
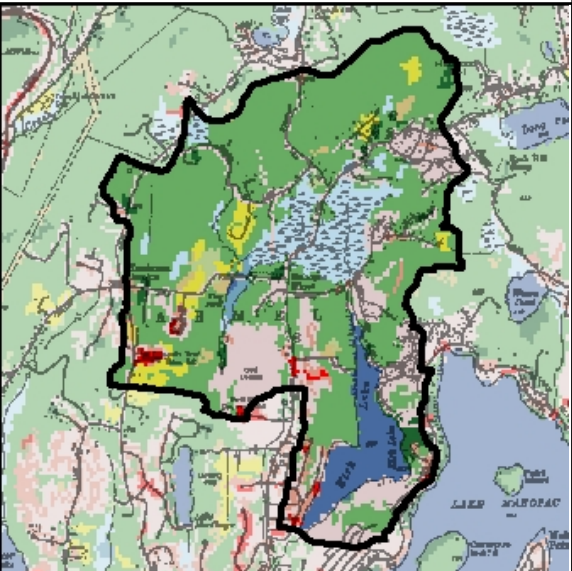











**Kirk Lake, Putnam Co., Kirk Lake Watershed Association**

|   |                                  |                          |                                   |
|---|----------------------------------|--------------------------|-----------------------------------|
|  |                                  |                          |                                   |
|  | <b>Lake Characteristics</b>      | Surface Area (ac/ha)     | 122   49                          |
|   |                                  | Max Depth (ft/m)         |                                   |
|   |                                  | Mean Depth (ft/m)        | 10   3                            |
|   |                                  | Retention Time (years)   | 0.24                              |
|   |                                  | Water Class              | B                                 |
|   |                                  | Dam Class                | B                                 |
|   | <b>Watershed Characteristics</b> | Watershed Area(ac/ha)    | 1985   803                        |
|   |                                  | Watershed/Lake Ratio     | 16                                |
|   |                                  | Lake and Wetlands        | 14.9%                             |
|   |                                  | Agricultural             | 3.5%                              |
|   |                                  | Forests, shrubs, grasses | 56.3%                             |
|   |                                  | Residential              | 25.2%                             |
|   | <b>CSLAP Participation</b>       | Years                    | 2011-2017                         |
|   |                                  | Volunteers               | Joseph Montuori, Patrick Montuori |

|                      |                            |                               |                       |
|----------------------|----------------------------|-------------------------------|-----------------------|
| <b>Trophic State</b> | <b>HABs Susceptibility</b> | <b>Invasive Vulnerability</b> | <b>PWL Assessment</b> |
| Mesoeutrophic        | Moderate                   | High                          | Stressed              |

| Open Water Indicators | 2017 Sampling Results |       |       |      |       |       |       |       |   | Seasonal Change | Long Term Avg. |
|-----------------------|-----------------------|-------|-------|------|-------|-------|-------|-------|---|-----------------|----------------|
|                       | 6/4                   | 6/17  | 7/1   | 7/16 | 7/30  | 8/12  | 8/27  | 9/9   |   |                 |                |
| Chl.a (µg/L)          | 5                     | 5.4   | 7.5   | 6.5  | 7.8   | 6.7   | 18.9  | 12.7  |  | 12.8            |                |
| BG Chl.a (µg/L)       | 0.5                   | 0.5   | 1.3   | 4.8  | 3.9   | 4.2   | 8.9   | 6.1   |  | 6.4             |                |
| Clarity (m)           | 3.3                   | 3.6   | 2.4   | 2.7  | 2.5   | 3.5   | 1.6   | 1.5   |  | 2.1             |                |
| pH                    | 7.1                   | 6.6   | 7.4   | 7.1  | 7.6   | 7.6   | 8.5   | 7.8   |  | 7.9             |                |
| Cond (µmho/cm)        | 449.3                 | 443.7 | 377.6 | 472  | 488.9 | 459.2 | 492.9 | 486.6 |  | 353             |                |
| Surf Temp (°C)        | 19                    | 22    | 25    | 25   | 24    | 24    | 24    | 24    |  | 24              |                |
| TN (mg/L)             | .346                  | .362  | .657  | .307 | .728  | .425  | .633  | .577  |  | 0.608           |                |
| TP (mg/L)             | .021                  | .021  | .018  | .013 | .015  | .019  | .028  | .027  |  | 0.023           |                |
| N:P Ratio             | 16                    | 17    | 37    | 24   | 49    | 22    | 23    | 21    |  |                 |                |

