Bedford Lake Questions and Answers, 2015 CSLAP

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

A1. Lake conditions in 2015 were slightly more favorable than usual in Bedford Lake- shoreline blue green algae blooms were not reported, and open water blooms were delayed until the fall. This may have been in response to the summer copper sulfate treatments. Toxin readings continue to be below detection levels in all lake samples.

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

A2. The seasonal changes in phosphorus and water clarity did not appear to be well synchronized with the changes in algae levels; this may have been in response to the copper treatments. Chloride levels were indicative of moderate to fairly low impacts from road salt runoff.

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

A3. Bedford Lake had less favorable water quality- lower water clarity and higher algae levels, including more extensive blooms- than many other nearby lakes. However, these conditions are common to other shallow lakes in the area.

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

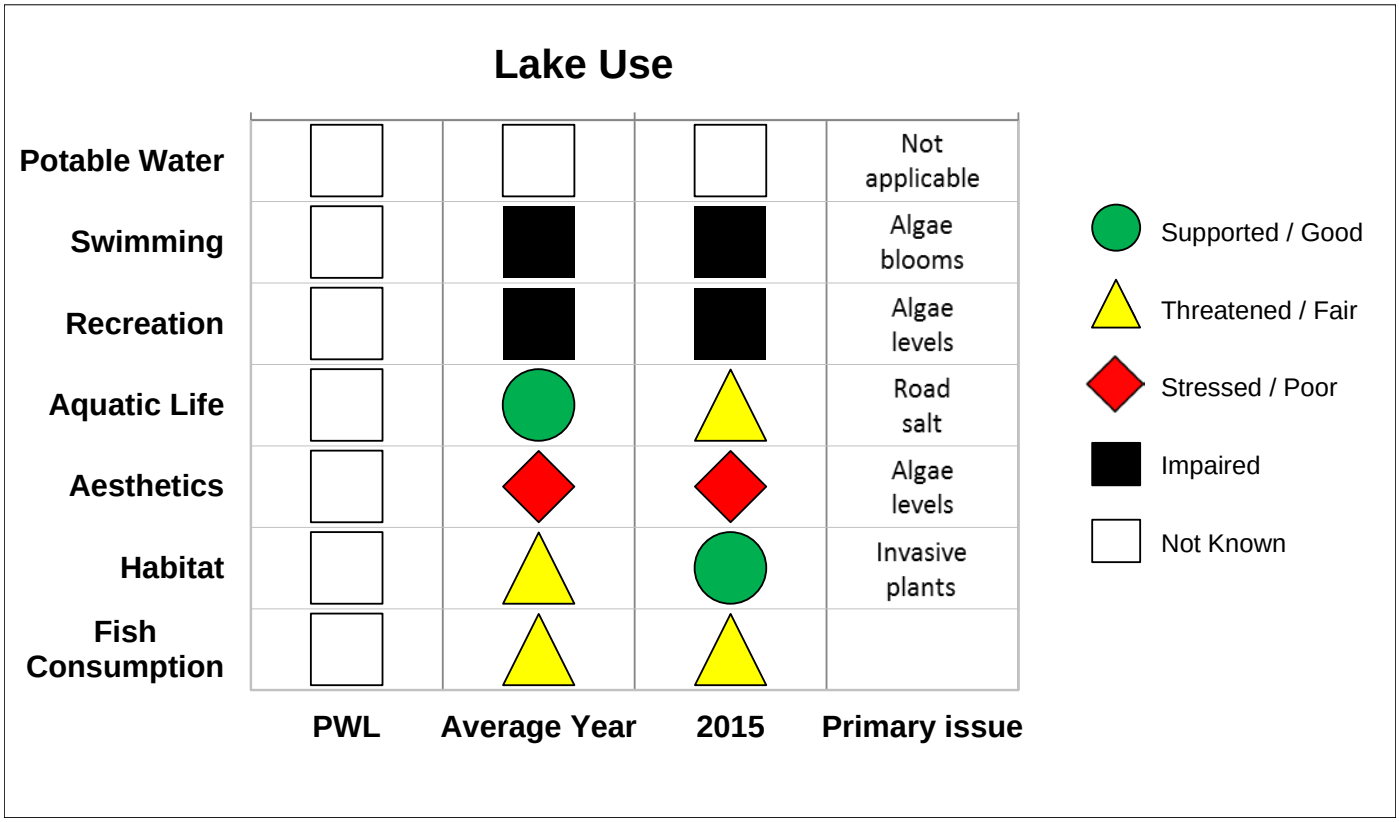
A4. No clear long term trends have been detected- nor would be detectable with only four years of data. However, conductivity readings may be on the rise; any potential sources of conductivity (shoreline erosion) should be evaluated.

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

A5. The lake presently suffers from algae blooms and at times reduced water clarity. Reducing nutrient levels, as discussed below, may reduce the intensity and frequency of future shoreline and open water blooms. Lake residents and visitors should avoid exposure to any discolored water or surface scums. The lake is also susceptible to the introduction of other invasive species found in nearby lakes, particularly Eurasian watermilfoil and hydrilla.

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 will help to reduce nutrient loading to the lake and therefore improve water quality. Lake residents should continue to keep outside boats from entering the lake to reduce the risk of new invasive species, since nearby lakes harbor several invasive plants not found in the lake.

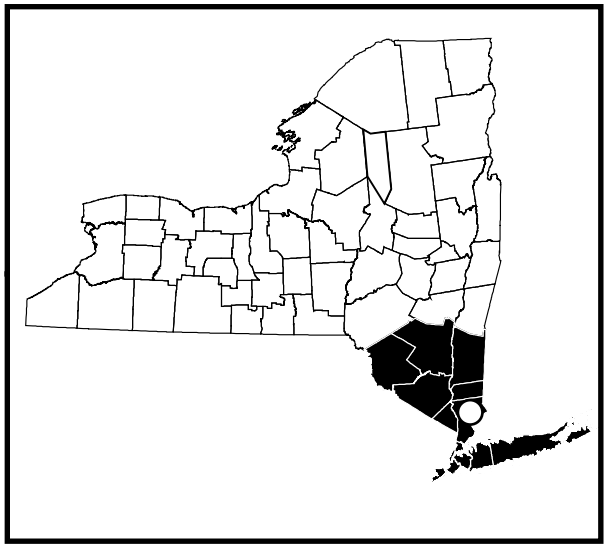


CSLAP 2015 Lake Water Quality Summary:
Bedford Lake

General Lake Information

Location	Town of Bedford
County	Westchester
Basin	Lower Hudson River
Size	10.0 hectares (24.8 acres)
Lake Origins	Augmented by 67ft long/18ft high "laid up" dam (1895)
Watershed Area	281 hectares (694 acres)
Retention Time	0.08 years (estimated)
Mean Depth	1.3 meters (estimated)
Sounding Depth	2.8 meters
Public Access?	none
Major Tributaries	Kisco River
Lake Tributary To…	Kisco River to Muscoot Reservoir to New Croton Reservoir to Lower Hudson River
WQ Classification	B (contact recreation = swimming)
Lake Outlet Latitude	41.19496
Lake Outlet Longitude	-73.70376
Sampling Years	2012-2015
2015 Samplers	Peter Chieco
Main Contact	Peter Chieco

Lake Map



Background

Bedford Lake, aka Howlands Lake, is a 25 acre, class B lake found in the Town of Bedford in Westchester County, just north of the New York City region of New York State. It was first sampled as part of CSLAP in 2012.

It is one of 15 CSLAP lakes among the more than 625 lakes and ponds found in Westchester County, and one of 67 CSLAP lakes among the nearly 3700 lakes and ponds in the Lower Hudson River drainage basin.

Lake Uses

Bedford 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—boating and fishing; aesthetics and aquatic life. There is no public access to the lake.

It is not known by the report authors if Bedford Lake has been stocked as part of any private stocking efforts. It is not stocked by the state of New York.

General statewide fishing regulations are applicable in Bedford Lake.

There are no lake-specific fish consumption advisories on Bedford Lake.

Historical Water Quality Data

CSLAP sampling was conducted on Bedford Lake from 2012 through 2015. The CSLAP reports for the lake will eventually be found on the NYSFOLA website at http://nysfola.mylaketown.com, and the most recent CSLAP report can be found on the NYSDEC web page at http://www.dec.ny.gov/lands/77829.html.

No other water quality data for the lake have been provided to the NYSDEC.

None of the unnamed ephemeral tributaries to the lake, nor the outlet of the lake, have been monitored through the NYSDEC Rotating Intensive Basins (RIBS) or stream biomonitoring programs.

Lake Association and Management History

Bedford Lake is served by the Bedford Lake Park Association. The lake association has been involved in aquatic plant management, and applied aquatic herbicides (Aquathol K) to control curly leafed pondweed (Potamogeton crispus) and two native plants in 2005. The lake association also applied copper sulfate to control nuisance algae, including applications on June 24th, July 3rd, and August 14th in 2014, and on June 15th, June 30th, July 14th and July 28th in 2015.

It is not known if the lake association maintains 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 – Bedford Lake" section in Appendix C.

Evaluation of Eutrophication Indicators

Each of the trophic indicators (Secchi disk transparency, chlorophyll *a*, and total phosphorus) was close to normal for Bedford Lake in 2015, although each of these trophic indicators were slightly lower than in previous years. However, algae levels were lower than usual in the first part of the summer (during the timeframe of the copper treatments), with blue green algae dominance delayed until September. Blue green algae blooms were reported along the shoreline of the lake in July in 2012 and in the open water (away from the shoreline) in 2013. Blue green algae blooms were measured in the open water and along the shoreline in August of 2014, consistent with seasonally increasing nutrient levels. However, open water blue green algae blooms in 2015 were not reported until September, and shoreline blooms were not reported at any time. Water clarity has decreased slightly over the last several years, coincident with an increase in nutrient levels but a drop in water clarity.

