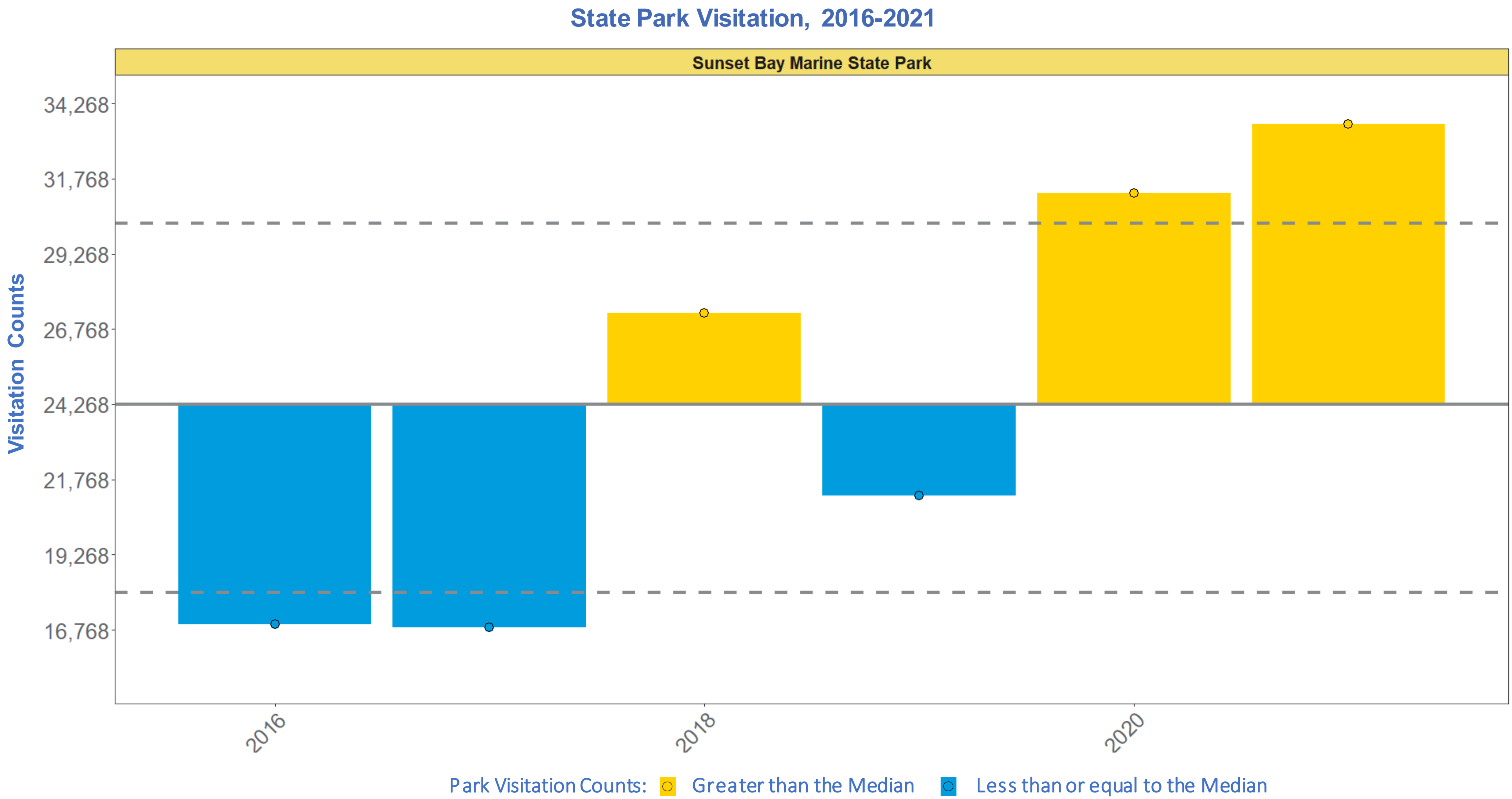

Figure A1.43 Description: State park visitation data displayed are from Sunset Bay Marine State Park (Source: New York State Office of Parks, Recreation and Historic Preservation (OPRHP), data.NY.gov) for years 2016-2021. This graph uses the 2016-2021 median as a baseline (solid gray line) for depicting change; the dotted gray lines indicate the 25th and 75th percentiles, i.e., the normal range of values.

Key Points:

- Visitation at the Sunset Bay Marine State Park has increased from 16,953 in 2016 to 33,584 in 2021

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