James River Reference Curves

Science Advisory Panel Meeting

April 26, 2013

HDR | HydroQual

Compliance with Current Criteria

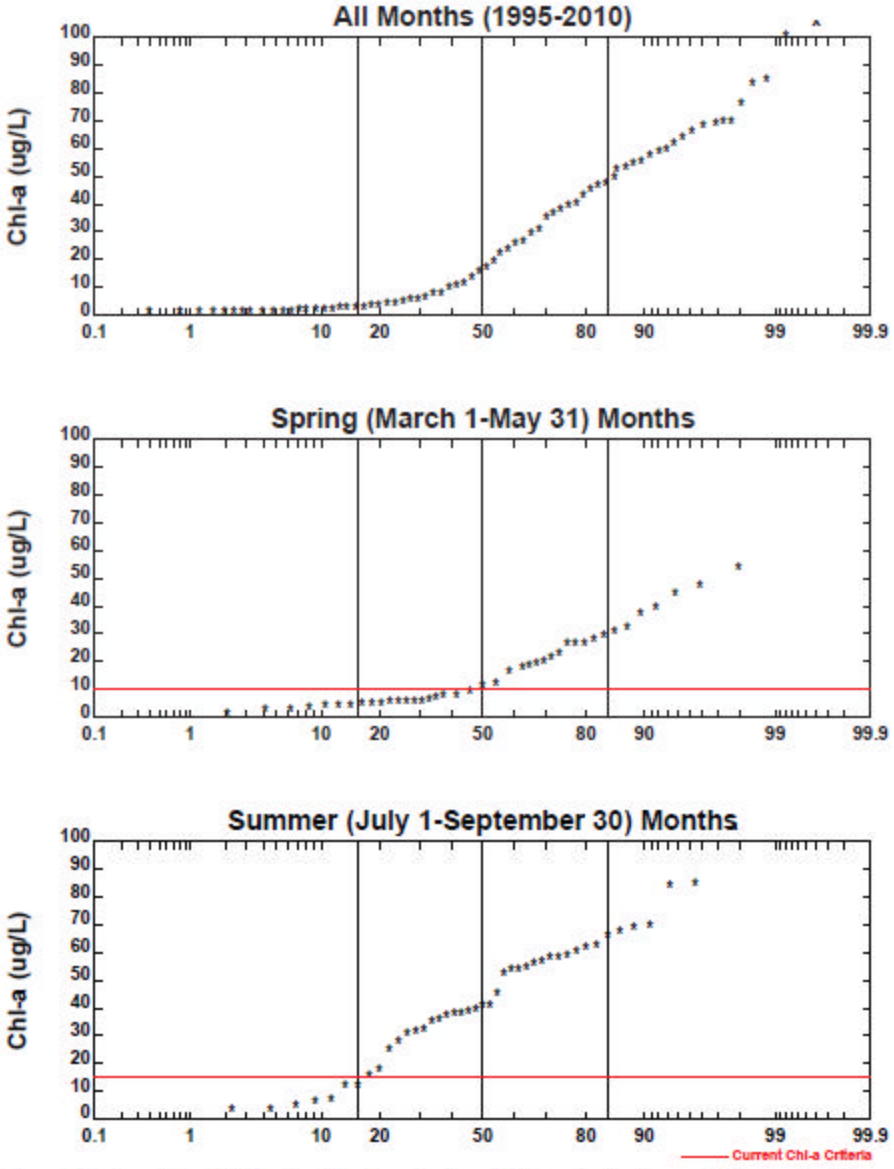


Figure 33. Cumulative Distribution Functions for Annual Chlorophyll-a Concentrations and with Current Spring and Summer Chlorophyll-a Criteria for Station TF5.5

Compliance with Current Criteria

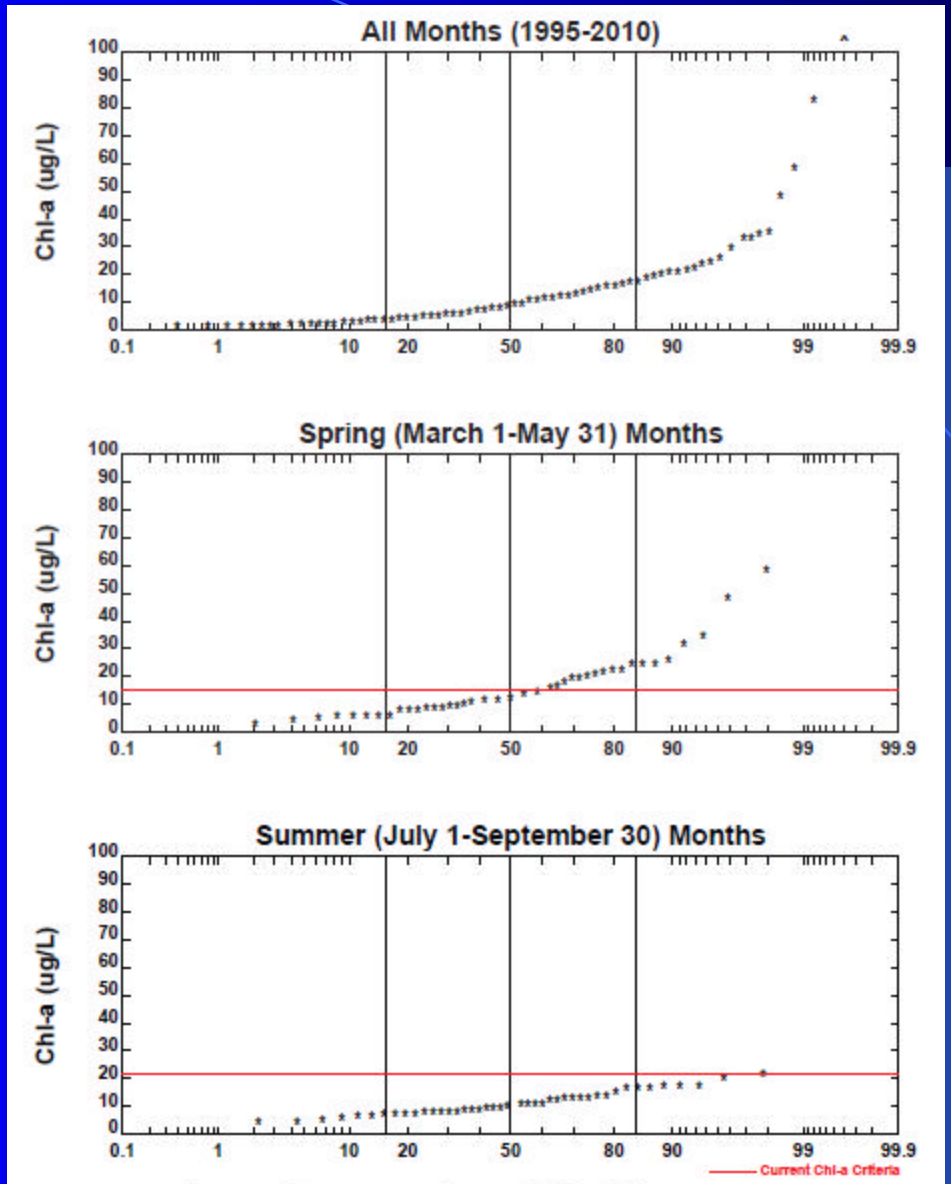


Figure 34. Cumulative Distribution Functions for Annual Chlorophyll-a Concentrations and Compliance with Current Spring and Summer Chlorophyll-a Criteria for Station RET5.2

