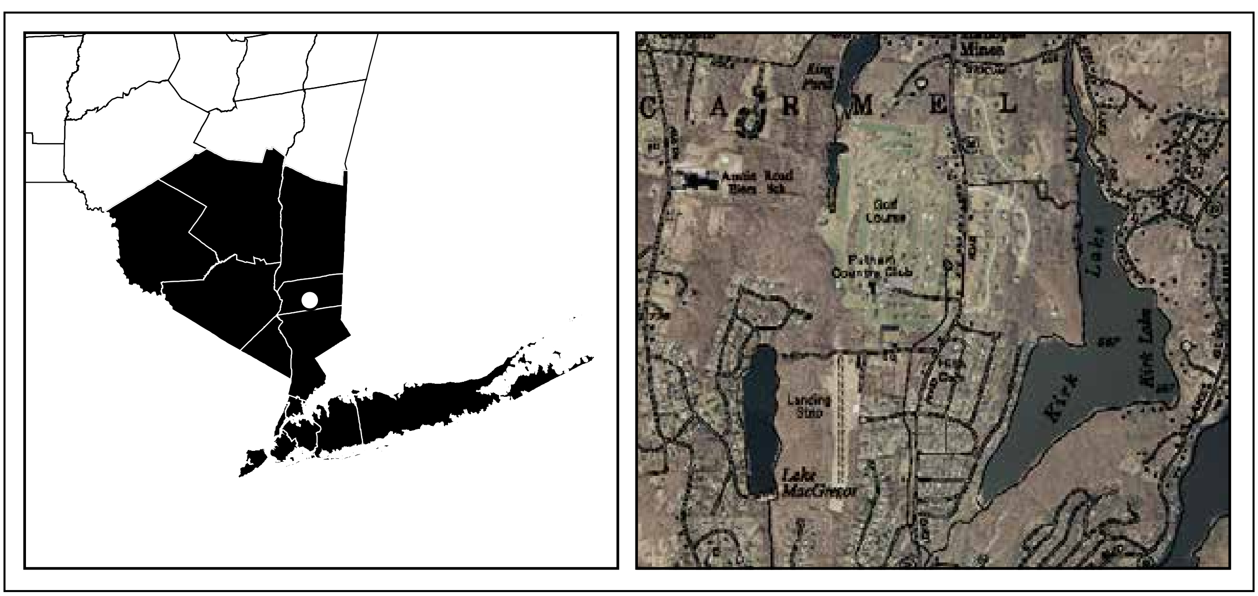
CSLAP 2014 Lake Water Quality Summary:
Kirk Lake

General Lake Information

Location	Town of Carmel
County	Putnam
Basin	Lower Hudson River
Size	49.9 hectares (123.4 acres)
Lake Origins	Augmented by 28ft by 220ft masonry and earthen dam built in 1881
Watershed Area	803 hectares (1984 acres)
Retention Time	0.2 years
Mean Depth	3.1 meters
Sounding Depth	6.9 meters
Public Access?	None
Major Tributaries	Tribs of Secor and Kirk Lakes
Lake Tributary To…	Muscoot River, Upper, and tribs to Amawalk Reservoir
WQ Classification	B
Lake Outlet Latitude	41.379167
Lake Outlet Longitude	-73.758056
Sampling Years	2011-2014
2014 Samplers	Joe Montuori, Susan and Art Nicoletti
Main Contact	Joe Montuori

Lake Map



Background

Kirk Lake is a 123 acre Class B pond in the town of Kent, Putnam County. 2011 is the first year Kirk Lake has been sampled under direction from the Citizens Statewide Lake Assessment Program (CSLAP).

It is one of 15 CSLAP lakes among the more than 75 lakes found in Putnam County, and one of 67 CSLAP lakes among the more than 350 lakes and ponds in the Lower Hudson River drainage basin

Lake Uses

Kirk Lake is a Class B pond, meaning the best intended uses are contact recreation – swimming and bathing, and non contact recreation – boating and fishing, aquatic life, and aesthetics. The lake actively supports each of these uses.

All New York State fishing regulations are applicable. The state of New York does not stock fish in Kirk Lake; it is not known if private stocking occurs.

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

Historical Water Quality Data

CSLAP sampling was conducted on Kirk Lake for the first time in 2011. The CSLAP reports and scorecards for the lake can be found on the NYSFOLA website at http://nysfola.mylaketown.com and on the NYSDEC web page at http://www.dec.ny.gov/lands/77821.html.

Fisheries surveys on the lake indicate that carp, largemouth bass, small mouth bass, rock bass, white and yellow perch, sunfish, and catfish can be found in the lake.

There is some historical data from the lake from Western Connecticut State University in 1988. Allied Biological also conducted some water quality monitoring of the lake in 2013 and 2014, and the New York City Department of Environmental Protection (DEP) conducts occasional water quality monitoring of the lake, dating back to at least 2003. These data will be summarized in a series of reports provided by consultant Jim Sutherland to the Kirk Lake Watershed Association. The results from the latter show conditions mostly consistent with those measured through CSLAP.

Lake Association and Management History

Kirk Lake is served by the Lake Gardens Property Owners Association and the Kirk Lake Watershed Association. The mission of the Watershed Network is to "enhance the quality of the natural environment in the area that drains into Kirk Lake". These organizations maintain a blog and Facebook page, and engage in a variety of lake management and educational activities. These include water quality monitoring (CSLAP), aquatic plant management (grass carp stocking and drawdown), lake cleanup, conducting resident surveys, and the development of a watershed management plan

More information about these lake organizations can be found at http://www.kirklake.org/ and http://sites.google.com/site/kirklakenetwork/.

Summary of 2014 CSLAP Sampling Results

Evaluation of 2014 Annual Results Relative to 2011-2013

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 –Kirk Lake" section in Appendix C.

Evaluation of Eutrophication Indicators

Water clarity readings were higher than normal in 2014, and these readings have increased over the last few years. This is consistent with a decrease in phosphorus readings over the same period, although algae levels have not exhibited a similar change. It is not yet known if the lake has exhibited longer-term trends, although the historical data from the lake is mostly similar to what has been measured through CSLAP.

The productivity of Kirk Lake increases (water clarity decreases, nutrients and algae increase) during the summer (June through September). This seasonal increase was also apparent from June through August in 2014.

Kirk Lake can best be described as *eutrophic*, or highly productive, due to high phosphorus and chlorophyll *a* readings and low Secchi disk transparency readings, although 2014 water clarity readings are more typical of *mesotrophic* lakes. The trophic state index (TSI) evaluation suggests that each of these trophic indicators is "internally consistent"—that is, each indicator could be predicted by looking at the other indicators. Overall trophic conditions are summarized in 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. However, the lake is not classified for 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

Color readings are close to those found in the typical NYS lake, and do not likely affect water transparency. Nitrogen readings (NOx, ammonia, and total nitrogen) are relatively low, although the role of nitrogen in algae dynamics in the lake should continue to be evaluated. Ammonia readings have increased slightly over the last few years, although these readings continue to be fairly low. pH readings continue to be typical of alkaline lakes, although these readings have decreased slightly over the last few years (perhaps consistent with lower nutrient levels). Conductivity readings are typical of hardwater lakes. Conductivity was higher than usual in 2014, but no trends have been apparent. Calcium readings are high enough to support zebra mussel colonization, and these readings have been higher than usual in 2014. However, these exotic animals have not been reported in the lake. Additional data will be needed to determine if any longer-term changes have occurred. Overall limnological conditions are summarized in the Lake Scorecard and Lake Condition Summary Table.

