Laurel Lake Questions and Answers, 2015 CSLAP

Q1. What is the condition of our lake this year?

A1. Water quality conditions in Laurel Lake have been fairly consistent over the last four years, showing moderate to low water clarity due to moderate to high nutrient and algae levels. Algae levels increase in late summer, leading to shoreline blue green algae blooms that have been reported in August to September in the last two years.

Q2. Is there anything new that showed up in the testing this year?

A2. Chloride sampling results are typical of lakes with low levels of road salt runoff, and it is not likely that any lake impacts from road salt have been apparent.

Q3. How does the condition of our lake this year compare with other lakes in the area?

A3. Laurel Lake had slightly lower water clarity, but similar nutrient and algae levels, than the typical lake in the area, although lake conditions were better than in previous years. Aquatic plant coverage is slightly higher than in these other lakes, but it is not known if this is comprised of native or invasive plants.

Q4. Are there any trends in our lake's condition?

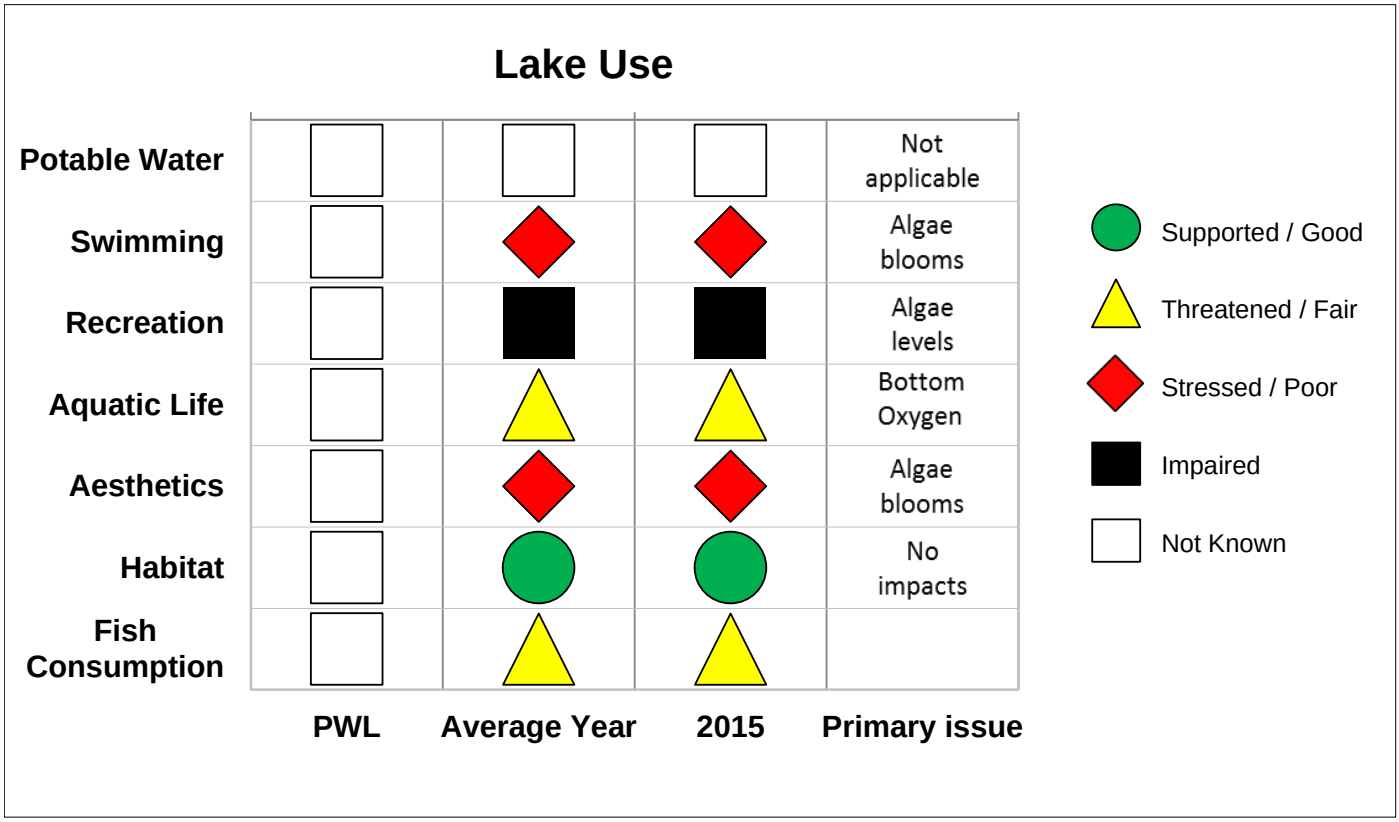
A4. With only four years of CSLAP data, trends can't be detected in the CSLAP dataset. The limited data indicates a recent increase in clarity due to a decrease in nutrient and algae levels. This resulted in improved lake perception.

Q5. Should we be concerned about the condition of our lake? Are we close to a tipping point?

A5. Laurel Lake is susceptible to shoreline blue green algae blooms, although it is not known if the timing of the blooms in the last few years (late summer) is typical for the lake. Nutrient levels are high enough to indicate the need for nutrient control—reduction of phosphorus and nitrogen loading to the lake—to reduce susceptibility to blooms.

Q6. Are any actions indicated, based on the trends and this year's results?

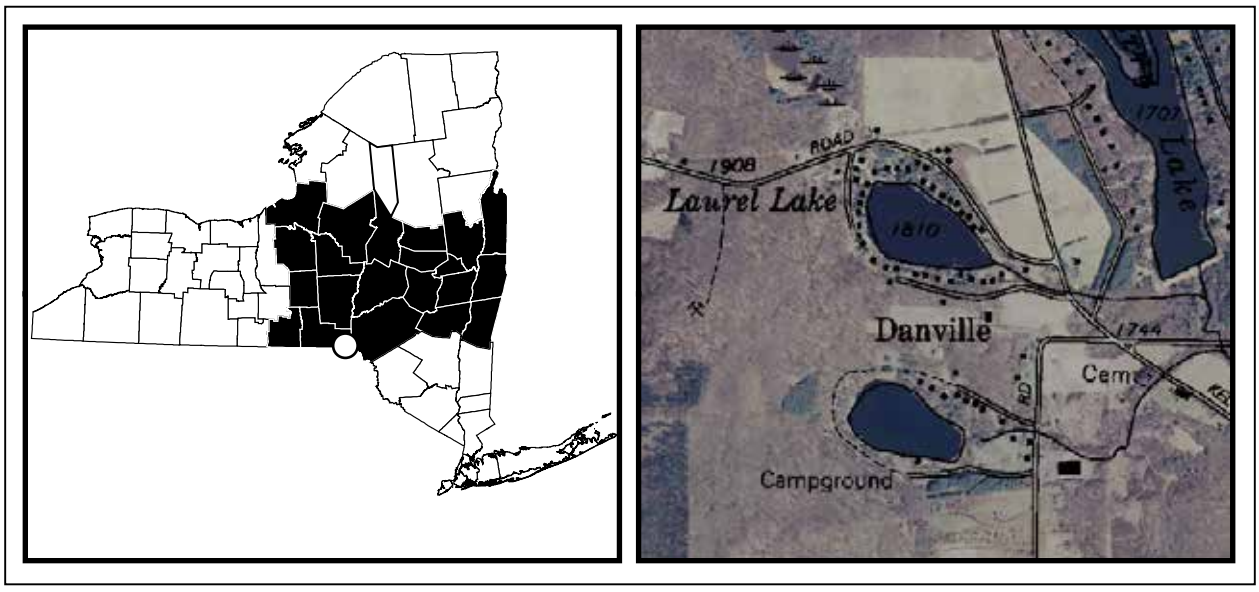
A6. Individual stewardship activities such as pumping your septic system, growing a buffer of native plants next to the water bodies, and reducing erosion from shoreline properties and runoff into the lake will help to maintain lake health by reducing nutrient and sediment loading to the lake. Visiting boats should be inspected to reduce the risk of new invasive species, since nearby lakes harbor several invasive plants not presently found in the lake.



CSLAP 2015 Lake Water Quality Summary:
Laurel Lake

General Lake Information

Location	Town of Sanford
County	Broome
Basin	Delaware River
Size	5.2 hectares (13 acres)
Lake Origins	Natural
Watershed Area	28.5 hectares (70.4 acres)
Retention Time	1.9 years
Mean Depth	5.6 meters (estimated)
Sounding Depth	12.2 meters
Public Access?	None- private access only
Major Tributaries	Ephemeral tributaries
Lake Tributary To…	Unnamed outlet to Sherman Creek to West Branch Delaware River
WQ Classification	B (contact recreation = swimming)
Lake Outlet Latitude	42.010
Lake Outlet Longitude	-75.480
Sampling Years	2012-2015
2015 Samplers	Vic Corbin and Lars Updale
Main Contact	Vic Corbin



Background
Laurel Lake is a 13 acre, class B lake found in the Town of Sanford in Broome County, along the Pennsylvania border in the Southern Tier region of New York State. It was sampled for the first time through CSLAP in 2012.

It is one of five CSLAP lakes among the nearly 200 lakes and ponds found in Broome County, and one of 15 CSLAP lakes among the nearly 1000 lakes and ponds in the Delaware River drainage basin.

Lake Uses
Laurel Lake is a Class B lake; this means that the best intended use for the lake is for contact recreation—swimming and bathing, non-contact recreation—fishing and boating, aquatic life, and aesthetics. The lake is used by lake residents and invited guests for swimming and passive boating—the lake has no public access.

It is not known by the report authors if Laurel Lake has recently been stocked as part of any private stocking effort; the lake is not stocked by the state of New York.

General statewide fishing regulations are applicable in Laurel Lake, and there are no lake-specific fish consumption advisories on Laurel Lake.

Historical Water Quality Data
CSLAP sampling was conducted on Laurel Lake for the first time in 2012. The most recent CSLAP report and scorecard will be posted on the NYSFOLA website at http://nysfola.mylaketown.com and can be found on the NYSDEC web page at http://www.dec.ny.gov/lands/77821.html.

Laurel Lake has not been sampled through any of the regional or statewide lake monitoring programs, and no NYSDEC fisheries monitoring has been conducted on the lake. SUNY Oneonta conducted some work on the lake in 2011; a detailed report can be found at http://www.oneonta.edu/academics/biofld/PUBS/ANNUAL/2011/22%20Laurel%20Lake%20REPORT.pdf. This study found phosphorus, conductivity, and calcium levels comparable to those measured through CSLAP, and algae (chlorophyll *a*) readings that were at the higher end of the range measured in CSLAP, and total nitrogen and pH at the low end of the CSLAP range. An algal bloom was also reported at that time.

Lake Association and Management History
Laurel Lake is represented by the Laurel Lake Association. It is not known to what extent the lake association is actively engaged in lake management actions or if they maintain a web site.

Summary of 2015 CSLAP Sampling Results

Evaluation of 2015 Annual Results Relative to 2012-2014
The summer (mid-June through mid-September) average readings are compared to historical averages for all CSLAP sampling seasons in the "Lake Condition Summary" table, and are compared to individual historical CSLAP sampling seasons in the "Long Term Data Plots – Laurel Lake" section in Appendix C.