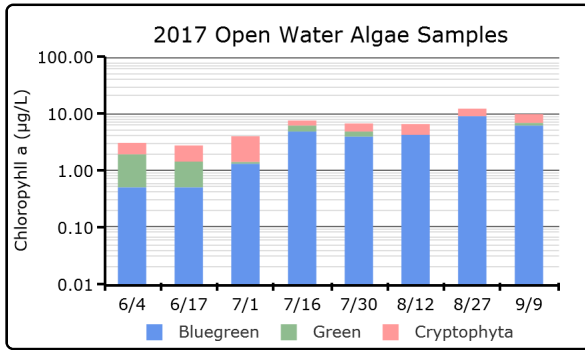
**Shoreline bloom and HABs notifications**

|                       |                      |                                     |                         |
|-----------------------|----------------------|-------------------------------------|-------------------------|
| Date of first listing | Date of last listing | # of weeks on DEC notification list | # of weeks with updates |
| 7/28/2017             | 7/28/2017            | 1                                   | 1                       |

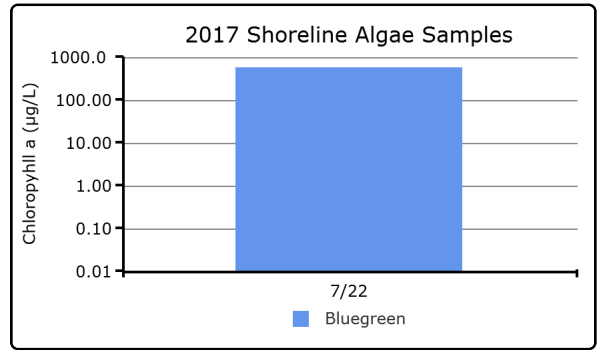
| Shoreline HAB Sample Dates 2017 |              | 7/22   |  |  |  |  |  |  |  |
|---------------------------------|--------------|--------|--|--|--|--|--|--|--|
| HAB Indicators                  | HAB Criteria |        |  |  |  |  |  |  |  |
| BGA                             | 25 µg/L      | 560.25 |  |  |  |  |  |  |  |
| Microcystin                     | 20 µg/L      |        |  |  |  |  |  |  |  |
| Anatoxin-a                      |              | ND     |  |  |  |  |  |  |  |