Evaluation of Biological Condition

Zooplankton, macrophyte, and macroinvertebrate data have not been collected through CSLAP at Kirk Lake. Phytoplankton samples analyzed by Aquatic Analysts found more than 70 algae (and blue green algae) species in 2013 or 2014 in surface samples, with green algae (chlorophytes) and dinoflagellates (pyrrophytes) usually the most abundant, particularly in mid to late summer. However, biomass densities of cyanobacteria (blue green algae) were often high in August and September. The fluoroprobe screening samples analyzed by SUNY ESF in the last few years indicated moderate to high algae levels and a fairly high percentage of blue green algae in some of these samples. Blue green algae and total algae levels increase from June through August, and then decrease through the fall. These readings were slightly lower in 2014, and peaked later in the year.

Shoreline blue green algae blooms have been reported in several recent years. These open water and bloom samples exhibited a wide variety of blue green algae species (*Woronichinia, Aphanizomenon, Anabaena, Nostoc*, *Lyngbya*, and *Microcystis*), as well as diatoms, green algae, and other non-blue green species. Most of the blue green species can produce algal toxins, although toxin levels were below the threshold established by the World Health Organization for unsafe swimming in the open water. Moderately high toxin levels in some shoreline bloom samples suggest a moderate risk for swimmers within dense shoreline surface blooms and scums. Shoreline blooms were less extensive and seasonally delayed in 2014.

The lake association has reported that at least two exotic plants—Eurasian watermilfoil (*Myriophyllum spicatum*), and water chestnut (*Trapa natans*)—have been found in the lake, and are growing extensive enough to warrant active management through grass carp stocking and lake cleanups. Grass carp have been stocked at times since at least 1999.

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

Evaluation of Lake Perception

Recreational and water quality assessments were more favorable than usual in 2014, consistent with higher clarity (and despite slightly higher than usual open water algae levels) and consistent with a recent improvement in both indicators of lake perception.

Water quality assessments indicated that the lake most frequently exhibited "not quite crystal clear water", more favorable than expected given the measured water quality conditions in the lake. Aquatic plants typically grow to the lake surface, and at times significantly affect the recreational suitability of the lake. Recreational assessments have most often been cited as "slightly impaired", consistent with the surface weed growth, and consistent with the measured water quality conditions (though less favorable than expected given the water quality assessments). Lake perception degrades during the summer, consistent with the seasonal increase in lake productivity. These seasonal changes were mostly apparent in 2014. Overall lake perception is summarized in the Lake Scorecard and Lake Condition Summary Table.

Evaluation of Local Climate Change

Water temperatures have decreased slightly over the last three years, but it is not yet known if water temperatures are changing in Kirk Lake.

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. However, phycocyanin readings were occasionally above the levels indicating susceptibility for harmful algal blooms (HABs). This is consistent with the fluoroprobe screening results indicating occasionally elevated levels of blue green algae in the last few years, and the occasional presence of shoreline blooms. The analysis of algae samples from the open water and shoreline blooms indicated fairly low toxin levels in the open water, but microcystin readings near (but below) the levels indicating unsafe swimming conditions in some shoreline blooms. Anatoxin-a has occasionally been detectable- lake residents and their pets should avoid exposure to shoreline blooms or discolored water.

Lake Condition Summary

Category	Indicator	Min	11-14 Avg	Max	2014 Avg	Classification	2014 Change?	Long-term Change?
Eutrophication Indicators	Water Clarity	1.23	1.99	3.75	2.35	Eutrophic	Higher Than Normal	Not yet known
	Chlorophyll *a*	3.70	14.65	33.80	15.81	Eutrophic	Within Normal Range	Not yet known
	Total Phosphorus	0.016	0.025	0.073	0.022	Eutrophic	Lower Than Normal	Not yet known
Potable Water Indicators	Hypolimnetic Ammonia							Not known
	Hypolimnetic Arsenic							Not known
	Hypolimnetic Iron							Not known
	Hypolimnetic Manganese							Not known
Limnological Indicators	Hypolimnetic Phosphorus							Not known
	Nitrate + Nitrite	0.01	0.01	0.05	0.01	Low NOx	Within Normal Range	Not yet known
	Ammonia	0.01	0.05	0.20	0.05	Low Ammonia	Within Normal Range	Not yet known
	Total Nitrogen	0.31	0.65	0.92	0.65	Intermediate Total Nitrogen	Within Normal Range	Not yet known
	pH	6.79	7.98	8.90	7.83	Alkaline	Within Normal Range	Not yet known
	Specific Conductance	195	315	393	356	Hardwater	Higher than Normal	Not yet known
	True Color	1	17	28	15	Intermediate Color	Within Normal Range	Not yet known
	Calcium	14.8	20.6	23.2	21.3	Highly Susceptible to Zebra Mussels	Within Normal Range	Not yet known
Lake Perception	WQ Assessment	1	2.4	4	2.2	Not Quite Crystal Clear	Within Normal Range	Not yet known
	Aquatic Plant Coverage	1	2.9	4	2.5	Surface Plant Growth	Within Normal Range	Not yet known
	Recreational Assessment	1	2.5	3	2.0	Excellent	Within Normal Range	Not yet known
Biological Condition	Phytoplankton					Not measured through CSLAP	Not known	Not known
	Macrophytes					Not measured 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					Eurasian watermilfoil, water chestnut	Not known	Not known
Local Climate Change	Air Temperature	15	23.8	36	23.8		Within Normal Range	Not yet known
	Water Temperature	18	24.1	30	24.1		Within Normal Range	Not yet known
Harmful Algal Blooms	Open Water Phycocyanin	1	65	331	29	Some readings indicate high risk of BGA	Not known	Not known
	Open Water FP Chl.a	1	10	21	10	Few readings indicate high algae levels	Not known	Not known
	Open Water FP BG Chl.a	0	7	19	5	Few readings indicate high BGA levels	Not known	Not known
	Open Water Microcystis	0.4	0.2	0.4	<0.30	Mostly undetectable open water MC-LR	Not known	Not known
	Open Water Anatoxin a	<DL	0.3	0.7	<DL	Open water Anatoxin-a at times detectable	Not known	Not known
	Shoreline Phycocyanin					No shoreline blooms sampled for PC	Not known	Not known
	Shoreline FP Chl.a	114	672	1732	170	All readings indicate very high algae levels	Not known	Not known
	Shoreline FP BG Chl.a	91	630	1636	164	All readings indicate very high BGA levels	Not known	Not known
	Shoreline Microcystis	4.6	7.0	15.4	4.6	At times elevated 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

Kirk Lake is listed on the 2008 Lower Hudson River basin Priority Waterbody List (PWL) as "unassessed".

Potable Water (Drinking Water)

The CSLAP dataset at Kirk 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 limited CSLAP indicators suggest that any "unofficial" potable water use of the lake might be threatened by excessive algae and algal toxins, particularly near shoreline blooms.

Contact Recreation (Swimming)

The CSLAP dataset at Kirk Lake, including water chemistry data, physical measurements, and volunteer samplers' perception data, suggests that swimming and contact recreation may be *impaired* by excessive algae and the occasional production of algal toxins, and *threatened* by low water clarity.

Non-Contact Recreation (Boating and Fishing)

The CSLAP dataset on Kirk Lake, including water chemistry data, physical measurements, and volunteer samplers' perception data, suggest that non-contact recreation may be *stressed* by excessive weeds, particularly Eurasian watermilfoil and water chestnut, although these impacts were not as apparent in the last few years.

