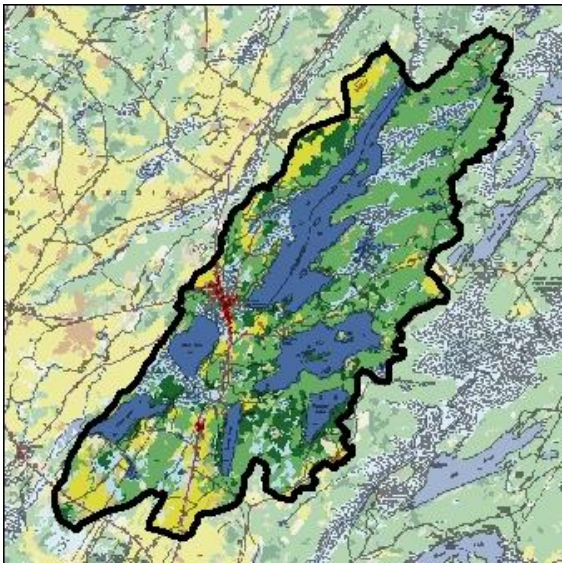
Butterfield Lake	Butterfield Lake Cottage Owners' Association	Town of Redwood	Jefferson County



Lake Characteristics	Surface area (ac/ha)	1005 / 407
	Max depth (ft/m)	48 / 15
	Mean depth (ft/m)	14 / 3
	Retention time (years)	2.3
	Lake Classification	B
	Dam Classification	0
Watershed Characteristics	Watershed area (ac /ha)	4250/1720
	Watershed / Lake ratio	4
	Lake & wetlands %	35%
	Agricultural %	10%
	Forest, shrub, grasses %	53%
	Residential	3%
	Urban	0%
CSLAP Participation	Years	1986-2010, 2012-2019
	Volunteers	Walter Dutcher

Trophic state	HABs Susceptibility	Invasive Vulnerability	PWL Assessment
Mesoeutrophic	Frequent blooms, Moderate Susceptibility	Invasives present, High Vulnerability	Stressed

Butterfield Lake – 2019 Sampling Season Results

"Seasonal change" shows current year variability. Light red color indicates eutrophic conditions in top table and bloom conditions in bottom table. Summer averages for each of the CSLAP years and long term trend analyses show trends in key water quality indicators over a consistent index period (mid-June thru mid-September).

Open Water Indicators	2019 Sampling Results								Seasonal change	Long Term Avg	Long Term Trend?	19 Diff from Avg
	6/8	6/24	7/5	7/20	8/4	8/19	9/1	9/15				
Clarity (m)	4.1	4.8	3.7	3.0	3.0	2.4	3.4	3.2		2.8	no	no
Surface TP (mg/l)										0.017	no	
Surface TDP (mg/l)												
Deep TP (mg/l)						>0.02	>0.02	>0.02		0.166	↑	
Deep TDP (mg/l)						>0.02	<0.01	<0.01				
TN (mg/l)	0.341	0.396	0.381	0.413	0.488	0.467	0.419	0.461		0.501	no	no
TDN (mg/l)		0.334	0.356	0.314	0.469	0.386	0.402	0.386				
N:P Ratio										31		
Deep/Surface NH4	7	6	9	8	17		15	16		11		
Chl.a (ug/l)	3.0	2.6	3.2	5.4	12.4	12.9	13.1			9.9	no	no
pH	6.7	7.0	7.0	7.5	7.1	7.0	7.2	7.0		7.8	no	↓
Cond (umho/cm)	160	208	202	197	195	167	168	162		141	no	↑
Calcium (mg/L)	11				10					15	no	↓
Chloride (mg/L)		16		17		18		20		22	no	no
Upper Temp (degC)	18	21	25	25	23	24	21	19		22	no	no
Deep Temp (degC)	9	10	11	11	10	11	10	10		13	↓	no
FP BG Chl.a (ug/l)	0	2	1	8	19	11	12	14		4	no	↑
HABs reported?	no	no	no	no	no	no	no	no				

