Putnam Lake Questions and Answers, 2015 CSLAP

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

A1. The condition of Putnam Lake has improved slightly over the last few years- higher clarity and lower algae levels- but it likely that much of this improvement came from the Cutrine treatments.

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

A2. Chloride sampling results are typical of lakes with significant impacts from road salt runoff, although no impacts have been reported or measured. It is not known if shoreline blooms ceased (or moved to different parts of the lake) in response to the algacide treatments.

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

A3. Putnam Lake had slightly lower water clarity, but also slightly lower algae and nutrient levels, than other nearby lakes. Aquatic plant coverage was slightly lower than in many of these lakes, perhaps due to lower light transmission to the lake bottom.

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

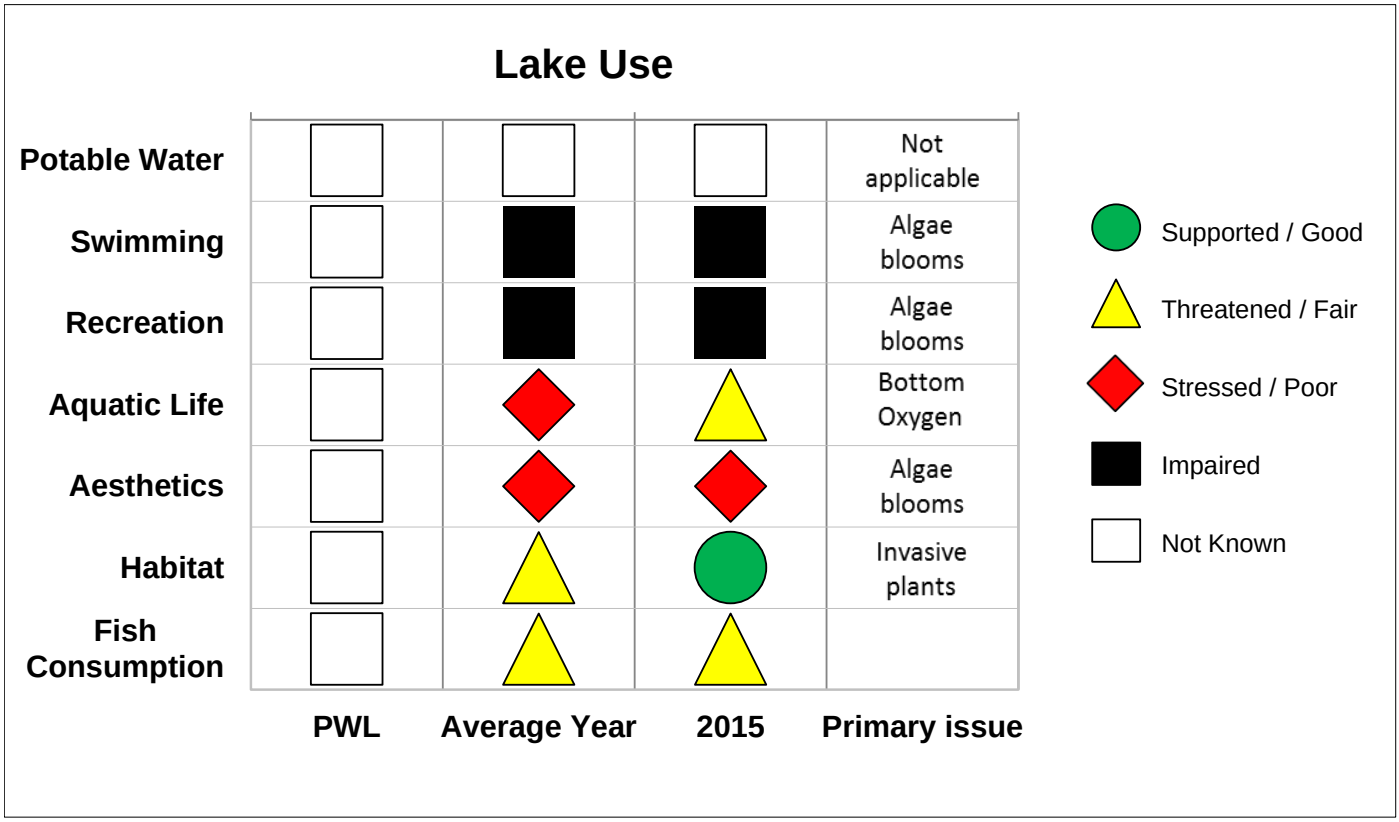
A4. With only three years of data, trends can't be evaluated. The rise in clarity and drop in algae levels may be due to the copper (Cutrine) treatments.

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

A5. The CSLAP data indicates a very high susceptibility to shoreline algae blooms, and it is likely that nutrient reduction may be needed to reduce this susceptibility. This susceptibility, or at least the frequency of blooms, may have been reduced by the Cutrine treatments.

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 improve lake conditions 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 found in the lake.