Lake productivity increases slightly during the summer, with water clarity readings decreasing and nutrient and algae levels increase (although the change in the latter may have been suppressed by the copper sulfate treatments). This occurs in most years and was also measured in 2014, although late summer changes were variable among these indicators

The lake can be characterized as *eutrophic*, or highly productive, based on water clarity, total phosphorus readings, and chlorophyll *a* readings (all typical of *eutrophic* lakes). The trophic state indices (TSI) evaluation suggests that water clarity readings are higher than expected given the algae and phosphorus readings in the lake. It is not known how much of this discrepancy is influenced by the copper sulfate treatments. 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, but the lake is not used for drinking water. Potable water conditions, at least as measurable through CSLAP, are summarized in the Lake Scorecard and Lake Condition Summary Table.

Evaluation of Limnological Indicators

Ammonia and total nitrogen levels in Bedford Lake were lower than usual in 2015, while conductivity was higher. It is not yet known if any of these indicators has exhibited any clear long-term trends, although the higher conductivity has been observed over several years, and may be indicative of an increase in erodible materials entering the lake. Most of the other limnological indicators- total nitrogen, nitrogen-to-phosphorus ratios, pH and color- have decreased slightly over the last few years. However, the lake continues to be an alkaline lake

with intermediate hardness and color, and high total nitrogen levels; the latter is consistent with high algae levels.

Chloride levels in the 2015 samples, collected for the first time through CSLAP and cited in Appendix A, ranged from 14 to 16 mg/l. These values fall within the "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 within than the range of values found in most NYS lakes, including those in the Finger Lakes region. 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

It is not known if phytoplankton, zooplankton, macrophyte, or macroinvertebrate studies have been conducted at the lake. The fluoroprobe data indicates high algae levels, and many of the highest overall algae levels were comprised primarily of blue green algae. When algae levels are lower, particularly in early summer, the dominant algae species are green algae. Blooms tend to peak in mid to late summer in most years, with a seasonal increase in blue green algae dominance. However, the algae dynamics in the lake may be altered by the copper sulfate treatments.

The target of the aquatic plant management activities in the lake in previous years included curly leafed pondweed (*Potamogeton crispus*), and two native plants—slender naiad (*Najas flexilis*) and leafy pondweed (*Potamogeton foliosus*).

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

Evaluation of Lake Perception

The lake is described as "excellent" to "slightly impaired" for most recreational uses, due to water quality conditions described as "not quite crystal clear" to having "definite algae greenness". Plants usually grow to the lake surface only in late summer. These assessments were slightly more favorable in 2015 to those in previous years, perhaps due to the copper sulfate treatments. However, these assessments continue to be more favorable than in other lakes with similar water quality conditions. Additional years of data will help to determine if these assessments are representative of normal conditions in the lake. Overall lake perception is summarized on the Lake Scorecard and Lake Condition Summary Table.

Evaluation of Local Climate Change

It is not yet known if air or water temperature readings have exhibited any clear long-term changes, if these readings could indicate local climate change or if any changes can be evaluated through CSLAP. Water temperature readings have decreased slightly in recent years.

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. The fluoroprobe algae readings are at times above the levels indicating susceptibility for harmful algal blooms (HABs)

in the main body of the lake, and shoreline and open water blue green algae blooms have been measured periodically since 2012, including in the fall of 2015. The most significant blooms have been dominated by blue green algae, particularly in later summer; however, open water and shoreline microcystis (algae toxin) levels have consistently been well below the thresholds for safe swimming.

Lake Condition Summary

Category	Indicator	Min	Overall Avg	Max	2015 Avg	Classification	2015 Change?	Long-term Change?
Eutrophication Indicators	Water Clarity	0.40	1.28	2.51	1.09	Eutrophic	Within Normal Range	Not yet known
	Chlorophyll *a*	4.80	38.12	139.00	32.61	Eutrophic	Within Normal Range	Not yet known
	Total Phosphorus	0.026	0.081	0.222	0.078	Eutrophic	Within Normal Range	Not yet known
Potable Water Indicators	Hypolimnetic Ammonia							
	Hypolimnetic Arsenic							
	Hypolimnetic Iron							
	Hypolimnetic Manganese							
Limnological Indicators	Hypolimnetic Phosphorus							
	Nitrate + Nitrite	0.00	0.03	0.22	0.01	Low NOx	Within Normal Range	Not yet known
	Ammonia	0.02	0.11	0.31	0.05	Intermediate Ammonia	Lower Than Normal	Not yet known
	Total Nitrogen	0.39	0.92	1.88	0.64	Intermediate Total Nitrogen	Lower Than Normal	Not yet known
	pH	7.10	7.79	8.83	7.68	Alkaline	Within Normal Range	Not yet known
	Specific Conductance	164	240	339	295	Intermediate Hardness	Higher than Normal	Not yet known
	True Color	8	21	52	14	Intermediate Color	Within Normal Range	Not yet known
	Calcium	14.2	17.2	18.9	15.0	May be Susceptible to Zebra Mussels	Within Normal Range	Not yet known
Lake Perception	WQ Assessment	1	2.4	4	2.3	Not Quite Crystal Clear	Within Normal Range	Not yet known
	Aquatic Plant Coverage	1	1.6	3	1.0	Subsurface Plant Growth	Within Normal Range	Not yet known
	Recreational Assessment	1	2.3	4	1.9	Excellent	Within Normal Range	Not yet known
Biological Condition	Phytoplankton					Open water-high 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					Brittle naiad; Curly leafed pondweed?	Not known	Not known
Local Climate Change	Air Temperature	10	21.4	30	20.6		Within Normal Range	Not yet known
	Water Temperature	18	23.8	30	23.8		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	0	42	375	13	Most readings indicate low risk of BGA	Not known	Not known
	Open Water FP Chl.a	2	19	83	17	Some readings indicate high algae levels	Not known	Not known
	Open Water FP BG Chl.a	0	9	76	9	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
	Screening FP Chl.a	72.0	192.0	395.3		All readings indicate very high algae levels	Not known	Not known
	Screening FP BG Chl.a	68.5	190.9	395.3		All readings indicate very high BGA levels	Not known	Not known
	Shoreline Microcystis	<DL	0.3	0.4		Mostly undetectable shoreline bloom MC-LR	Not known	Not known
	Shoreline Anatoxin a	<DL	<DL	<DL		Shoreline bloom Anatoxin-a consistently not detectable	Not known	Not known

Evaluation of Lake Condition Impacts to Lake Uses

Bedford Lake is not presently among the lakes listed on the Lower Hudson River drainage basin Priority Waterbody List (PWL).

Potable Water (Drinking Water)

The CSLAP dataset at Bedford 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 high algae levels indicate threats to any "unofficial" potable water use.

Public Bathing

The CSLAP dataset at Bedford Lake, including water chemistry data, physical measurements, and volunteer samplers' perception data, suggests that public bathing is *impaired* due to poor water clarity, excessive algae and nutrient levels, and blue green algae blooms along the shoreline and in the open water (and the continuing need for algacides). 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 Bedford Lake, including water chemistry data, physical measurements, and volunteer samplers' perception data, suggest that recreation- swimming, boating, fishing and other non-contact uses- is *impaired* by poor clarity, excessive algae, and blue green algae blooms, and this use may also be *threatened* by invasive plants (curly leafed pondweed and brittle naiad).

Aquatic Life

The CSLAP dataset on Bedford Lake, including water chemistry data, physical measurements, and volunteer samplers' perception data, suggest that aquatic life should be fully supported, although this use may be *threatened* by blue green algae blooms and road salt runoff. Additional data are needed to evaluate the food and habitat conditions for aquatic organisms in the lake.

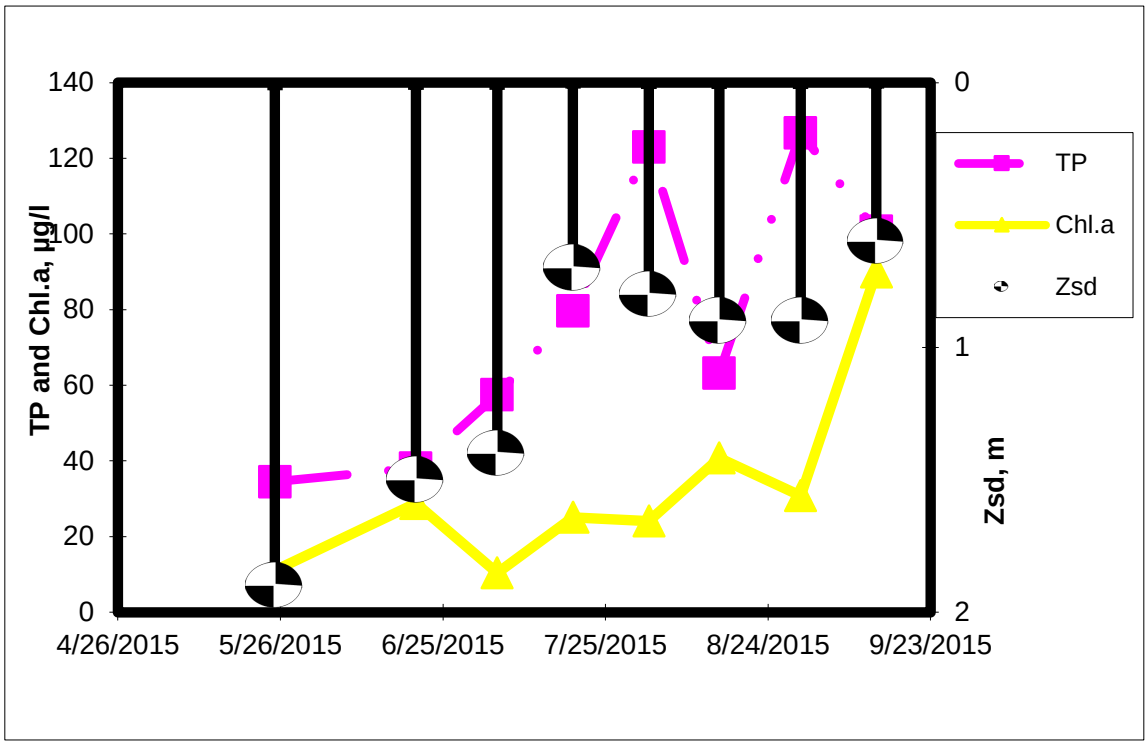
Aesthetics
The CSLAP dataset on Bedford Lake, including water chemistry data, physical measurements, and volunteer samplers' perception data, suggest that aesthetics may be *stressed* by excessive algae, shoreline blooms, and poor water clarity.