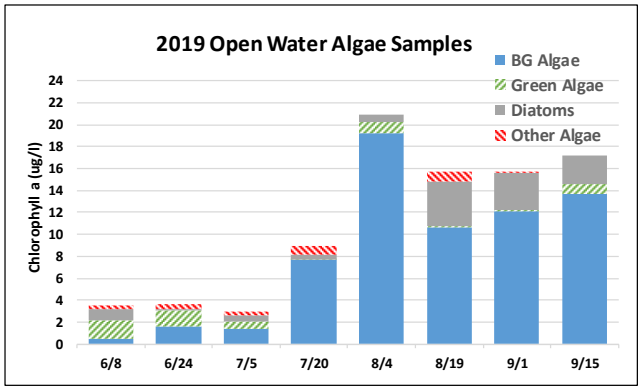
Shoreline bloom and HABs notifications

Date of first listing	Date of last listing
9/8/2019	9/8/2019

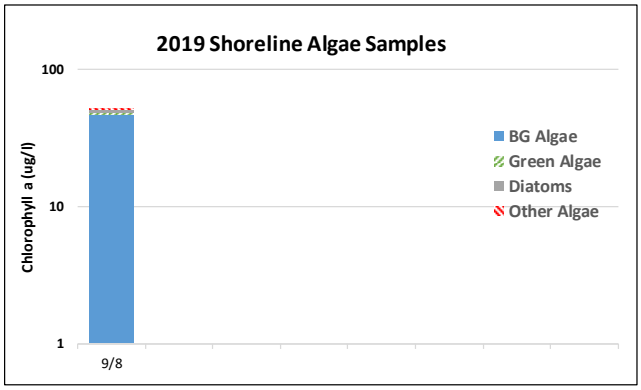
Shoreline HAB Sample Dates 2019

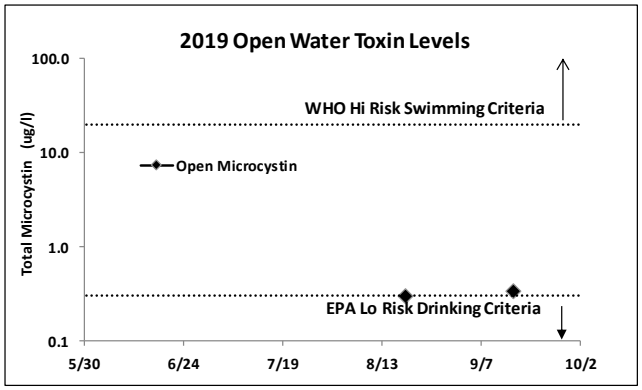
HAB Indicators	HAB criteria	9/8
BGA	25 - 30 ug/L	46.7
Microcystin	20 ug/L	0.4
Microscopy	Dominant	Dolichospermum, Anabaena, Tabellaria