Aquatic Life

The CSLAP dataset on Kirk Lake, including water chemistry data, physical measurements, and volunteer samplers' perception data, suggest that aquatic life should be supported, although this use may be *threatened* by invasive plants and high algae levels. Additional data are needed to evaluate the food and habitat conditions for aquatic organisms in the lake.

Aesthetics

The CSLAP dataset on Kirk Lake, including water chemistry data, physical measurements, and volunteer samplers' perception data, suggest that aesthetics may be *threatened* by excessive weeds and shoreline algae blooms.

Fish Consumption

There are no fish consumption advisories posted for Kirk Lake.

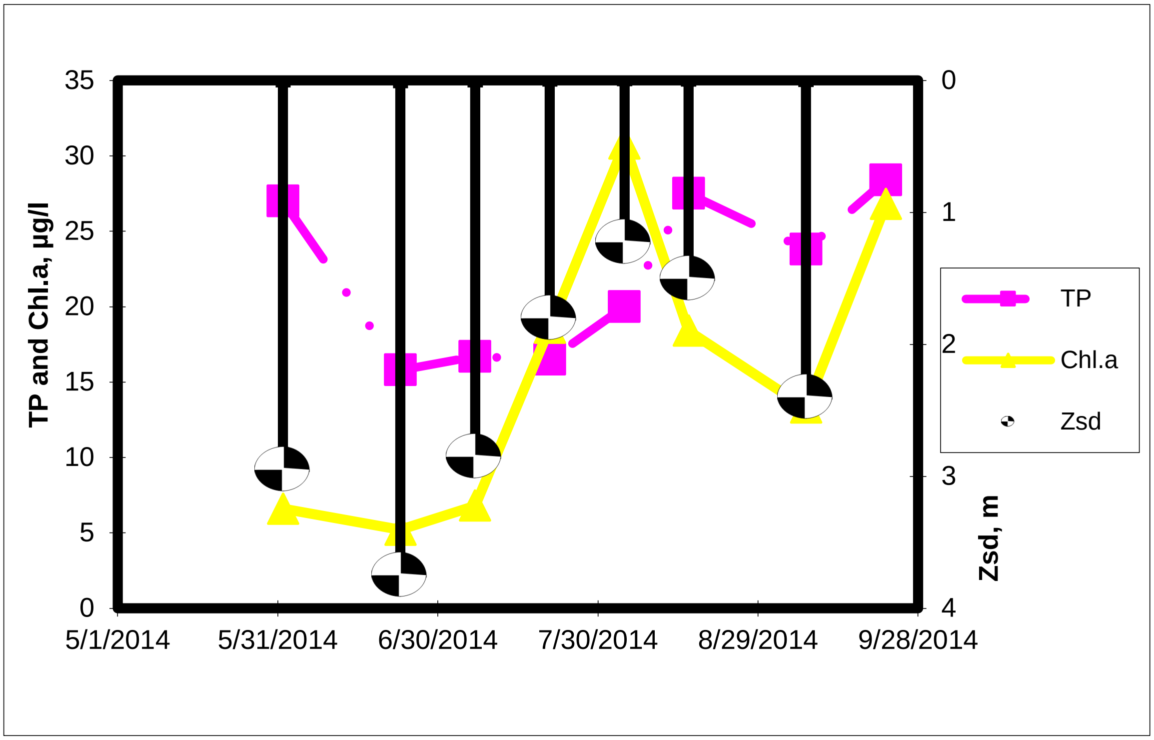
Additional Comments and Recommendations

Lake residents should report and avoid exposure to any suspicious shoreline algae blooms. Any activities initiated in recent years to reduce nutrient levels in the lake may have been effective and should be continued.

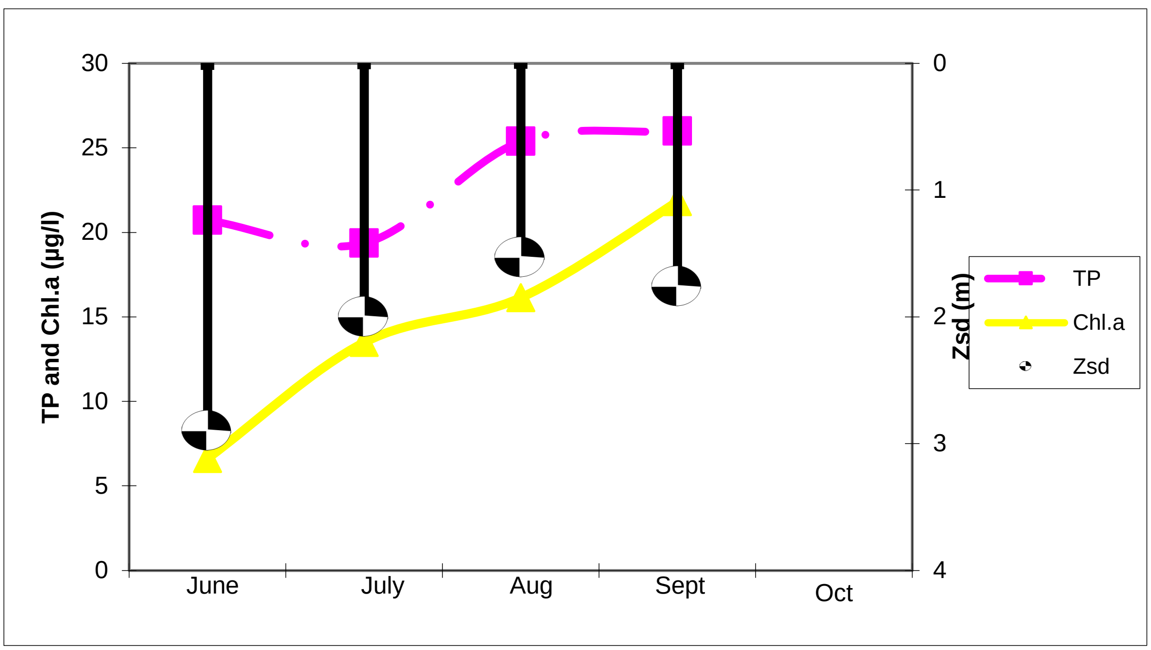
Aquatic Plant IDs-2014

No aquatic plants submitted for identification in 2014.