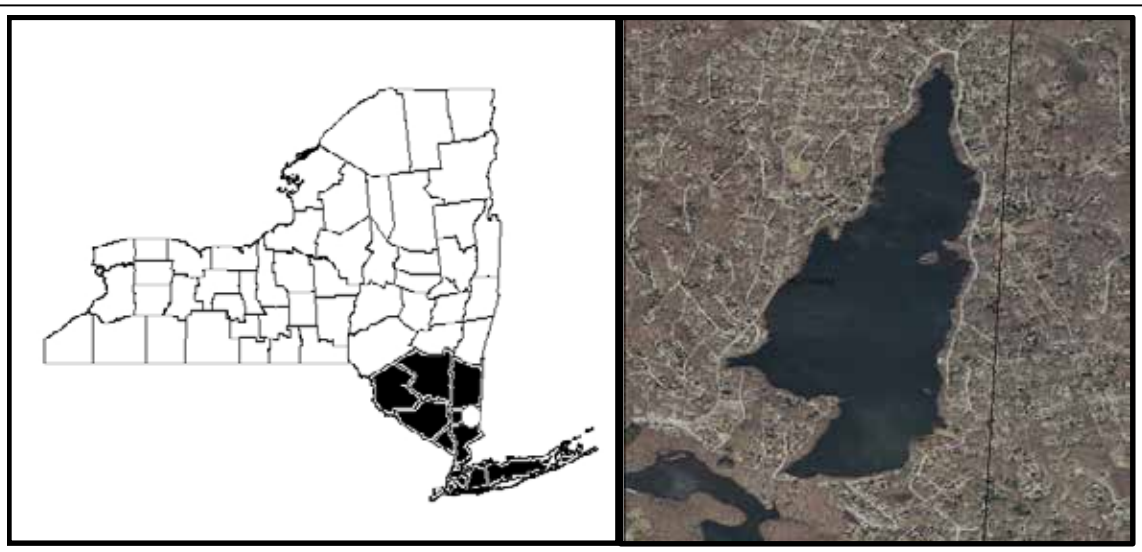


CSLAP 2015 Lake Water Quality Summary:
Putnam Lake

General Lake Information

Location	Town of Patterson
County	Putnam
Basin	Lower Hudson River
Size	91.5 hectares (226 acres)
Lake Origins	Augmented by 295 foot long by 24 foot high earthen dam (1931)
Watershed Area	695 hectares (1717 acres)
Retention Time	0.75 years
Mean Depth	3.4 meters
Sounding Depth	5.4 meters
Public Access?	Park and other access for town residents
Major Tributaries	Morlock Brook and at least three additional unnamed inlets
Lake Tributary To…	Bog Brook to Lost Lake to East Branch Croton River to East Branch Reservoir to … to Lower Hudson River
WQ Classification	B (contact recreation = swimming)
Lake Outlet Latitude	41.457828
Lake Outlet Longitude	-73.543299
Sampling Years	2013-2015
2015 Samplers	Hank Earle and Patricia Ploeger
Main Contact	Patricia Ploeger

Lake Map



Background

Putnam Lake is a 226 acre, class B lake found in the Town of Patterson in Putnam County, just north of the New York City region of New York State. It was first sampled as part of CSLAP in 2013.

It is one of 15 CSLAP lakes among the more than 260 lakes and ponds found in Putnam County, and one of 67 CSLAP lakes among the more than 3680 lakes and ponds in the Lower Hudson River drainage basin.

Lake Uses

Putnam 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, although there have historically been three beaches supporting swimming for lake residents, two of which (Jackson Beach and Warren Beach) are presently used for swimming. Other beach locations are used for boating access to lake residents, and the entire shoreline of the lake is designated as parkland for use by all Putnam Lake residents.

It is not known by the report authors if Putnam 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 Putnam Lake.

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

Historical Water Quality Data

CSLAP sampling was conducted on Putnam Lake for the first time in 2013. The CSLAP reports for the lake can be found on the NYSFOLA website at http://nysfola.mylaketown.com, and the NYSDEC web page at http://www.dec.ny.gov/lands/77848.html.

Water quality studies were conducted by Western Connecticut State University in 1978 and 1983, which showed elevated nutrient levels in the lake. A 2001 study of the lake by Putnam County and the town of Patterson also found elevated nutrient and algae levels, and dense growth of Eurasian watermilfoil (*Myriophyllum spicatum*), an exotic plant. This study recommended stocking grass carp to control excessive weed growth.

The lake was sampled in 1987 as part of the Adirondack Lake Survey Corporation (ALSC) study of about 1600 high elevation lakes in New York state, including a number in the Lower Hudson River basin. That study evaluated the chemical and biological condition of the lake. The biological monitoring results from this study are discussed below. The ALSC study showed lower phosphorus and higher water clarity readings than in the 2013 CSLAP study of the lake, suggesting some degradation in water quality over the last 15-25 years. The lake was only weakly stratified (only a slight temperature gradient from top to bottom). Calcium levels indicate a susceptibility to zebra mussel infestations, and elevated chloride levels indicate some lake impacts associated with road salting operations.

Putnam Lake was sampled by the NYSDEC as part of the Lake Classification and Inventory (LCI) survey of the lake in August, September and October of 2003. This sampling showed water quality conditions that were comparable to those measured through CSLAP in recent years.

Allied Biological (ABI) conducted additional water quality monitoring in 2013; a planned aquatic plant survey was not conducted due to the lack of significant plant growth in the lake in 2013. SUNY Purchase conducted a bathymetric survey of the lake in 2011. Depth profiles collected in 2013 showed deepwater oxygen depletion.

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

Putnam Lake was originally created in 1931 and developed in the early 1930s by the Home Guardian Company primarily for summer cottages and as a water supply for firefighting. At that time, the lake supported a variety of recreational uses, and management of the lake was overseen by the Putnam Lake Community Council (also known as the Putnam Lake Property Owners Association). However, the town assumed responsibility for the clubhouse in the mid-1990s.

In 2013, the Putnam Lake Park District was established under the Town of Patterson. It now oversees the lake, beaches, parkland, Memorial Field and the boat house. The web page is found at: www.PutnamLakeParkDistrict.com. The Park District is presently considering a number of lake management options and is monitoring the water quality closely in order to create a comprehensive plan for Putnam Lake. A $60,000 stormwater project was approved in the 2006 NYS budget for the lake as a water quality improvement project (WQIP) grant.

Summary of 2015 CSLAP Sampling Results

Evaluation of 2015 Annual Results Relative to 2013-2014

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 – Putnam Lake” section in Appendix C.

Evaluation of Eutrophication Indicators

Water quality trends cannot be evaluated with only a limited data. Water clarity has increased in each of the last two years, although this may have been driven by the Cutrine treatment in mid-July of 2014 and in mid-June and late-July in 2015. This is also consistent with a decrease in algae levels. However, phosphorus levels were also lower in 2015. Despite the apparent improvement, the lake can still be considered highly productive, as discussed below.

Lake productivity increases significantly during the summer, with water clarity readings decreasing and nutrient and levels increasing. These seasonal changes have been apparent in all three years of CSLAP sampling. Blue green algae blooms were regularly reported in the open

water and along the shoreline, although bloom occurrences in 2014 may have been reduced after the chemical treatment, and were further reduced in 2015. Deepwater oxygen data collected by the CSLAP volunteers indicated anoxic conditions (DO essentially = 0) at the extreme bottom of the lake during much of the summer, despite the lack of strong thermal stratification.

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 transparency may be slightly higher than expected given the nutrient and algae levels in the lake. This suggests that algae growth is patchy, consistent with the observation of shoreline blooms in some locations. 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

Conductivity readings have increased each year, while color readings have decreased (perhaps coincident with the decrease in algae levels). Each of the other limnological indicators has varied slightly from year to year (within the period 2013 to 2015).

Chloride levels in the 2015 samples, collected for the first time through CSLAP and cited in Appendix A, ranged from 50 to 135 mg/l. These values fall within the range of “major” 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 well above the range of values found in most NYS lakes. These readings suggest a high 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

The fluoroprobe data indicates very high algae levels, particularly along the shoreline, and a high percentage of blue green algae within the algal community. This indicates a high susceptibility to harmful algal blooms in the open water and especially along the shoreline. Blooms were found throughout the 2013 sampling season, with fewer blooms reported in 2014 and in 2015. The latter may have been due to the Cutrine treatment in mid-July of 2014 and early and mid-summer in 2015 affecting both open water and shoreline algae levels.