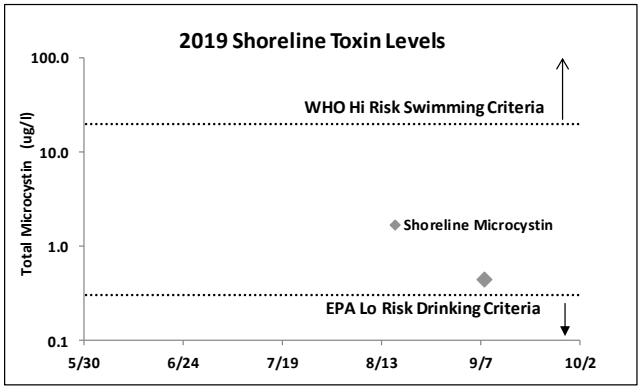
HABs Status Open water Algae



Shoreline Algae

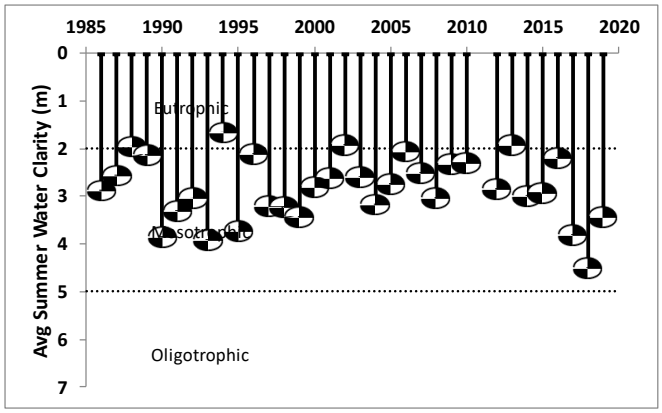




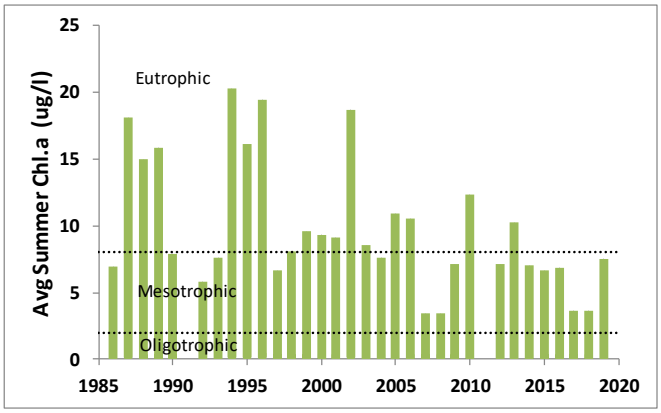


Butterfield Lake – Long-Term Trend Analysis

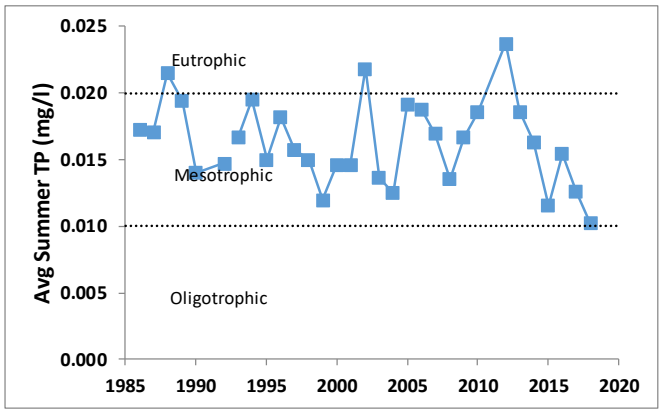
Clarity



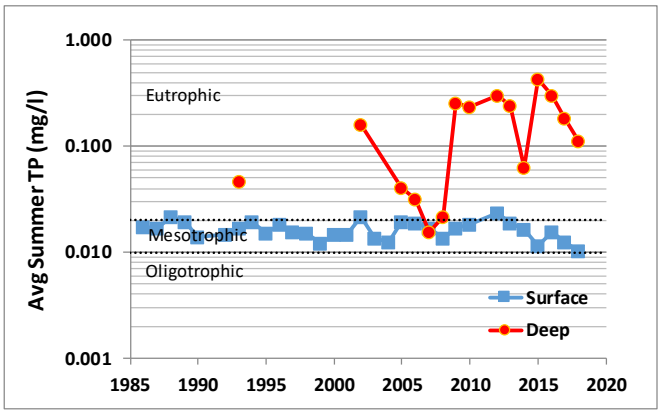
Chlorophyll *a*



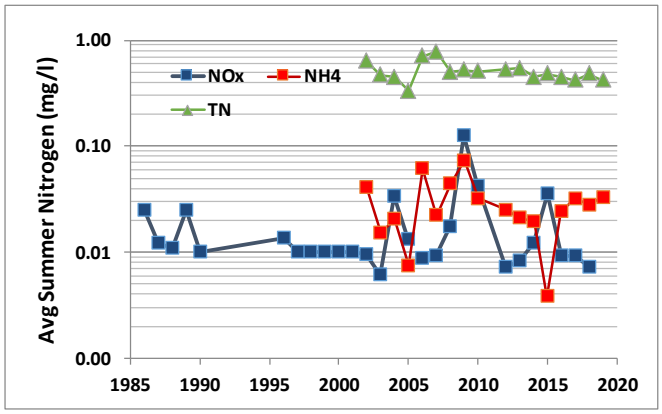
Surface Phosphorus



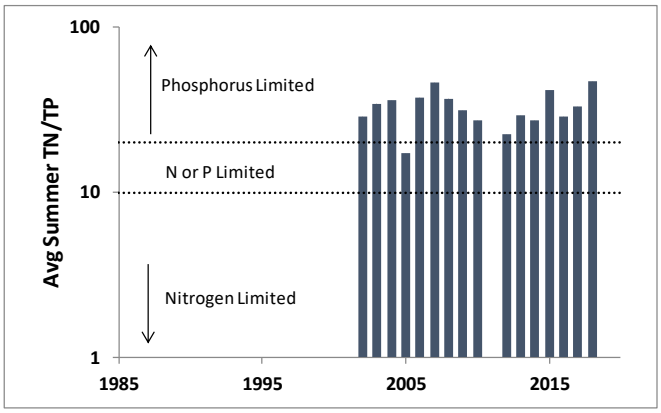
Surface and Deep Phosphorus



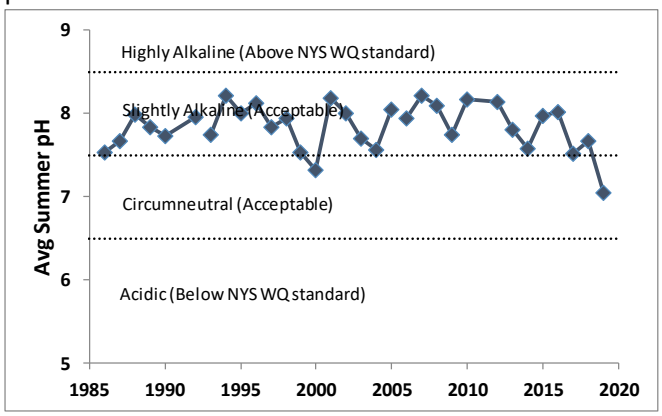
Nitrogen



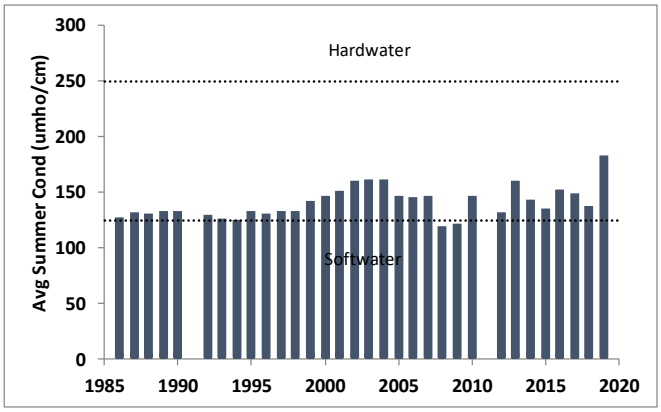
TN : TP



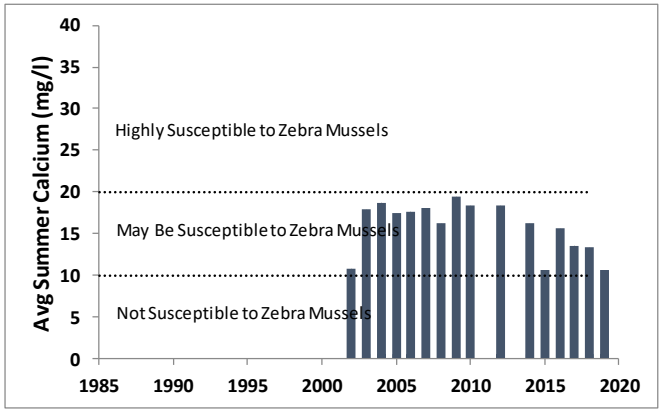
pH



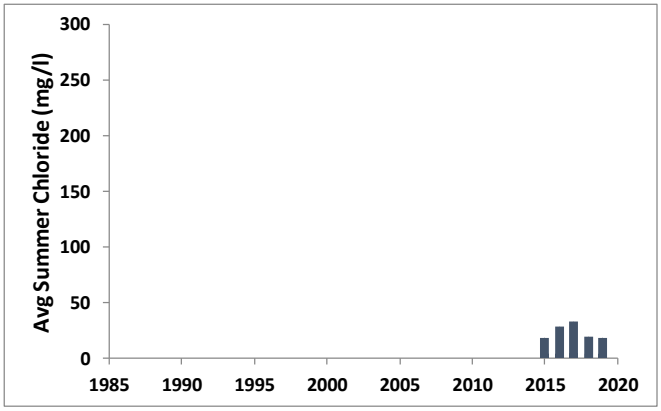
Specific Conductance



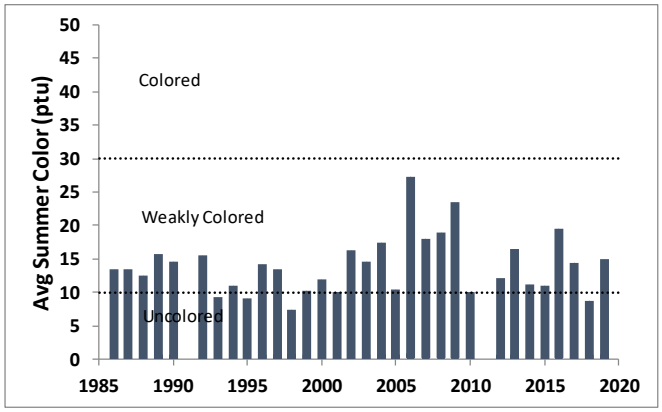
Calcium



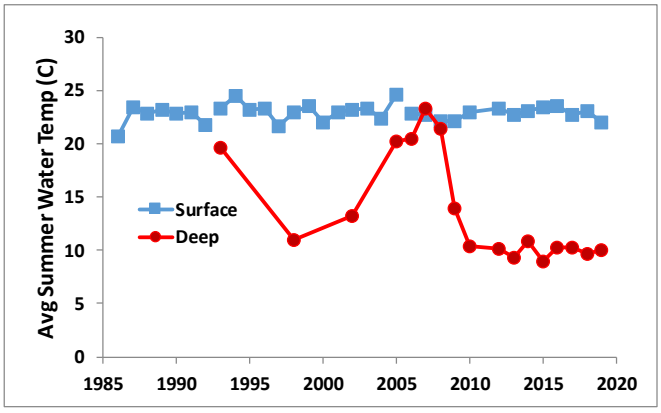
Chloride



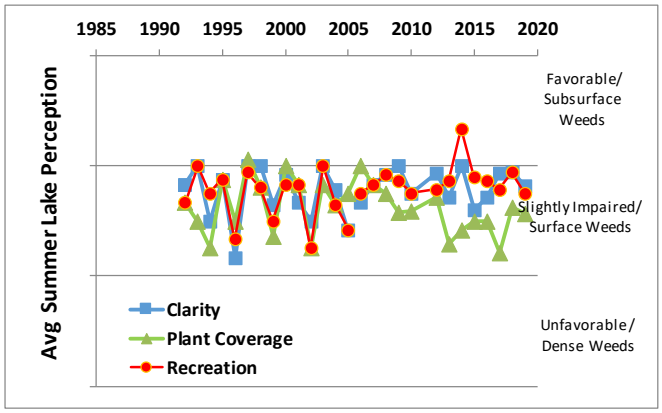
Color