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

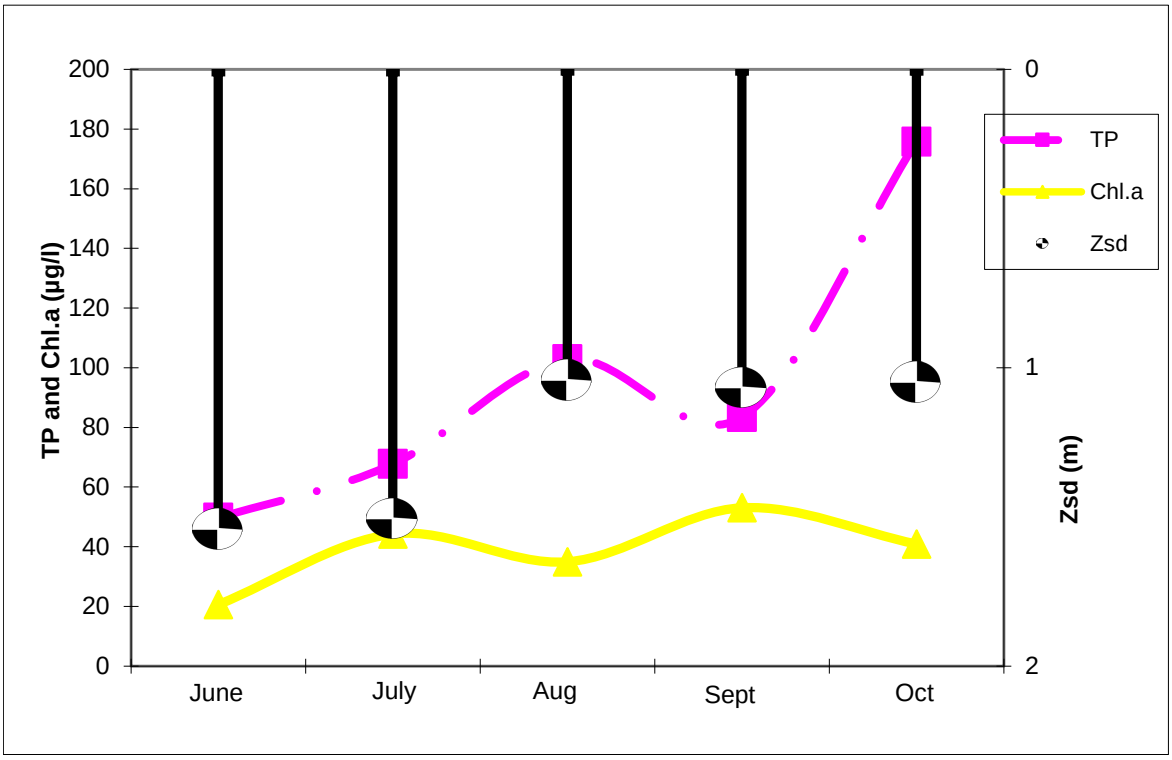
Additional Comments and Recommendations
Additional aquatic plant surveys should be conducted at Bedford Lake to determine if other invasive species found in nearby lakes, including Eurasian watermilfoil, are present in the lake. The higher conductivity in recent years may be an indication of new sources of nutrient inputs to the lake- these should be investigated by the lake community. Lake residents should continue to be on the lookout for shoreline blue green algae blooms, and avoid exposure to surface scums or heavily discolored water.

Aquatic Plant IDs-2015
None submitted for identification.

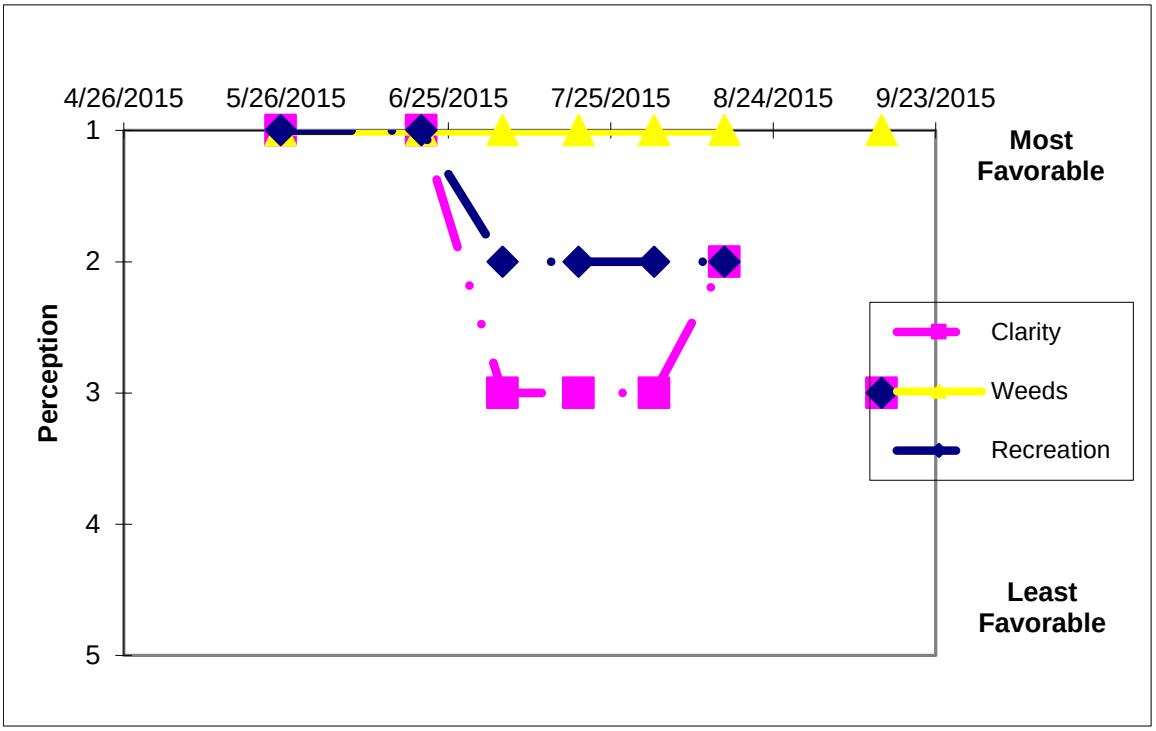
Time Series: Trophic Indicators, 2015



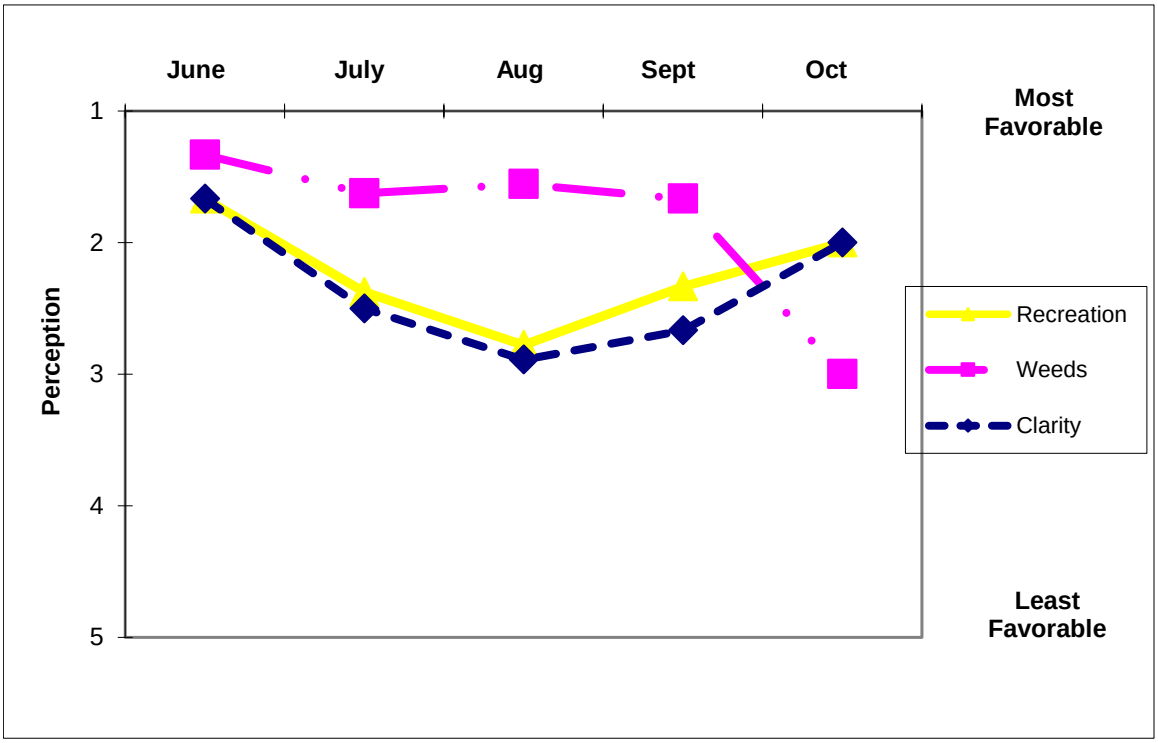
Time Series: Trophic Indicators, Typical Year (2012-2015)