# HAB Status

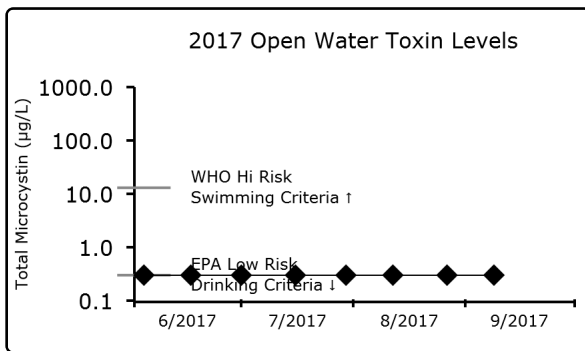
## 2017 Open Water Algae Samples



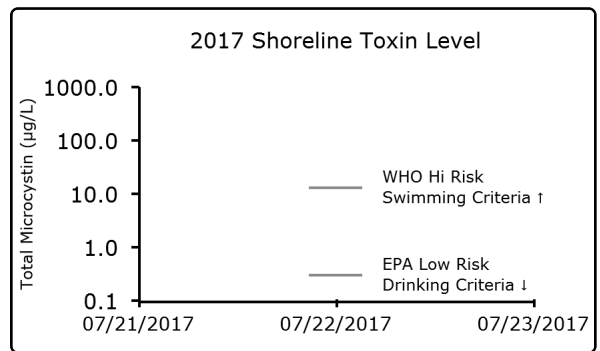
## 2017 Shoreline Algae Samples



## 2017 Open Water Toxin Levels

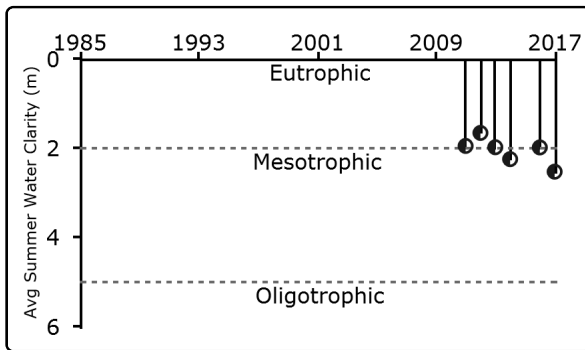


## 2017 Shoreline Toxin Levels

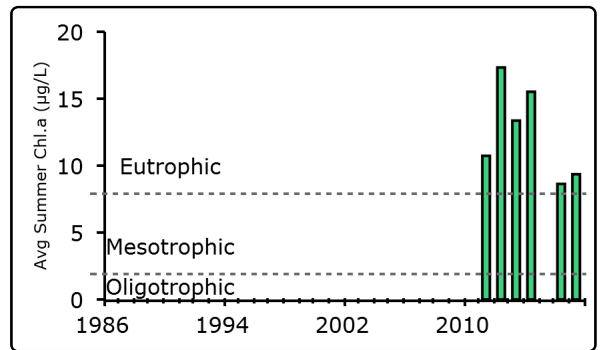


# Kirk Lake Long Term Trend Analysis

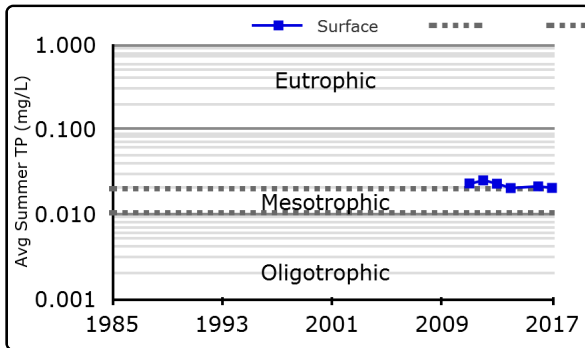
## Clarity



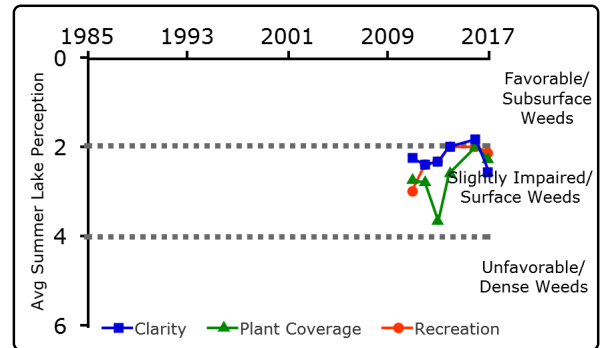
## Chlorophyll a



## Surface and Deep Phosphorus

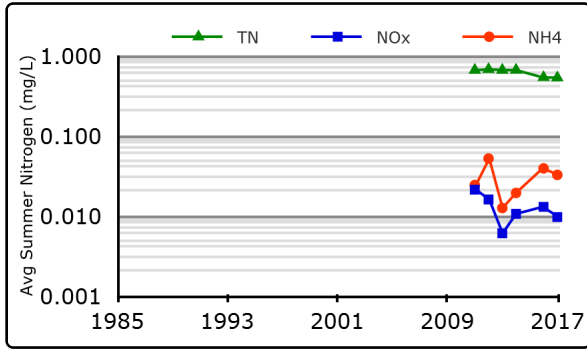


## Lake Perception

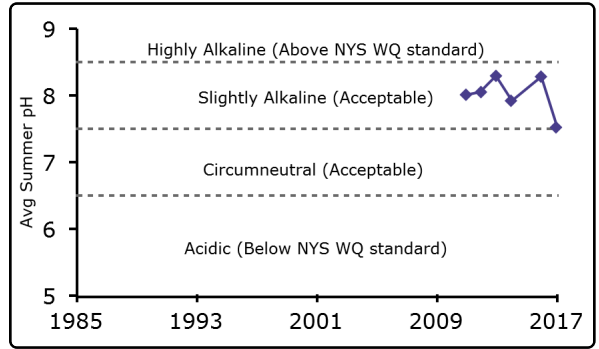


# Kirk Lake Long Term Trend Analysis

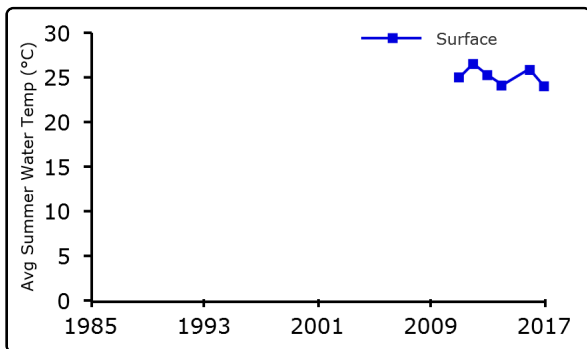
## Nitrogen



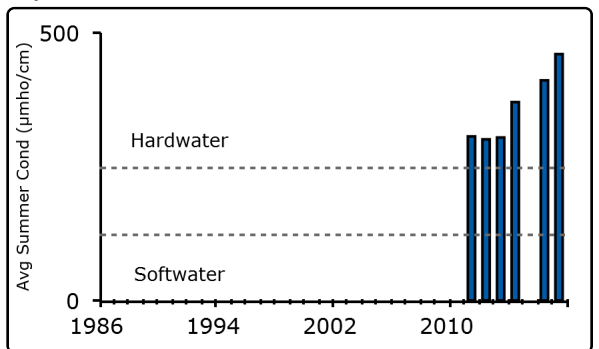
## pH



## Temperature

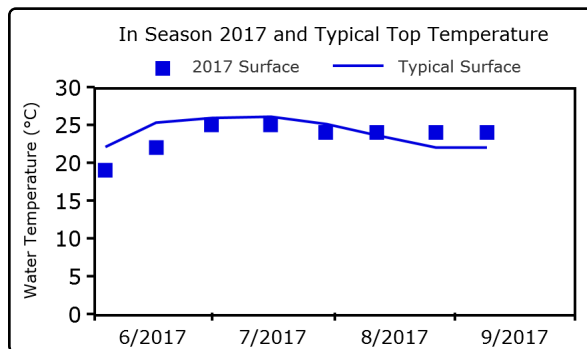


## Specific Conductance

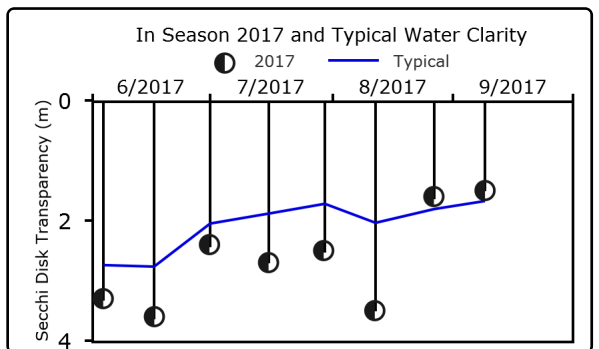


# Kirk Lake In-Season Analysis

## In Season Temperature
























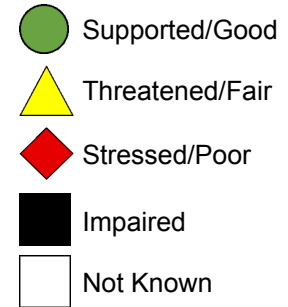
## In Season Water Clarity



# Scorecard

## Lake Use

|                  |   |   |   |                 |
|------------------|---|---|---|-----------------|
| Potable Water    |  |  |  | Not applicable  |
| Swimming         |  |  |  | No impacts      |
| Recreation       |  |  |  | Algae levels    |
| Aquatic Life     |  |  |  | No impacts      |
| Aesthetics       |  |  |  | Algae blooms    |
| Habitat          |  |  |  | Invasive plants |
| Fish Consumption |  |  |  | Not applicable  |



PWL      Average Year      2017      Primary Issue

## Summary

**2017 compared to prior years:** Kirk Lake is usually (slightly) *eutrophic*, based on low water clarity and high nutrient (phosphorus) and algae (chlorophyll *a*) levels. However, water clarity was much higher than usual in 2017, due to lower phosphorus (, nitrogen) and chlorophyll *a* levels. Conductivity was substantially higher than normal, although pH dropped slightly. There was slightly less surface coverage of aquatic plants in 2017; this may have contributed to slightly more favorable recreational assessments.