Compliance with Current Criteria

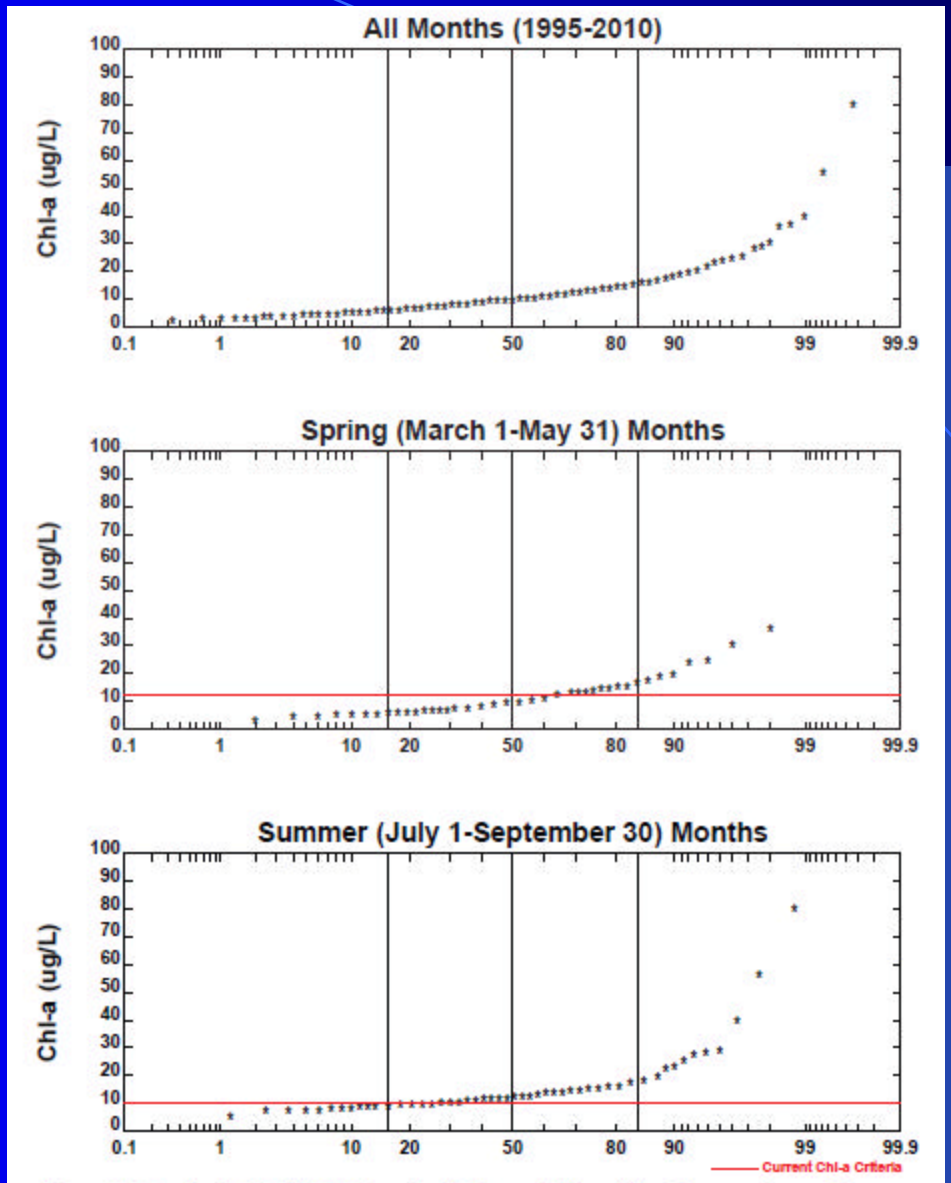


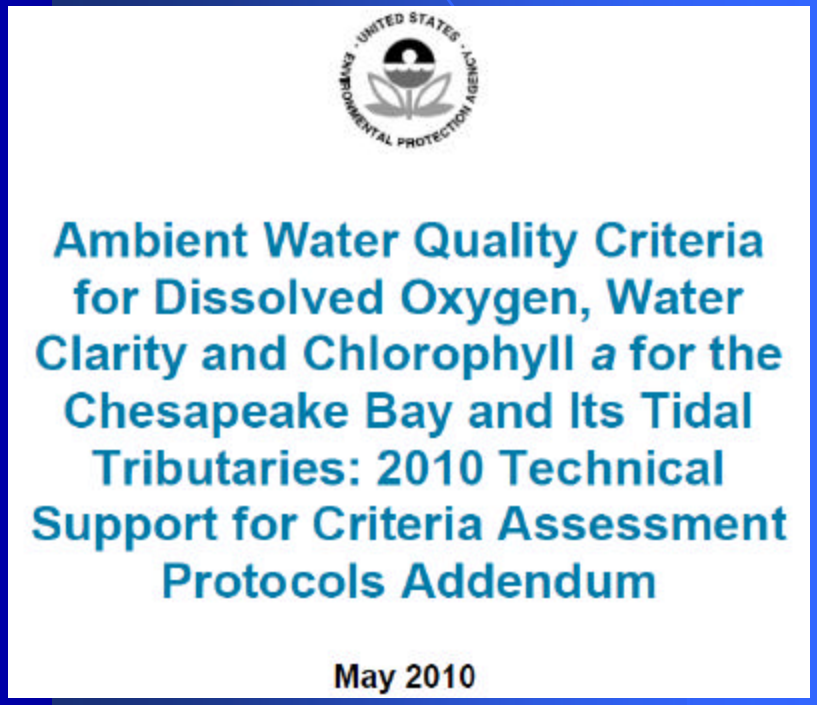
Figure 35. Cumulative Distribution Functions for Annual Chlorophyll-a Concentrations and Compliance with Current Spring and Summer Chlorophyll-a Criteria for Station LE5.5-W

Reference Curve

A biologically-based reference curve with which to assess chlorophyll-a criteria attainment in Chesapeake Bay is not yet available. A dataset has not been identified from which there is confidence that a biological reference curve can be derived.

In its current form, the published P-IBI work does not provide for a suitable representation of the integrated season biological community conditions necessary to inform appropriate seasonal reference conditions for Chesapeake Bay chlorophyll-a criteria assessments.

Further work is needed to specify a metric that can provide *a priori* identification of an unimpaired system on the relevant timescale, from which allowable exceedance of the chlorophyll-a criteria can be inferred. EPA, therefore, recommends a default 10% reference curve for assessing the chlorophyll-a criteria.