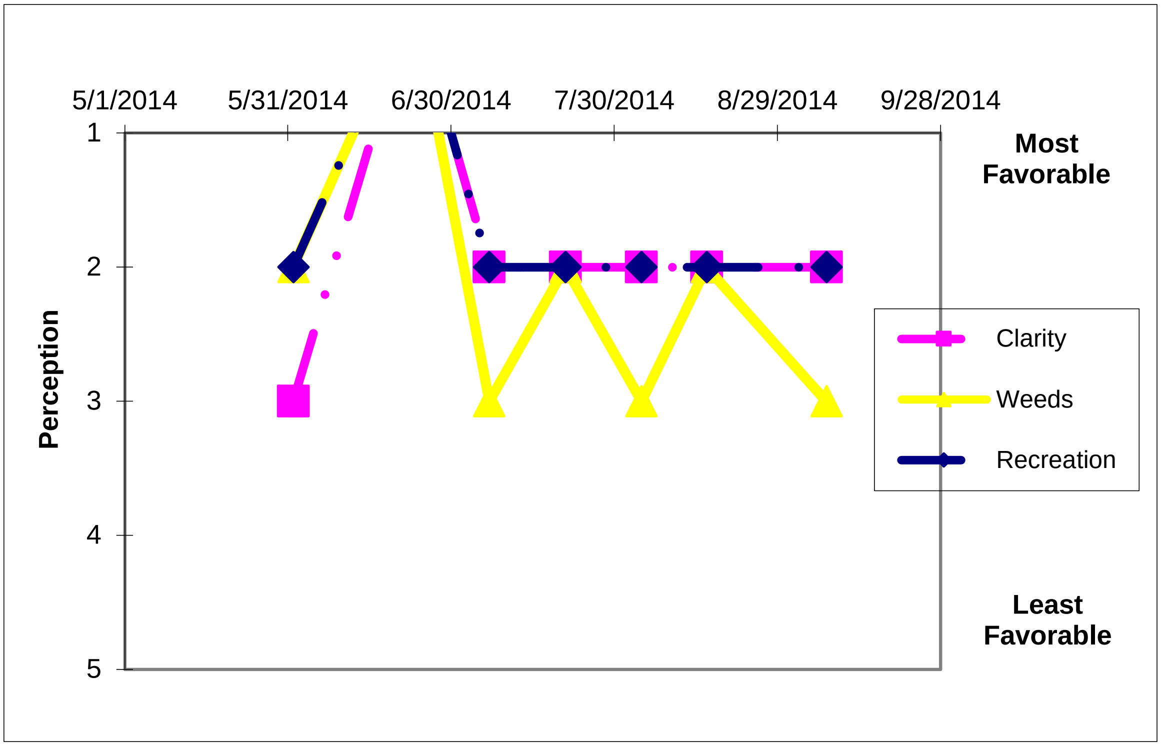
Time Series: Trophic Indicators, 2014



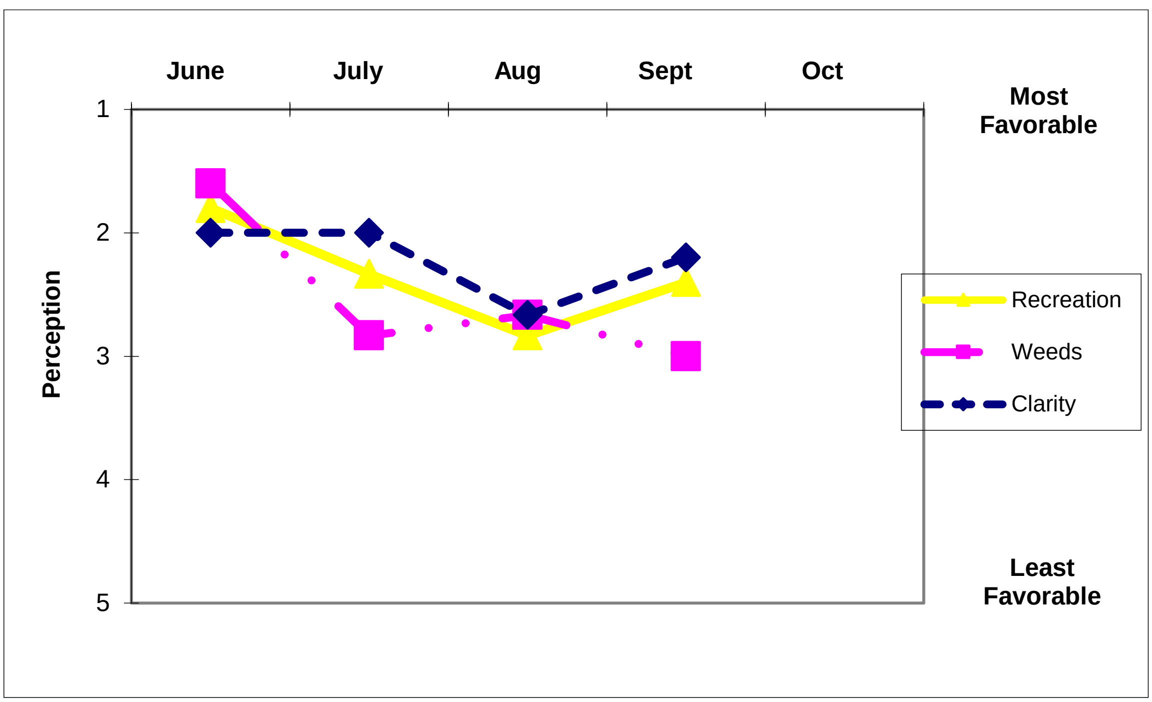
Time Series: Trophic Indicators, Typical Year (2011-2014)



Time Series: Lake Perception Indicators, 2014



Time Series: Lake Perception Indicators, Typical Year (2011-2014)



Appendix A- CSLAP Water Quality Sampling Results for Kirk Lake

LNum	PName	Date	Zbot	Zsd	Zsamp	Tot.P	NO3	NH4	TDN	TN/TP	TColor	pH	Cond25	Ca	Chl.a
230	Kirk L	6/5/2011	6.6	3.15	1.5	0.019	0.01	0.03	0.36	42.03	0.5	8.32	335	21.0	5.10
230	Kirk L	6/19/2011	6.9	2.55	1.5	0.018	0.01	0.03	0.31	38.25	19	8.09	341		3.70
230	Kirk L	7/7/2011	6.9	2.25	1.5	0.021	0.02	0.03	0.44	46.00	22	7.92	328		6.30
230	Kirk L	7/18/2011	6.8	1.85	1.5	0.016	0.03	0.01	0.50	69.64	16	7.92	317		7.30
230	Kirk L	7/18/2011	grab	bloom											
230	Kirk L		grab	bloom											
230	Kirk L	8/1/2011	6.1	1.90	1.5	0.024	0.01	0.02	0.76	70.05	1	8.84	339	22.0	5.00
230	Kirk L	8/15/2011	6.6	1.95	1.5	0.020	0.01	0.04	0.77	84.37	19	7.75	324		14.80
230	Kirk L	8/15/2011	grab	bloom											
230	Kirk L	8/30/2011	6.6	1.25	1.5	0.033	0.02	0.02	0.90	60.47	25	7.88	267		
230	Kirk L	8/30/2011	grab	bloom											
230	Kirk L	9/12/2011	6.0	1.55	1.5	0.029	0.05	0.03	0.92	70.92	24	7.67	230		27.30
230	Kirk L	6/26/2012	6.8	2.10	1.5	0.024	0.02	0.04	0.48	43.82	15	7.29	322	23.2	12.50
230	Kirk L	7/10/2012	5.6	1.80	1.5	0.019	0.01	0.01	0.52	61.98	28	8.10	313		8.10
230	Kirk L	7/24/2012	7.3	1.45	1.5	0.028	0.02	0.02	0.89	70.12	23	8.58	299		33.80
230	Kirk L	8/9/2012	6.2	1.35	1.5	0.034	0.01	0.02	0.61	40.02	11	8.90	306		18.20
230	Kirk L	8/21/2012	6.2	1.55	1.5	0.020	0.01	0.17	0.77	85.14	15	7.88	278	14.8	9.60
230	Kirk L	9/9/2012	6.7	1.75	1.5	0.024	0.03	0.04	0.74	67.74	15	7.55	288		21.80
230	Kirk L	9/23/2012	7.5	1.65	1.5	0.025	0.01	0.08	0.46	40.90	13	7.50	300		21.50
230	Kirk L	9/30/2012	7.2	1.45	1.5	0.026	0.01	0.20	0.80	67.00	12	7.59	195		20.20
230	Kirk L	6/30/2013	7.3	3.40	1.5	0.026	0.01	0.01	0.37	31.92	21	8.18	327.8		3.90
230	Kirk L	7/15/2013	7.4	2.50	1.5	0.018					17	8.2	305.1		8.80
230	Kirk L	7/29/2013		1.45	1.5	0.021	0.01	0.02	0.66	67.86	23	8.4	266.6		
230	Kirk L	8/12/2013	6.5	1.25	1.5	0.025			0.76	66.51	23	8.32	316.1		21.50
230	Kirk L	8/12/2013			bloom										
230	Kirk L	8/26/2013	7.5	1.45	1.5	0.026			0.77	65.80	17	8.89	323.2		21.30
230	Kirk L	9/9/2013	7.2	1.88	1.5	0.020	0.01	0.05	0.72	81.34	25	7.77	287.9		11.30
230	Kirk L	9/28/2013	7.3	2.05	1.5	0.073	0.01	0.08	0.72	21.87	15	7.51	301		16.90
230	Kirk L	9/30/2013			bloom										
230	Kirk L	10/1/2013													
230	Kirk L	10/22/2013													
230	Kirk L	10/10/2013	7.3	1.75	1.5				0.65		16	7.7	320.4		14.00
230	Kirk L	6/1/2014	8.4	2.95	1.5	0.027	0.02	0.04	0.49	39.76	22	7.77	245	21.0	6.60
230	Kirk L	6/23/2014	7.3	3.75	1.5	0.016			0.43	60.29	12	6.79	393		5.20
230	Kirk L	7/7/2014	7.6	2.85	1.5	0.017	0.02	0.06	0.50	66.13	13	8.09	328		6.80
230	Kirk L	7/21/2014		1.80	1.5	0.017			0.73	96.67	13	7.92	378		18.60
230	Kirk L	8/4/2014	7.3	1.23	1.5	0.020	0.01	0.06	0.81	88.77	6	7.90	362	21.5	30.80
230	Kirk L	8/16/2014	7.1	1.50	1.5	0.028			0.74	59.28	22	8.05	381		18.40
230	Kirk L	9/7/2014	7.5	2.40	1.5	0.024			0.73	67.39	13	8.77	382		13.30
230	Kirk L	10/3/2014													
230	Kirk L	9/22/2014				0.028			0.75	58.41	18	7.38	383		26.80