Evaluation of Eutrophication Indicators

Water quality conditions, at least as related to eutrophication indicators (water clarity, chlorophyll *a* (algae), and nutrients (phosphorus)), have been similar in each of the four years sampled through CSLAP. Water transparency readings were slightly higher than usual in 2014 and 2015, consistent with slightly lower chlorophyll *a* readings in both years and lower phosphorus readings in 2015.

Lake productivity is usually highest in mid-summer, as manifested in lower water clarity and higher algae levels, and stabilizes in late summer. In 2015, productivity increased during the summer, although surface phosphorus readings have not shown clear seasonal trends. Deepwater phosphorus are slightly elevated and deepwater ammonia levels are highly elevated (and were higher than usual in 2014 and 2015), indicating deepwater anoxia (lack of oxygen).

The lake can be characterized as *mesoeutrophic*, or moderately to highly productive, based on water clarity and chlorophyll *a* readings (typical of *eutrophic* lakes), and total phosphorus readings (typical of *mesotrophic* lakes). The trophic state indices (TSI) evaluation suggests that phosphorus readings are consistently lower than expected given the algae and water clarity readings. This suggests that the lake may be susceptible to small changes in phosphorus loading to the lake; this may help to explain the high frequency of shoreline blooms. Overall trophic conditions are summarized on the Lake Scorecard and Lake Condition Summary Table.

Evaluation of Potable Water Indicators

Algae levels are high enough to render the lake susceptible to taste and odor compounds or elevated DBP (disinfection by product) compounds that could affect the potability of the water, although the lake is not used for drinking water. Deepwater ammonia readings are higher than those measured at the lake surface, so deepwater intakes may not support “unofficial” potable water use. Potable water conditions, at least as measurable through CSLAP, are summarized in the Lake Scorecard and Lake Condition Summary Table.

Evaluation of Limnological Indicators

Conductivity readings were higher than usual in 2015, and these readings (along with ammonia and color readings) have increased slightly over the last few years. NOx readings have decreased over the last few years, although these readings were close to normal in 2015. However, it is premature to evaluate trends with only four years of data, and the differences in these indicators was small in 2015.

Chloride levels in the 2015 samples, collected for the first time through CSLAP and cited in Appendix A, ranged from 5 to 14 mg/l. These values fall within the “minor” to “moderate” road salt runoff levels cited by the New Hampshire DES. These readings are well below the state potable water quality standard of 250 mg/l and below the range of values found in most NYS lakes. These readings suggest a low to moderate likelihood of biological impacts from road salt. Additional data will help to determine if these represent normal readings for the lake.

Overall limnological conditions are summarized in the Lake Scorecard and Lake Condition Summary Table.

Evaluation of Biological Condition

Phytoplankton samples were identified by SUNY Oneonta in 2011. They reported that:

"*In June the algal community was dominated by chrysophytes, a group of algae that do well in cooler water temperatures and higher nutrient conditions. This provides more evidence in support of the conclusion that the lake is continuing to show signs of eutrophication, as indicated by previous monitoring and recommendations. In July, cyanobacteria (blue-green algae) were equally as abundant as the chrysophyte group, though they were not "blooming" at this point.*"

Zooplankton, macroinvertebrate, macrophyte, and fisheries sampling has not been conducted through CSLAP at Laurel Lake. The fluoroprobe screening samples analyzed by SUNY ESF in the last few years indicate that blue green algae levels are low to moderate in most open water samples (and increase slightly during the summer) and highly elevated in at least some shoreline blooms. These blooms were dominated by *Anabaena* with some *Microcystis*, two blue green algae species that can produce toxins. Both open water and shoreline blue green algae levels peak in August, although shoreline blooms also extended into September in 2015. There are often a mix of algae species in the open water.

Biological conditions in the lake are summarized in the Lake Scorecard and Lake Condition Summary Table.

Evaluation of Lake Perception

Lake perception (water quality perception, recreational assessments and plant coverage) was slightly more favorable in 2014 and 2015 than in 2012 and 2013, consistent with slightly higher water clarity and slightly lower algae levels. These assessments steadily degrade during the summer, consistent with increasing lake productivity in late summer. Aquatic plant coverage appears to be relatively stable during the summer. These seasonal changes were also apparent in 2015, although conditions stabilized in August. Overall lake perception is summarized on the Lake Scorecard and Lake Condition Summary Table.

Evaluation of Local Climate Change

Additional data will help to determine if water temperatures can be used to assess local climate change or if these changes cannot be well evaluated through CSLAP. Air temperatures were slightly higher than normal in 2015, consistent with frequent reports of "hot and humid" weather; the latter may have contributed to very high water levels. However, water temperatures were close to normal.

Evaluation of Algal Toxins

Algal toxin levels can vary significantly within blooms and from shoreline to lake, and the absence of toxins in a sample does not indicate safe swimming conditions. Fluoroprobe algae levels approach the criteria for open water harmful algal blooms (HABs), and shoreline blooms were documented in association with high blue green algae levels in shoreline samples, particularly in August and September. While open water toxin (microcystin) levels have been well below the thresholds for safe swimming, shoreline bloom toxin levels are higher in some of these samples (though still below these criteria). Lake residents and pets should continue to avoid exposure to surface scums or heavily discolored water often associated with blue green algae blooms.

Lake Condition Summary

Category	Indicator	Min	Overall Avg	Max	2015 Avg	Classification	2015 Change?	Long-term Change?
Eutrophication Indicators	Water Clarity	0.95	1.81	3.40	2.20	Eutrophic	Higher Than Normal	Not yet known
	Chlorophyll *a*	3.30	11.96	28.80	10.70	Eutrophic	Within Normal Range	Not yet known
	Total Phosphorus	0.013	0.019	0.034	0.017	Mesotrophic	Lower Than Normal	Not yet known
Potable Water Indicators	Hypolimnetic Ammonia	0.76	1.72	2.45	2.19	Highly Elevated Deepwater NH4	Higher than Normal	Not known
	Hypolimnetic Arsenic							Not known
	Hypolimnetic Iron							Not known
	Hypolimnetic Manganese							Not known
Limnological Indicators	Hypolimnetic Phosphorus	0.011	0.054	0.108	0.078	Close to Surface TP Readings	Higher than Normal	Not known
	Nitrate + Nitrite	0.01	0.01	0.05	0.01	Low NOx	Within Normal Range	Not yet known
	Ammonia	0.01	0.03	0.05	0.03	Low Ammonia	Within Normal Range	Not yet known
	Total Nitrogen	0.20	0.46	0.83	0.44	Low Total Nitrogen	Within Normal Range	Not yet known
	pH	6.36	7.82	9.42	7.77	Alkaline	Within Normal Range	Not yet known
	Specific Conductance	19	38	48	44	Softwater	Higher than Normal	Not yet known
	True Color	12	21	33	23	Intermediate Color	Within Normal Range	Not yet known
	Calcium	3.3	3.5	3.8	3.3	Not Susceptible to Zebra Mussels	Within Normal Range	Not yet known
Lake Perception	WQ Assessment	1	2.0	4	1.5	Not Quite Crystal Clear	Within Normal Range	Not yet known
	Aquatic Plant Coverage	3	3.0	4	3.0	Surface Plant Growth	More Favorable Than Normal	Not yet known
	Recreational Assessment	1	2.1	5	1.5	Excellent	Within Normal Range	Not yet known
Biological Condition	Phytoplankton					Open water-low blue green algae biomass; Shoreline-high blue green algae in bloom	Not known	Not known
	Macrophytes					Not sampled through CSLAP	Not known	Not known
	Zooplankton					Not measured through CSLAP	Not known	Not known
	Macroinvertebrates					Not measured through CSLAP	Not known	Not known
	Fish					Warmwater fishery?	Not known	Not known
	Invasive Species					None observed	Not known	Not known
Local Climate Change	Air Temperature	14	22.8	31	24.5		Within Normal Range	Not yet known
	Water Temperature	20	23.6	28	24.0		Within Normal Range	Not yet known

Category	Indicator	Min	Overall Avg	Max	2015 Avg	Classification	2015 Change?	Long-term Change?
Harmful Algal Blooms	Open Water Phycocyanin	1	40	378	65	Most readings indicate low risk of BGA	Not known	Not known
	Open Water FP Chl.a	0	7	25	5	Few readings indicate high algae levels	Not known	Not known
	Open Water FP BG Chl.a	0	3	20	1	Few readings indicate high BGA levels	Not known	Not known
	Open Water Microcystis	<DL	0.2	0.9	<DL	Mostly undetectable open water MC-LR	Not known	Not known
	Open Water Anatoxin a	<DL	<DL	<DL	<DL	Open water Anatoxin-a consistently not detectable	Not known	Not known
	Shoreline Phycocyanin					No shoreline blooms sampled for PC	Not known	Not known
	Shoreline FP Chl.a	14.1	1512.3	9191.3	3347.3	Most readings indicate high algae levels	Not known	Not known
	Shoreline FP BG Chl.a	0.0	1496.5	9191.3	3345.8	Most readings indicate high BGA levels	Not known	Not known
	Shoreline Microcystis	<DL	2.5	9.4	<DL	At times measurable shoreline bloom MC-LR	Not known	Not known
	Shoreline Anatoxin a	<DL	<DL	<DL	<DL	Shoreline bloom Anatoxin-a consistently not detectable	Not known	Not known

Evaluation of Lake Condition Impacts to Lake Uses

Laurel Lake is not presently among the lakes listed on the Delaware River drainage basin Priority Waterbody List (PWL).

Potable Water (Drinking Water)

The CSLAP dataset at Laurel Lake, including water chemistry data, physical measurements, and volunteer samplers' perception data, is inadequate to evaluate the use of the lake for potable water, and the lake is not used for this purpose. The elevated shoreline algae levels and high deepwater ammonia readings indicate some threats to any "unofficial" potable water use.

Public Bathing

The CSLAP dataset at Laurel Lake, including water chemistry data, physical measurements, and volunteer samplers' perception data, suggests that public bathing, if conducted at a public swimming beach, would be *stressed* by excessive algae and shoreline blooms, although these impacts may be variable from year to year. Additional information about bacterial levels is needed to evaluate the safety of the water for swimming.

Recreation (Swimming and Non-Contact Uses)

The CSLAP dataset on Laurel Lake, including water chemistry data, physical measurements, and volunteer samplers' perception data, suggest that recreation would be *impaired* by excessive algae and potentially toxic blooms.

Aquatic Life

The CSLAP dataset on Laurel Lake, including water chemistry data, physical measurements, and volunteer samplers' perception data, suggest that aquatic life may be *threatened* by hypolimnetic anoxia (depleted deepwater oxygen readings) by shoreline algae blooms. Additional data are needed to evaluate the food and habitat conditions for aquatic organisms in the lake.