The preliminary aquatic plant monitoring conducted by Allied Biological in 2013 found two exotic plant species- curly leafed pondweed (*Potamogeton crispus*), and water chestnut (*Trapa natans*), as well as at least four native plant species. Neither this survey nor the ALSC study of the lake in 1987 (see below) found the Eurasian watermilfoil cited in the 1980s studies of the lake, but more extensive survey work may determine if this plant is still present.

The ALSC study in 1987 found a fisheries community dominated by bluegill, yellow perch, largemouth bass, yellow bullhead, rock bass, and white perch. Using a fish index for biotic integrity (IBI) developed by the state of Minnesota, the quality of the fish community in 1987 would have been identified as “good”. There were at least 11 plant species (3 submergent, 2 floating leaf, and 6 emergent species) found in the lake in 1987, but no invasive species were found, suggesting that the quality of the aquatic plant community was “fair”. An evaluation of the benthic macroinvertebrate community suggests that macroinvertebrates are “threatened”, consistently with the eutrophic conditions and elevated chloride levels in the lake.

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

Evaluation of Lake Perception

Recreational assessments have improved over the last three years; this shift was limited to the period after the Cutrine treatment, which also significantly “improved” water quality assessments. The improved recreational assessments are also consistent with a seasonal decrease in water clarity readings and decrease in algae levels. Aquatic plant coverage has increased over the last three years, perhaps due to higher water clarity. The less significant seasonal water quality changes in 2015 may have led to less significant seasonal changes in lake perception in 2015. 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 temperatures were slightly higher than normal in 2015.

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 have at times been well above the criteria for harmful algal blooms (HABs) in the main body of the lake and along the shoreline in 2013 and in 2014 prior to the lake treatment. Shoreline microcystis (algae toxin) levels have been above the thresholds for safe swimming in some years (2013) but not others (2014 and 2015); it is not known if this difference was associated with the chemical treatment. Open water algal toxin levels in all three years were below the safe swimming threshold, suggesting that higher risks for swimmers are more likely to be associated with blooms along the shoreline, not in locations where visible blooms are not present.

Lake Condition Summary

Category	Indicator	Min	Overall Avg	Max	2015 Avg	Classification	2015 Change?	Long-term Change?
Eutrophication Indicators	Water Clarity	0.68	1.17	2.30	1.40	Eutrophic	Higher Than Normal	Not yet known
	Chlorophyll *a*	6.00	35.73	108.50	28.30	Eutrophic	Within Normal Range	Not yet known
	Total Phosphorus	0.030	0.060	0.079	0.053	Eutrophic	Lower Than Normal	Not yet known
Potable Water Indicators	Hypolimnetic Ammonia							
	Hypolimnetic Arsenic							
	Hypolimnetic Iron							
	Hypolimnetic Manganese							
Limnological Indicators	Hypolimnetic Phosphorus							
	Nitrate + Nitrite	0.00	0.02	0.11	0.01	Low NOx	Within Normal Range	Not yet known
	Ammonia	0.01	0.11	0.37	0.12	Intermediate Ammonia	Within Normal Range	Not yet known
	Total Nitrogen	0.33	1.12	3.93	0.85	High Total Nitrogen	Lower Than Normal	Not yet known
	pH	7.25	7.91	8.84	7.85	Alkaline	Within Normal Range	Not yet known
	Specific Conductance	344	496	657	598	Hardwater	Higher than Normal	Not yet known
	True Color	6	15	33	11	Intermediate Color	Lower Than Normal	Not yet known
	Calcium	22.2	24.6	27.7	23.6	Highly Susceptible to Zebra Mussels	Within Normal Range	Not yet known
Lake Perception	WQ Assessment	2	3.0	5	2.4	Definite Algal Greenness	Within Normal Range	Not yet known
	Aquatic Plant Coverage	1	2.3	4	2.9	Subsurface Plant Growth	Less Favorable than Normal	Not yet known
	Recreational Assessment	2	3.0	4	2.5	Slightly Impaired	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					Fair quality of the aquatic plant community	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					Potamogeton crispus, Myriophyllum spicatum, Nitellopsis obtusa, Trapa natans	Not known	Not known
Local Climate Change	Air Temperature	15	22.3	29	23.1		Within Normal Range	Not yet known
	Water Temperature	17	24.6	30	25.8		Higher Than Normal	Not yet known

Category	Indicator	Min	Overall Avg	Max	2015 Avg	Classification	2015 Change?	Long-term Change?
Harmful Algal Blooms	Open Water Phycocyanin	3	98	277	61	Some readings indicate high risk of BGA	Not known	Not known
	Open Water FP Chl.a	5	23	55	17	Some readings indicate high algae levels	Not known	Not known
	Open Water FP BG Chl.a	0	19	55	12	Some readings indicate high BGA levels	Not known	Not known
	Open Water Microcystis	<DL	0.9	4.8	<DL	Mostly undetectable open water MC-LR	Not known	Not known
	Open Water Anatoxin a	<DL	<DL	0.2	<DL	Open water Anatoxin-a at times detectable	Not known	Not known
	Shoreline Phycocyanin					No shoreline blooms sampled for PC	Not known	Not known
	Screening FP Chl.a	6	8313	78420	16	Most readings indicate high algae levels	Not known	Not known
	Screening FP BG Chl.a	0	7760	73700	10	Most readings indicate high BGA levels	Not known	Not known
	Shoreline Microcystis	<DL	795	12632	<DL	Very high shoreline bloom MC-LR	Not known	Not known
	Shoreline Anatoxin a	<DL	<DL	3.9	<DL	Shoreline bloom Anatoxin-a at times detectable	Not known	Not known

Evaluation of Lake Condition Impacts to Lake Uses

Putnam Lake is cited on the 2008 Lower Hudson River drainage basin Priority Waterbody List (PWL) as having "minor impacts" due to excessive aquatic vegetation and algae growth. The PWL listing for the lake can be found in Appendix B.

Potable Water (Drinking Water)

The CSLAP dataset at Putnam 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 would threaten any "unofficial" potable water use.

Public Bathing

The CSLAP dataset at Putnam 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 especially shoreline blue green algae blooms. 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 Putnam Lake, including water chemistry data, physical measurements, and volunteer samplers' perception data, suggest that recreation is *impaired* by shoreline algae blooms, and this use at times may also be *threatened* by invasive plants.