Surface and Deep Temperature

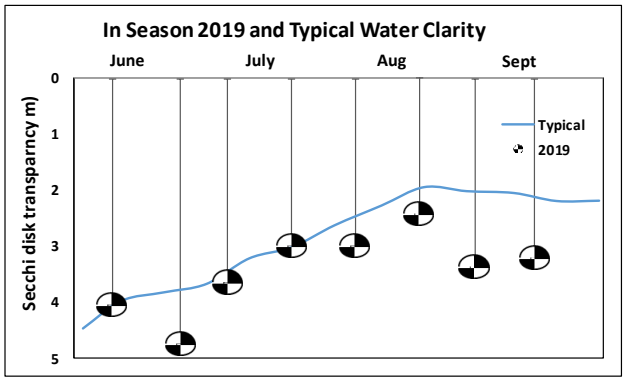


Lake Perception

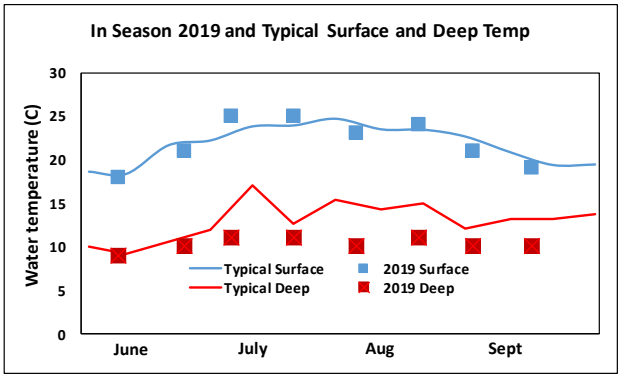


Butterfield Lake – In-Season Analysis

In Season Water Clarity



In Season Water Temperature



Butterfield Lake – Lake Scorecard

Water Quality Indicators		Average Year	2019
Trophic Status	Phosphorus	Mesotrophic	
	Chlorophyll A	Eutrophic	Mesotrophic
	Secchi	Mesotrophic	Mesotrophic
Aquatic Invasive Species		Present	
Lake Perception		Fair	Fair
Harmful Algal Blooms		Poor	Poor
Open Water Algae Levels		Fair	Fair

Water Quality Assessments

The Waterbody Inventory/Priority Waterbodies List (WI/PWL) is a statewide inventory of New York's water resources that is used to track a waters ability to support its' best use(s), identify pollutant(s) causing impairment of best use(s), and follow the status of