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
230	Kirk L	6/5/2011	surf	21	22	2	1	1	0	0	5									
230	Kirk L	6/19/2011	surf	26	25	2	3	3	2	4	456	18.90	4.40							
230	Kirk L	7/7/2011	surf	26	27	2	3	3	8	0	0	7.50	2.80							
230	Kirk L	7/18/2011	surf	25	27	2	3	3	12	4	4	23.40	3.40							
230	Kirk L	7/18/2011	bloom											5.91	<0.9	<0.1				
230	Kirk L		bloom											15.42	<0.4	<0.1				
230	Kirk L	8/1/2011	surf	27	28	4	3	4	234	234	234	87.50	6.90	<0.3	<0.9	<0.1				
230	Kirk L	8/15/2011	surf	21	25	2	3	3	25	0	234	97.80	5.50	<0.3	,0.5	<0.1				
230	Kirk L	8/15/2011	bloom											<0.6	<0.9	<0.1				
230	Kirk L	8/30/2011	surf	22	21	3	2	3	48	4	4	331.20	9.80							
230	Kirk L	8/30/2011	bloom											10.01	<0.9	<0.1				
230	Kirk L	9/12/2011	surf	26	24	3	3	4	23	7	4	300.00	10.10	<0.3	<0.9	<0.1				
230	Kirk L	6/26/2012	surf	16	26	3	2	3	5	0	46	15.70	0.80	<0.30	<0.410		4.42	2.57	I	
230	Kirk L	7/10/2012	surf	30		2	3	2	2	4	4	52.20	0.70	<0.30	<0.423		7.18	6.07	F	
230	Kirk L	7/24/2012	surf	31	27	2	3	2	0	0	0	106.00	1.80	<0.30	<0.585		17.60	13.33	I	
230	Kirk L	8/9/2012	surf	27	27					0	46	43.30	1.00	<0.30	<0.552		5.51	4.18	F	
230	Kirk L	8/21/2012	surf	29	28	3	3	3	2	4	4	5.50	0.60	<0.30	<0.642		1.18	1.18	B	
230	Kirk L	9/9/2012	surf	26	25	2	3	2	2	4	4	76.40	1.20	0.36	0.67		13.83	10.13	B	
230	Kirk L	9/23/2012	surf	16	20	2	3	2	0	0	0	81.60	1.20	<0.30	<3.205		10.09	8.38	I	
230	Kirk L	9/30/2012	surf	18	19	2	3	2	8	0	4	95.90	1.20	<0.30	<3.205		15.88	13.71	C	
230	Kirk L	6/30/2013	surf	25	26	1	3	3	2	0	0	9.30	3.00	<0.30	<0.650		3.80	0.40	I	
230	Kirk L	7/15/2013	surf	32	30	2	4	2	0	0	0	33.60	2.00	<0.30	<0.910		8.00	6.30		I
230	Kirk L	7/29/2013	surf	36	26	3	4	2	2	0	0	133.00	4.10	<0.30	<0.380		21.10	18.50	H	I
230	Kirk L	8/12/2013	surf	25	25	3	4	3	2	0	0	111.00	2.90	<0.30	<0.380		12.70	10.50		
230	Kirk L	8/12/2013	bloom											<0.60	<0.680		114.20	91.40		
230	Kirk L	8/26/2013	surf	27	24	3	4	2	8	0	0	67.70	4.20	<0.30	<0.570		12.60	11.00	F	fi
230	Kirk L	9/9/2013	surf	17	21	2	3	2	0	0	0	16.30	1.50	<0.30	<0.100		2.20	1.50	I	I
230	Kirk L	9/28/2013	surf	19	19	3	3	3	1	0	0	38.00	3.00	<0.30	<10.600		6.50	4.00	F	A
230	Kirk L	9/30/2013	ABI											12.22	<21.210		1732.00	1636.00		a
230	Kirk L	10/1/2013	ABI																	
230	Kirk L	10/22/2013	ABI																	
230	Kirk L	10/10/2013	surf	16	18	3	3	3	1	0	0	35.10	1.80	<0.30	<0.090		7.50	5.50	B	A
230	Kirk L	6/1/2014	surf	25	20	3	2	2	1	0	0	0.60	2.40	<0.37	<0.09	<0.001	9.50	0.00	i	i
230	Kirk L	6/23/2014	surf	24	25					0	0	6.50	0.50	<0.58	<0.44	<0.002	2.80	0.50	i	i
230	Kirk L	7/7/2014	surf	24	26	2	3	2	0	0	0	14.10	0.80	<0.40	<0.48	<0.001	6.10	2.00	d	i
230	Kirk L	7/21/2014	surf	24	26	2	2	2	0	0	0	38.40	1.10	<0.39	<0.03	<0.001	12.30	9.40	i	i
230	Kirk L	8/4/2014	surf	23	24	2	3	2	0	0	0	60.30	0.70	<0.38	<0.05	<0.001			i	i
230	Kirk L	8/16/2014	surf	15	21	2	2	2	0	0	0	48.60	0.80	<0.39	<0.03	<0.001	14.30	12.10	i	i
230	Kirk L	9/7/2014	surf	22	24	2	3	2	0	0	0	14.60	0.60	<0.64	<0.03	<0.001	5.10	2.90	i	i
230	Kirk L	10/3/2014	bloom											4.60	<0.25	<0.002	170.20	163.80		
230	Kirk L	9/22/2014	surf									50.00	1.20	<0.48	<0.04	<0.001	19.60	10.60		