Reference Curve

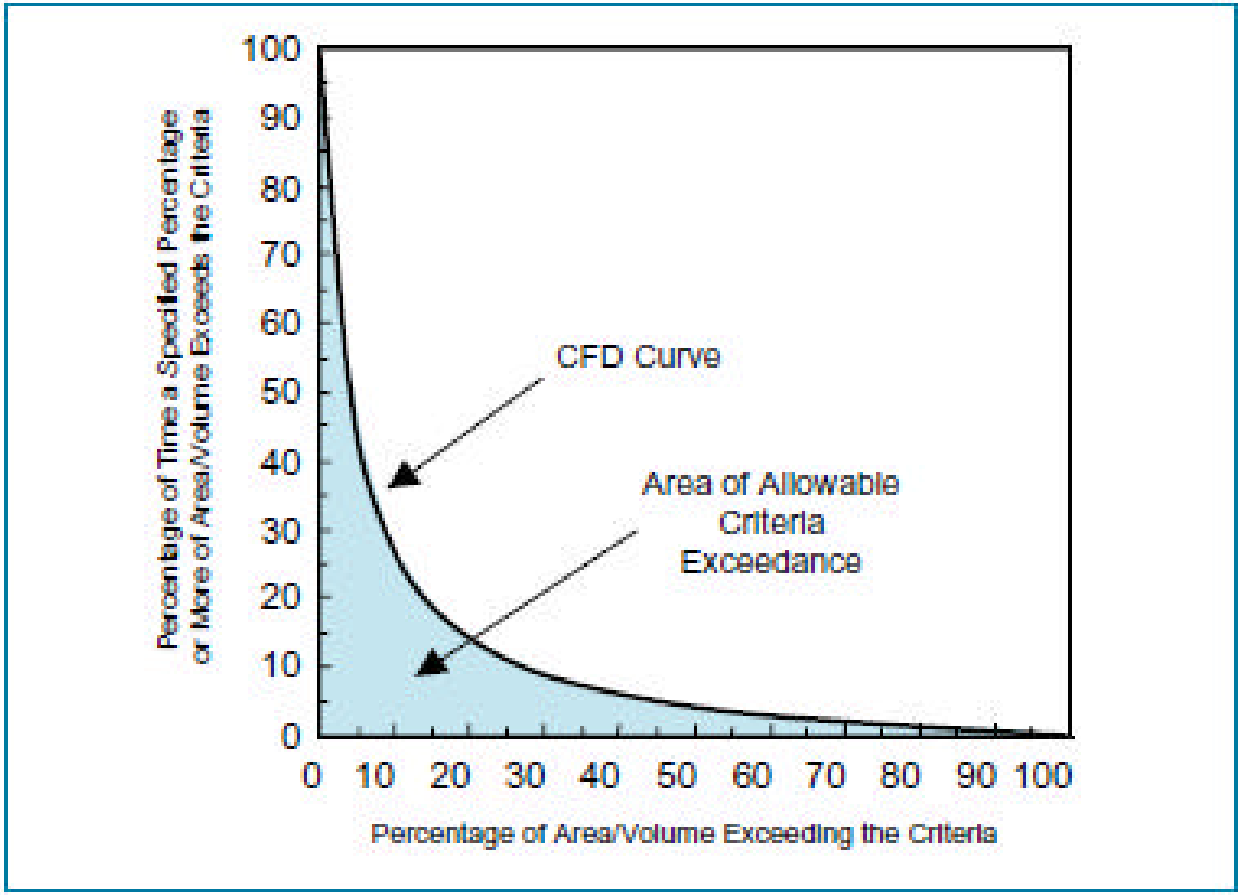
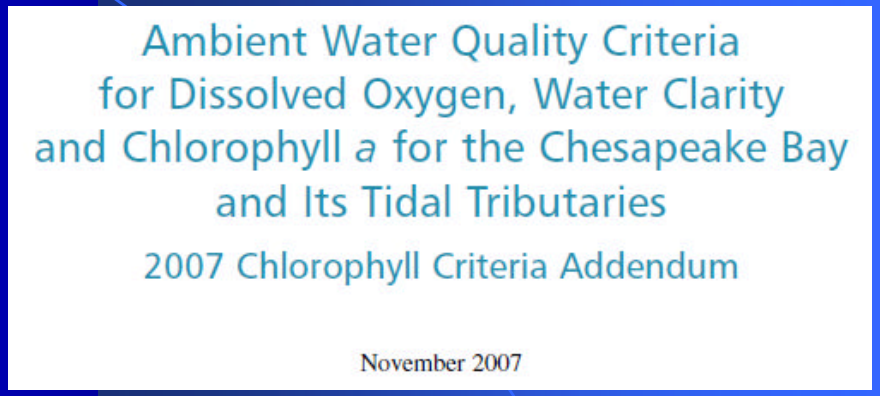


Figure VI-18. Cumulative frequency distribution curve in the shape of a hyperbolic curve that represents approximately 10 percent allowable exceedances equally distributed between time and space.

Alternative Considerations

Consideration of phytoplankton (chlorophyll-a) biomass contribution to dissolved oxygen impairment, water clarity impairment and harmful algal bloom impairment.

In James River, DO impairment is not really an issue.



Water clarity impairments need to take into consideration the influence of suspended inorganic solids and colored dissolved organic matter (CDOM) as well as chlorophyll-a.

HAB impairments are an issue in the James River:

- microcystin production in the upper James River
- larval fish mortality after exposure to Cochlodinium polykrikoides in the lower James River

Alternative Considerations

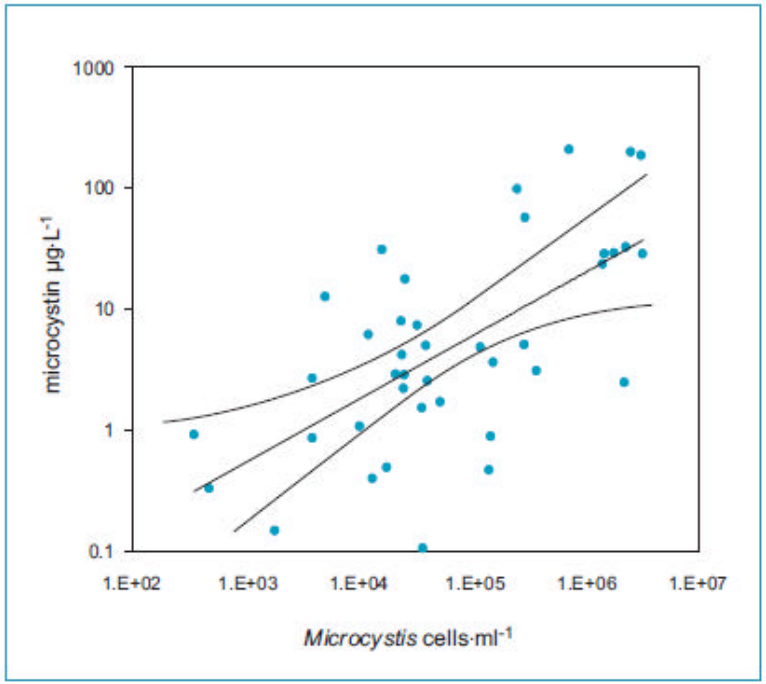


Figure VI-4. Microcystin toxin relationship with *Microcystis aeruginosa* concentrations for Chesapeake Bay monitoring data.