restoration, protection and other water quality activities and efforts. Data collected through CSLAP contributes to the WI/PWL. In order to be included as an assessment unit in the WI/PWL, a lake, pond, or reservoir must be at least 6.4 acres in size.

To view current water quality assessment results:

- Visit https://www.dec.ny.gov/pubs/109457.html - follow the link to launch the DECinfo Locator
- Search for waterbody name, address or nearby landmark in the search tool at the top of the left banner
- Click and Expand the 'DEC Information Layers' tab of the left banner
- Click and expand the 'Environmental Monitoring' tab of the left banner
- Check the 'Lakes and Reservoirs' layer
- Click on the waterbody of interest in the map view to display a pop-up with more information about the waterbody
- Follow the 'Fact Sheet' link in the pop-up to learn more about the current use assessment of the waterbody

Lake Stewardship Actions

Individual stewardship activities can help improve water quality: maintain your septic system, reduce fertilizer use, grow a buffer of native plants next to the lake shore, and reduce shoreline erosion and runoff into the lake. Visiting boats should be inspected to prevent the spread of invasive species, and continued community education about and monitoring for invasive species is recommended. Routine education about algae and harmful algal blooms (HABs) within your lake community is recommended; to learn more about HABs and see examples of HABs visit http://www.dec.ny.gov/chemical/81962.html. Occurrences of HABs can be reported to NYSDEC. For more information on keeping New York waters clean, visit http://www.dec.ny.gov/public/43661.html.