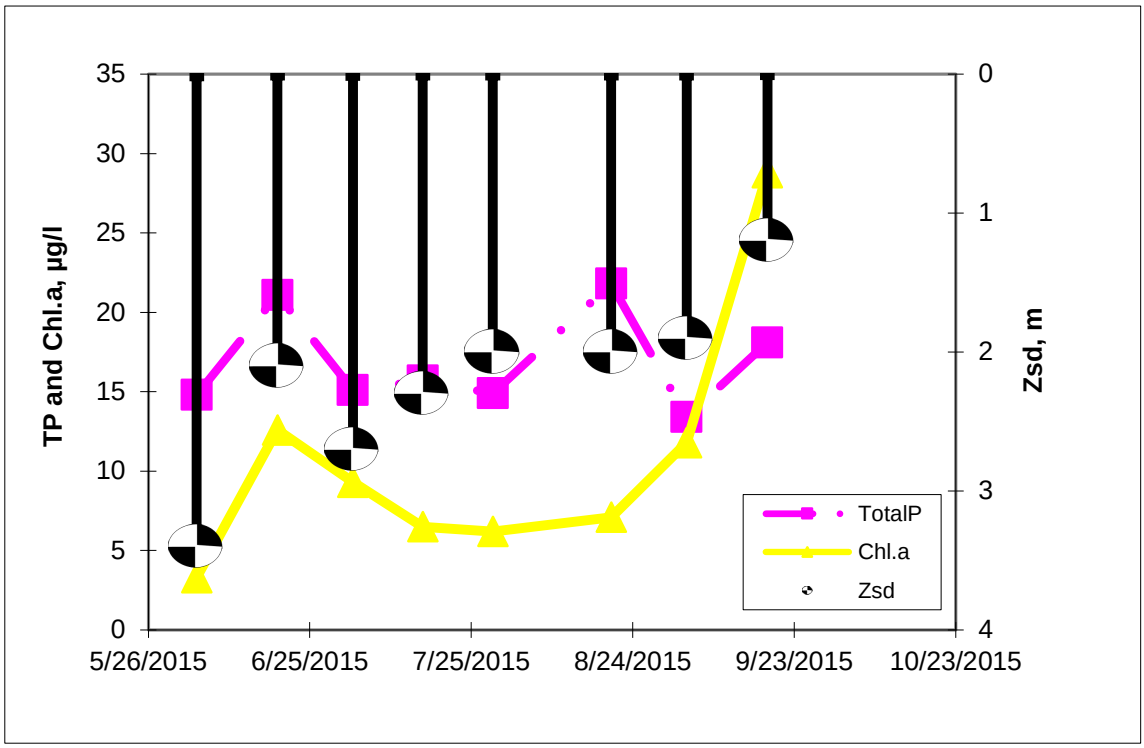
Aesthetics and Habitat
The CSLAP dataset on Laurel Lake, including water chemistry data, physical measurements, and volunteer samplers' perception data, suggest that aesthetics may be *poor* by shoreline algal blooms. Habitat may be good, perhaps due to the lack of any invasive species.

Fish Consumption
There are no fish consumption advisories posted for Laurel Lake.

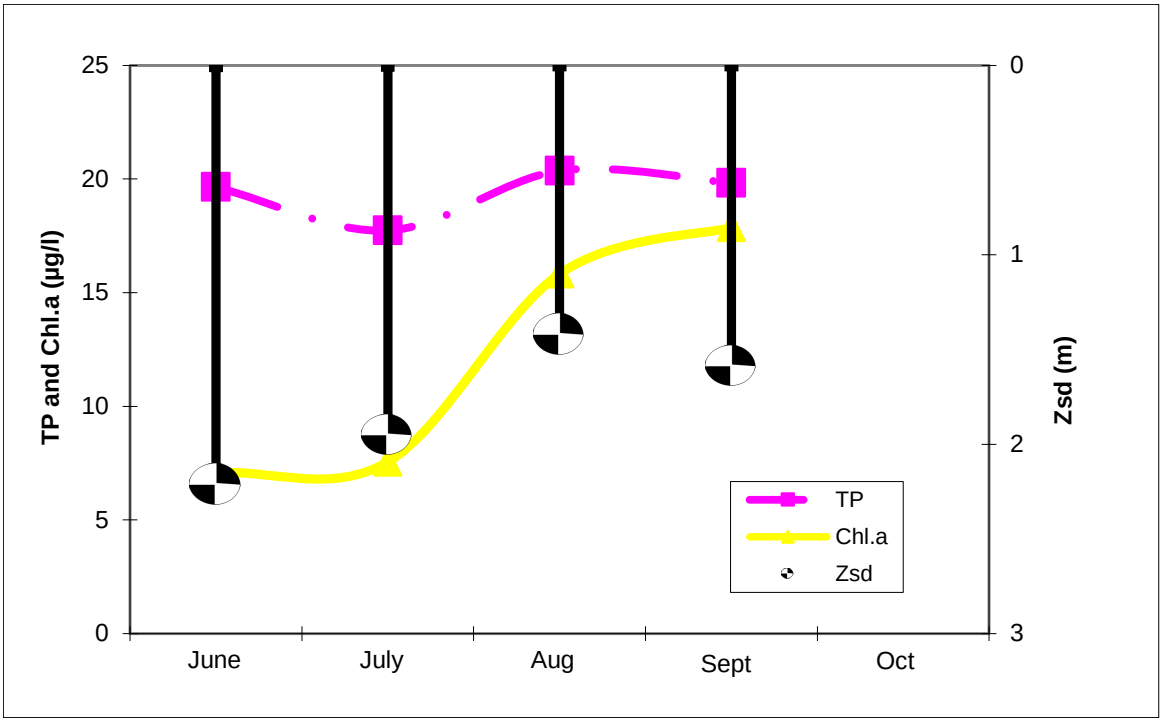
Additional Comments and Recommendations
Aquatic plant sampling may help to determine if any invasive plants are found in the lake and if the consistent surface plant growth is associated with native or non-native plants. Lake residents should continue to report (and avoid exposure to) any shoreline blooms that might fit the description of a blue green algae bloom.

Aquatic Plant IDs-2015
None submitted for identification in 2015.

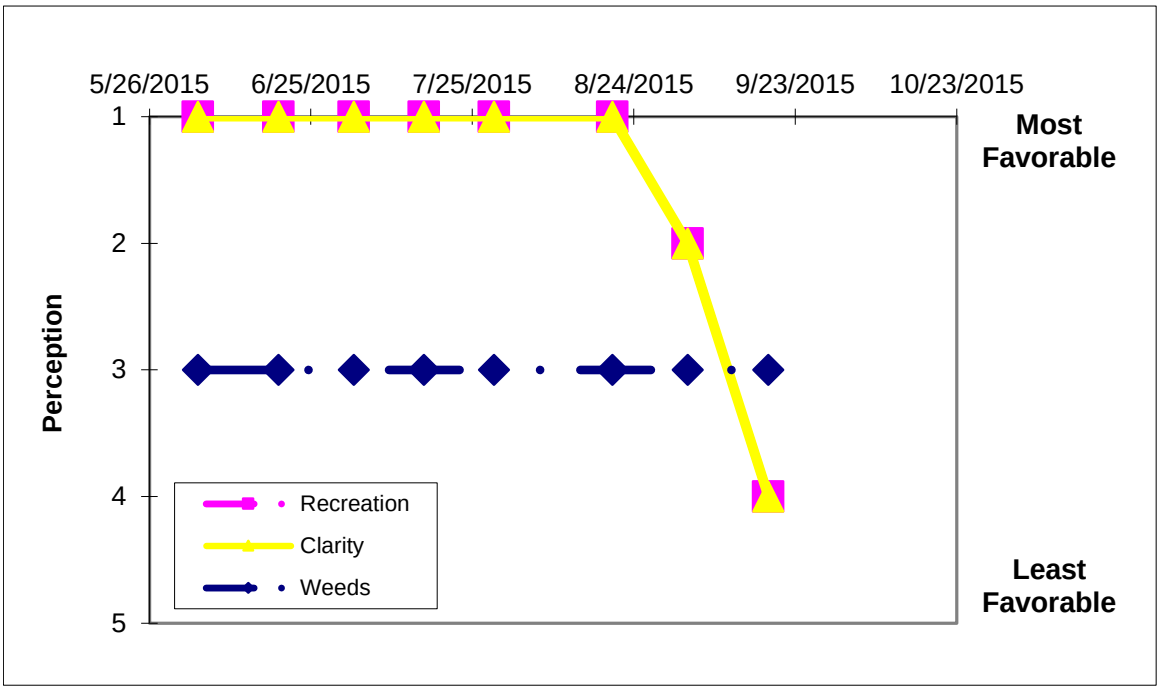
Time Series: Trophic Indicators, 2015



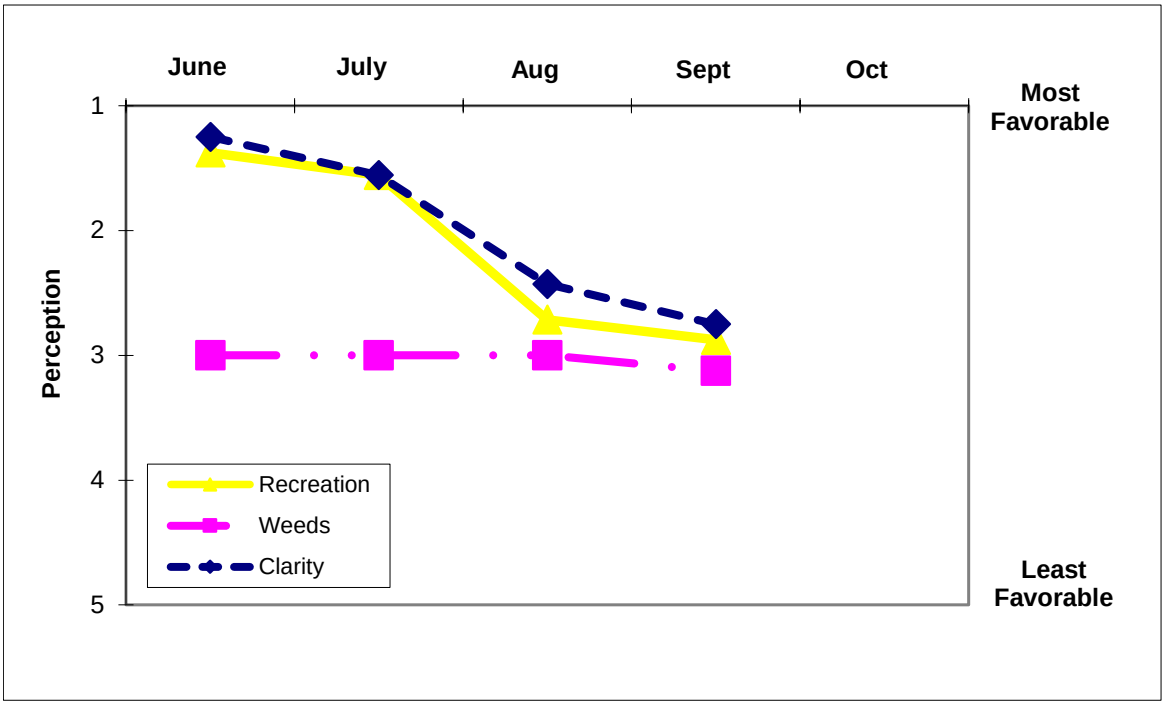
Time Series: Trophic Indicators, Typical Year (2012-2015)