Aquatic Life

The CSLAP dataset on Putnam Lake, including water chemistry data, physical measurements, and volunteer samplers' perception data, suggest that aquatic life may be *stressed* by elevated pH, and *threatened* by road salt runoff, harmful algae blooms and invasive plants (curly leafed pondweed). Additional data are needed to evaluate the food and habitat conditions for aquatic organisms in the lake.

Aesthetics and Habitat

The CSLAP dataset on Putnam Lake, including water chemistry data, physical measurements, and volunteer samplers' perception data, suggest that aesthetics may be *poor* due to excessive algae, shoreline blooms, and poor water clarity, although these impacts may have been reduced by the Cutrine application in mid-July in 2014 and twice in 2015. Habitat may be *fair* to *poor* due to invasive plants.

Fish Consumption

There are no fish consumption advisories posted for Putnam Lake.

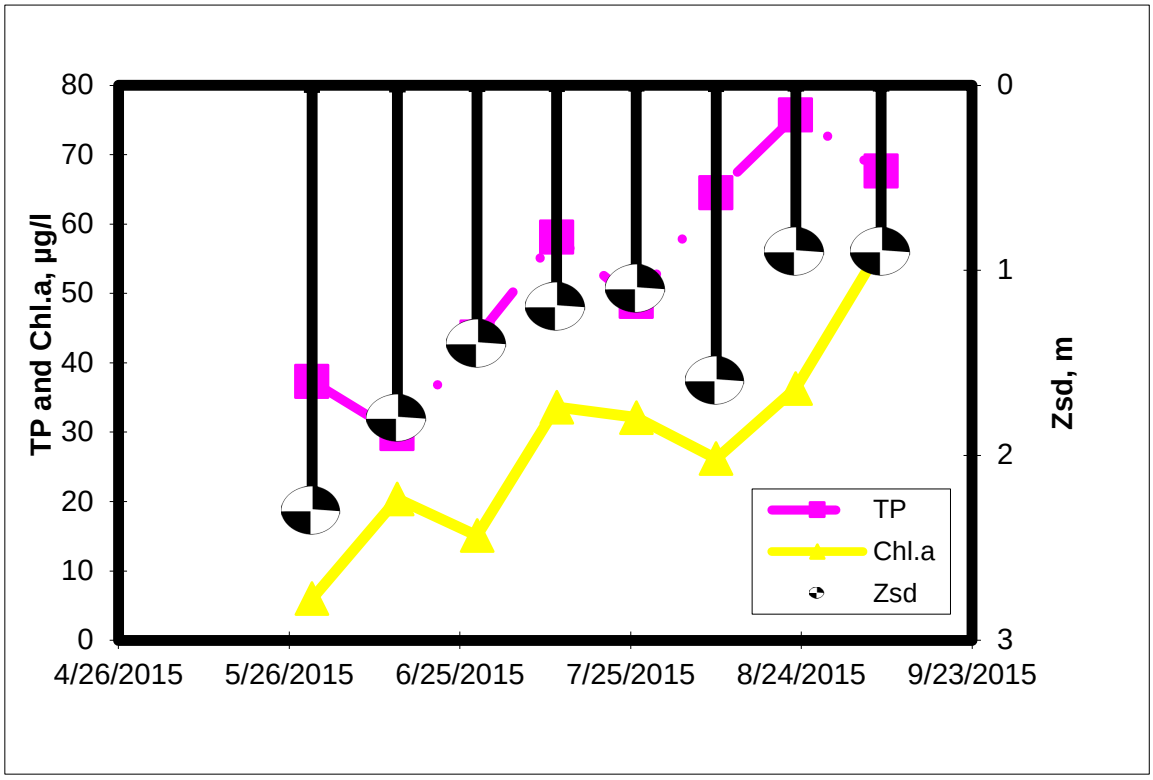
Additional Comments and Recommendations

Additional data will help to determine if the conditions measured and reported in the last three years are typical for Putnam Lake, and the extent to which open water and shoreline blooms are affected by the use of algacides. Lake residents should report and avoid exposure to any surface scums or discolored water often associated with blue green algae blooms.

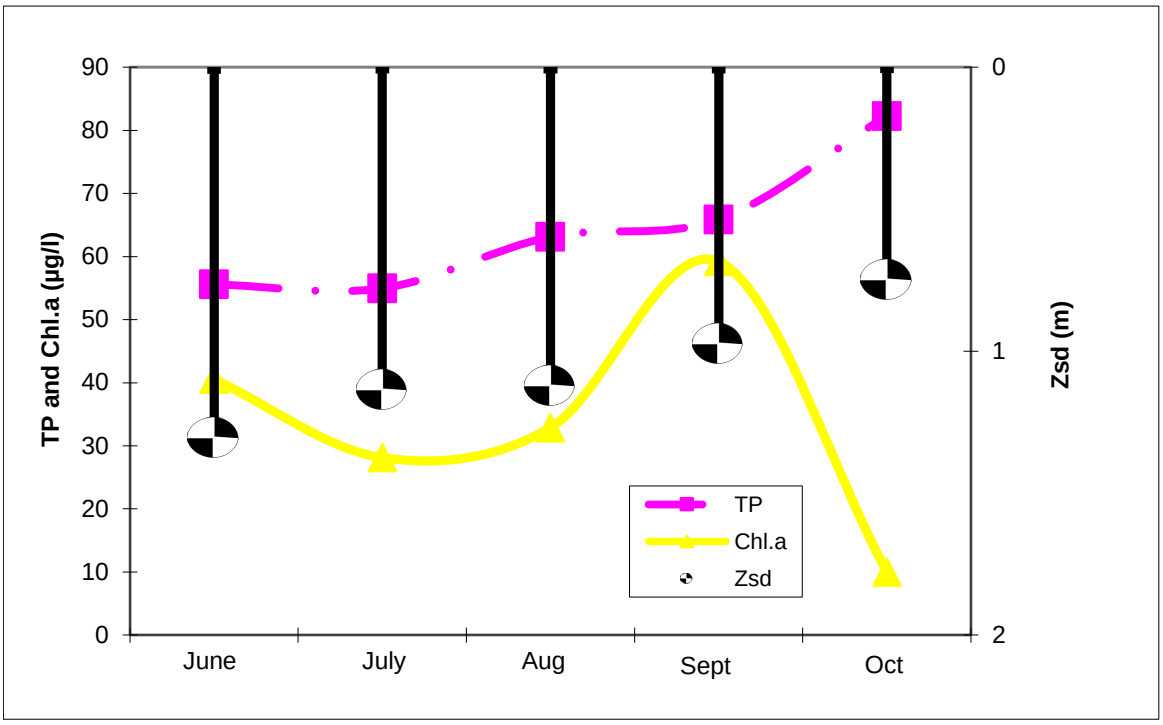
Aquatic Plant IDs-2015

None submitted for identification in 2015.

