# Water Quality Trends for Patchogue Bay

# 2020

This report summarizes water quality data for fecal coliform and total coliform in Patchogue Bay for the years 2003-2020.

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# Background

As part of the Village of Patchogue's "*Watershed Management Plan for Reducing Pathogen Loading in Patchogue Bay*" (2014), the Village of Patchogue reviews collected microbiological indicator data to assess progress toward minimizing Total Maximum Daily Loads (TMDL) for pathogens.

Fecal coliform and total coliform are considered to be microbiological indicator organisms, which are assumed to indicate the presence of pathogenic organisms associated with fecal material from warm blooded animals.

## Sample Collection

Water samples are collected frequently from Patchogue Bay by the New York State Department of Environmental Conservation (NYSDEC) and Suffolk County Department of Health Services (SCDHS) and analyzed for various water quality parameters.  Sampling locations are shown below.
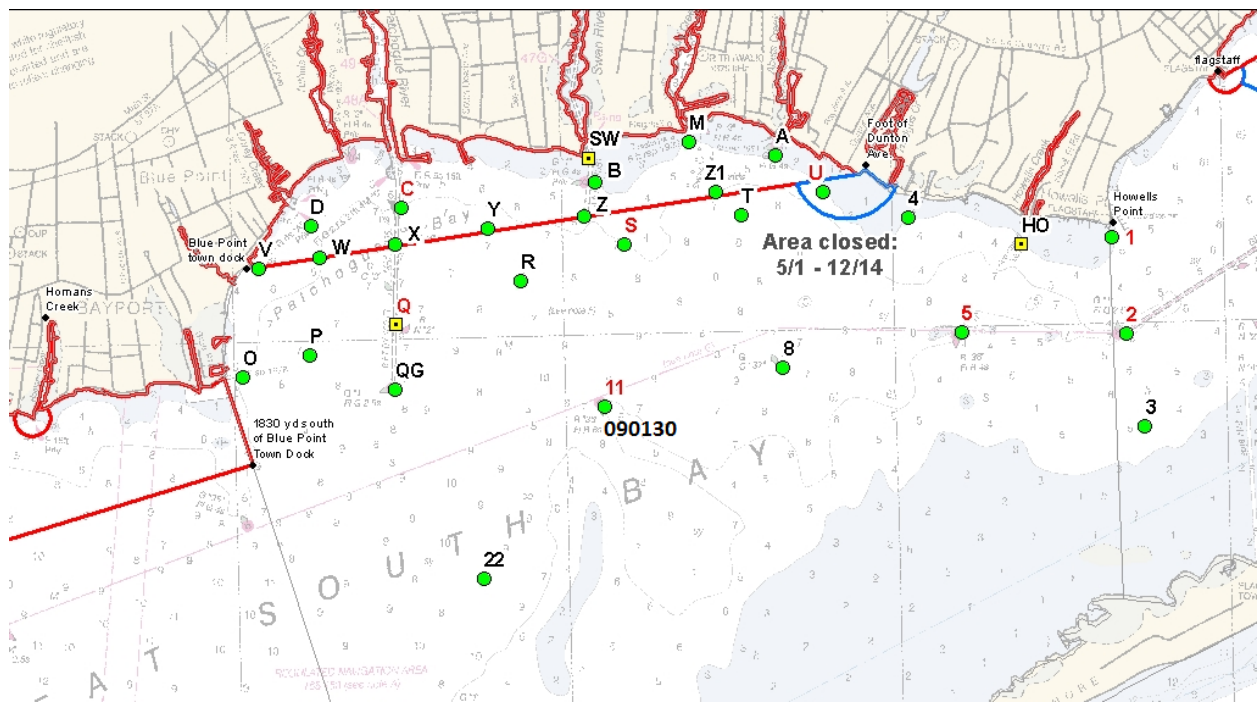


For the purposes of this water quality trend report, eight locations were selected for Patchogue Bay. The locations are: 6-A, 6-M, 6-SW, 6-W, 6-X, 6-Y, 6-Z, and 090-130.

These locations were selected to coincide with four sampling stations that exhibited exceedances for fecal and/or total coliform as presented in the "*Final Report for Shellfish Pathogen TMDLs for 27 303(d)-listed Waters*", prepared by Battelle (2007).  That report listed stations 6-A, 6-M, 6-SW, and 6-X for fecal and total coliform data associated with Patchogue Bay. However, it should be noted that stations 6-A, 6-M, and 6-SW are located at the mouths of estuaries within the hamlet of East Patchogue (Abets Creek, Mud Creek, and Swan River, respectively) and are not associated with

stormwater discharges from the Village of Patchogue. As a result, stations 6-W, 6-Y, and 6-Z, which are located approximately ½-mile south of the Village of Patchogue, were included to better represent the potential contributions from stormwater discharges from the Village.