Time Series: Lake Perception Indicators, 2015



Time Series: Lake Perception Indicators, Typical Year (2012-2015)



Appendix A- CSLAP Water Quality Sampling Results for Laurel Lake

LNum	PName	Date	Zbot	Zsd	Zsamp	Tot.P	NO3	NH4	TDN	TN/TP	TColor	pH	Cond25	Ca	Chl.a	Cl
233	Laurel Lake	6/10/2012	12.20	1.80	1.50	0.015	0.01	0.01	0.20	29.28	17	7.75	32	3.3	5.20	
233	Laurel Lake	6/25/2012	12.20	1.80	1.50	0.015	0.01	0.04	0.26	37.40		7.65	31		13.10	
233	Laurel Lake	7/6/2012	12.20	1.85	1.50	0.013	0.01	0.01	0.34	57.27	15	6.90	32		4.70	
233	Laurel Lake	7/21/2012	12.20	1.85	1.50	0.019	0.03	0.02	0.48	54.77	14	8.42	34		7.60	
233	Laurel Lake	8/4/2012	12.20	1.75	1.50	0.027	0.01	0.02	0.39	32.02	14	8.22	32	3.8	9.80	
233	Laurel Lake	8/18/2012	12.20	1.35	1.50	0.021	0.01	0.02	0.52	53.95	13	7.44	33		16.20	
233	Laurel Lake	9/1/2012	12.20	0.95	1.50	0.019	0.01	0.04	0.70	82.32	12	9.08	33		28.80	
233	Laurel Lake	9/15/2012	12.20	1.35	1.50	0.020	0.05	0.04	0.53	58.63	21	8.18	19		13.10	
233	Laurel Lake	6/15/2013	12.20	1.80	1.50	0.034	0.04	0.02	0.51	33.46		7.49	34		8.50	
233	Laurel Lake	6/28/2013	12.20	1.80	1.50	0.019			0.35	40.89	21	7.60	34		4.50	
233	Laurel Lake	7/12/2013	12.20	1.95	1.50	0.021	0.01	0.01	0.32	32.44	30	8.03	36		8.40	
233	Laurel Lake	7/26/2013	12.20	0.95	1.50	0.020			0.58	64.37	22	8.38	48			
233	Laurel Lake	8/10/2013	12.20	0.95	1.50	0.021	0.01	0.03	0.66	68.26	21	8.07	37		22.60	
233	Laurel Lake	8/26/2013	12.20	1.05	1.50	0.017			0.83	106.61	25	9.42	36		27.10	
233	Laurel Lake	9/6/2013	12.20	1.45	1.50	0.025	0.01	0.02	0.79	68.25	25	8.55	38		25.90	
233	Laurel Lake	9/20/2013	12.20	1.25	1.50	0.032			0.51	34.69	29	7.66	39		14.60	
233	Laurel Lake	6/6/2014	12.2	2.35	1.5	0.021	0.01	0.03	0.34	36.45	20	6.36	40	3.6	3.90	
233	Laurel Lake	6/19/2014	12.2	2.65	1.5	0.018			0.36	44.50	22	7.52	40		5.50	
233	Laurel Lake	7/5/2014	12.2	2.65	1.5	0.018	0.01	0.04	0.36	44.99	21	8.18	42		6.00	
233	Laurel Lake	7/18/2014	12.2	1.30	1.5	0.023			0.37	35.69	27	7.29	38		11.70	
233	Laurel Lake	8/1/2014	12.2	1.45	1.5	0.017	0.03	0.05	0.52	66.00	16	7.66	38	3.8	13.20	
233	Laurel Lake	8/15/2014	12.2	1.40	1.5	0.017			0.50	64.57	15	7.29	38		14.80	
233	Laurel Lake	8/17/2014			bloom											
233	Laurel Lake	9/1/2014	12.2	1.95	1.5	0.014	0.01	0.01	0.47	72.00	18	7.75	38		9.90	
233	Laurel Lake	9/12/2014	12.2	2.65	1.5	0.015			0.40	60.27	17	7.24	38		10.00	
233	Laurel Lake	6/4/2015	12.7	3.40	1.5	0.015	0.01	0.02	0.33	22.03	14	7.67	46	3.3	3.30	
233	Laurel Lake	6/19/2015	12.7	2.10	1.5	0.021			0.36	16.92	15	7.41	44		12.60	
233	Laurel Lake	7/3/2015	12.7	2.70	1.5	0.015	0.01	0.03	0.36	24.04	26	7.71	45		9.30	5.00
233	Laurel Lake	7/16/2015	12.7	2.30	1.5	0.016			0.43	27.64	30	7.06	43		6.50	
233	Laurel Lake	7/29/2015	12.7	2.00	1.5	0.015	0.01	0.04	0.36	24.09	33	8.21	44	3.4	6.20	
233	Laurel Lake	8/20/2015	12.7	2.00	1.5	0.022			0.75	34.17	23	7.46	45		7.10	
233	Laurel Lake	9/3/2015	12.7	1.90	1.5	0.013	0.01	0.04	0.40	30.00	24	8.48	40		11.80	13.90
233	Laurel Lake	8/23/2015			Bloom											
233	Laurel Lake	8/30/2015			Bloom											
233	Laurel Lake	8/30/2015			Bloom											
233	Laurel Lake	9/16/2015			bloom											
233	Laurel Lake	9/18/2015	12.7	1.20	1.5	0.018			0.55	30.33	15	8.17	44		28.80	
233	Laurel Lake	8/2/2015			stream	0.129										
233	Laurel Lake	6/10/2012			10.70	0.037		0.76								
233	Laurel Lake	7/6/2012			10.70	0.045		0.93								
233	Laurel Lake	8/4/2012			10.70	0.062		1.21								
233	Laurel Lake	9/1/2012			10.70	0.069		1.39								
233	Laurel Lake	6/6/2014			10.7	0.037		1.93								
233	Laurel Lake	6/19/2014			10.7	0.040										
233	Laurel Lake	7/5/2014			10.7	0.028		1.47								
233	Laurel Lake	7/18/2014			10.7	0.047										
233	Laurel Lake	8/1/2014			10.7	0.027		2.16								
233	Laurel Lake	8/15/2014			10.7	0.026										
233	Laurel Lake	9/1/2014			10.7	0.011		2.09								
233	Laurel Lake	9/12/2014			10.7	0.026										
233	Laurel Lake	6/4/2015			11.2	0.037		2.10								
233	Laurel Lake	6/19/2015			11.2	0.052										
233	Laurel Lake	7/3/2015			11.2	0.067		2.03								
233	Laurel Lake	7/16/2015			11.2	0.087										
233	Laurel Lake	7/29/2015			11.2	0.082		2.19								
233	Laurel Lake	8/20/2015			11.2	0.094										
233	Laurel Lake	9/3/2015			11.2	0.108		2.45								
233	Laurel Lake	9/18/2015			11.2	0.094										

LNum	PName	Date	Site	TAir	TH20	QA	QB	QC	QD	QF	QG	AQ-PC	AQ-Chla	MC-LR	Ana-a	Cyl	FP-Chl	FP-BG	HAB form	Shore HAB
233	Laurel Lake	6/10/2012	epi	29	20	2	3	1	0	0	0	0.70	2.00	<0.30	<0.417		1.52	0.35	I	
233	Laurel Lake	6/25/2012	epi	24	25	2	3	2	0	0	0	2.30	2.00	<0.30	<0.410		1.58	0.00	I	
233	Laurel Lake	7/6/2012	epi	28	25	2	3	2	0	0	0	6.30	1.00	0.31	<0.392		3.61	0.87	I	
233	Laurel Lake	7/21/2012	epi	23	25	3	3	2	0	0	0	33.90	0.90	<0.30	<0.585		6.17	4.23	I	
233	Laurel Lake	8/4/2012	epi	27	28	2	3	2	2	0	7	43.50	0.80	<0.30	<0.330		7.71	5.64	I	
233	Laurel Lake	8/18/2012	epi	20	23	3	3	4	1	4	4	79.00	0.80	<0.30	<0.223		7.71	5.84	I	
233	Laurel Lake	8/19/2012	bloom											1.20	<1.314		62.23	0.00	C	
233	Laurel Lake	9/1/2012	epi	24	25	3	4	5	346	4	4	67.90	1.30	<0.30	<0.580		10.92	8.73	I	
233	Laurel Lake	9/1/2012	Bloom											1.37	<1.038		940.75	940.50		
233	Laurel Lake	9/15/2012	Epi	16	21	4	3	5	1345	4	4	24.20	1.50	<0.30	<3.299		4.24	0.60	I	
233	Laurel Lake	6/15/2013	Epi	22	20	1	3	1	5	0	0	4.50	5.90	<0.30	<0.440		5.80	0.00	I	I
233	Laurel Lake	6/28/2013	Epi	23	25	1	3	3	5	0	0	4.30	3.90	<0.30	<0.650		3.20	0.00	I	I
233	Laurel Lake	7/12/2013	Epi	23	27	1	3	1	0	0	0	20.80	3.60	<0.30	<0.370		5.70	2.00	I	I
233	Laurel Lake	7/26/2013	Epi	22	24	3	3	3	1	0	0	80.80	3.50	<0.30	<0.400		12.10	9.40	I	I
233	Laurel Lake	8/10/2013	Epi	23	24	3	3	4	135	4	4	162.30	5.80	<0.30	<0.380		24.80	19.90	I	A
233	Laurel Lake	8/22/2013	Bloom											5.81	<0.770		797.00	790.00	a	
233	Laurel Lake	8/22/2013	Bloom											8.30	<0.770		966.30	936.50	a	
233	Laurel Lake	8/22/2013	Bloom											<0.60	<0.770		36.20	29.00	h	
233	Laurel Lake	8/23/2013	Bloom											<0.60	<0.770		14.10	7.20	h	
233	Laurel Lake	8/26/2013	Epi	18	22	3	3	3	18	0	0	86.60	6.50	<0.30	<0.570		13.20	7.20	I	I
233	Laurel Lake	9/6/2013	Epi	22	20	2	3	2	0	0	0	51.00	13.40	<0.30	<1.240		20.30	4.60	I	I
233	Laurel Lake	9/20/2013	Epi	21	25	3	3	2	1	4	4	16.90	8.60	<0.30	<0.100		0.00	0.00	F	F
233	Laurel Lake	6/6/2014	Epi	17	22	1	3	1	5	0	0	0.50	1.90	<1.83	<0.17	<0.001	1.32	0.00	i	i
233	Laurel Lake	6/19/2014	Epi	25	24	1	3	1	0	0	0	2.60	0.80	<0.58	<0.44	<0.002	2.35	0.00	i	i
233	Laurel Lake	7/5/2014	Epi	25	26	1	3	1	0	0	0	5.80	0.60	<0.62	<0.03	<0.002	2.03	0.36	i	i
233	Laurel Lake	7/18/2014	Epi	21	25	1	3	2	1	0	0	24.40	1.20	<0.39	<0.21	<0.003	9.41	3.09	i	i
233	Laurel Lake	8/1/2014	Epi	25	24	2	3	1	0	0	0	24.30	1.00	<0.33	<0.01	<0.002	8.45	3.44	i	i
233	Laurel Lake	8/15/2014	Epi	18	22	3	3	4	56	0	0	29.60	0.90	<0.35	<0.03	<0.001	8.95	5.27	i	i
233	Laurel Lake	8/17/2014	Epi											9.45	<0.06	<0.002	429.75	374.75		c
233	Laurel Lake	9/1/2014	Epi	25	23	2	3	1	0	0	0	9.80	0.80	<0.29	<0.14	<0.002	4.73	0.38	i	i
233	Laurel Lake	9/12/2014	Epi	14	22	2	3	2	5	0	0	10.40	0.70	<0.24	<0.03	<0.001	4.15	0.64	i	i
233	Laurel Lake	6/4/2015	Epi	14	20	1	3	1	0	0	0	6.80	0.90	<0.77	<0.126	<1.739	1.20	0.00	I	I
233	Laurel Lake	6/19/2015	Epi	25	24	1	3	1	0	0	0	7.60	1.60	<0.55	<0.004	<0.024	6.40	0.00	I	I
233	Laurel Lake	7/3/2015	Epi	23	22	1	3	1	0	0	0	9.70	0.90	<0.88	<0.010	<32.565	3.90	0.00	I	I
233	Laurel Lake	7/16/2015	Epi	27	25	1	3	1	0	0	0	9.00	1.10	<0.30	<0.009	<0.049	2.80	0.60	I	I
233	Laurel Lake	7/29/2015	Epi	31	27	1	3	1	0	0	0	5.45	0.60	<0.25	<0.004	<0.015	2.40	0.30	I	I
233	Laurel Lake	8/20/2015	Epi	27	26	1	3	1	0	0	0	378.10	1.90	<0.28	<0.003	<0.010	3.60	0.50	I	I
233	Laurel Lake	9/3/2015	Epi	29	26	2	3	2	8	4	4			<0.30	<0.007	<0.035	7.40	2.20	I	A
233	Laurel Lake	8/23/2015	Bloom											<0.95	<0.010	<0.031	3762.00	3762.00		
233	Laurel Lake	8/30/2015	Bloom											<0.56	<0.012	<0.048	16.83	10.78		
233	Laurel Lake	8/30/2015	Bloom											<0.56	<0.012	<0.048	419.00	419.00		
233	Laurel Lake	9/16/2015	Epi											<0.78	<0.019	<0.044	9191.25	9191.25		
233	Laurel Lake	9/18/2015	Epi	20	22	4	3	4	36	4	4	37.40	2.40	<0.30	<0.007	<0.035	15.40	3.10	D	D
233	Laurel Lake	8/2/2015	stream																	
233	Laurel Lake	6/10/2012	hypo		7															
233	Laurel Lake	7/6/2012	hypo		7															
233	Laurel Lake	8/4/2012	hypo		9															
233	Laurel Lake	9/1/2012	hypo		11															
233	Laurel Lake	6/15/2013	hypo		8															
233	Laurel Lake	6/28/2013	hypo		8															
233	Laurel Lake	7/12/2013	hypo		8															
233	Laurel Lake	8/10/2013	hypo		8															
233	Laurel Lake	8/23/2013	hypo		10															
233	Laurel Lake	9/6/2013	hypo		10															
233	Laurel Lake	9/20/2013	hypo		9															
233	Laurel Lake	9/26/2013	hypo		8															
233	Laurel Lake	6/6/2014	hypo		8															
233	Laurel Lake	6/19/2014	hypo		8															
233	Laurel Lake	7/5/2014	hypo		8															
233	Laurel Lake	7/18/2014	hypo		8															
233	Laurel Lake	8/1/2014	hypo		9															