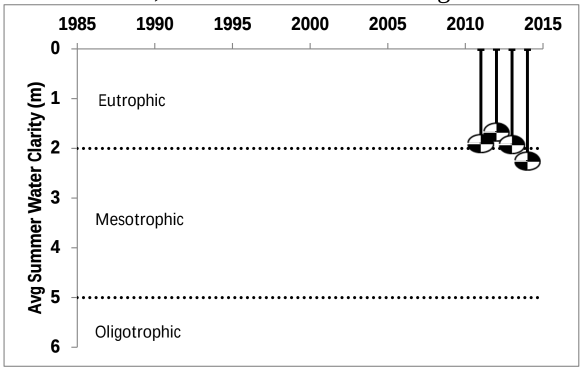
Legend Information

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	calcium (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 D- Long Term Trends: Kirk Lake

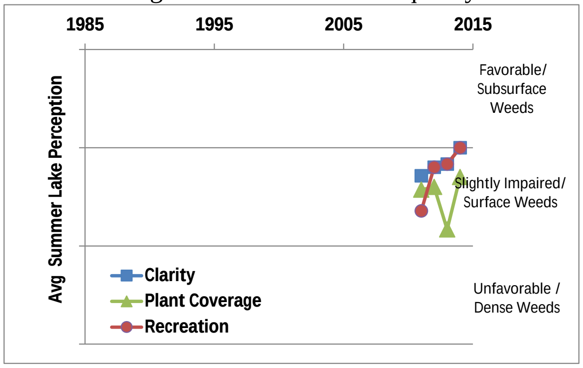
Long Term Trends: Water Clarity

- Too early to ID trends; slight ↑ since '12
- Most readings typical of *mesoeutrophic* lakes, consistent with TP and algae levels



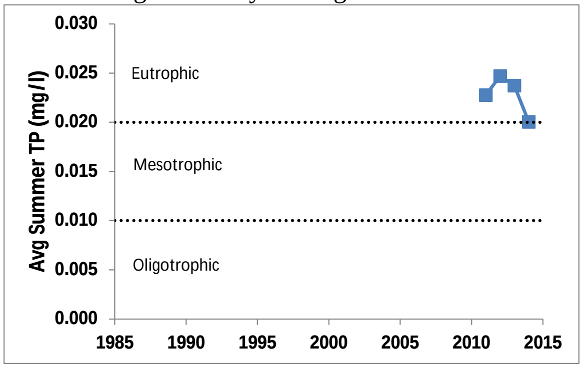
Long Term Trends: Lake Perception

- Too early for trends; slight ↑ WQ since '12
- Recreational perception closely linked to changes in weeds and water quality



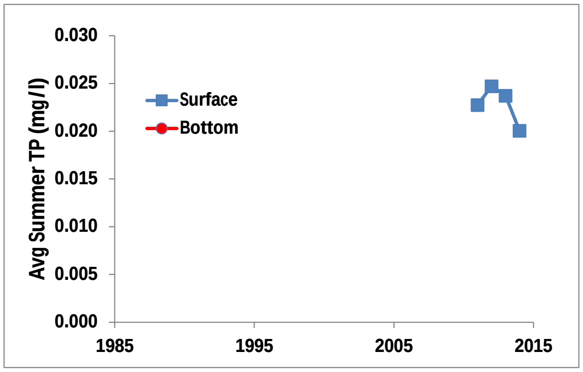
Long Term Trends: Phosphorus

- Too early to ID trends; slight ↓ since '12
- Most readings typical of *eutrophic* lakes, in range of clarity and algae levels



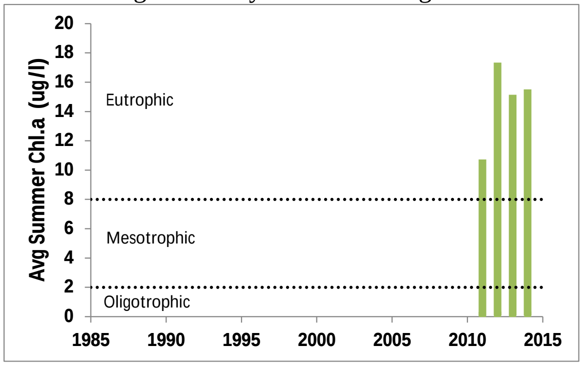
Long Term Trends: Bottom Phosphorus

- Too early to evaluate trends
- Likely that bottom and surface TP readings are similar in shallow lakes



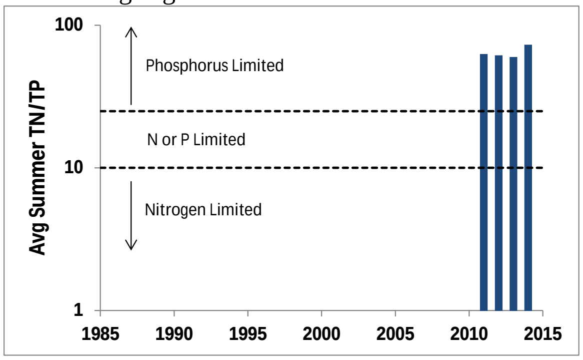
Long Term Trends: Chlorophyll a

- Too early to evaluate trends
- Most readings typical of *eutrophic* lakes, in range of clarity and TP readings



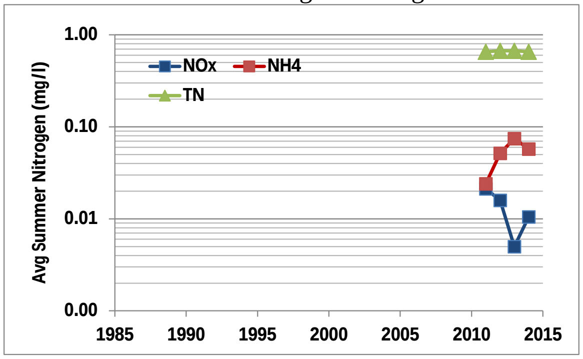
Long Term Trends: N:P Ratio

- Too early to ID trends; slightly higher '14
- Most readings indicate phosphorus limits algae growth



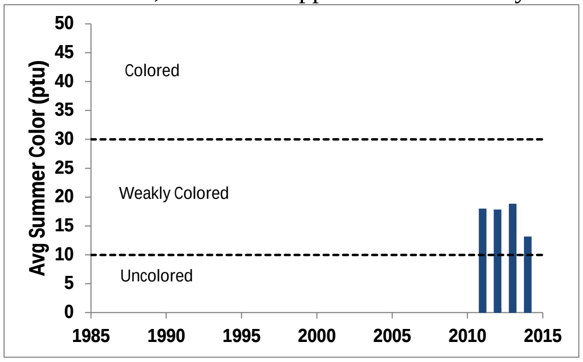
Long Term Trends: Nitrogen

- Too early to evaluate trends
- Fairly low NOx and ammonia, but slightly elevated total nitrogen readings



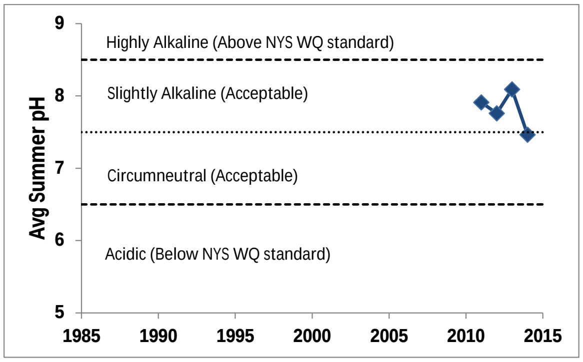
Long Term Trends: Color

- Too early to evaluate trends
- Most readings typical of *weakly colored* lakes, and do not appear to affect clarity