It should be noted that the NYSDEC ceased analyzing for total coliform in 2003; therefore, the SCDHS location of 090-130 is used to report total coliform results. Since this location is located south of Patchogue Bay and within Great South Bay, water quality may be influenced by sources from numerous municipalities.

Additionally, stations 6-W and 6-Y were inactivated on July 31, 2019 because the shellfish closure line in northern Patchogue Bay is monitored by adjacent stations 6-V, 6-X, and 6-Z.

## Water Quality Standards

New York State participates in the National Shellfish Sanitation Program (NSSP) which recommends strict bacteriological water quality standards for shellfish harvesting areas to be designated as approved, or certified, for the harvest of shellfish for human consumption. The NSSP standards for fecal coliform and total coliform are as follows:

- Fecal Coliform – The geometric mean of samples shall not exceed 14 MPN / 100 mL
- Fecal Coliform – The 90th percentile value of the samples shall not exceed 49 MPN / 100 mL
- Total Coliform – The geometric mean of samples shall not exceed 70 MPN / 100 mL
- Total Coliform – The 90th percentile value of the samples shall not exceed 330 MPN / 100 mL

# Data Analysis Methodology and Results

A 28-year record (1993 – 2020) of fecal coliform and total coliform data was used to calculate the statistical geometric mean ("geomean") and 90th percentile values used in this report.

The main benefit of using geometric means is that they help smooth out the effects of occasional very high or very low values. It is common in microbiology to use a rolling geometric mean to analyze trends. For this report, data from the previous 30 sampling events are used to create one data point for the rolling geometric mean. A sample size of 30 is typically used in statistical analyses to reduce statistical errors.

The 90th percentile is a measure of statistical distribution. The 90th percentile tells you the value for which 90% of the data points are smaller and 10% are bigger. For this report, data from the previous 30 sampling events are used to create one data point for the rolling 90th percentile. A sample size of 30 is typically used in statistical analyses to reduce statistical errors.

Some of the SCDHS sampling data was expressed as "<20", indicating the minimum detection level. Since the actual measurement is not known, and choosing one would be random and arbitrary, a value of "19.9" was selected.

For dates in which two samples were collected in one day (e.g., morning and afternoon), the higher values of the set were used in the analyses.

The most recent 30 sample data points used to generate the geometric mean and 90th percentile data are presented in Table 1 below and are inclusive of data from 2018 to 2020. Due to COVID impacts on the ability of NYSDEC staff to perform water sampling, samples were only collected for locations 6-X and 6-Z during 2020.

**Table 1. Summary of Stations for Fecal and/or Total Coliform**

| Station ID | Fecal Coliform (MPN/100 mL) | | Total Coliform (MPN/100 mL) | | No. of Samples | Effective Date |
|---|---|---|---|---|---|---|
| | Geomean (>14 MPN) | 90th Percentile (>49 MPN) | Geomean (>70 MPN) | 90th Percentile (>330 MPN) | | |
| 6-A | 12.8 | **144** | N/A | N/A | 30 | 11/6/19 |
| 6-M | **18.1** | **168** | N/A | N/A | 30 | 11/6/19 |
| 6-SW | **64.4** | **588** | N/A | N/A | 30 | 11/6/19 |
| 6-W | 4.9 | 23 | N/A | N/A | 30 | 7/24/19 |
| 6-X | 6.3 | 23 | N/A | N/A | 30 | 12/7/20 |
| 6-Y | 4.5 | 14.9 | N/A | N/A | 30 | 7/24/19 |
| 6-Z | 5.3 | 17.5 | N/A | N/A | 30 | 12/7/20 |
| 090-130 | **19.6*** | 19.9 | 24.3 | 75 | 30 | 10/13/20 |

Notes: Bold values indicate concentrations higher than the NSSP Standards
* - Beginning in 2019, the method detection limit for SCDHS analyses was 18 MPN / 100 mL.

# Water Quality Trends

Trending charts for fecal coliform and total coliform are provided below.