LNum	PName	Date	Site	TAir	TH20	QA	QB	QC	QD	QF	QG	AQ-PC	AQ-Chla	MC-LR	Ana-a	Cyl	FP-Chl	FP-BG	HAB form	Shore HAB
233	Laurel Lake	8/15/2014	hypo		10															
233	Laurel Lake	9/1/2014	hypo		9															
233	Laurel Lake	9/12/2014	hypo		9															
233	Laurel Lake	6/4/2015	hypo		9															
233	Laurel Lake	6/19/2015	hypo		8															
233	Laurel Lake	7/3/2015	hypo		8															
233	Laurel Lake	7/16/2015	hypo		9															
233	Laurel Lake	7/29/2015	hypo		9															
233	Laurel Lake	8/20/2015	hypo		8															
233	Laurel Lake	9/3/2015	hypo		9															
233	Laurel Lake	9/18/2015	hypo		13															

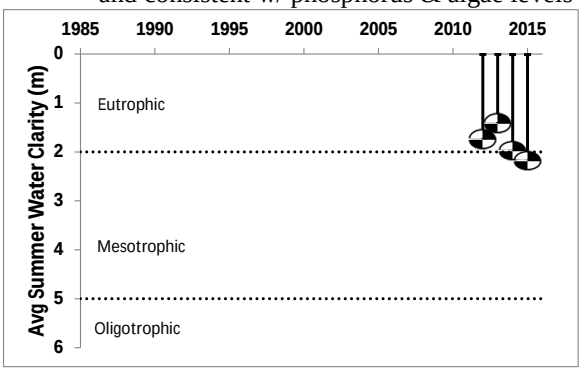
Legend Information

Indicator	*Description*	*Detection Limit*	*Standard (S) / Criteria (C)*
General Information			
Lnum	lake number (unique to CSLAP)		
Lname	name of lake (as it appears in the Gazetteer of NYS Lakes)		
Date	sampling date		
Field Parameters			
Zbot	lake depth at sampling point, meters (m)		
Zsd	Secchi disk transparency or clarity	0.1m	1.2m (C)
Zsamp	water sample depth (m) (epi = epilimnion or surface; bot = bottom)	0.1m	none
Tair	air temperature (C)	-10C	none
TH20	water temperature (C)	-10C	none
Laboratory Parameters			
Tot.P	total phosphorus (mg/l)	0.003 mg/l	0.020 mg/l (C)
NOx	nitrate + nitrite (mg/l)	0.01 mg/l	10 mg/l NO3 (S), 2 mg/l NO2 (S)
NH4	total ammonia (mg/l)	0.01 mg/l	2 mg/l NH4 (S)
TN	total nitrogen (mg/l)	0.01 mg/l	none
TN/TP	nitrogen to phosphorus (molar) ratio, = (TKN + NOx)*2.2/TP		none
TCOLOR	true (filtered) color (ptu, platinum color units)	1 ptu	none
pH	powers of hydrogen (S.U., standard pH units)	0.1 S.U.	6.5, 8.5 S.U. (S)
Cond25	specific conductance, corrected to 25C (umho/cm)	1 umho/cm	none
Ca, Cl	calcium, chloride (mg/l)	1 mg/l	none
Chl.a	chlorophyll a (ug/l)	0.01 ug/l	none
Fe	iron (mg/l)	0.1 mg/1	1.0 mg/l (S)
Mn	manganese (mg/l)	0.01 mg/l	0.3 mg/l (S)
As	arsenic (ug/l)	1 ug/l	10 ug/l (S)
AQ-PC	Phycocyanin (aquaflor) (unitless)	1 unit	none
AQ-Chl	Chlorophyll *a* (aquaflor) (ug/l)	1 ug/l	none
MC-LR	Microcystis-LR (ug/l)	0.01 ug/l	1 ug/l potable (C) 20 ug/l swimming (C)
Ana	Anatoxin-a (ug/l)	variable	none
Cyl	Cylindrospermposin (ug/l)	0.1 ug/l	none
FP-Chl, FP-BG	Fluoroprobe total chlorophyll, fluoroprobe blue-green chlorophyll (ug/l)	0.1 ug/l	none
Lake Assessment			
QA	water quality assessment; 1 = crystal clear, 2 = not quite crystal clear, 3 = definite algae greenness, 4 = high algae levels, 5 = severely high algae levels		
QB	aquatic plant assessment; 1 = no plants visible, 2 = plants below surface, 3 = plants at surface, 4 = plants dense at surface, 5 = surface plant coverage		
QC	recreational assessment; 1 = could not be nicer, 2 = excellent, 3 = slightly impaired, 4 = substantially impaired, 5 = lake not usable		
QD	reasons for recreational assessment; 1 = poor water clarity, 2 = excessive weeds, 3 = too much algae, 4 = lake looks bad, 5 = poor weather, 6 = litter/surface debris, 7 = too many lake users, 8 = other		
QF, QG	Health and safety issues today (QF) and past week (QG); 0 = none, 1 = taste/odor, 2 = GI illness humans/animals, 3 = swimmers itch, 4 = algae blooms, 5 = dead fish, 6 = unusual animals, 7 = other		
HAB form, Shore HAB	HAB evaluation; A = spilled paint, B = pea soup, C = streaks, D = green dots, E = bubbling scum, F = green/brown tint, G = duckweed, H = other, I = no bloom		

Appendix C- Long Term Trends: Laurel Lake

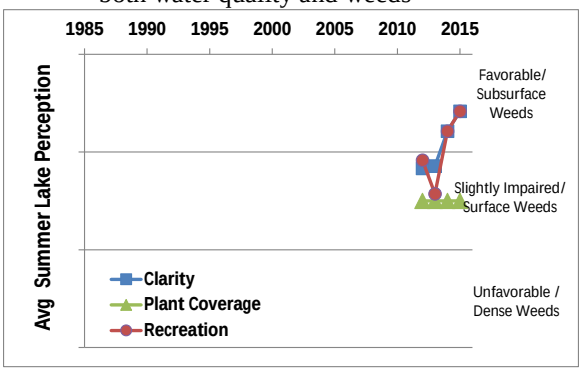
Long Term Trends: Water Clarity

- Slight increase 2012 to 2015
- Most readings typical of *mesoeutrophic* lakes and consistent w/ phosphorus & algae levels



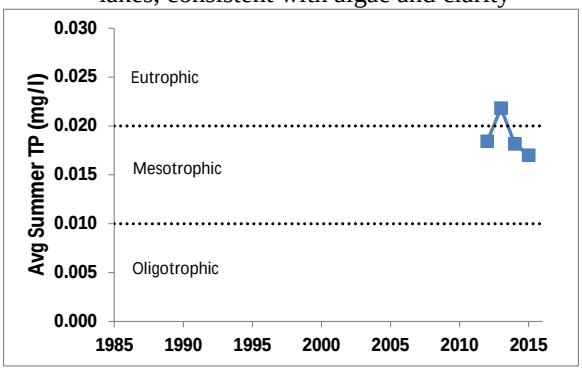
Long Term Trends: Lake Perception

- ↑ WQ/rec assessment 2012-15, with ↑ Zsd
- Recreational perception linked to changes in both water quality and weeds