Time Series: Lake Perception Indicators, 2015



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



Appendix A- CSLAP Water Quality Sampling Results for Bedford Lake

LNum	PName	Date	Zbot	Zsd	Zsamp	Tot.P	NO3	NH4	TDN	TN/TP	TColor	pH	Cond25	Ca	Chl.a	Cl
232	Bedford L	6/16/2012	2.80	1.40	1.50	0.039	0.01	0.04	0.70	39.43	39	7.97	181	16.2	38.40	
232	Bedford L	7/8/2012	2.70	1.30	1.50	0.059	0.01	0.02	0.80	29.85	18	8.15	197		72.00	
232	Bedford L	7/12/2012			bloom											
232	Bedford L	7/22/2012	2.70	1.24	1.50	0.109	0.03	0.31	1.07	21.70	23	7.38	197		36.70	
232	Bedford L	8/5/2012	2.75	1.43	1.50	0.064	0.01	0.03	0.91	30.96	27	8.48	172		36.00	
232	Bedford L	8/19/2012	2.75	0.81	1.50	0.222	0.04	0.29	1.33	13.19	16	7.72	164	18.3	33.70	
232	Bedford L	9/9/2012	2.75	0.82	1.50	0.094	0.03	0.20	1.03	24.20	36	7.94	219		47.60	
232	Bedford L	9/30/2012	2.60	1.01	1.50	0.089	0.03	0.08	1.03	25.62	20	7.46	210		53.90	
232	Bedford L	10/14/2012	2.50	1.05	1.50	0.176	0.03	0.24	1.68	21.02	34	7.10	186		40.90	
232	Bedford L	7/22/2012			bloom											
232	Bedford L	6/2/2013	2.79	2.05	1.50	0.042	0.22	0.10	0.71	37.25	42	7.80	224	18.5	10.60	
232	Bedford L	6/16/2013	2.85	0.98	1.50	0.058			0.81	30.69		7.49	186		8.90	
232	Bedford L	7/7/2013	2.70	1.95	1.50	0.026	0.06	0.03	1.72	144.51	32	8.83	190		139.00	
232	Bedford L	7/21/2013	3.00	2.35	1.50	0.086			0.90	23.10	17	7.74	218		23.00	
232	Bedford L	8/4/2013	2.70	2.51	1.50	0.096	0.01	0.03	1.18	27.17	18	8.09	228		4.80	
232	Bedford L	8/18/2013	2.12	1.27	1.50	0.058			0.65	24.69	52	8.63	189			
232	Bedford L	9/8/2013	2.70	1.20	1.50	0.064	0.01	0.12	0.86	29.30	22	7.87	231		53.40	
232	Bedford L	9/27/2013	2.70	1.98	1.50	0.040			0.53	29.46	16	8.18	233		22.90	
232	Bedford L	6/8/2014	2.8	1.45	1.5	0.056	0.01	0.05	0.47	18.52	13	7.60	262	18.9	28.00	
232	Bedford L	6/22/2014	6.0	1.87	1.5	0.065			0.44	14.79	14	7.22	242		8.90	
232	Bedford L	7/6/2014	2.8	1.92	1.5	0.068	0.04	0.17	0.81	26.38	22	8.08	253		13.80	
232	Bedford L	7/20/2014	2.7	1.20	1.5	0.057			0.94	35.87	21	7.57	238		34.10	
232	Bedford L	8/3/2014	2.7	0.79	1.5	0.083	0.11	0.14	1.13	29.80	9	7.49	270	18.7	43.80	
232	Bedford L	8/3/2014			bloom											
232	Bedford L	8/31/2014			bloom											
232	Bedford L	8/18/2014	2.7	0.64	1.5	0.091			1.05	25.44	13	7.59	262		53.90	
232	Bedford L	8/31/2014	2.7	0.40	1.5	0.103	0.01	0.11	1.88	40.19	12	8.00	282		65.70	
232	Bedford L	9/21/2014	2.7	0.81	1.5	0.114			1.66	32.06	15	7.55	281		50.70	
232	Bedford L	5/25/2015	2.7	1.90	1.5	0.035	0.01	0.03	0.39	11.22	10	7.84	339	15.8	11.00	
232	Bedford L	6/20/2015	2.7	1.50	1.5	0.038			0.58	15.14	8	7.86	263		28.80	
232	Bedford L	7/5/2015	2.7	1.40	1.5	0.058	0.00	0.06	0.62	10.85	21	7.46	317		10.40	53.7
232	Bedford L	7/19/2015	2.8	0.70	1.5	0.080			0.67	8.35	14	7.38	275		25.10	
232	Bedford L	8/2/2015	2.6	0.80	1.5	0.123	0.01	0.04	0.55	4.48	18	7.98	277	14.2	24.10	
232	Bedford L	8/15/2015	2.6	0.90	1.5	0.063			0.72	11.33	14	8.07	331		40.80	
232	Bedford L	8/30/2015	2.6	0.90	1.5	0.127	0.02	0.09	1.05	8.26	12	7.70	329		30.80	62.9
232	Bedford L	9/13/2015	2.6	0.60	1.5	0.101			0.56	5.58	11	7.16	225		89.90	

LNum	PName	Date	Site	TAir	TH20	QA	QB	QC	QD	QF	QG	AQ-PC	AQ-Chla	MC-LR	Ana-a	Cylin	FP-Chl	FP-BG	HAB form	Shore HAB
232	Bedford L	6/16/2012	epi	17	22	2	3	2	0	0	0	15.60	3.50	<0.30	<0.413		1.52	0.34		
232	Bedford L	7/8/2012	epi	25	27	2	3	2	0	0	0	14.40	0.90	<0.30	<0.392		5.23	0.92		
232	Bedford L	7/12/2012	bloom																	d
232	Bedford L	7/22/2012	epi	30	27	2	3	2	0	0	0	58.70	1.80	<0.30	<0.585		14.40	8.55		
232	Bedford L	8/5/2012	epi	30	29	2	3	2	0	0	0	66.90	1.70	<0.30	<0.659		17.19	13.37		
232	Bedford L	8/19/2012	epi	27	27	2	3	2	0	0	0	7.30	3.80	0.35	<0.223		14.41	2.34		
232	Bedford L	9/9/2012	epi	25	26	2	3	2	0	0	0	12.60	6.20	<0.30	<0.725		23.93	0.00		
232	Bedford L	9/30/2012	epi	26	24	2	3	2	0	0	0	27.80	5.50	<0.30	<3.205		21.50	0.76		
232	Bedford L	10/14/2012	epi	19	20	2	3	2	0	0	0	48.40	5.80	<0.30	<3.205		29.97	9.02		
232	Bedford L	7/22/2012	bloom											<0.60	<0.657		395.30	395.30		abcde
232	Bedford L	6/2/2013	epi	25	21	2	1	2	0	0	0	13.20	2.50	<0.30	<0.630		4.50	1.40	I	I
232	Bedford L	6/16/2013	epi	24	19	3	1	3	1	0	0	27.80	5.40	<0.30	<0.440		11.50	2.10	ABCDEF	
232	Bedford L	7/7/2013	epi	28	25	3	1	3	0	0	0	374.60	12.00	<0.30	<0.510		82.90	75.80	EFH	FHI
232	Bedford L	7/21/2013	epi	23	30	3	1	3	0	0	0	56.40	4.70	<0.30	<0.910		14.70	9.20	FI	FGH
232	Bedford L	8/4/2013	epi	24	25	2	1	2	0	0	0	8.60	3.70	<0.30	<0.390		5.40	0.60	FI	I
232	Bedford L	8/18/2013	epi	22	24	3	1	3	1	0	0	13.70	12.80	<0.30	<0.390		18.70	0.00	BFI	BEFGI
232	Bedford L	9/8/2013	epi	19	22	4	1	3	1	0	0	30.20	10.50	0.29	<1.240		17.80	2.30	ABCEFG	FG
232	Bedford L	9/27/2013	epi	10	18	2	1	2	0	0	0	24.10	11.70	<0.30	<0.100		23.20	3.90	I	I
232	Bedford L	6/8/2014	epi	16	21	1	1	1	0	0	0	0.30	2.50	<1.83	<0.17	<0.001	1.90	0.00	i	i
232	Bedford L	6/22/2014	epi	18	24	1	1	1	0	0	0	2.50	0.60	<0.58	<0.44	<0.002	2.40	0.00	fi	fi
232	Bedford L	7/6/2014	epi	16	25	1	2	2	0	0	0	6.00	1.00	<0.62	<0.03	<0.002	5.40	0.90	go	i
232	Bedford L	7/20/2014	epi	18	25	3	1	3	0			37.60	1.70	<0.39	<0.03	<0.001	14.90	6.00	efgi	i
232	Bedford L	8/3/2014	epi	18	25	4	1	4	15			83.60	1.40	<0.33	<0.01	<0.002	26.70	20.50	df	d
232	Bedford L	8/3/2014	epi											<0.67	<0.03	<0.003	72.00	68.50	d?	d
232	Bedford L	8/31/2014	epi											<0.77	<0.32	<0.004	108.80	108.80		bcd
232	Bedford L	8/18/2014	epi	22	24	4	2	4	13	0	0	101.60	1.20	<0.42	<0.03	<0.001	33.50	28.10	bef	ef
232	Bedford L	8/31/2014	epi	22	24	4	1	4	134	4	4	107.70	1.10	<0.29	<0.14	<0.002	32.10	31.50	bcde	bcde
232	Bedford L	9/21/2014	epi	18	20	3	1	2	0	0	0	38.00	3.30	<0.48	<0.04	<0.001	31.00	3.70	fi	fi
232	Bedford L	5/25/2015	epi	20	21	1	1	1	0	0	0	25.60	0.40	<1.34	<0.032	<0.080	5.60	3.90	I	I
232	Bedford L	6/20/2015	epi	19	24	1	1	1	0	7	0	3.50	1.90	<0.55	<0.004	<0.024	10.10	0.00	I	I
232	Bedford L	7/5/2015	epi	20	24	3	1	2	1	0	0	5.10	1.60	<0.88	<0.010	<32.565	8.10	0.00	FGH	I
232	Bedford L	7/19/2015	epi	24	25	3	1	2	1	0	0	16.40	2.80	<0.30	<0.009	<0.015	13.10	0.90	F	I
232	Bedford L	8/2/2015	epi	18	23	3	1	2	1	0	0	22.71	2.66	<0.19	<0.004	<0.015	11.30	2.80	F	F
232	Bedford L	8/15/2015	epi	23	25	2	1	2	0	0	0			<0.44	<0.002	<0.014	12.50	6.00	F	I
232	Bedford L	8/30/2015	epi	21	25									<0.39	<0.012	<0.031	18.80	5.40	FGH	I
232	Bedford L	9/13/2015	epi	20	23	3	1	3	1	0	0	3.10	349.00	<0.27	<0.009	<0.022	59.80	51.20	FG	I