Source: Adapted from Tango and Butler 2007.

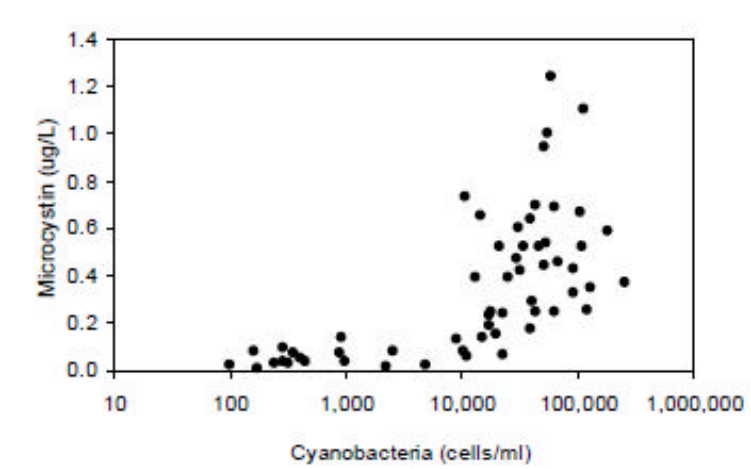
Ambient Water Quality Criteria for Dissolved Oxygen, Water Clarity and Chlorophyll *a* for the Chesapeake Bay and Its Tidal Tributaries

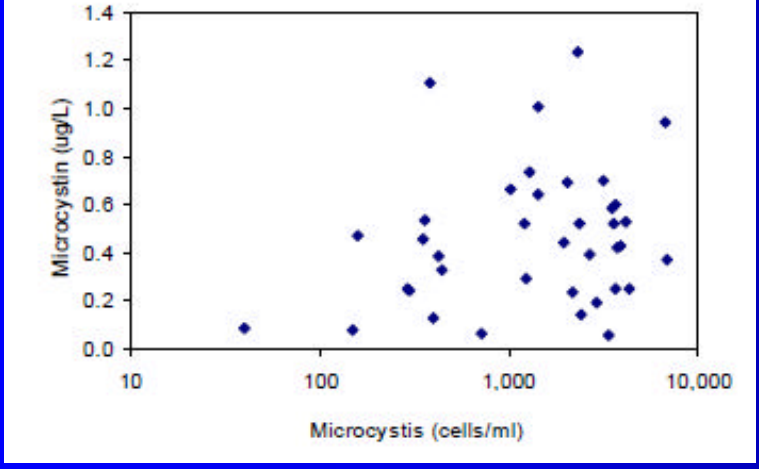
2007 Chlorophyll Criteria Addendum

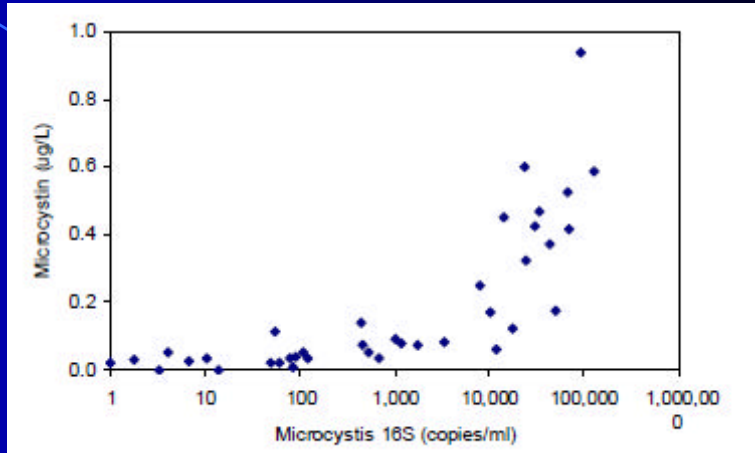
November 2007

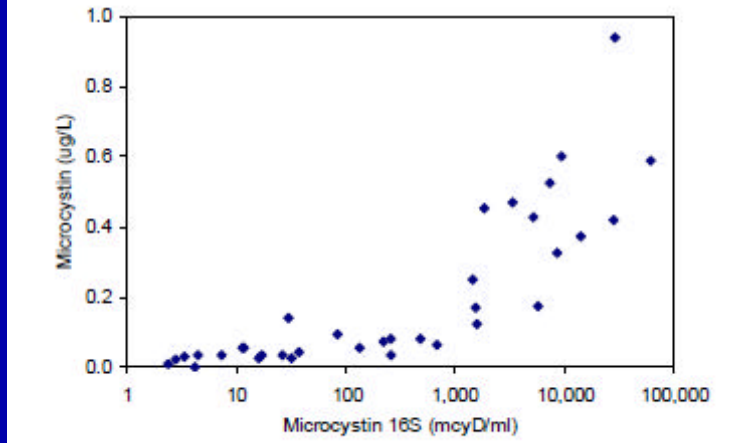
Buchanan al. (2005) performed analysis to determine the chlorophyll-a thresholds that would prevent Microcystis bloom events. Average thresholds that separated high-risk conditions from middle and low-risk conditions for surface and above-pycnocline chlorophyll-a were 28.96 and 29.17 ug/L, respectively