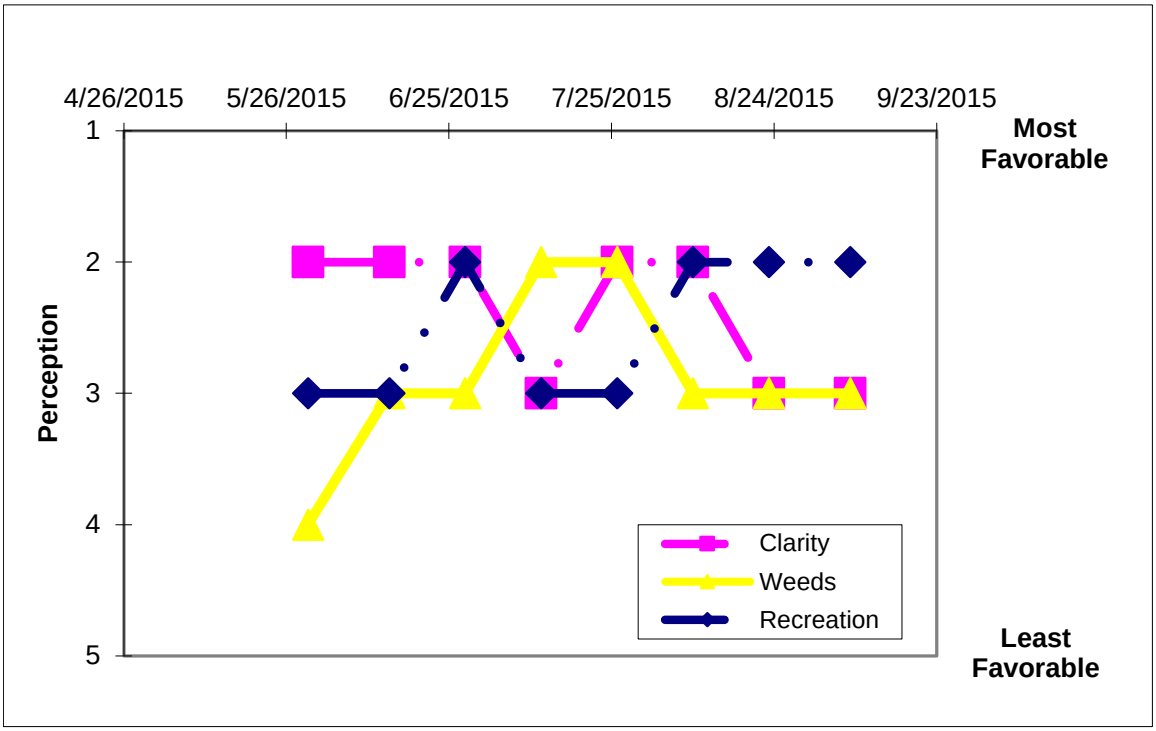
Time Series: Trophic Indicators, 2015



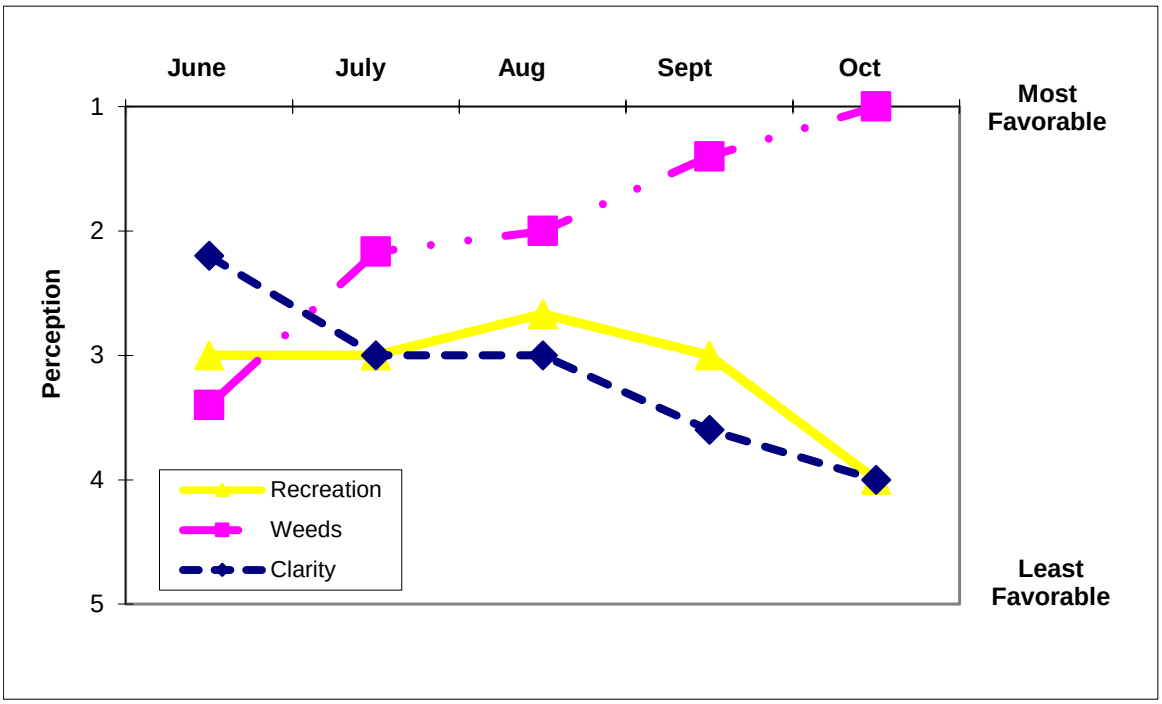
Time Series: Trophic Indicators, Typical Year (2013-2015)



Time Series: Lake Perception Indicators, 2015



Time Series: Lake Perception Indicators, Typical Year (2013-2015)