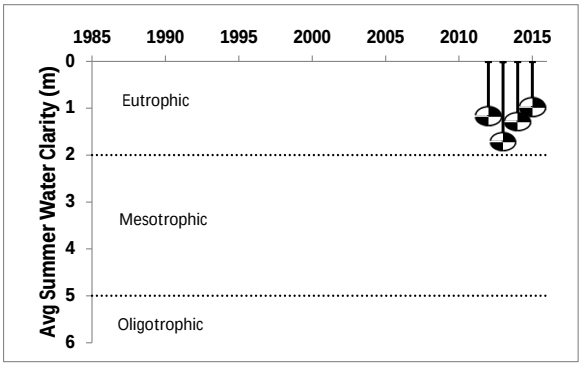
Legend Information

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 (mg/l); 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: Bedford Lake

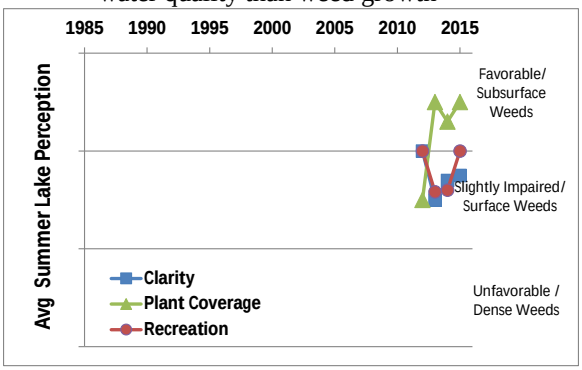
Long Term Trends: Water Clarity

- ↑ over last three years
- Most readings typical of *eutrophic* lakes



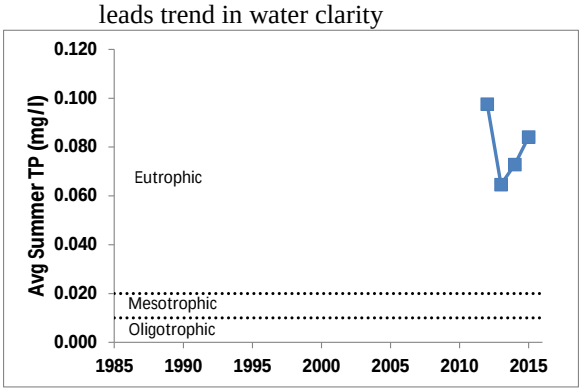
Long Term Trends: Lake Perception

- Variable perception; less weed growth last 3
- Recreational perception more closely tied to water quality than weed growth



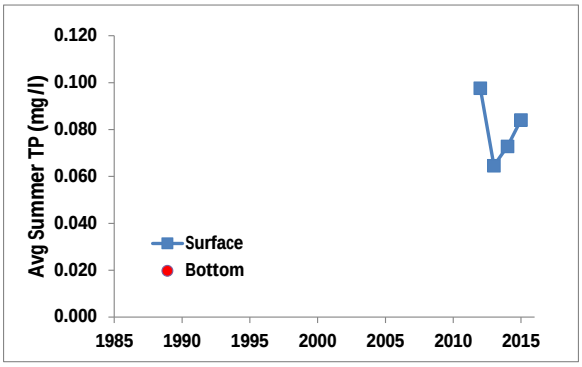
Long Term Trends: Phosphorus

- Phosphorus levels variable year to year
- Most readings typical of *eutrophic* lakes, and leads trend in water clarity



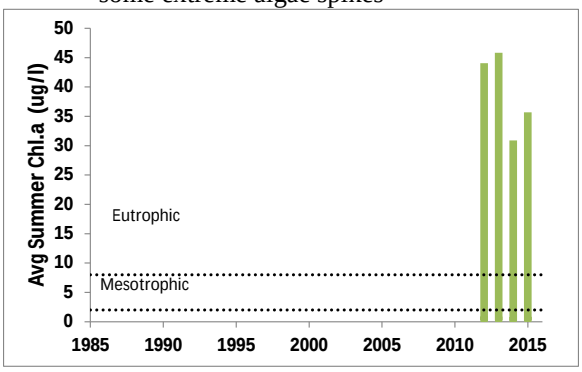
Long Term Trends: Bottom Phosphorus

- Bedford Lake not thermally stratified
- Deepwater TP levels probably similar to surface TP levels



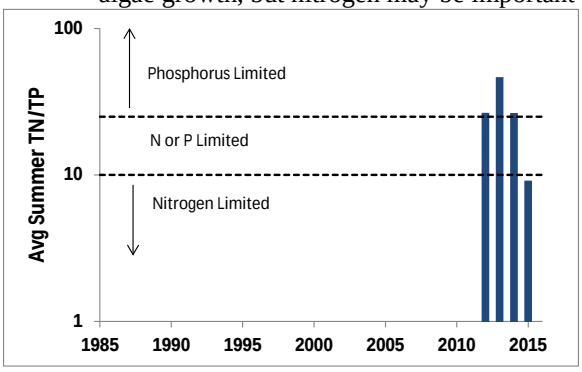
Long Term Trends: Chlorophyll a

- Algae levels lower in last two years
- Most readings typical of *eutrophic* lakes with some extreme algae spikes



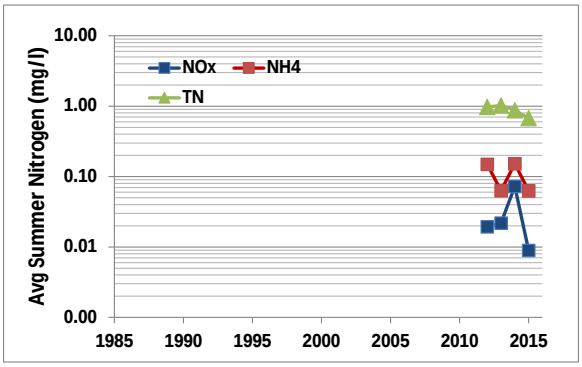
Long Term Trends: N:P Ratio

- N:P ratios variable year to year; slight drop?
- Most readings indicate phosphorus limits algae growth, but nitrogen may be important



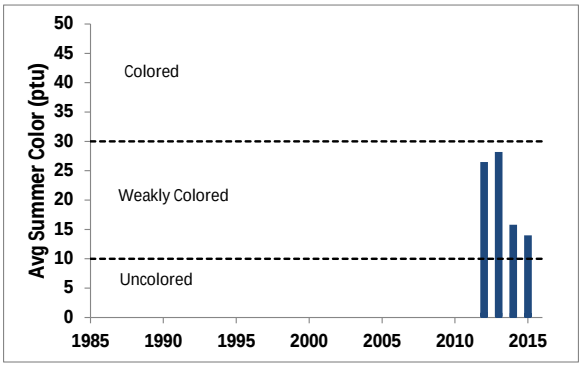
Long Term Trends: Nitrogen

- Variable N readings
- Relatively high total nitrogen, but low ammonia and NOx



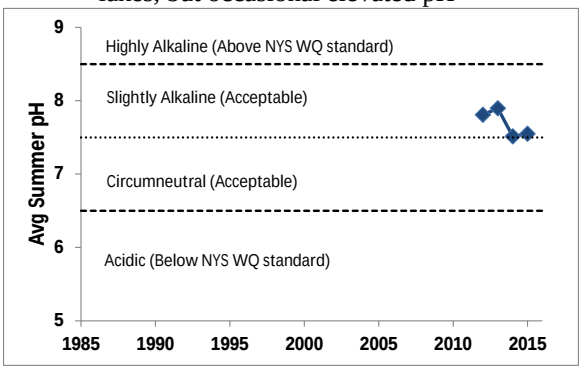
Long Term Trends: Color

- Lower color in 2014 and 2015
- Most readings typical of *weakly colored* lakes



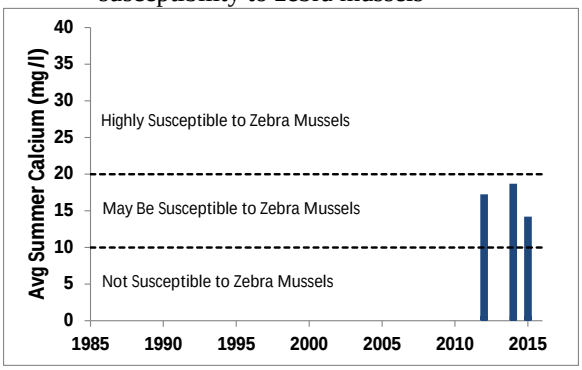
Long Term Trends: pH

- pH lower last two years
- Most readings typical of *slightly alkaline* lakes, but occasional elevated pH