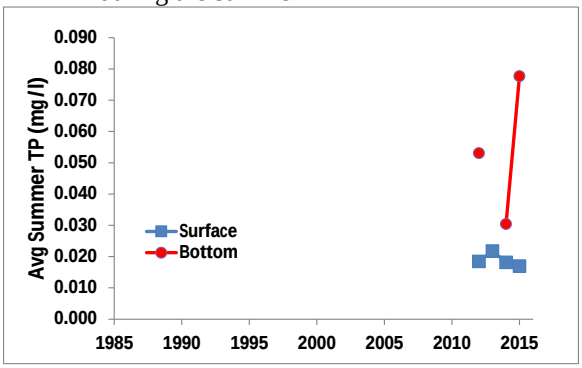
Long Term Trends: Phosphorus

- Slight ↓ TP consistent with ↑ clarity
- Most readings typical of *mesoeutrophic* lakes, consistent with algae and clarity



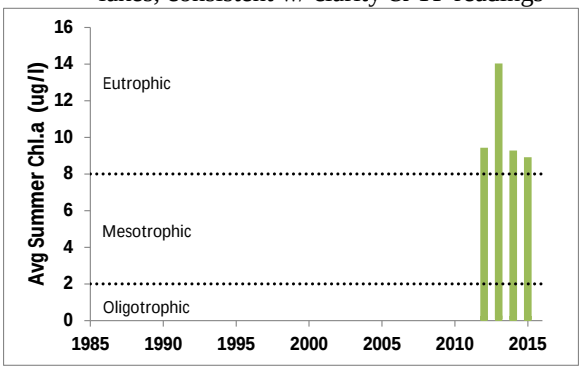
Long Term Trends: Bottom Phosphorus

- Deepwater TP slightly elevated
- Bottom TP may migrate to lake surface during the summer



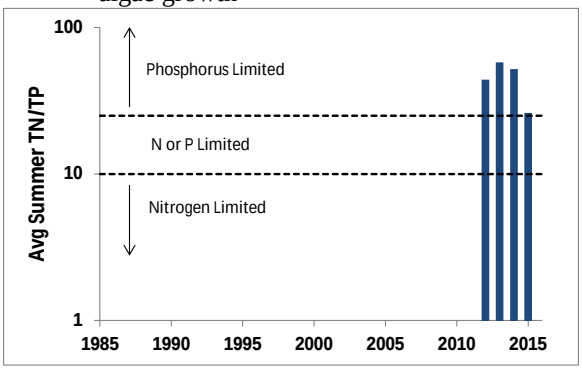
Long Term Trends: Chlorophyll a

- Chl. pattern consistent with clarity, TP
- Most readings typical of *mesoeutrophic* lakes, consistent w/ clarity & TP readings



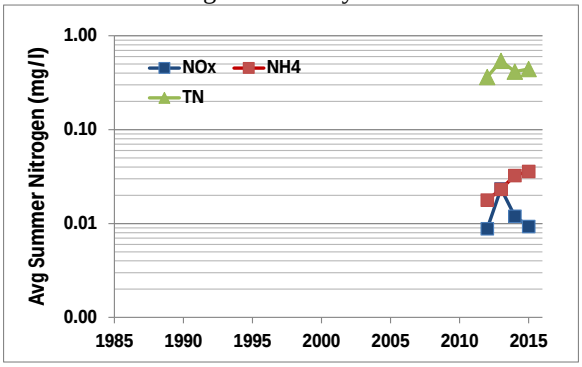
Long Term Trends: N:P Ratio

- Slight decrease over last few years
- Most readings indicate phosphorus limits algae growth



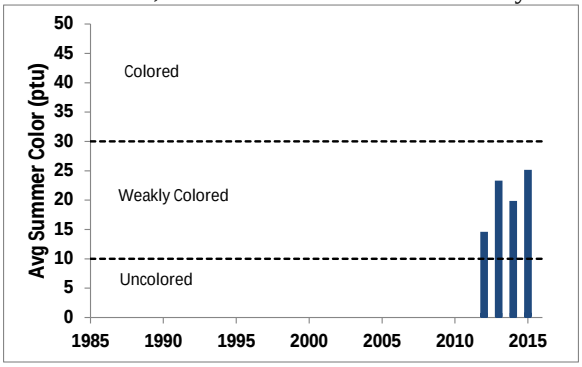
Long Term Trends: Nitrogen

- ↑ NH4 and TN; ↓ NOx
- Low NOx and ammonia but slightly higher total nitrogen all three years



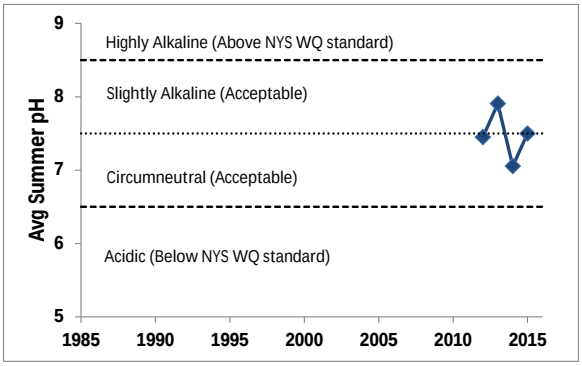
Long Term Trends: Color

- ↑ color last few years
- Most readings still typical of *weakly colored* lakes, but should not affect water clarity



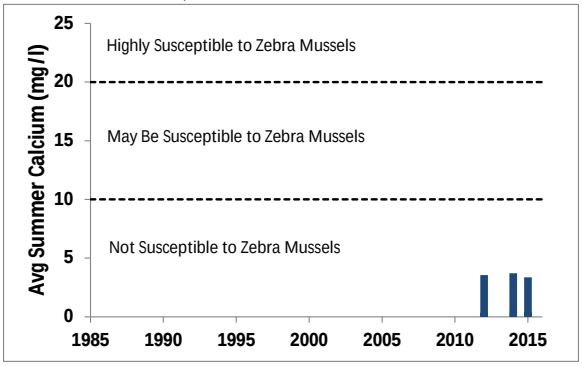
Long Term Trends: pH

- Variable pH last four years
- Most readings typical of *slightly alkaline* to *circumneutral* lakes



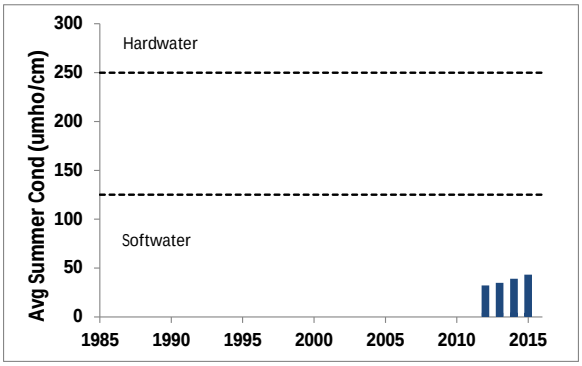
Long Term Trends: Calcium

- Stable calcium levels 2012-15
- Data indicates low susceptibility to zebra mussels, but these not found in lake



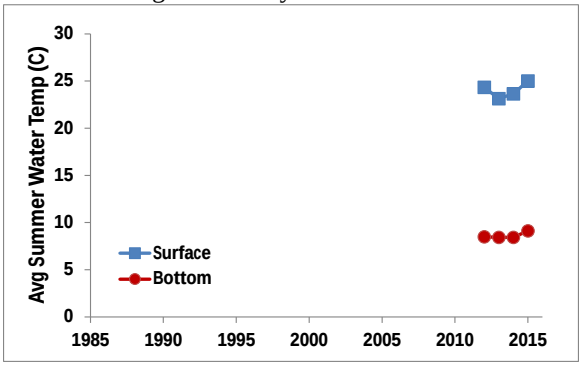
Long Term Trends: Conductivity

- Slight increase 2012-15; all readings low
- Most readings typical of lakes with *softwater*



Long Term Trends: Water Temperature

- Slight ↑ surface T; deep T fairly stable
- Much lower deepwater temperatures indicate strong thermal layers



Appendix D:
Algae Testing Results from SUNY ESF Study

Most algae are harmless, naturally present, and an important part of the food web. However excessive algae growth can cause health, recreational, and aesthetic problems. Some algae can produce toxins that can be harmful to people and animals. High quantities of these algae are called harmful algal blooms (HABs). CSLAP lakes have been sampled for a variety of HAB indicators since 2008. This was completed on selected lakes as part of a NYS DOH study from 2008-2010. In 2011, enhanced sampling on all CSLAP lakes was initiated through an EPA-funded project that has continued through the current sampling season. This study has evaluated a number of HAB indicators as follows:

- Algae types - blue green, green, diatoms, and "other"
- Algae densities
- Microscopic analysis of bloom samples
- Algal toxin analysis

Some of these results are reported in other portions of these reports. This appendix the seasonal change in blue green algae, other algae types, and the primary algal toxin (microcystin-LR, a liver toxin). Analysis was completed on open water samples and, for some lakes, shoreline samples that were collected when visual evidence of blooms were apparent. Results are compared to the DEC criteria of 25-30 ug/l blue green chlorophyll a and 20 ug/l microcystin-LR (based on the World Health Organization (WHO) threshold for unsafe swimming conditions) and the WHO provisional criteria for long-term protection of treated water supplies (= 1 ug/l microcystin-LR). The data for algae types are drawn from a high end fluorometer used by SUNY ESF. While these results are useful for timely approximation of lake conditions, they are not as accurate as the total chlorophyll results measured as a regular part of CSLAP since 1986 in all open water samples. Therefore these results are used judiciously in the assessment of sampled waterbodies.

Two separate samples are evaluated. A sample is taken at the CSLAP sample point at the deepest point of the lake at every sample session. In addition, shoreline samples can be taken when a bloom is visible. It should be noted that shoreline conditions can vary significantly over time and from one location to another. The shoreline bloom sampling results summarized below are not collected as routinely as open water samples, and therefore represent snapshots in time. It is assumed that sampling results showing high blue green algae and/or toxin levels indicate that algae blooms may be common and/or widespread on these lakes. However, the absence of elevated blue green algae and toxin levels does not assure the lack of shoreline blooms on these lakes. Elevated open water readings may indicate a higher likelihood of shoreline blooms, but in some lakes, these shoreline blooms have not been (well) documented.

The results from these samples are summarized within the CSLAP report for the lake.