**Figure 1. Fecal Coliform Data – Rolling Geometric Mean for Stations 6-A, 6-M, and 6-SW.**
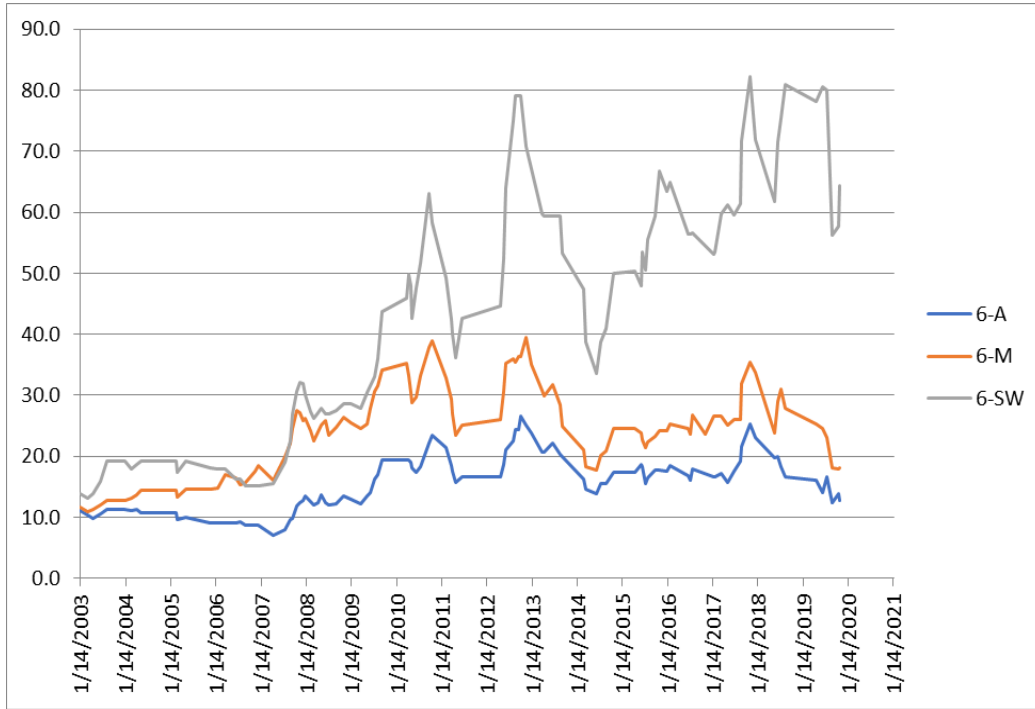


\Figure 2. Fecal Coliform Data – Rolling Geometric Mean for
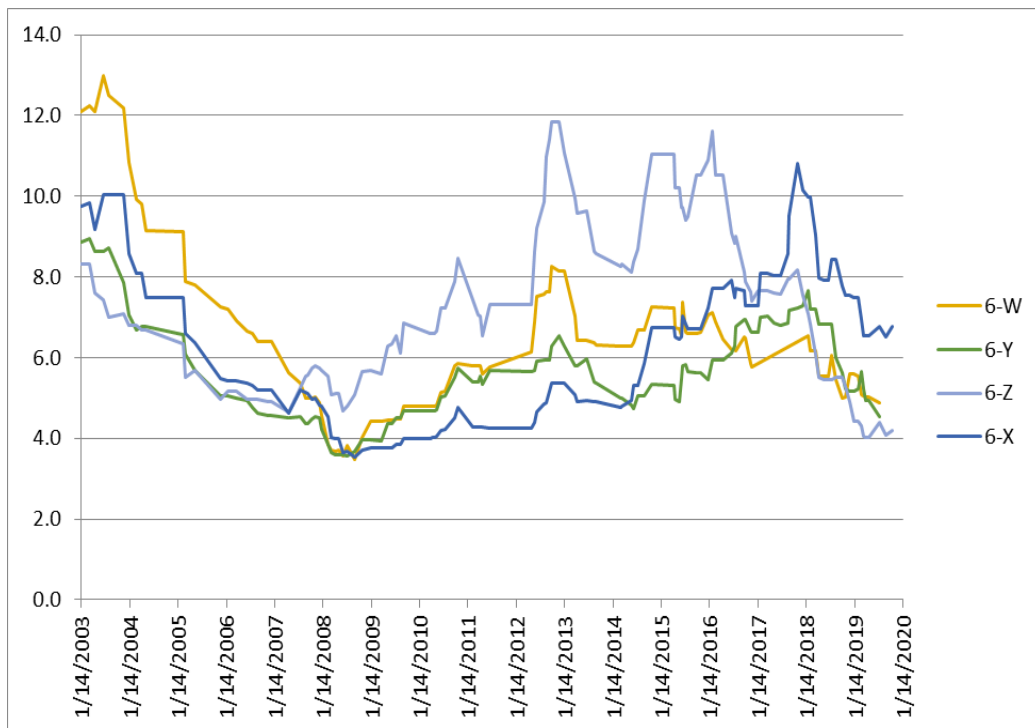Stations 6-W, 6-X, 6-Y, and 6-Z.