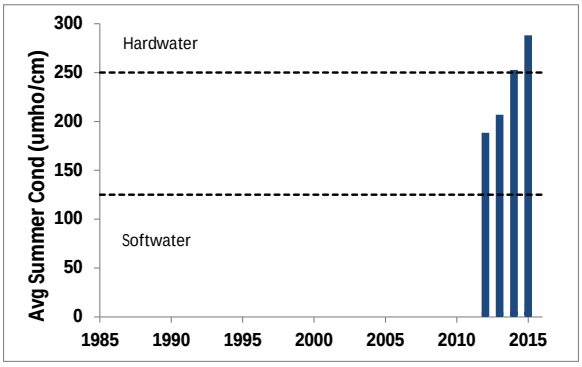
Long Term Trends: Calcium

- Calcium levels slightly variable year to year
- Most readings indicate intermediate susceptibility to zebra mussels



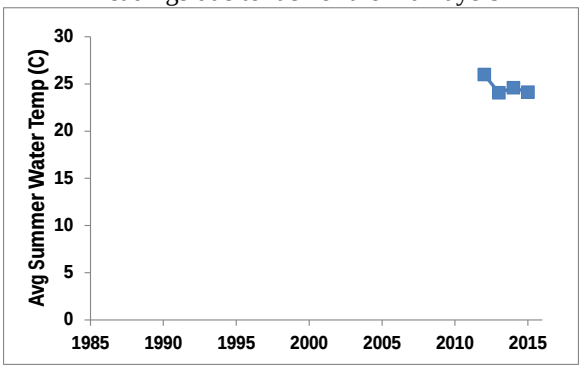
Long Term Trends: Conductivity

- Conductivity increasing last few years
- Most readings typical of lakes with *intermediate* hardness to hard water



Long Term Trends: Water Temperature

- Similar temperature readings all three years
- Deepwater temperature similar to surface readings due to lack of 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.