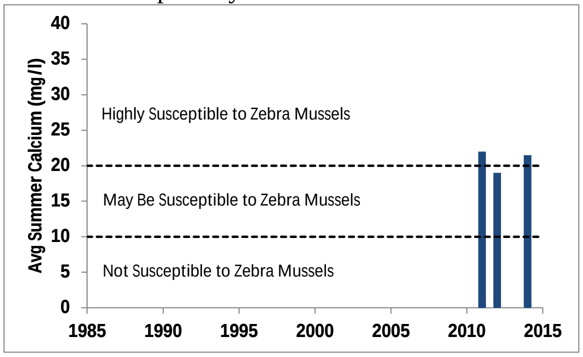
Long Term Trends: pH

- Too early to evaluate trends
- Most readings typical of *slightly alkaline* lakes



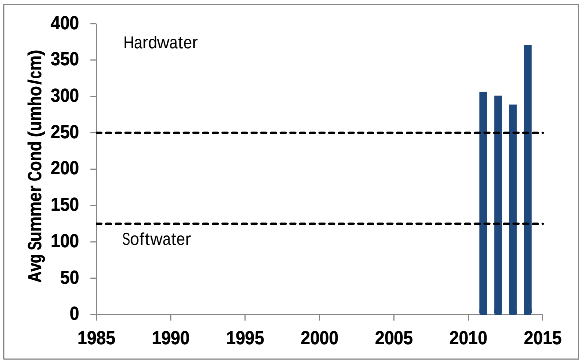
Long Term Trends: Calcium

- Too early to evaluate trends
- Most readings indicate moderate to high susceptibility to zebra mussels



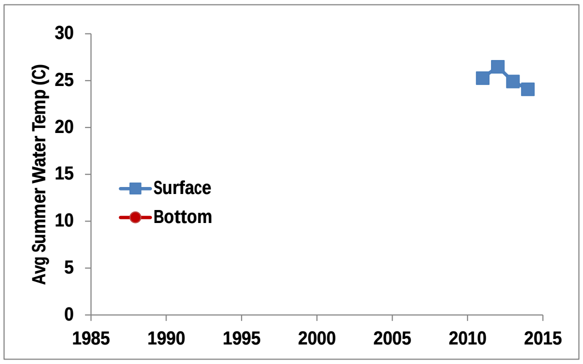
Long Term Trends: Conductivity

- Too early to evaluate trends
- Most readings typical of lakes with *hard water*



Long Term Trends: Water Temperature

- Too early to evaluate trends
- Surface and bottom temperatures similar in shallow lakes



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 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.