Alternative Considerations

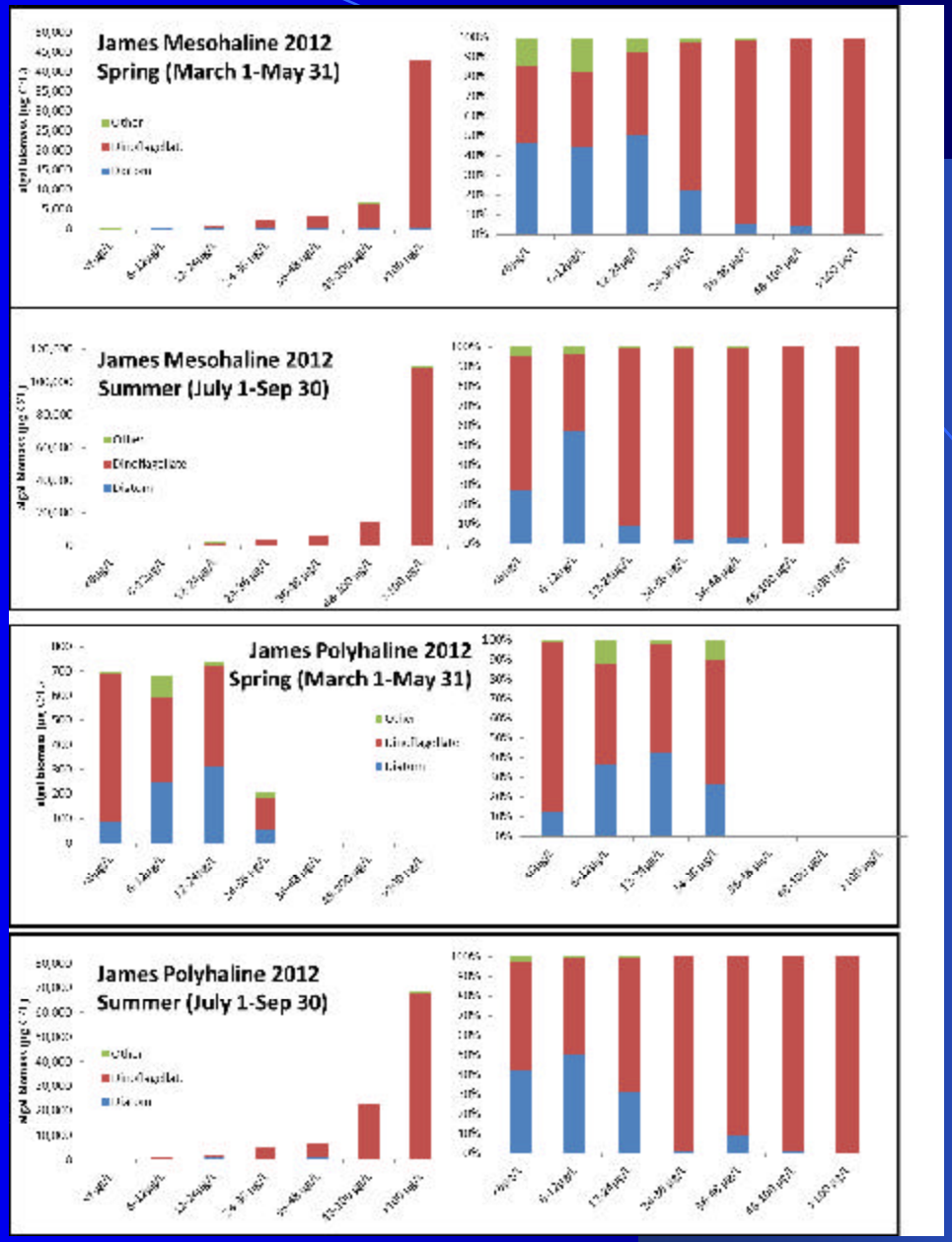








Alternative Considerations



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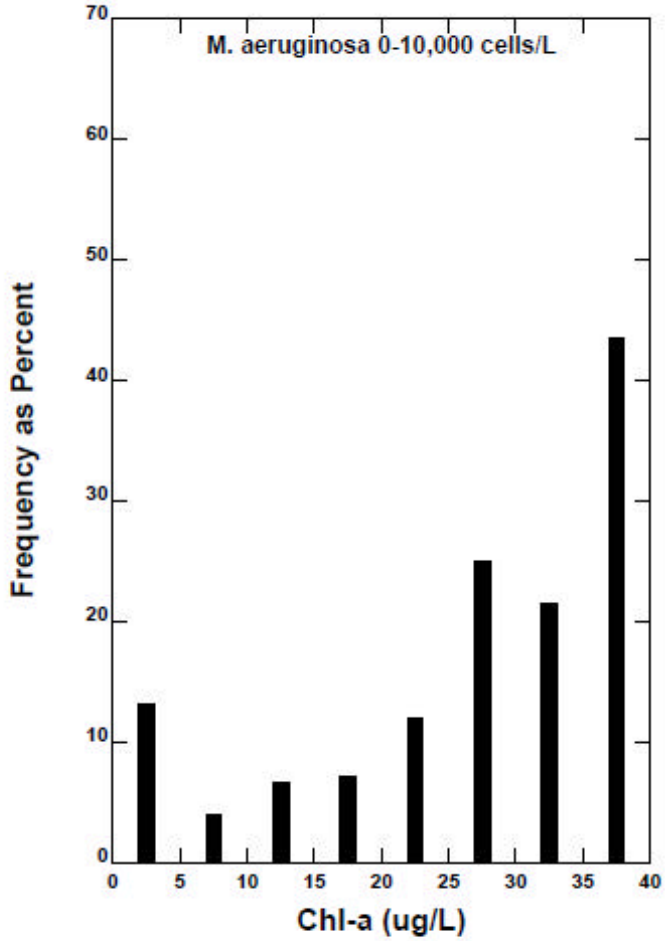


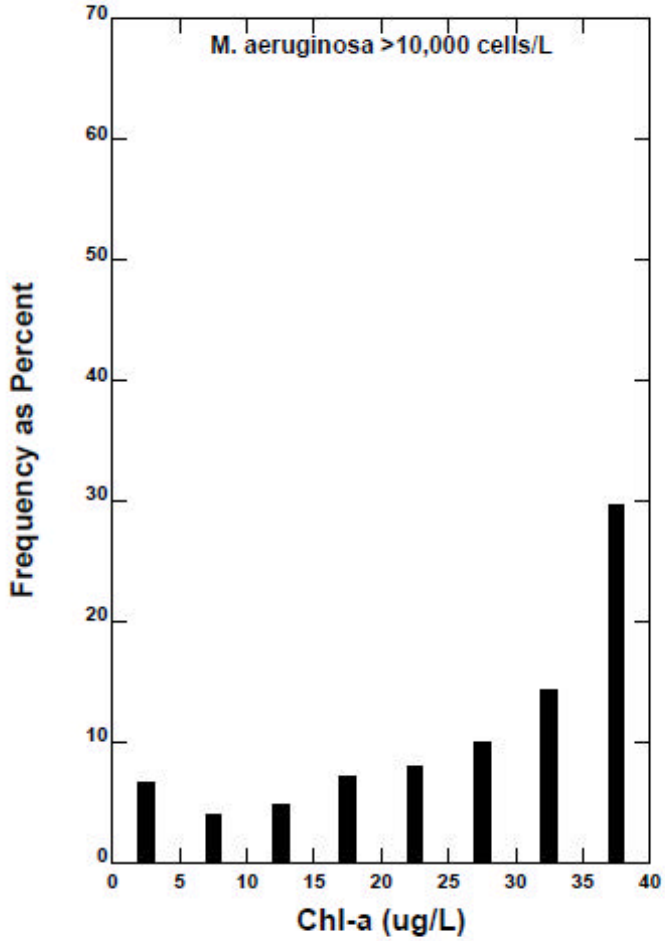


Figure 66. Frequency (as a Percent) of the Occurrence of Microcystis-aeruginosa as a Function of Chlorophyll-a for Stations TF5.4, TF5.5 and TF5.5A