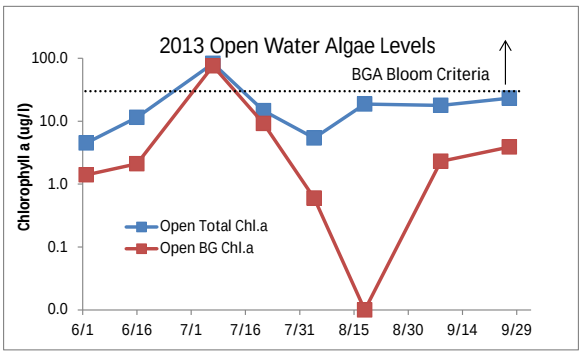


Figure D1:
2013 Open Water Total and BGA Chl.a

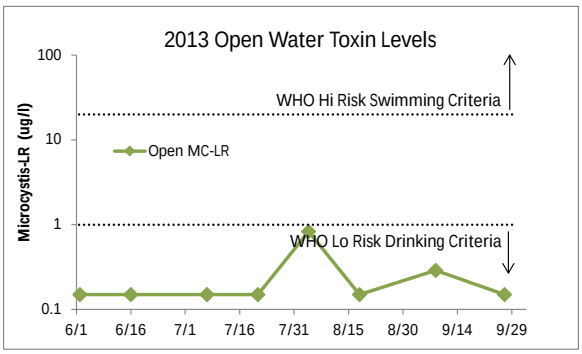


Figure D2:
2013 Open Water Microcystin-LR

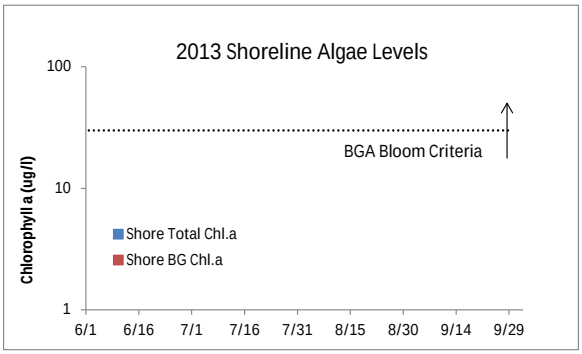


Figure D3:
2013 Shoreline Total and BGA Chl.a

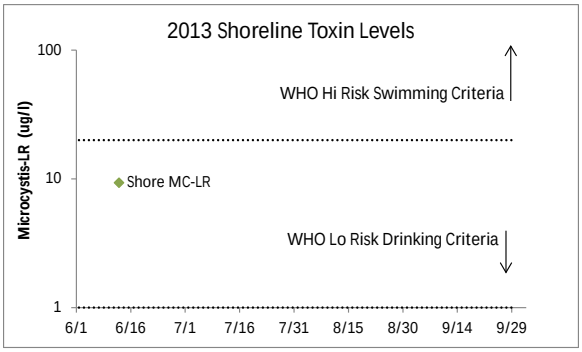


Figure D4:
2013 Shoreline Microcystin-LR

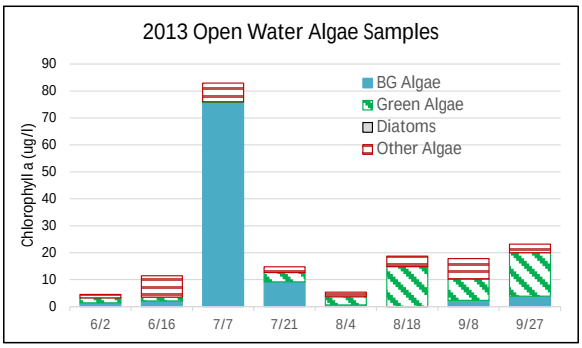


Figure D5:
2013 Open Water Algae Types

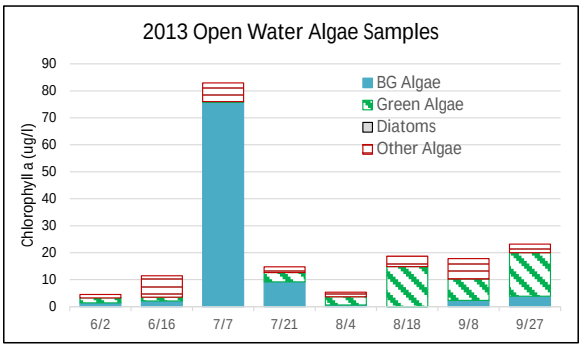


Figure D6:
2013 Shoreline Algae Types

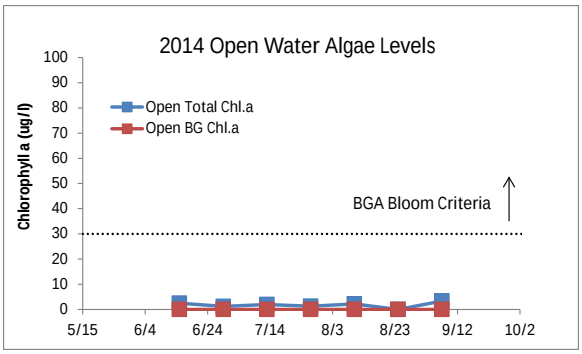


Figure D7:
2014 Open Water Total and BGA Chl.a

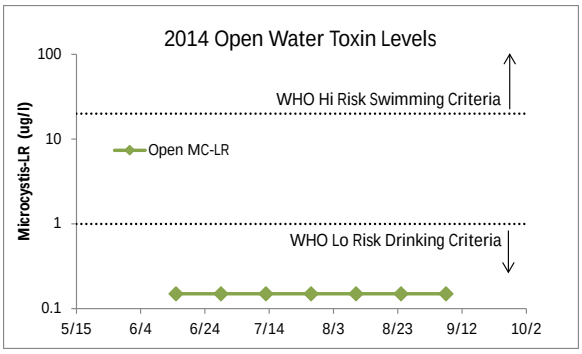


Figure D8:
2014 Open Water Microcystin-LR

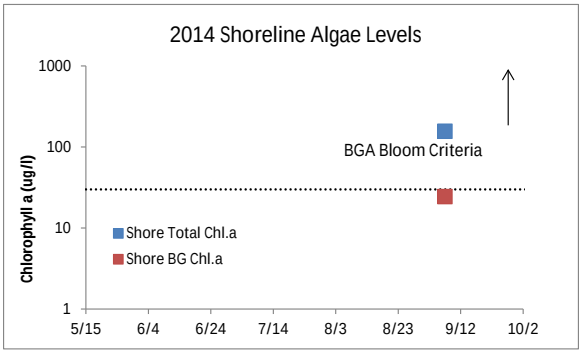


Figure D9:
2014 Shoreline Total and BGA Chl.a

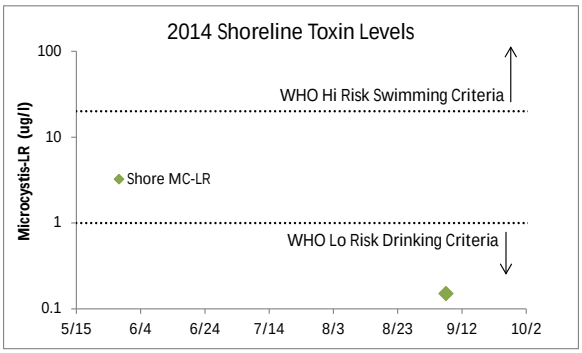


Figure D10:
2014 Shoreline Microcystin-LR

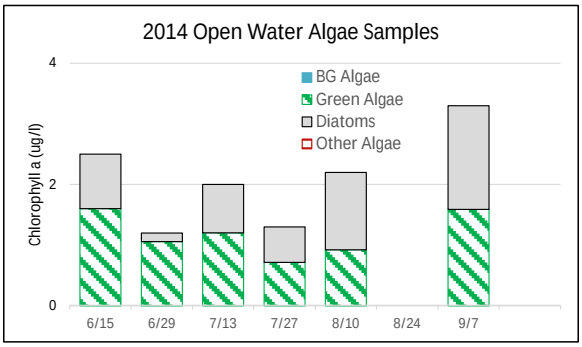


Figure D11:
2014 Open Water Algae Types

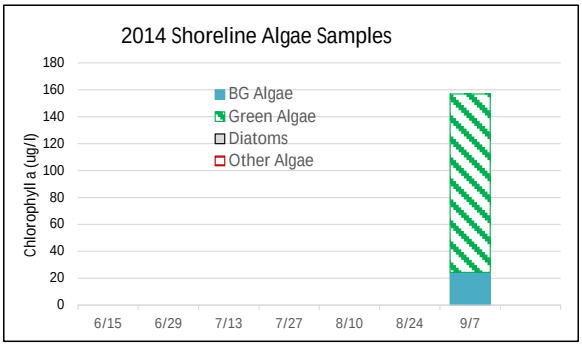


Figure D12:
2014 Shoreline Algae Types

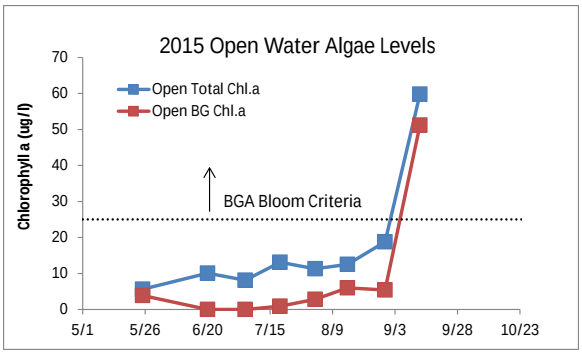


Figure D13:
2015 Open Water Total and BGA Chl.a

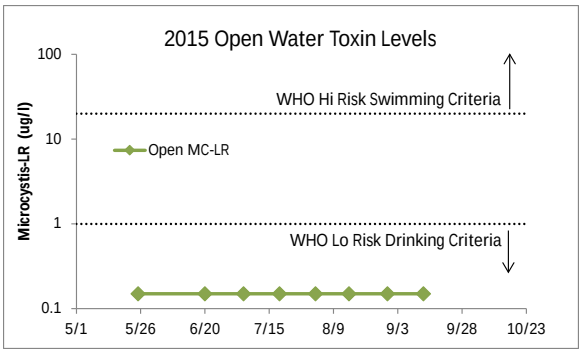


Figure D14:
2015 Open Water Microcystin-LR

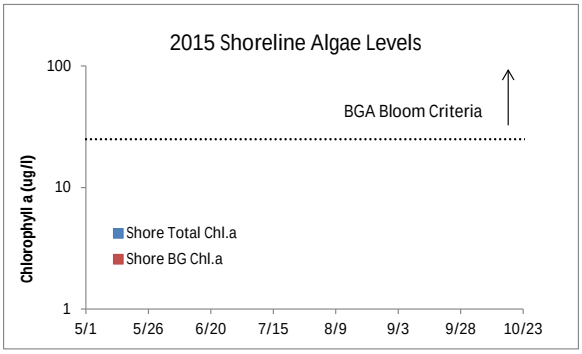


Figure D15:
2015 Shoreline Total and BGA Chl.a

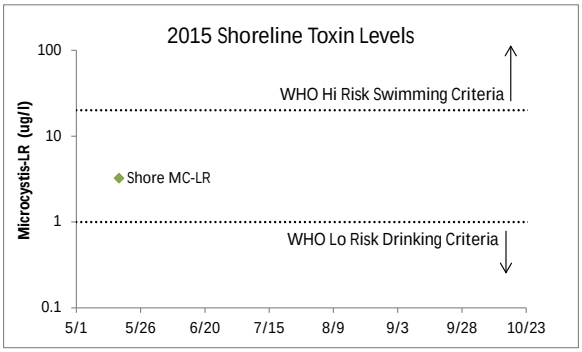


Figure D16:
2015 Shoreline Microcystin-LR

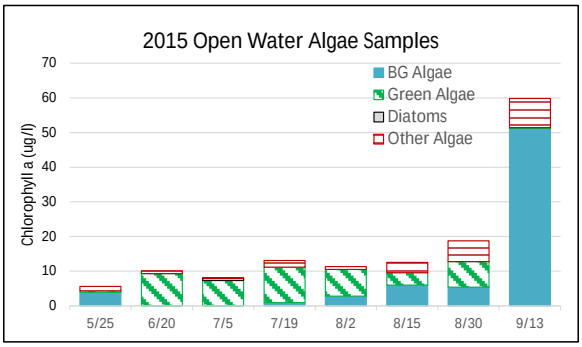


Figure D17:
2015 Open Water Algae Types

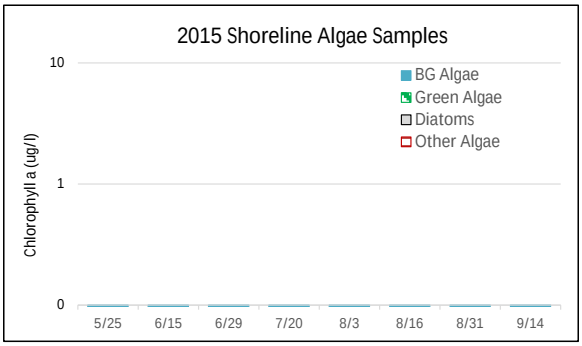


Figure D18:
2015 Shoreline Algae Types

Appendix E:
AIS Species in Westchester County

The table below shows the invasive aquatic plants and animals that have been documented in Westchester 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).

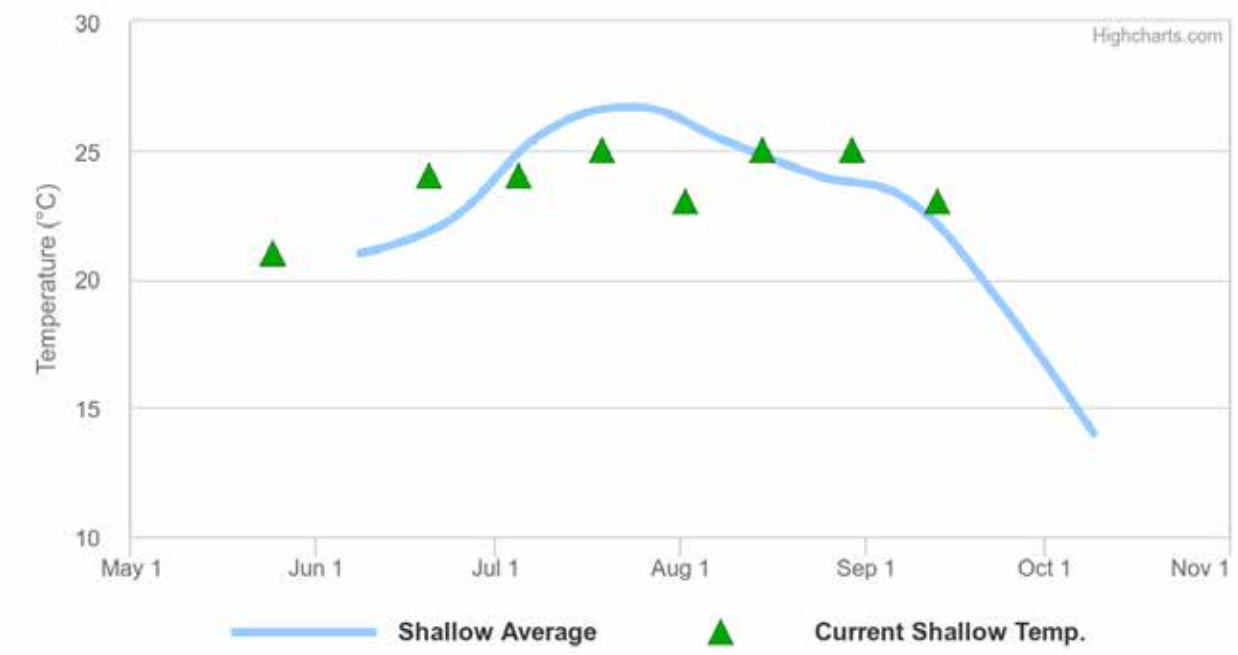
This list is not complete, but instead represents only those species that have been reported and verified within the county. If any additional aquatic invasive species (AIS) are known or suspected in these or other waterbodies in the county, this information should be reported through iMap invasives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

Aquatic Invasive Species - Westchester County			
Waterbody	**Kingdom**	**Common name**	**Scientific name**
Cross River Reservoir	Plant	Eurasian watermilfoil	*Myriophyllum spicatum*
Cross River Reservoir	Animal	Virile crayfish	*Orconectes virilis*
Croton River	Plant	Hydrilla	*Hydrilla verticillata*
Croton River	Plant	Eurasian watermilfoil	*Myriophyllum spicatum*
Croton River	Plant	Brittle naiad	*Najas minor*
Croton River	Plant	Curly leafed pondweed	*Potamogeton crispus*
Grassy Sprain Reservoir	Animal	American alligator	*Alligator mississippiensis*
Howlands Lake	Plant	Brittle naiad	*Najas minor*
Hudson River	Plant	Water chestnut	*Trapa natans*
Hudson River	Animal	Zebra mussel	*Dreissena polymorpha*
Huguenot Lake	Animal	American alligator	*Alligator mississippiensis*
Lake Katonah	Plant	Curly leafed pondweed	*Potamogeton crispus*
Lake Lincolndale	Plant	Eurasian watermilfoil	*Myriophyllum spicatum*
Lake Lincolndale	Plant	Brittle naiad	*Najas minor*
Lake Mohegan	Plant	Eurasian watermilfoil	*Myriophyllum spicatum*
Lake Oscaleta	Plant	Eurasian watermilfoil	*Myriophyllum spicatum*
Lake Oscaleta	Plant	Brittle naiad	*Najas minor*
Lake Oscaleta	Plant	Curly leafed pondweed	*Potamogeton crispus*
Lake Rippowam	Plant	Eurasian watermilfoil	*Myriophyllum spicatum*
Lake Waccabuc	Plant	Brazilian elodea	*Egeria densa*
Lake Waccabuc	Plant	Eurasian watermilfoil	*Myriophyllum spicatum*
Lake Waccabuc	Plant	Brittle naiad	*Najas minor*
Lake Waccabuc	Plant	Curly leafed pondweed	*Potamogeton crispus*
Lake Waccabuc	Plant	Water chestnut	*Trapa natans*