Butterfield Lake - 2019 Lake Summary

Q. What is the condition of the lake?
A. Butterfield Lake continues to be mesoeutrophic, or moderately to highly productive, based on moderate water clarity, high algae levels (chlorophyll a), and moderate nutrient (phosphorus) levels. Soluble nutrients were analyzed again 2019. Most of the nitrogen in the lake is soluble, indicating a potential for more algae growth. The lake has near neutral pH, intermediate hardness water, moderately low water color, and moderately low nitrogen levels.

Q. How did 2019 compare to previous years?
A. Specific conductance and Blue green chlorophyll a readings were higher than normal in 2019. pH and Calcium readings were lower than normal in 2019. Each of the other water quality indicators was close to normal in 2019.

Q. How does this lake compare to other nearby lakes?
A. Compared to other nearby lakes, Butterfield Lake usually has higher pH, conductivity, calcium levels, and chloride levels. Butterfield Lake usually has similar water quality assessments, similar recreational assessments., and similar aquatic plant coverage.

Q. Are there any (statistically significant) trends?
A. Since 1986, deep phosphorus has increased slightly, and bottom water temperatures have decreased slightly.

Q. Has the lake experienced harmful algal blooms (HABs)?
A. Water quality conditions generally indicate a low susceptibility to blooms, with frequent blooms along the shoreline or in the open water. The open water algal community in the lake is usually comprised of high cyanobacteria levels. This community is dominated by *Anabaena*. Typically, open water algae levels are intermediate. Overall open water toxin levels are consistently below recreational levels of concern. Shoreline blooms have previously been documented in the lake, comprised primarily of cyanobacteria dominated by *Anabaena*. The shoreline algal community typically exhibits elevated toxin levels.

In 2019, overall algae levels were high, with cyanobacteria the most common taxa in open water samples, and with high cyanobacteria levels. Open water toxin levels were undetectable in 2019. Shoreline blooms in 2019 were documented in the lake, comprised primarily of cyanobacteria with at times low but detectable toxin levels. The most common taxa were *Anabaena.*

Q. Have any aquatic invasive species (AIS) been reported?
A. There is at least one invasive plant reported or present at Butterfield Lake. Invasive species reported in the lake include Eurasian watermilfoil, Curly leaf pondweed and frog bit. Zebra mussels have been reported in Butterfield Lake. Butterfield Lake has high vulnerability for new invasives, based on calcium levels.

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.

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 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 Scorecard represents key water quality indicator results for this lake in an easy-to-read format, comparing information from the current year and historical average of the CSLAP data. Indicators include (1) trophic status of phosphorus, chlorophyll (or algae) and secchi (or clarity); (2) presence or absence of aquatic invasive plants or animals; (3) lake user perception based on perceived physical condition and recreational suitability of the lake; (4) harmful algal bloom samples or reports; and (5) algae levels in the open water of routinely sampled sites.

The Lake Summary reviews and encapsulates the data in the lake report, including comparisons to historical data from this lake, and results from nearby lakes.

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 or a fixed depth in the hypolimnion of very deep lakes).

TN: Total nitrogen, measured in milligrams per liter at the lake surface. TN includes all forms of nitrogen, including **NOx** (nitrite and nitrate) and **NH_4** (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. This is an extracted chlorophyll measurement.

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 (> 250) usually indicate hardwater, and low readings (< 125) usually show softwater.

Calcium (mg/L): Calcium, a component of lake buffering capacity (the ability to neutralize acid inputs), as measured in milligrams per liter at the lake surface (1.5 meters below the surface).

Chloride (mg/L): Chloride, or chloride ions, as measured in milligrams per liter at the lake surface (1.5 meters below the surface).

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

Deep Temp (°C): Deep water temperature, measured in degrees Celsius.

BG Chl.a (µg/L): Chlorophyll a from blue-green algae, measured in micrograms per liter. This is an "unextracted" estimate using a fluoroprobe. This result is different from the extracted chlorophyll measurement described above.

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 pose a potential health risk and should be avoided.