Appendix A- CSLAP Water Quality Sampling Results for Putnam Lake

LNum	PName	Date	Zbot	Zsd	Zsamp	Tot.P	NO3	NH4	TDN	TN/TP	TColor	pH	Cond25	Ca	Chl.a	Cl
239	Putnam Lake	7/9/2013	5.40	1.20	1.50	0.045	0.01	0.02	0.88	43.12	16	8.73	395		23.10	
239	Putnam Lake	7/9/2013			bloom											
239	Putnam Lake	7/22/2013	5.25	0.75	1.50	0.056			0.99	38.82	18	8.84	406		31.40	
239	Putnam Lake	7/22/2013			bloom											
239	Putnam Lake	8/5/2013	5.30	0.83	1.50	0.060	0.01	0.02	0.84	30.75	17	8.10	429		45.90	
239	Putnam Lake	8/5/2013			bloom											
239	Putnam Lake	8/19/2013	5.25	0.95	1.50	0.056			1.20	47.24	19	7.46	344		36.80	
239	Putnam Lake	8/19/2013			bloom											
239	Putnam Lake	9/3/2013	5.40	0.80	1.50	0.067	0.01	0.01	1.26	41.57	29	8.39	430		90.80	
239	Putnam Lake	9/3/2013			bloom											
239	Putnam Lake	9/17/2013	5.20	0.80	1.50	0.077			1.42	40.74	21	7.56	406		74.40	
239	Putnam Lake	9/17/2013			bloom											
239	Putnam Lake	9/30/2013	5.30	0.68	1.50	0.072	0.01	0.30	1.40	43.08		7.84	461		14.90	
239	Putnam Lake	10/3/2013			bloom											
239	Putnam Lake	10/14/2013			bloom											
239	Putnam Lake	10/14/2013	5.40	0.75	1.50	0.075			1.07	31.41	20	7.62	472		10.00	
239	Putnam Lake	6/2/2014	5.2	1.45	1.5	0.079	0.11	0.13	0.84	23.46	17	7.59	512		20.70	
239	Putnam Lake	6/2/2014			bloom									27.7		
239	Putnam Lake	6/15/2014	5.2	1.00	1.5	0.072			3.93	120.26	12	7.89	460		108.50	
239	Putnam Lake	6/15/2014			bloom											
239	Putnam Lake	6/29/2014	5.2	0.88	1.5	0.054	0.01	0.03	1.02	41.56	33	8.27	464		38.20	
239	Putnam Lake	6/29/2014			bloom											
239	Putnam Lake	7/13/2014	5.3	0.78	1.5	0.074			1.32	39.33	12	8.64	445		31.80	
239	Putnam Lake	7/13/2014			bloom											
239	Putnam Lake	7/27/2014	5.3	1.80	1.5	0.048	0.02	0.37	1.12	51.20	13	7.25	485	23.4	16.80	
239	Putnam Lake	7/27/2014			bloom											
239	Putnam Lake	8/10/2014	5.1	1.30	1.5	0.071			1.16	35.75	13	7.67	510		26.60	
239	Putnam Lake	8/10/2014			bloom											
239	Putnam Lake	8/24/2014	5.4	1.15	1.5	0.052	0.01	0.01	0.88	37.39	10	7.34	399		25.50	
239	Putnam Lake	8/24/2014			bloom											
239	Putnam Lake	9/7/2014			bloom											
239	Putnam Lake	9/7/2014	5.1	1.70	1.5	0.047			0.78	36.45	13	7.92	502			
239	Putnam Lake	5/30/2015	5.2	2.30	1.5	0.037	0.00	0.01	0.33	8.77	6	7.45	497	22.2	6.00	
239	Putnam Lake	6/14/2015	5.3	1.80	1.5	0.030			0.73	24.50	9	7.63	609		20.40	
239	Putnam Lake	6/28/2015	5.2	1.40	1.5	0.044	0.02	0.18	0.64	14.65	10	7.75	657		15.10	135.0
239	Putnam Lake	7/12/2015	5.1	1.20	1.5	0.058			1.00	17.19	13	7.96	577		33.60	
239	Putnam Lake	7/26/2015	5.3	1.10	1.5	0.049	0.02	0.23	1.06	21.80	14	7.67	588	25.0	32.10	
239	Putnam Lake	8/9/2015	5.1	1.60	1.5	0.065			0.96	14.88	15	8.23	653		26.20	
239	Putnam Lake	8/23/2015	5.1	0.90	1.5	0.076	0.01	0.05	1.02	13.43	10	7.73	592		36.30	50.0
239	Putnam Lake	5/30/2015			bloom											
239	Putnam Lake	6/14/2015			bloom											
239	Putnam Lake	6/28/2015			bloom											
239	Putnam Lake	7/12/2015			bloom											
239	Putnam Lake	7/26/2015			bloom											
239	Putnam Lake	8/9/2015			bloom											
239	Putnam Lake	8/23/2015			bloom											
239	Putnam Lake	9/7/2015			bloom											
239	Putnam Lake	9/7/2015	5.2	0.90	1.5	0.068			1.08	15.95	12	8.34	609		56.70	