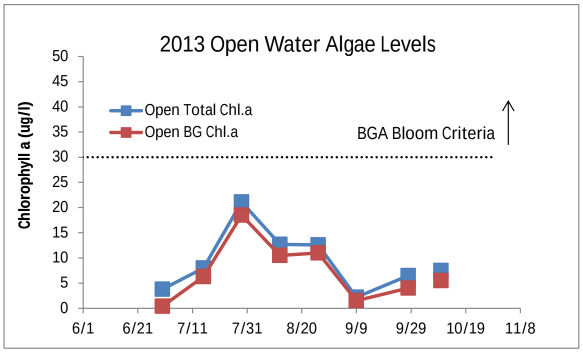


Figure D1:
2013 Open Water Total and BGA Chl.a

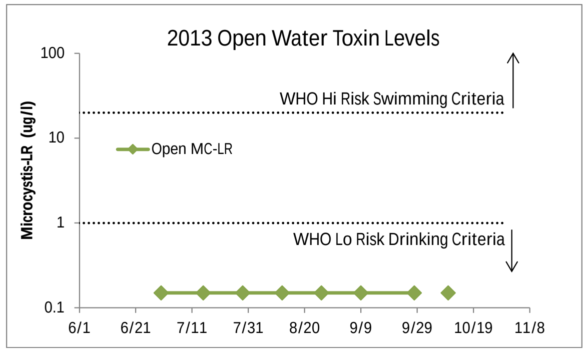


Figure D2:
2013 Open Water Microcystin-LR

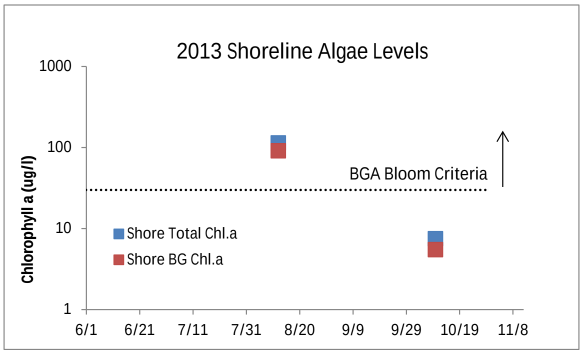


Figure D3:
2013 Shoreline Total and BGA Chl.a

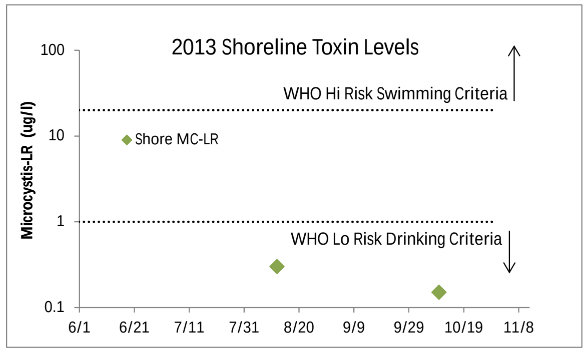


Figure D4:
2013 Shoreline Microcystin-LR

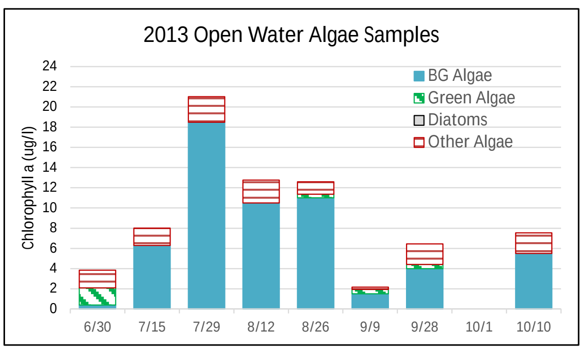


Figure D5:
2013 Open Water Algae Types

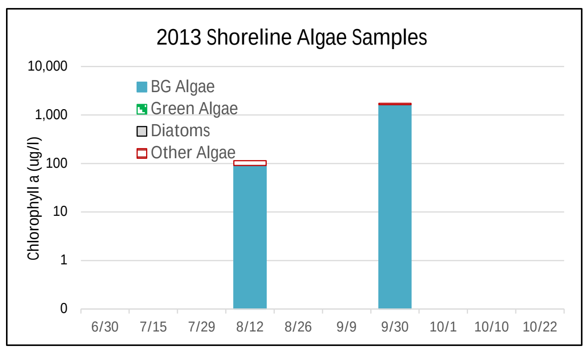


Figure D6:
2013 Shoreline Algae Types

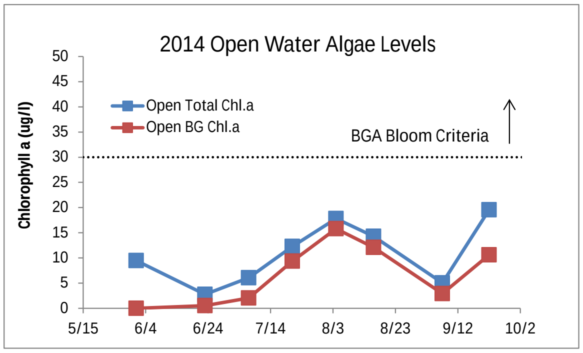


Figure D7:
2014 Open Water Total and BGA Chl.a

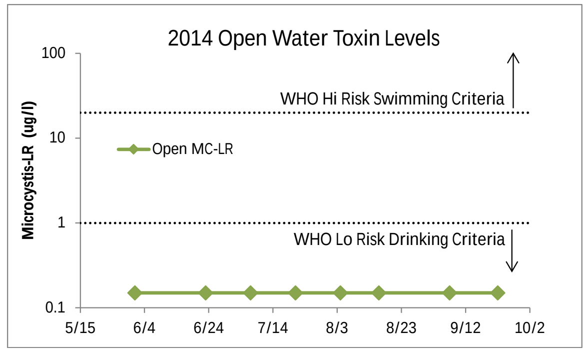


Figure D8:
2014 Open Water Microcystin-LR

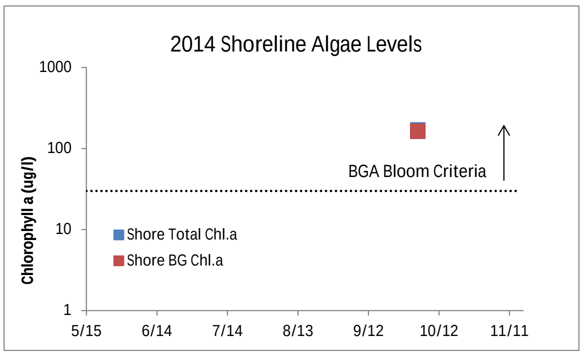


Figure D9:
2014 Shoreline Total and BGA Chl.a

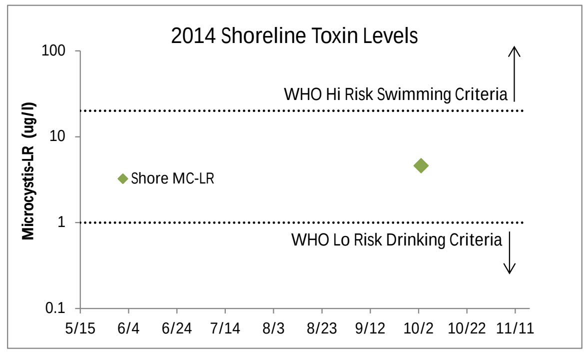


Figure D10:
2014 Shoreline Microcystin-LR

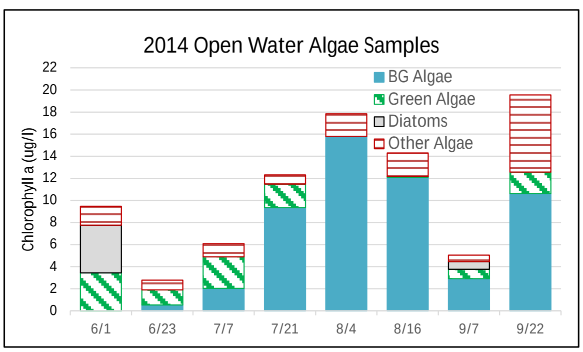


Figure D11:
2014 Open Water Algae Types

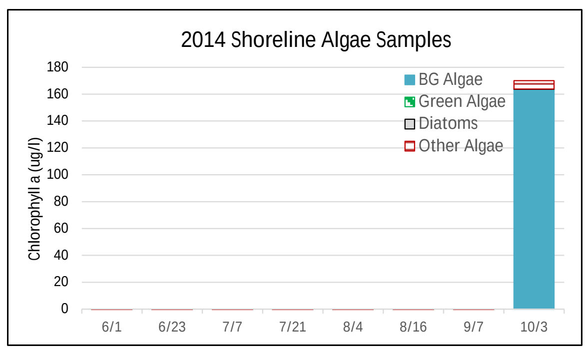


Figure D12:
2014 Shoreline Algae Types

Appendix E:
AIS Species in Putnam County

The table below shows the invasive aquatic plants and animals that have been documented in Putnam 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 - Putnam County			
Waterbody	**Kingdom**	**Common name**	**Scientific name**
Canopus Lake	Plant	Variable watermilfoil	*Myriophyllum heterophyllum*
Canopus Lake	Plant	Eurasian watermilfoil	*Myriophyllum spicatum*
Canopus Lake	Plant	Curly leafed pondweed	*Potamogeton crispus*
Croton Falls Reservoir	Plant	Eurasian watermilfoil	*Myriophyllum spicatum*
Duck Pond	Plant	Eurasian watermilfoil	*Myriophyllum spicatum*
Hudson River	Plant	Water chestnut	*Trapa natans*
Ice Pond	Plant	Brittle naiad	*Najas minor*
Kirk Lake	Plant	Eurasian watermilfoil	*Myriophyllum spicatum*
Lake Carmel	Plant	Eurasian watermilfoil	*Myriophyllum spicatum*
Lake Celeste	Plant	Curly leafed pondweed	*Potamogeton crispus*
Lake Mahopac	Animal	Zebra mussel	*Dreissena polymorpha*
Lake Mahopac	Plant	Eurasian watermilfoil	*Myriophyllum spicatum*
Lake Nimham	Plant	Brittle naiad	*Najas minor*
Lake Peekskill	Plant	Curly leafed pondweed	*Potamogeton crispus*
Lake Tibet	Plant	Eurasian watermilfoil	*Myriophyllum spicatum*
Lake Valhalla	Plant	Curly leafed pondweed	*Potamogeton crispus*
Loretta Lake	Plant	Eurasian watermilfoil	*Myriophyllum spicatum*
Lost Lake	Plant	Curly leafed pondweed	*Potamogeton crispus*
Oscawana Lake	Plant	Eurasian watermilfoil	*Myriophyllum spicatum*
Oscawana Lake	Plant	Water chestnut	*Trapa natans*
Palmer Lake	Plant	Eurasian watermilfoil	*Myriophyllum spicatum*
Palmer Lake	Plant	Brittle naiad	*Najas minor*
Peach Lake	Plant	Eurasian watermilfoil	*Myriophyllum spicatum*
Pelton Pond	Plant	Variable watermilfoil	*Myriophyllum heterophyllum*

Waterbody	Kingdom	Common name	Scientific name
Putnam Lake	Plant	Curly leafed pondweed	*Potamogeton crispus*
Putnam Lake	Plant	Water chestnut	*Trapa natans*
Roaring Brook Lake	Plant	Fanwort	*Cabomba caroliniana*
Roaring Brook Lake	Plant	Eurasian watermilfoil	*Myriophyllum spicatum*
Roaring Brook Lake	Plant	Curly leafed pondweed	*Potamogeton crispus*
Seven Hills Lake	Plant	Eurasian watermilfoil	*Myriophyllum spicatum*
Seven Hills Lake	Plant	Curly leafed pondweed	*Potamogeton crispus*
White Lake	Plant	Eurasian watermilfoil	*Myriophyllum spicatum*
White Lake	Plant	Curly leafed pondweed	*Potamogeton crispus*
White Pond	Plant	Eurasian watermilfoil	*Myriophyllum spicatum*
White Pond	Plant	Curly leafed pondweed	*Potamogeton crispus*
Wonder Lake	Plant	Water chestnut	*Trapa natans*

Appendix F: Watershed and Land Use Map for Kirk 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.