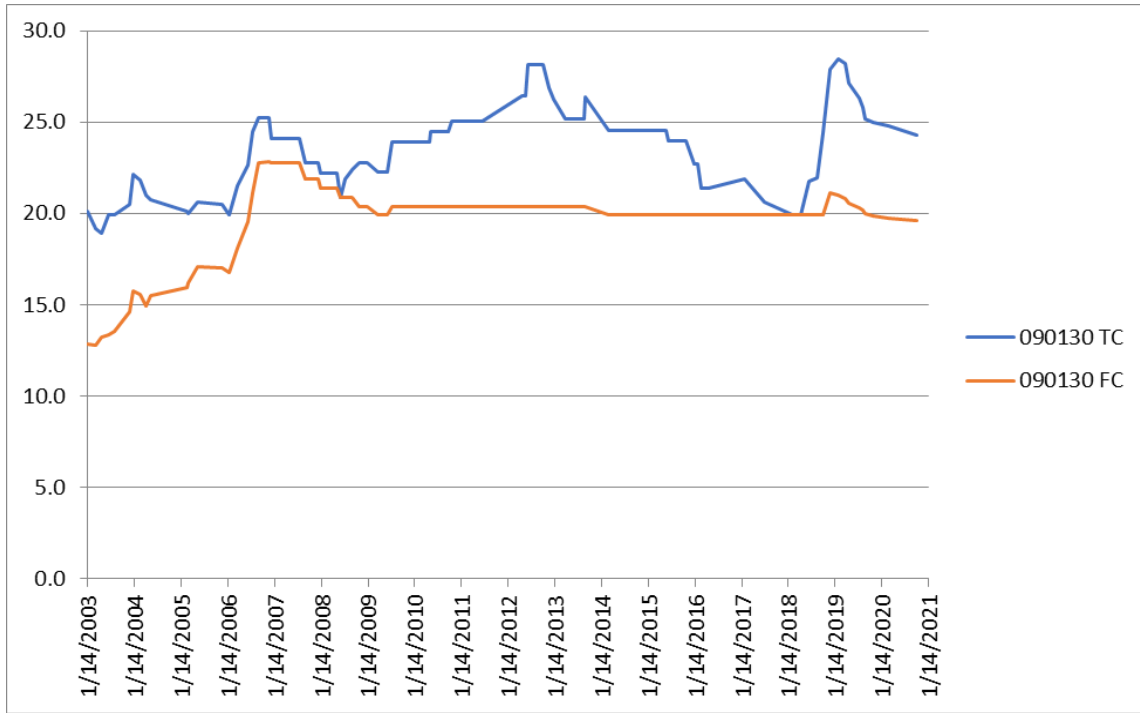**Figure 3. Fecal and Total Coliform Data – Rolling Geometric Mean for Station 090-130**
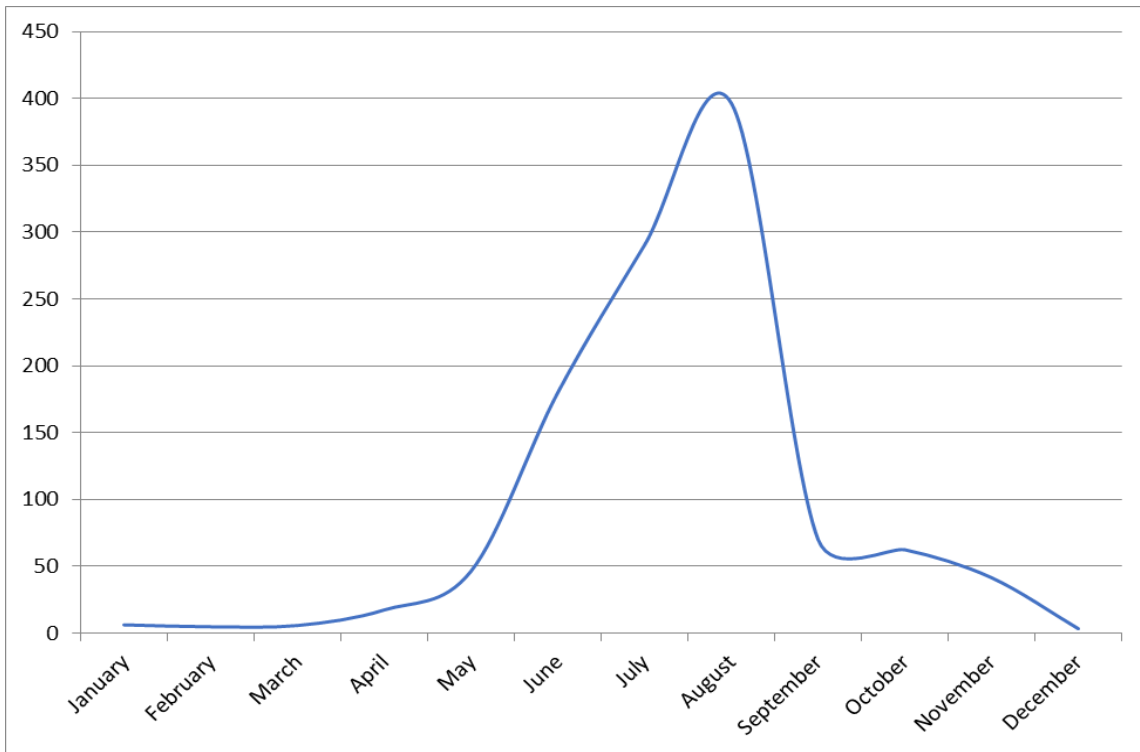