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
239	Putnam Lake	7/9/2013	epi	29	30	3	3	3	13	4		59.90	2.60	1.65	<0.510		17.50	15.70	F	abcdefg
239	Putnam Lake	7/9/2013	bloom											637.73	<1.010		1536.30	1435.50		abcdefg
239	Putnam Lake	7/22/2013	epi	25	29	5	3	3	13	3	3	175.60	5.50	4.76	<0.370		30.80	28.40	abcdefg	
239	Putnam Lake	7/22/2013	bloom											445.02	<1.820		1208.00	937.30		abcdefg
239	Putnam Lake	8/5/2013	epi	20	24	3	2	4	34	4	4	129.70	4.00	1.33	0.02		27.80	24.90	f	abcdefg
239	Putnam Lake	8/5/2013	bloom											291.85	3.88		1664.50	1564.00		abcdefg
239	Putnam Lake	8/19/2013	epi	25	24	5	2	4	34	4	4	123.10	3.30	1.25	<0.650		24.90	23.50	F	abcdfg
239	Putnam Lake	8/19/2013	bloom											314.58	<1.140		25037.00	24636.00		abcdefg
239	Putnam Lake	9/3/2013	epi	23	25	5	1	4	1345	46	4	157.50	4.70	<0.30	<0.570		36.90	34.60	cf	abceg
239	Putnam Lake	9/3/2013	bloom											626.84	<1.150		78420.00	73700.00		
239	Putnam Lake	9/17/2013	epi	16	21	4	1	3	14	4	4	235.50	5.30	1.70	<19.130		45.20	40.30	df	
239	Putnam Lake	9/17/2013	bloom											12631.72	<3.300		18650.00	16965.00		
239	Putnam Lake	9/30/2013	epi	15	19	4	1	4	134	4	4	243.70	5.30	1.76	<0.210		42.60	37.90	cdf	
239	Putnam Lake	10/3/2013	bloom											1112.17	<0.210		29087.50	26880.00		abcef
239	Putnam Lake	10/14/2013	bloom											>2800.00	<0.340		43407.50	39772.50		
239	Putnam Lake	10/14/2013	epi	18	17	4	1	4	134	4	4	197.80	4.00	2.80	<0.220		40.40	36.80	abcd	
239	Putnam Lake	6/2/2014	epi	27	21	2	3	3	6	0	0	3.10	3.90	<0.37	<0.09	<0.001	9.44	1.86	i	k
239	Putnam Lake	6/2/2014	bloom											<3.66	<0.17	<0.002	38.75	7.97		
239	Putnam Lake	6/15/2014	epi	17	21	2	4	3	25	4	4	5.90	8.70	<0.61	<0.08	<0.002	16.00	8.27	h	f
239	Putnam Lake	6/15/2014	bloom											<1.23	<0.35	<0.003	15.40	6.30	h	
239	Putnam Lake	6/29/2014	epi	24	26	3	4	4	124	4	4	115.80	0.90	<1.60	<0.48	<0.002	25.30	24.74	b	b
239	Putnam Lake	6/29/2014	bloom											<3.20	<0.67	<0.005	30.02	27.41		bh
239	Putnam Lake	7/13/2014	epi	24	27	3	2	4	1	4	4	277.40	1.50	<0.71	<0.48	<0.001	55.39	55.39	bf	b
239	Putnam Lake	7/13/2014	bloom											<0.81	<0.43	<0.007	135.67	115.60	b	bf
239	Putnam Lake	7/27/2014	epi	24	25	2	1	2	0	4	4	5.00	0.80	<0.63	<0.03	<0.001	4.91	0.09	d	d
239	Putnam Lake	7/27/2014	bloom											<1.27	<0.06	<0.002	22.05	4.21	d	d
239	Putnam Lake	8/10/2014	epi	22	26	2	1	2	0	0	0	16.30	1.00	<0.28	0.07	<0.001	7.38	1.29	a	a
239	Putnam Lake	8/10/2014	bloom											<0.76	1.08	<0.002	71.42	65.77	f	a
239	Putnam Lake	8/24/2014	epi	21	25	3	1	2	0	4	4	50.50	0.60	1.41	<0.10	<0.002	15.74	13.86	c	c
239	Putnam Lake	8/24/2014	bloom											6.13	<0.19	<0.003	33.60	31.24	c	c
239	Putnam Lake	9/7/2014	bloom											<0.58	<0.28	<0.003	18.76	9.38	i	d
239	Putnam Lake	9/7/2014	epi	20	26	2	1	2	0	4	4	38.40	0.80	<0.64	<0.14	<0.002	12.03	8.22	i	d
239	Putnam Lake	5/30/2015	epi	20	26	2	1	2	0	4	4	38.40	0.80	<0.64	<0.14	<0.002	12.03	8.22	I	I
239	Putnam Lake	6/14/2015	epi	24	22	2	4	3	268	0	0	5.70	1.40	<0.66	<0.313	<1.561	4.80	0.22	I	I
239	Putnam Lake	6/28/2015	epi	22	26	2	3	3	28	4	0	93.70	0.90	<0.55	<0.018	<0.139	13.50	12.11	I	I
239	Putnam Lake	7/12/2015	epi	17	27	2	3	2	28	0	0	19.00	0.90	<0.86	<0.007	<0.040	5.63	1.75	I	I
239	Putnam Lake	7/26/2015	epi	27	28	3	2	3	28	0	0	126.60	2.30	<0.76	<0.005	<0.028	28.31	19.82	I	I
239	Putnam Lake	8/9/2015	epi	24	26	2	2	3	0	0	5	116.80	0.90	<0.30	<0.002	<0.014	27.41	25.05	I	I
239	Putnam Lake	8/23/2015	epi	24	26	2	3	2	0	0	0	58.30	1.40	<0.44	<0.035	<0.023	11.10	5.32	I	I
239	Putnam Lake	5/30/2015	bloom	23	26	3	3	2	8	0	0	6.80	0.20	<0.28	0.21	<0.010	17.73	13.94		
239	Putnam Lake	6/14/2015	bloom											<1.33	<0.626	<3.123	6.03	0.00		
239	Putnam Lake	6/28/2015	bloom											<1.72	<0.053	<0.635	8.75	6.28		
239	Putnam Lake	7/12/2015	bloom											<1.30	<0.008	<0.048	8.95	1.73		
239	Putnam Lake	7/26/2015	bloom											<1.57	<0.005	<0.021	8.99	3.26		
239	Putnam Lake	8/9/2015	bloom											<0.46	<0.007	<0.037	26.72	24.37		
239	Putnam Lake	8/23/2015	bloom											<2.26	<0.007	<0.025	10.33	4.84		
239	Putnam Lake	9/7/2015	bloom											<1.29	0.54	<0.031	20.03	13.75		
239	Putnam Lake	9/7/2015	epi											<0.43	<0.020	<0.058	38.45	29.60	D	D

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 to 0.6 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 B: Priority Waterbody Listing for Putnam Lake

Lost Lake, Putnam Lake (1302-0053) MinorImpacts

Waterbody Location Information

Revised: 07/11/2008

Water Index No: H- 31-P44-24-17-P93a,P93b
Hydro Unit Code: 02030101/080 **Str Class:** B
Waterbody Type: Lake
Waterbody Size: 222.1 Acres
Seg Description: total area of both lakes

Drain Basin: Lower Hudson River
Lower Hudson River
Reg/County: 3/Putnam Co. (40)
Quad Map: BREWSTER (P-26-2)

Water Quality Problem/Issue Information

(CAPS indicate MAJOR Use Impacts/Pollutants/Sources)

Use(s) Impacted	Severity	Problem Documentation
Public Bathing	Stressed	Suspected
Recreation	Stressed	Suspected

Type of Pollutant(s)
Known: - - -
Suspected: ALGAL/WEED GROWTH (algal blooms, vegetation), Nutrients (phosphorus), Pathogens
Possible: - - -

Source(s) of Pollutant(s)
Known: - - -
Suspected: ON-SITE/SEPTIC SYST, URBAN/STORM RUNOFF, Other Source (waterfowl)
Possible: - - -

Resolution/Management Information

Issue Resolvability: 1 (Needs Verification/Study (see STATUS))
Verification Status: 3 (Cause Identified, Source Unknown)
Lead Agency/Office: DOW/Reg3
TMDL/303d Status: n/a
Resolution Potential: Medium

Further Details

Overview
Public bathing and other recreational uses in Putnam Lake are thought to experience minor impacts due to excessive aquatic vegetation and algal growth. Nutrient loadings from nonpoint sources are also thought to contribute to water quality problems. The most recent assessment of this lake is more than ten years old so it is recommended that the condition of the lake be verified.