Waterbody	Kingdom	Common name	Scientific name
Lounsbury Pond	Plant	Water chestnut	*Trapa natans*
Mohansic Lake	Plant	Eurasian watermilfoil	*Myriophyllum spicatum*
Muscoot Reservoir	Plant	Eurasian watermilfoil	*Myriophyllum spicatum*
Muscoot Reservoir	Animal	Rusty crayfish	*Orconectes rusticus*
Muscoot Reservoir	Plant	Curly leafed pondweed	*Potamogeton crispus*
Muscoot Reservoir	Plant	Water chestnut	*Trapa natans*
New Croton Reservoir	Plant	Hydrilla	*Hydrilla verticillata*
New Croton Reservoir	Plant	Eurasian watermilfoil	*Myriophyllum spicatum*
Peach Lake	Plant	Eurasian watermilfoil	*Myriophyllum spicatum*
Pine Lake	Plant	Water chestnut	*Trapa natans*
Tarrytown Reservoir	Plant	Eurasian watermilfoil	*Myriophyllum spicatum*
Teatown Lake	Plant	European four leaf clover	*Marsilea quadrifolia*
Teatown Lake	Plant	Eurasian watermilfoil	*Myriophyllum spicatum*
Teatown Lake	Plant	Water chestnut	*Trapa natans*
Titicus Reservoir	Plant	Eurasian watermilfoil	*Myriophyllum spicatum*
Troublesome Brook n of Tuckahoe	Animal	Asian Clam	*Corbicula fluminea*
Truesdale Lake	Plant	Curly leafed pondweed	*Potamogeton crispus*
Vernay Lake	Plant	Curly leafed pondweed	*Potamogeton crispus*
Wallace Pond	Plant	Curly leafed pondweed	*Potamogeton crispus*
Wampus Lake Reservoir	Plant	Eurasian watermilfoil	*Myriophyllum spicatum*
Wampus Lake Reservoir	Plant	Curly leafed pondweed	*Potamogeton crispus*

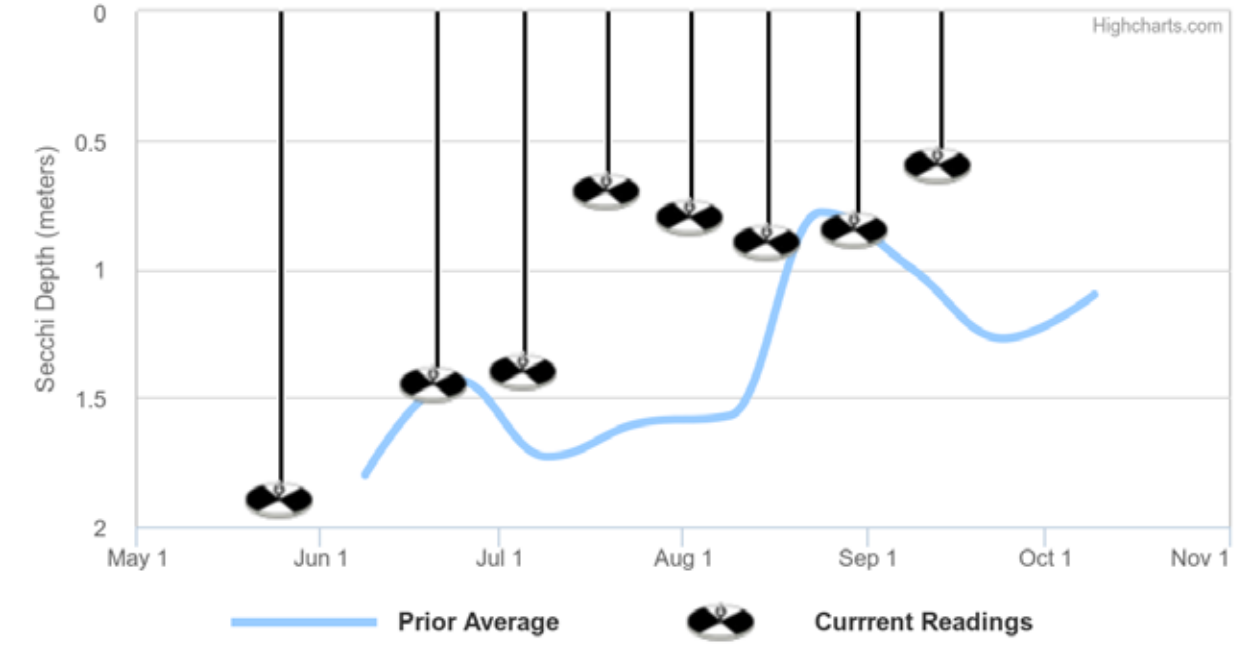
Appendix F: Current Year vs. Prior Averages for Bedford Lake

Current Year Water Temperatures vs. Prior Average

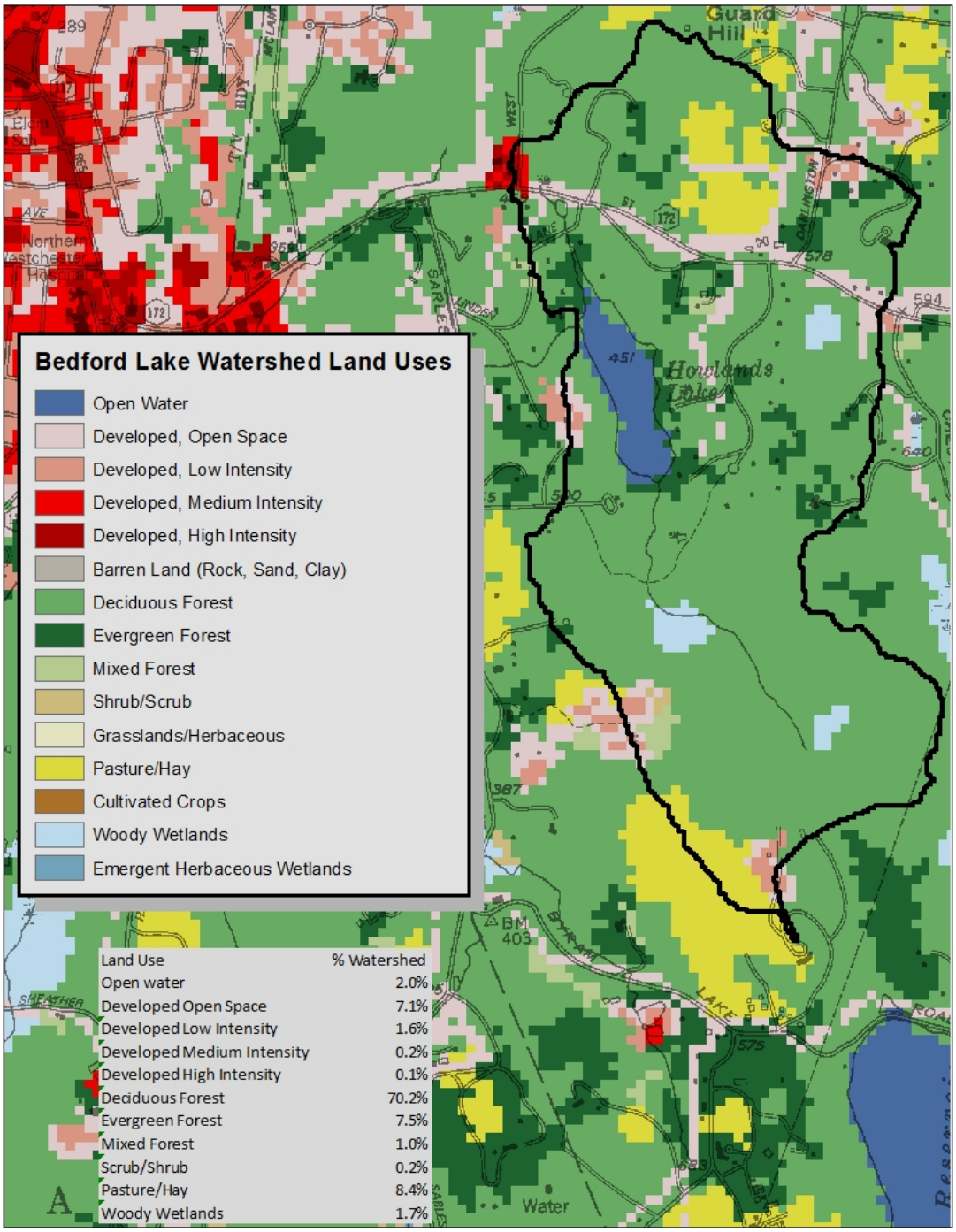


There are not enough shallow water sample temperatures to determine a trend for the current year when compared to the average of readings collected from 2012 to 2014.

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 F: Watershed and Land Use Map for Bedford 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.