Alternative Considerations

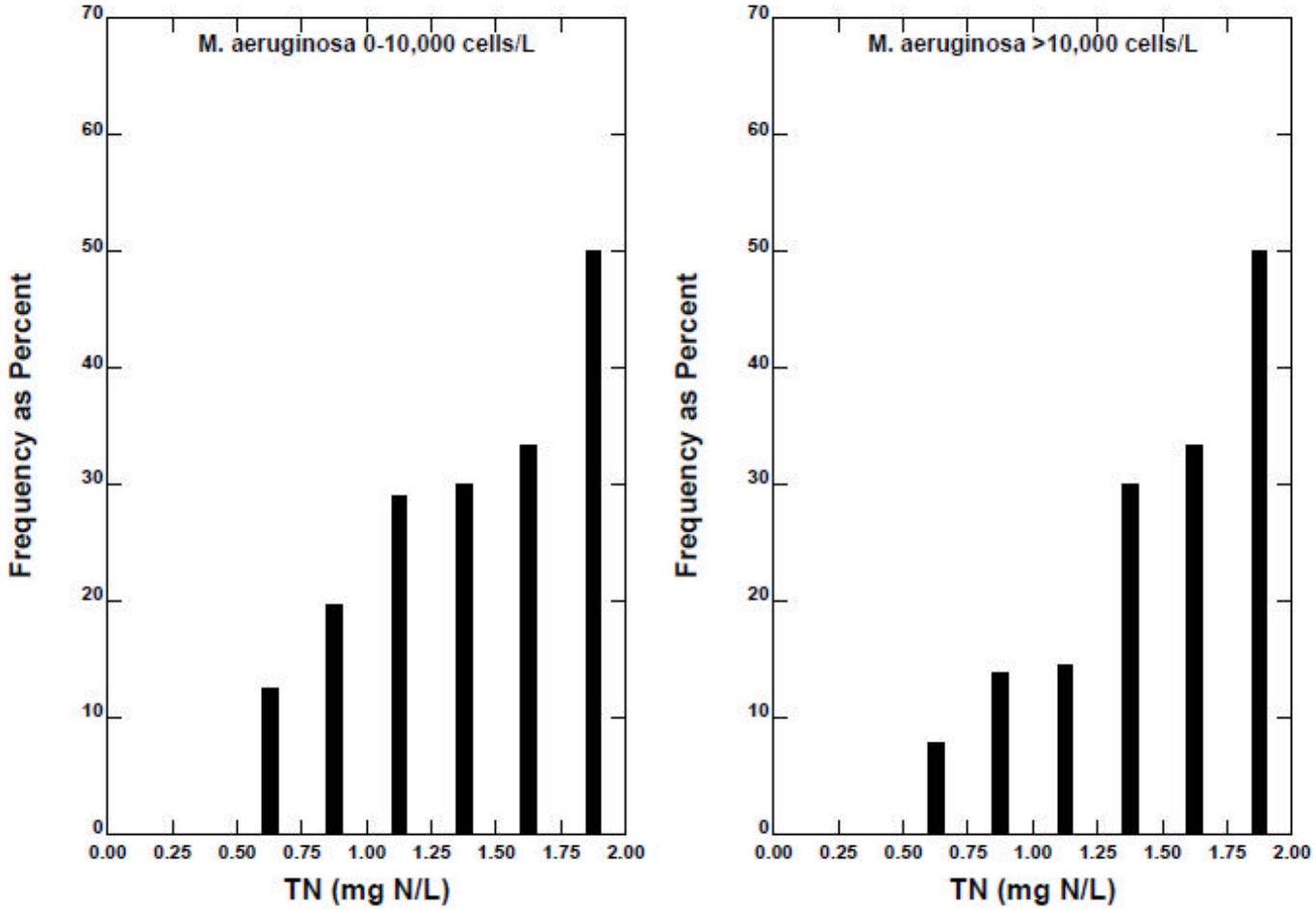


Figure 67. Frequency (as a Percent) of the Occurrence of Microcystis-aeruginosa as a Function of TN for Stations TF5.4, TF5.5 and TF5.5A

Alternative Considerations

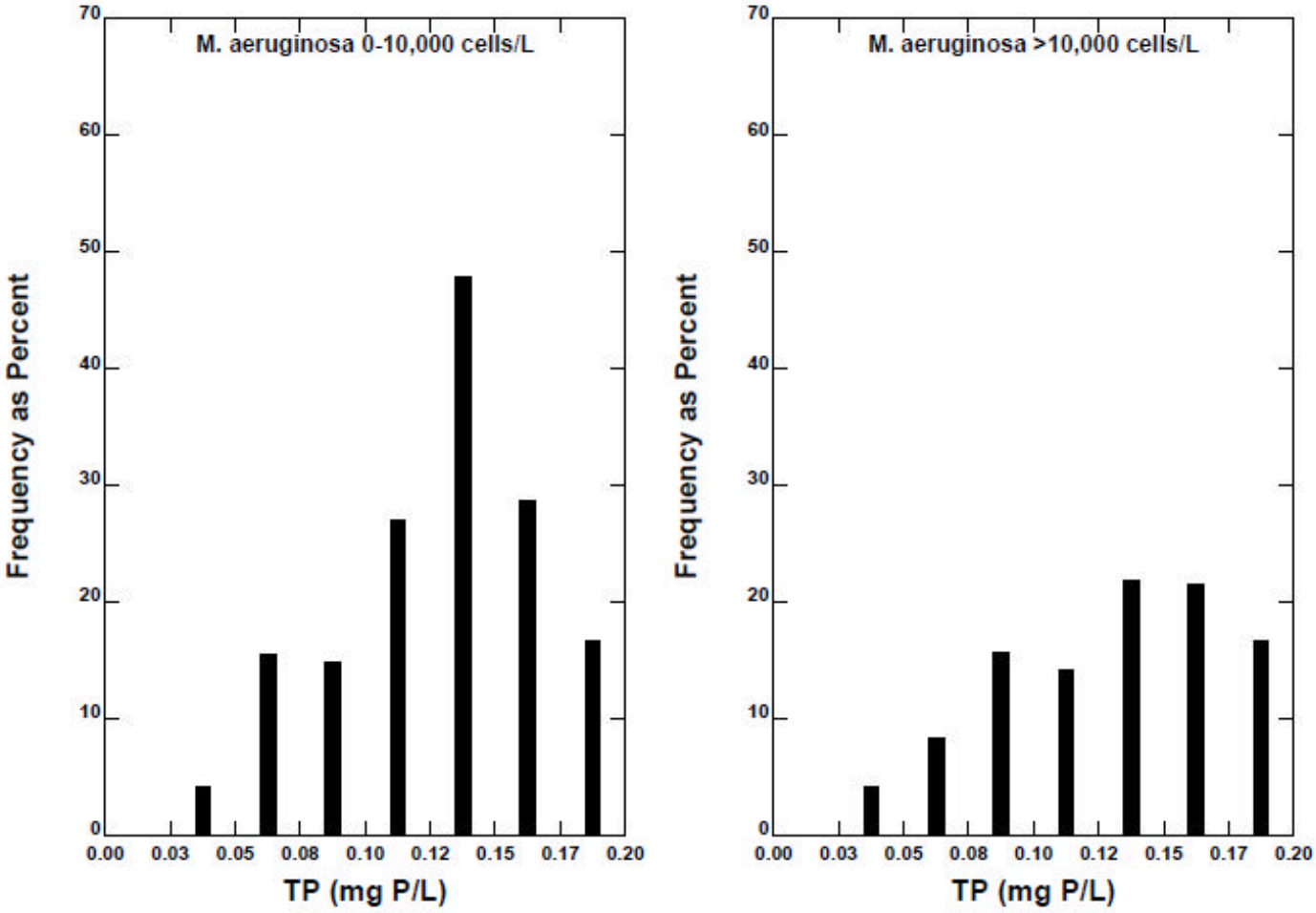
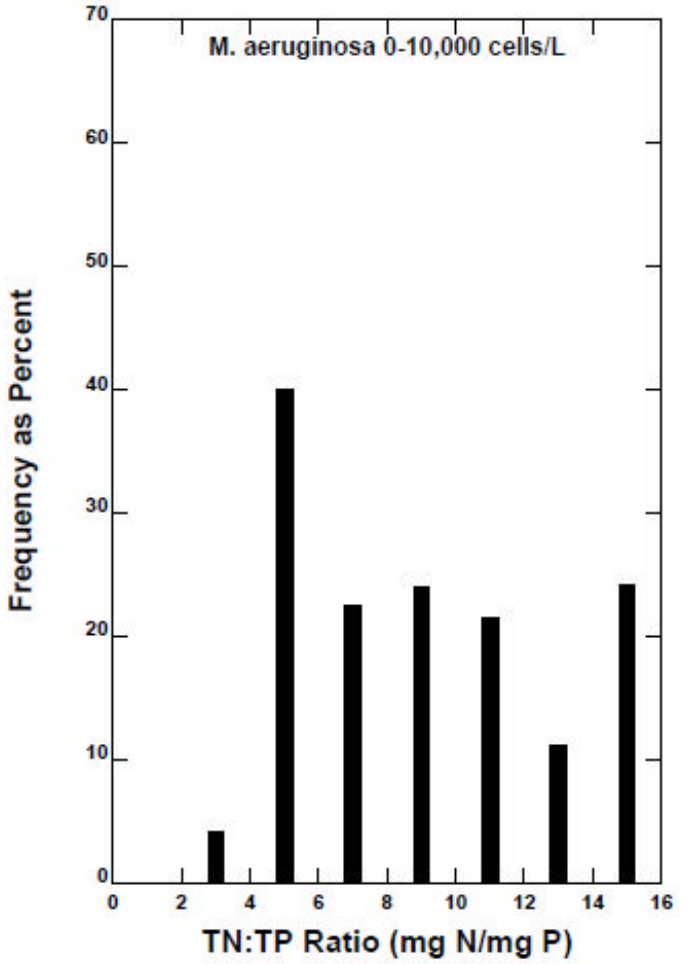