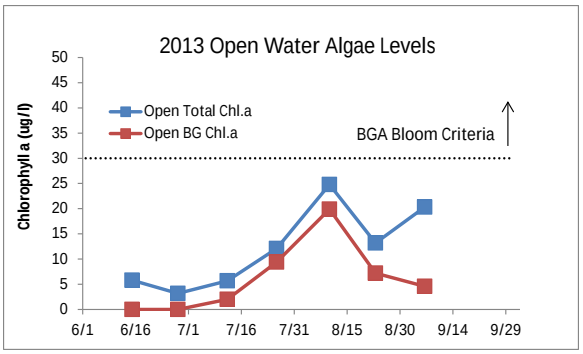


Figure D1:
2013 Open Water Total and BGA Chl.a

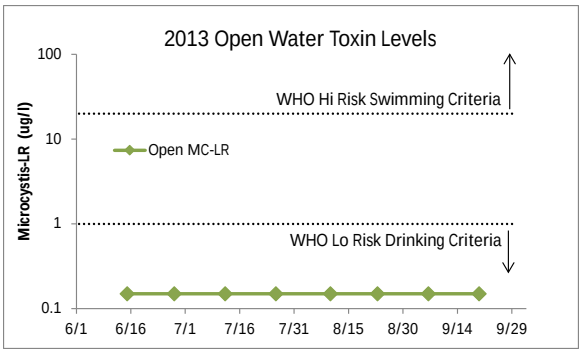


Figure D2:
2013 Open Water Microcystin-LR

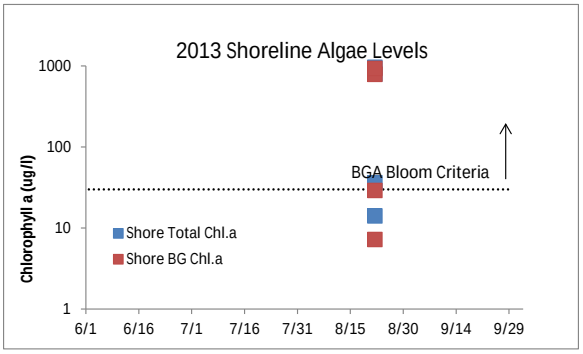


Figure D3:
2013 Shoreline Total and BGA Chl.a

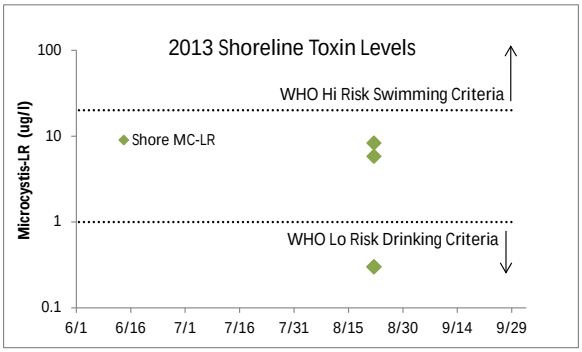


Figure D4:
2013 Shoreline Microcystin-LR

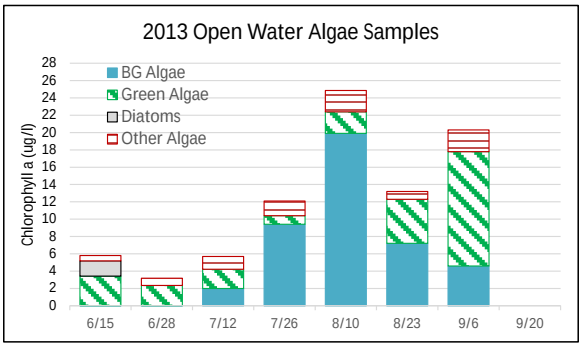


Figure D5:
2013 Open Water Algae Types

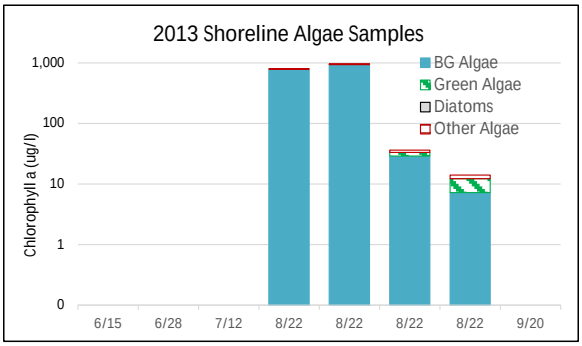


Figure D6:
2013 Shoreline Algae Types

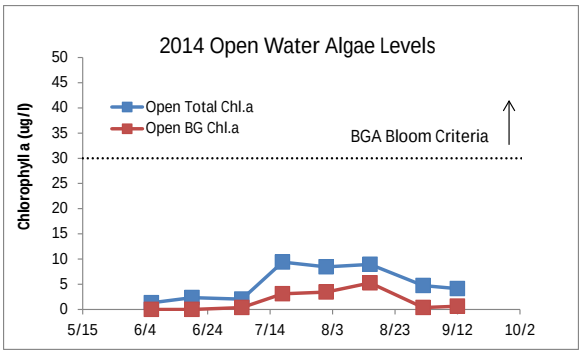


Figure D7:
2014 Open Water Total and BGA Chl.a

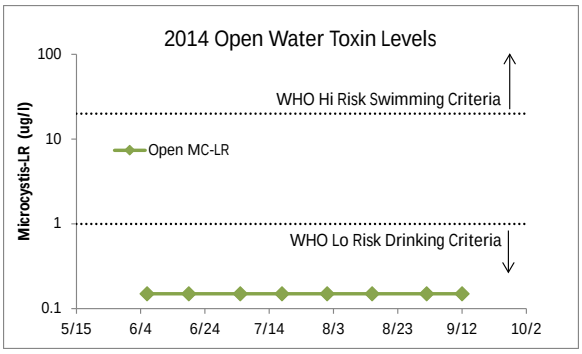


Figure D8:
2014 Open Water Microcystin-LR

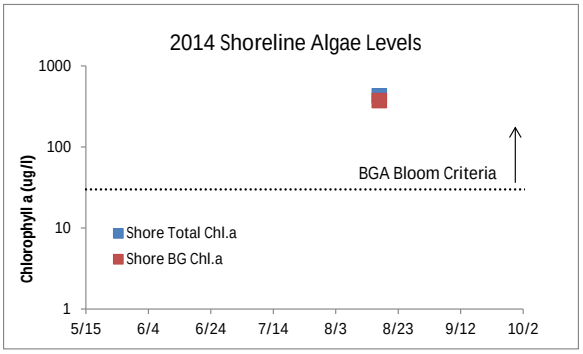


Figure D9:
2014 Shoreline Total and BGA Chl.a

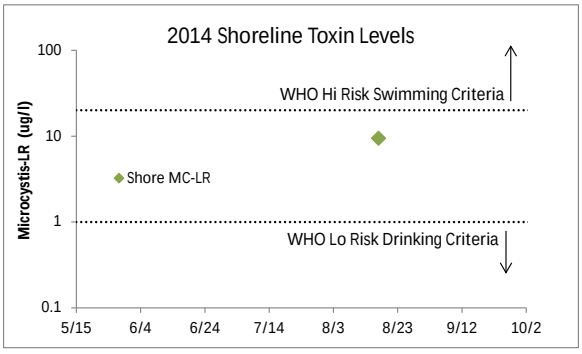


Figure D10:
2014 Shoreline Microcystin-LR

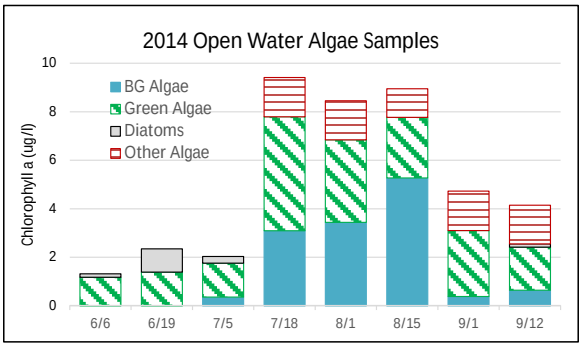


Figure D11:
2014 Open Water Algae Types

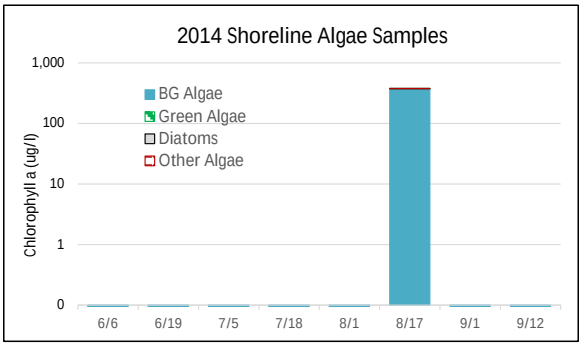


Figure D12:
2014 Shoreline Algae Types

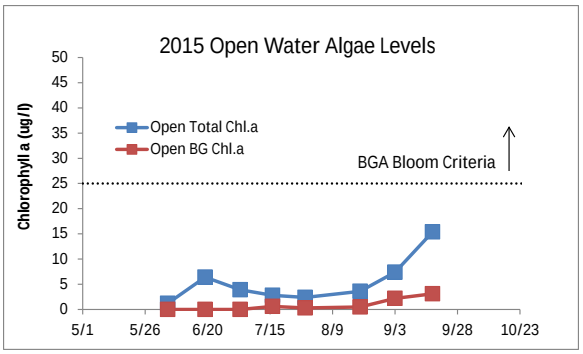


Figure D13:
2015 Open Water Total and BGA Chl.a

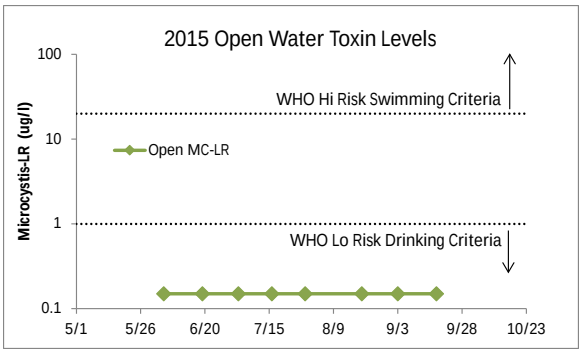


Figure D14:
2015 Open Water Microcystin-LR

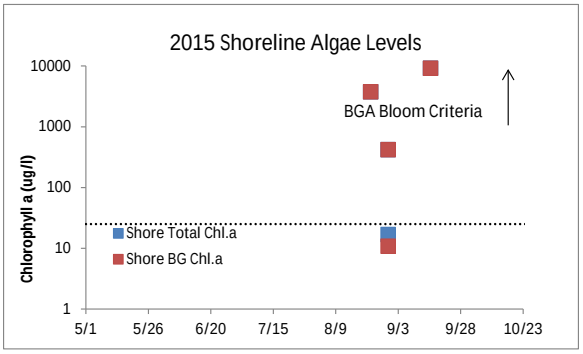


Figure D15:
2015 Shoreline Total and BGA Chl.a

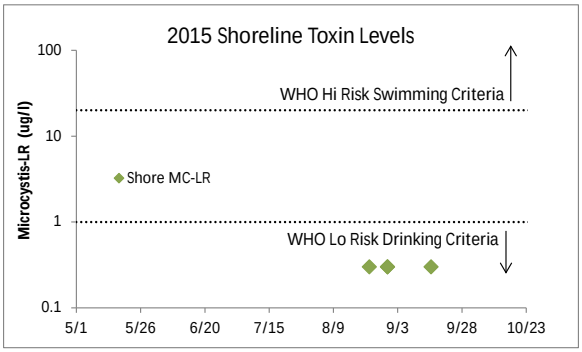


Figure D16:
2015 Shoreline Microcystin-LR

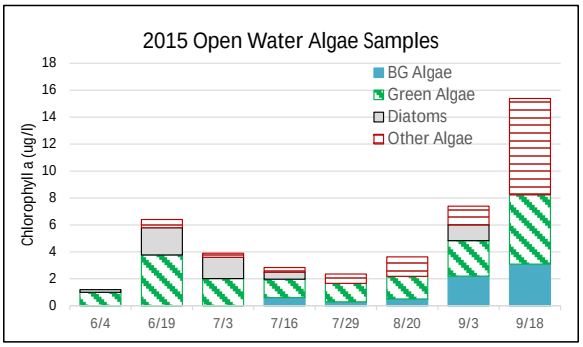


Figure D17:
2015 Open Water Algae Types

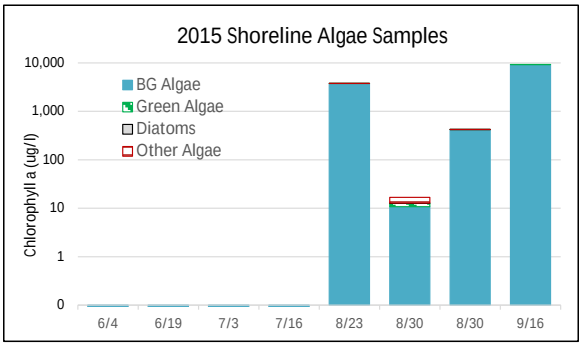


Figure D18:
2015 Shoreline Algae Types

Appendix E:
AIS Species in Broome County

The table below shows the invasive aquatic plants and animals that have been documented in Broome County, as cited in either the iMapInvasives database (http://www.imapinvasives.org/) or in the NYSDEC Division of Water database. These databases may include some, but not all, non-native plants or animals that have not been identified as "Prohibited and Regulated Invasive Species" in New York state regulations (6 NYCRR Part 575; http://www.dec.ny.gov/docs/lands_forests_pdf/islist.pdf).

This list is not complete, but instead represents only those species that have been reported and verified within the county. If any additional aquatic invasive species (AIS) are known or suspected in these or other waterbodies in the county, this information should be reported through iMap invasives or by contacting NYSDEC at dowinfo@dec.ny.gov.

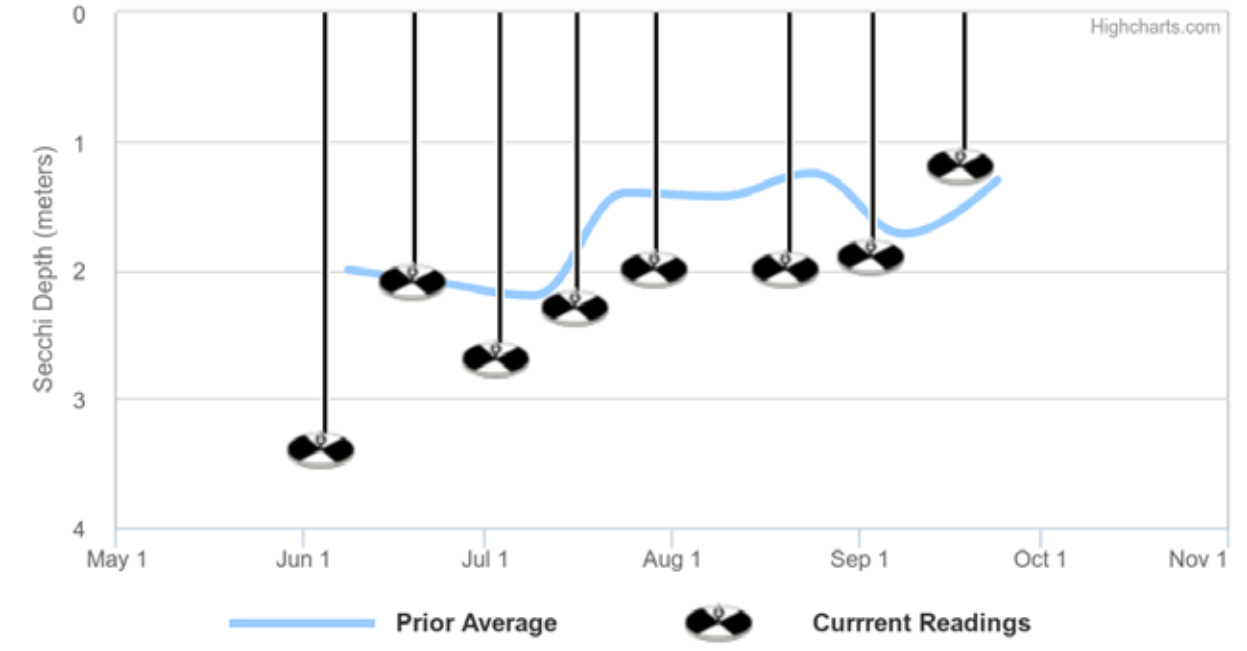