**Compared to nearby lakes:** Kirk Lake usually has lower water clarity, but slightly lower nutrient levels and algae levels, than other nearby (Lower Hudson region) lakes, although as noted above, the lake was less productive than usual in 2017. Aquatic plant coverage is comparable in many of these other lakes, perhaps reflecting management. Chloride levels are above the 75th percentile of New York state lakes, indicating the potential for aquatic life impacts (although no aquatic life impacts have been measured or reported).

**Trends:** Conductivity has increased substantially in recent years, and total nitrogen levels have decreased. Phosphorus readings have decreased, and lake perception (water quality, plant coverage, and recreation) have improved, but these changes are not significant.

**Algal blooms and HABS:** Kirk Lake exhibits periodic shoreline blue green algae blooms, comprised of a mix of cyanobacteria species. At times these blooms have measurable to slightly elevated toxin levels. Open water algae levels are occasionally elevated and most frequently comprised of *Anabaena*, and toxin levels are consistently low. No open water or shoreline blooms were reported in 2017.

**Aquatic invasive species:** Eurasian watermilfoil and water chestnut has been reported on Kirk Lake. Excessive weed growth is managed by hand harvesting. The lake is susceptible to other AIS due to eutrophic conditions. Although calcium levels appear to be high enough to support zebra mussels, these invasive mussels have not been found in the lake.

**Indicated Actions:** Individual stewardship activities such as pumping your septic system, growing a buffer of native plants next to the water bodies, and reducing erosion from shoreline properties and runoff into the lake will help to improve lake health by reducing nutrient and sediment loading to the lake. Visiting boats should be inspected to reduce the risk of new invasive species, and continued monitoring for invasive species is warranted. Continued algae bloom education and monitoring for HABS is recommended, particularly since shoreline blooms are periodically reported in the lake.

## How to Read the Report

This guide provides a description of the CSLAP report by section and a glossary. The sampling site is indicated in the header for lakes with more than one routine sampling site.

### **Physical Characteristics influence lake quality:**

- Surface area is the lake's surface in acres and hectares.
- Max depth is the water depth measured at the deepest part of the lake in feet and meters.
- Mean depth is either known from lake bathymetry or is 0.46 of the maximum depth.
- Retention time is the time it takes for water to pass through a lake in years. This indicates the influence of the watershed on lake conditions.
- Lake classification describes the "best uses" for this lake. Class AA, AAspec, and A lakes may be used as sources of potable water. Class B lakes are suitable for contact recreational activities, like swimming. Class C lakes are suitable for non-contact recreational activities, including fishing, although they may still support swimming. The addition of a T or TS to any of these classes indicates the ability of a lake to support trout populations and/or trout spawning.
- Dam classification defines the hazard class of a dam. Class A, B, C, and D dams are defined as low, intermediate, high, or negligible/no hazard dams in that order. "0" indicates that no class has been assigned to a particular dam, or that no dam exists.

### **Watershed characteristics influence lake water quality:**

- Watershed area in acres and hectares
- Land use data come from the most recent (2011) US Geological Survey National Land Use Cover dataset

**CSLAP Participation** lists the sampling years and the current year volunteers.

### **Key lake status indicators summarize lake conditions:**

- Trophic state of a lake refers to its nutrient loading and productivity, measured by phosphorus, algae, and clarity. An oligotrophic lake has low nutrient and algae levels (low productivity) and high clarity while a eutrophic lake has high nutrient and algae levels (high productivity) and low clarity. Mesotrophic lakes fall in the middle.
- Harmful algal bloom susceptibility summarizes the available historical HAB data and indicates the potential for future HAB events.
- Invasive vulnerability indicates whether aquatic invasive species are found in this lake or in nearby lakes, indicating the potential for further introductions.
- Priority waterbody list (PWL) assessment is based on the assessment of use categories and summarized as fully supported, threatened, stressed,

impaired, or precluded. Aesthetics and habitat are evaluated as good, fair, or poor. The cited PWL assessment reflects the “worst” assessment for the lake. The full PWL assessment can be found at <http://www.dec.ny.gov/chemical/36730.html#WIPWL>.