Figure 68. Frequency (as a Percent) of the Occurrence of Microcystis-aeruginosa as a Function of TP for Stations TF5.4, TF5.5 and TF5.5A

Alternative Considerations



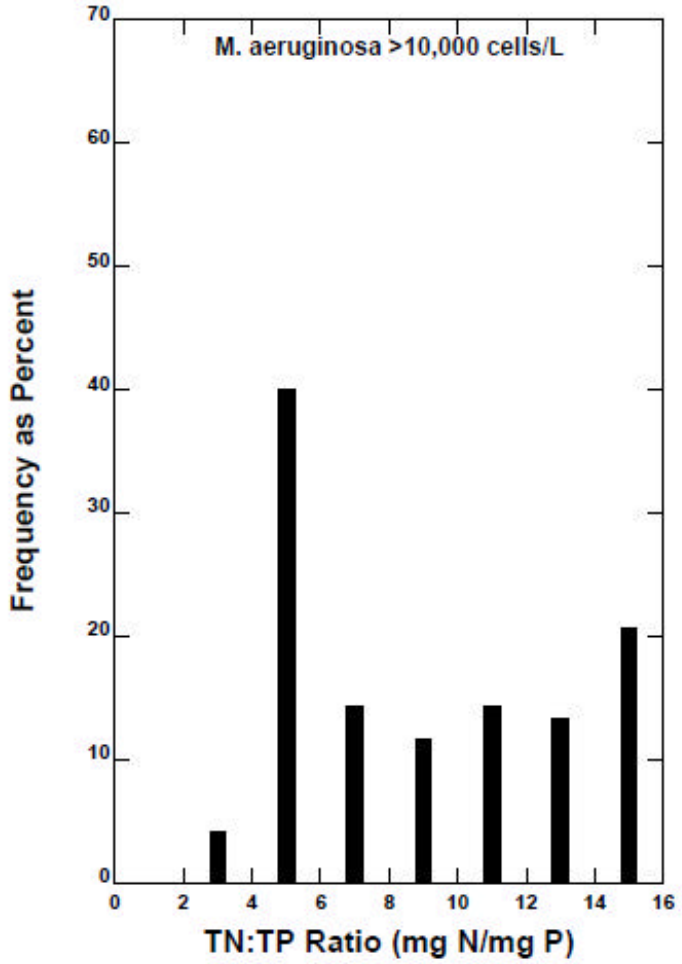
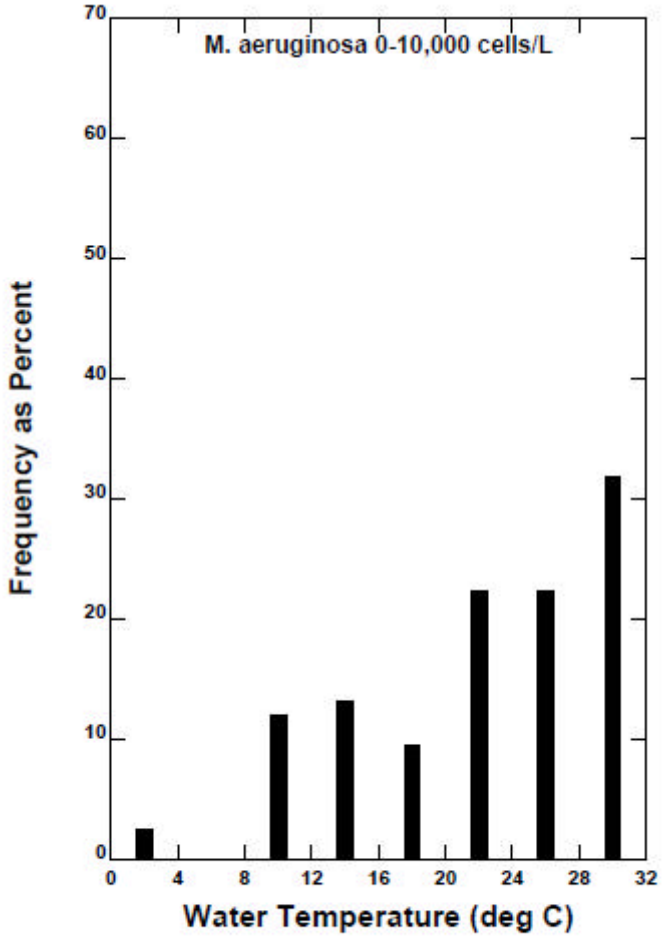