**Figure 4. Seasonal Fecal Coliform Data – Rolling Geometric Mean for Station 6-SW**

# Assessment and Conclusions

## Trends

While it would appear that fecal coliform concentrations have been increasing since 2009, it should be noted that seasonality plays a large role in influencing the geometric mean data. As shown in Figure 4, fecal coliform concentrations are generally low in the winter months and peak in the summer months. Prior to 2009, 23 percent of the fecal coliform samples were collected between the months of June and September. In comparison, 36 percent of the fecal coliform samples were collected during the same months from 2009 to 2020. As a result, even though use of the rolling geometric mean is meant to smooth out very high and very low data, it is reasonable to assume that a data set containing a higher percentage of elevated fecal coliform levels would result in higher rolling geometric means.

## Comparison to NSSP Standards

Due to staffing issues, laboratory sample limits, and COVID-19, the NYSDEC was unable to sample any of the year-round uncertified stations (A, M, SW) in Patchogue Bay during 2020. Additionally, stations 6-W and 6-Y were inactivated on July 31, 2019 because the shellfish closure line in northern Patchogue Bay is monitored by adjacent stations 6-V, 6-X, and 6-Z. Therefore, only a discussion of the data for stations 6-X and 6-Z, as well as SCDHS station 090-130, is provided below.

Stations 6-X and 6-Z were all below the fecal coliform geometric mean standard of 14 MPN / 100 mL and the fecal coliform 90th percentile standard of 49 MPN / 100 mL. There are no total coliform results for these stations.

It is plausible that the fecal coliform geometric mean at station 090-130 is below the standard of 14 MPN / 100 mL since the method detection limit of 18 MPN / 100 mL is higher than the standard. Station 090-130 was below the fecal coliform 90th percentile standard of 49 MPN / 100 mL, and was below the geometric mean and 90th percentile standards for total coliform.

## Conclusion

Since fecal coliform levels at the four stations located ½-mile south of the Village of Patchogue are below the NSSP standards, stormwater discharges from the Village of Patchogue do not likely exceed Total Maximum Daily Loads (TMDLs) for pathogens.

Additionally, analysis of the data indicates that seasonality plays a significant role in determining if surface waters meet or exceed the NSSP standards. Since the data utilized for this report is dependent upon the time of year that samples are collected by the NYSDEC, the seasonal variations need to be accounted for in determining compliance with the NSSP standards.

# References

Battelle, 2007. *Final Report for Shellfish Pathogen TMDLs for 27 303(d)-listed Waters*.

New York State Department of Environmental Conservation, *Water Quality Data for Shellfish Growing Area #6*

Suffolk County Department of Health Services (SCDHS), 2020. Surface water quality monitoring data provided by the SCDHS Office of Ecology, Yaphank, N.Y.

Village of Patchogue, 2014. *Watershed Management Plan for Reducing Pathogen Loading in Patchogue Bay.*