### **Current year sampling results**

- Results for each of the sampling sessions in the year are in tabular form. The seasonal change graphically shows the current year results. Red shading indicates eutrophic readings.
- HAB notification periods on the DEC website, updated weekly <http://www.dec.ny.gov/chemical/83310.html>
- Shoreline HAB sample dates and results. Samples are collected from the area that appears to have the worst bloom. Red shading indicates a confirmed HAB.
- HAB sample algae analysis. Algae types typically change during the season. These charts show the amount of the different types of algae found in each mid-lake or shoreline sample. Samples with high levels of BGA are HABs. The second set of charts show the level of toxins found in open water and shoreline samples compared to the World Health Organization (WHO) guidelines.
- If there are more than ten shoreline bloom samples collected in a year, bloom sample information is instead summarized by month (May-Oct.) as minimum, average, and maximum values for blue-green algae and microcystin.

**Long Term Trend Analysis** puts the current year findings in context. Summer averages (mid-June thru mid-September) for each of the CSLAP years show trends in key water quality indicators. The graphs include relevant criteria (trophic categories, water quality standards, etc.) and boundaries separating these criteria.

**In-Season Analysis** shows water temperature and water clarity during the sampling season. These indicate seasonal changes and show the sample year results compared to the typical historical readings for those dates.

**The Lake Use Scorecard** presents the results of the existing Priority Waterbody List assessment for this lake in a graphical form and compares it to information from the current year and average values from CSLAP data and other lake information. Primary issues that could impact specific use categories are identified, although more issues could also affect each designated use.

**The Lake Summary** reviews and encapsulates the data in the lake report, and provides suggested actions for lake management.

## Glossary of water quality and HAB indicators

**Clarity (m):** The depth to which a Secchi disk lowered into the water is visible, measured in meters. Water clarity is one of the trophic indicators for each lake.

**TP (mg/L):** Total phosphorus, measured in milligrams per liter at the lake surface (1.5 meters below the surface). TP includes all dissolved and particulate forms of phosphorus.

**Deep TP:** Total phosphorus measured in milligrams per liter at depth (1-2 meters above the lake bottom at the deepest part of the lake)

**TN:** Total nitrogen, measured in milligrams per liter at the lake surface. TN includes all forms of nitrogen, including **NO<sub>x</sub>** (nitrite and nitrate) and **NH<sub>4</sub>** (ammonia).

**N:P Ratio:** The ratio of total nitrogen to total phosphorus, unitless (mass ratio). This ratio helps determine if a lake is phosphorous or nitrogen limited.

**Chl.a (µg/L):** Chlorophyll a, measured in micrograms per liter. Indicates the amount of algae in the water column.

**pH:** A range from 0 to 14, with 0 being the most acidic and 14 being the most basic or alkaline. A healthy lake generally ranges between 6.5 and 8.5.

**Cond (µmho/cm):** Specific conductance is a measure of the conductivity of water. A higher value indicates the presence of more dissolved ions. High ion concentrations indicate hardwater, and low show softwater.

**Upper Temp (°C):** Surface temperature, measured in degrees Celsius

**Deep Temp (°C):** Bottom temperature, measured in degrees Celsius

**BG Chl.a (µg/L):** Chlorophyll a from blue-green algae, measured in micrograms per liter

**HABs: Harmful Algal Blooms.** Algal blooms that have the appearance of cyanobacteria (BGA)

**BGA:** Blue-green algae, also known as cyanobacteria

**Microcystin (µg/L):** The most common HAB liver toxin; total microcystin above 20 micrograms per liter indicates a “high toxin” bloom. However, ALL BGA blooms should be avoided, even if toxin levels are low.

**Anatoxin-a (µg/L):** A toxin that may be produced in a HAB which targets the central nervous system. Neither EPA nor NYS has developed a risk threshold for anatoxin-a, although readings above 4 micrograms per liter are believed to represent an elevated risk.