Figure 69. Frequency (as a Percent) of the Occurrence of Microcystis-aeruginosa as a Function of the Ratio of TN:TP for Stations TF5.4, TF5.5 and TF5.5A

Alternative Considerations



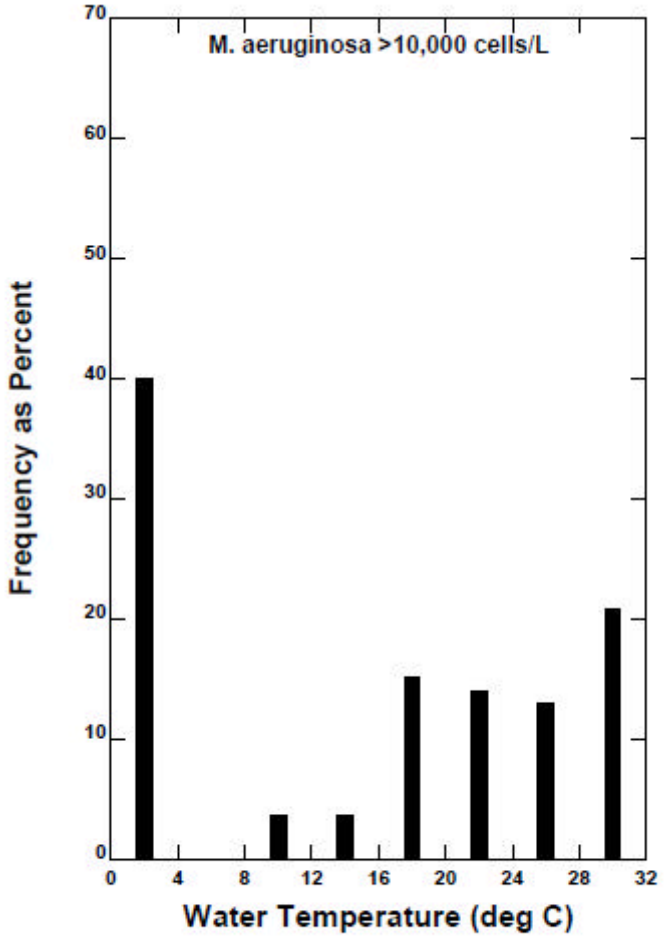


Figure 70. Frequency (as a Percent) of the Occurrence of Microcystis-aeruginosa as a Function of Water Temperature for Stations TF5.4, TF5.5 and TF5.5A

Alternative Considerations

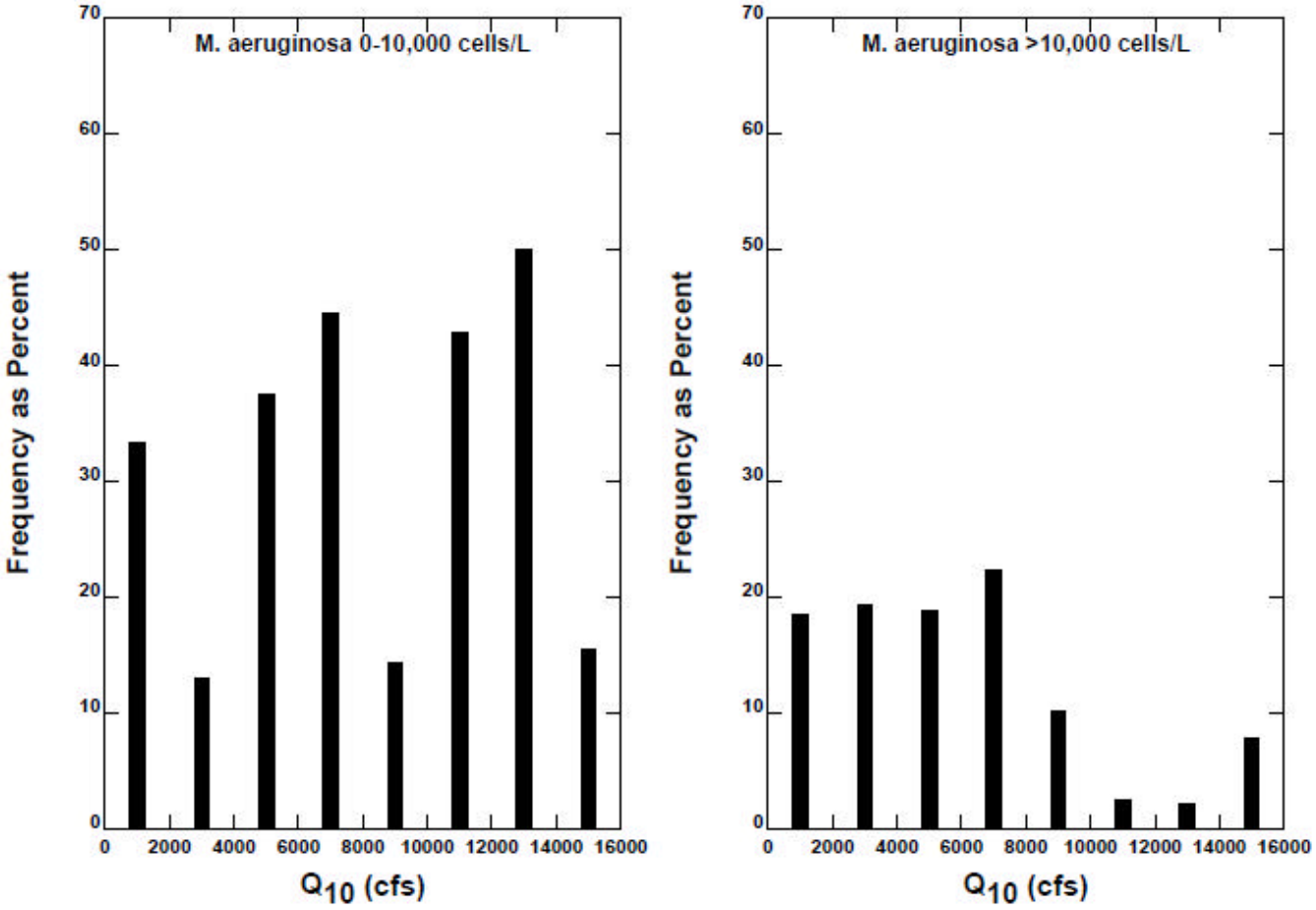


Figure 71. Frequency (as a Percent) of the Occurrence of Microcystis-aeruginosa as a Function of 10-day Averaged Freshwater Flow (Q10) for Stations TF5.4, TF5.5 and TF5.5A