Aquatic Invasive Species - Broome County			
Waterbody	**Kingdom**	**Common name**	**Scientific name**
Arctic Lake	Plant	Eurasian watermilfoil	*Myriophyllum spicatum*
Arctic Lake	Plant	Eurasian watermilfoil	*Myriophyllum spicatum*
Beaver Lake	Animal	Banded mystery snail	*Viviparus georgianus*
Chenango River	Animal	Asian Clam	*Corbicula fluminea*
Deer Lake	Plant	Water chestnut	*Trapa natans*
Susquehanna River near Binghamton	Animal	Asian Clam	*Corbicula fluminea*
Susquehanna River near Five Mile Pt	Animal	Asian Clam	*Corbicula fluminea*
Susquehanna River near Kirkwood	Animal	Asian Clam	*Corbicula fluminea*
Susquehanna River	Animal	Zebra mussel	*Dreissena polymorpha*
Susquehanna River	Plant	Eurasian watermilfoil	*Myriophyllum spicatum*
Taft Pond	Plant	Eurasian watermilfoil	*Myriophyllum spicatum*
Taft Pond	Plant	Curly leafed pondweed	*Potamogeton crispus*
Unnamed Pond 1	Plant	Hydrilla	*Hydrilla verticillata*
Unnamed Pond 2	Plant	Hydrilla	*Hydrilla verticillata*
Whitney Point Reservoir	Plant	Eurasian watermilfoil	*Myriophyllum spicatum*

Appendix F: Current Year vs. Prior Averages for Laurel Lake

Current Year Water Temperatures vs. Prior Average

There are not enough shallow water sample temperatures to determine a trend for the current year when compared to the average of readings collected from 2012 to 2014. There are not enough deep water sample temperatures to determine a trend for the current year when compared to the average of readings collected from 2012 to 2014.

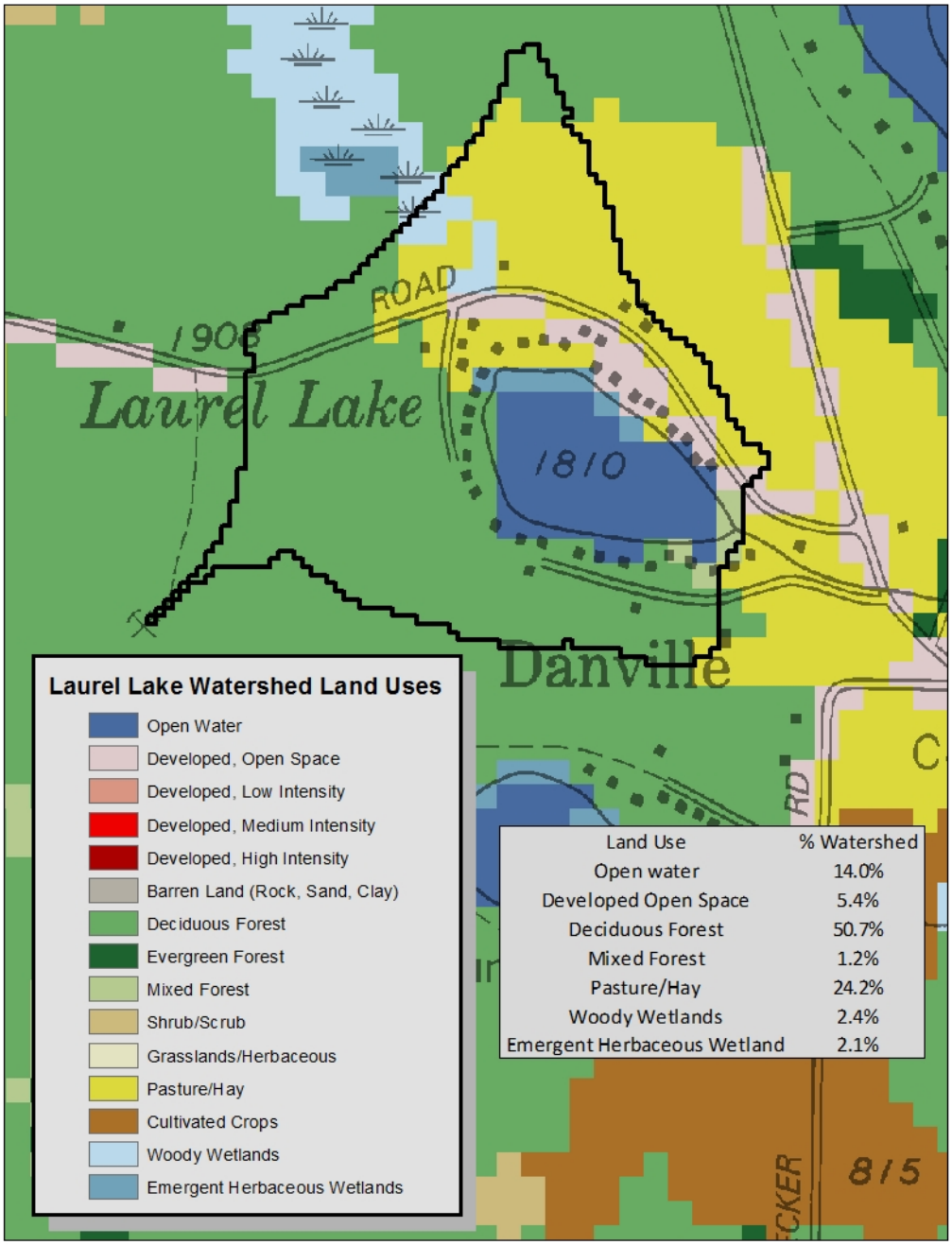
Current Year Secchi Readings vs. Prior Average



There are not enough session Secchi readings to determine a trend for the current year when compared to the average of readings collected from 2012 to 2014

Appendix G: Watershed and Land Use Map for Laurel Lake

This watershed and land use map was developed using USGS StreamStats and ESRI ArcGIS using the 2006 land use satellite imagery. The actual watershed map and present land uses within this watershed may be slightly different due to the age of the underlying data and some limits to the use of these tools in some geographic regions and under varying flow conditions. However, these maps are intended to show the approximate extent of the lake drainage basin and the major land uses found within the boundaries of the basin.



Land Use	% Watershed
Open water	14.0%
Developed Open Space	5.4%
Deciduous Forest	50.7%
Mixed Forest	1.2%
Pasture/Hay	24.2%
Woody Wetlands	2.4%
Emergent Herbaceous Wetland	2.1%