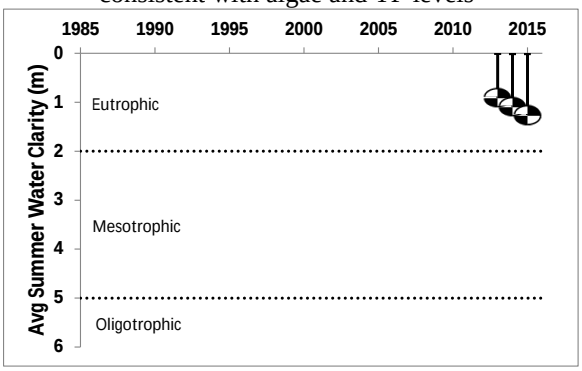
Previous Assessment
The recreational use (swimming, boating, fishing), and aesthetics in Putnam Lake are restricted by algal blooms and excessive aquatic weed growth in the lake. Sampling at public beaches have revealed occasional elevated coliform levels, but not sufficiently high to result in swimming closures. Failing and/or inadequate on-site septic systems serving lake shore camps and year-round residences and other runoff from urban/suburban development in the watershed are considered likely sources of pollutants. Waterfowl (geese) are another likely source of pathogens. (Putnam County WQCC, 1996)

New York City Watershed
Putnam Lake is tributary to the Croton System of New York City water supply reservoirs (see New Croton Reservoir, Segment 1302-0010). A Watershed Agreement is in place between NYCDEP and the Croton Watershed communities which sets forth programs and funding for watershed protection. In addition, NYCDEP has developed a phosphorus TMDL for the entire Croton System Watershed to aid in the management of nutrients. An Implementation Plan for this TMDL is being developed. (NYCDEP, July 2006)

Appendix C- Long Term Trends: Putnam Lake

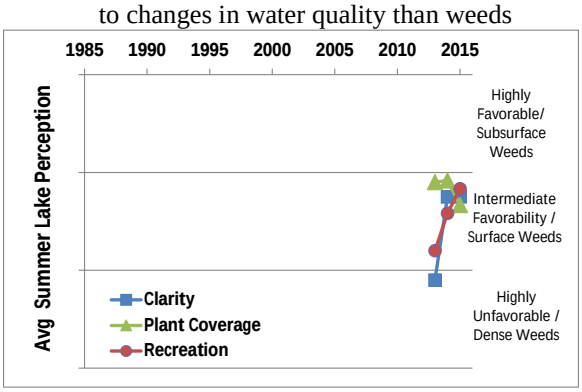
Long Term Trends: Water Clarity

- Slight increase last three years
- Most readings now typical of *eutrophic* lakes, consistent with algae and TP levels



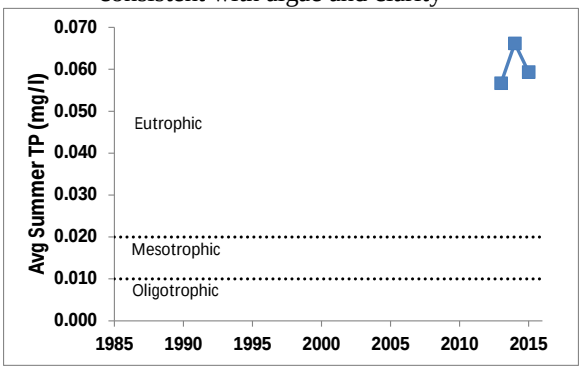
Long Term Trends: Lake Perception

- Improving recreation/WQ assessments
- Recreational perception more closely linked to changes in water quality than weeds



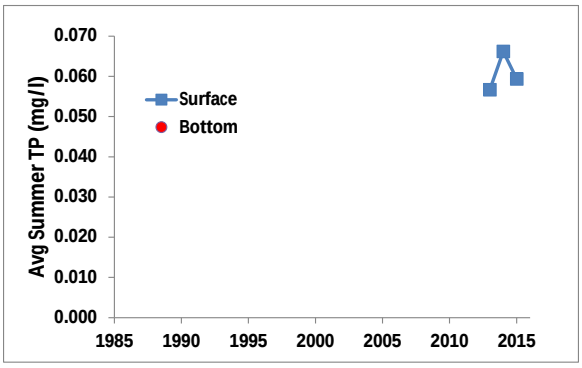
Long Term Trends: Phosphorus

- Variable over three years
- Most readings typical of *eutrophic* lakes, consistent with algae and clarity



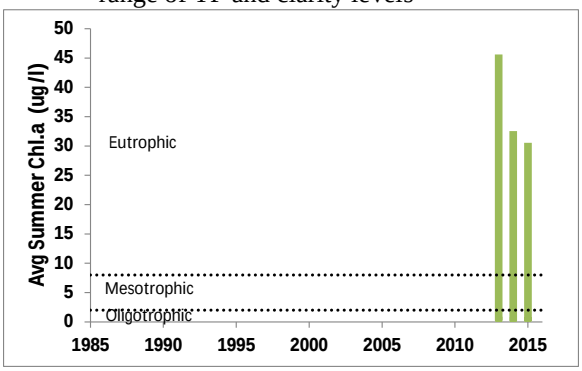
Long Term Trends: Bottom Phosphorus

- Bottom P not measured in shallow lakes
- Deep TP often similar to surface TP in shallow lakes



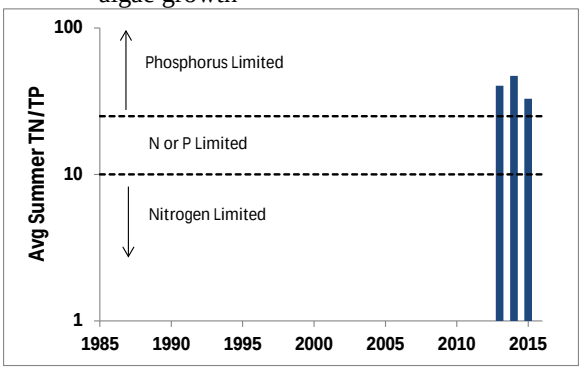
Long Term Trends: Chlorophyll a

- Decreasing chl.a compare to ↑ clarity
- Most readings typical of *eutrophic* lakes, in range of TP and clarity levels



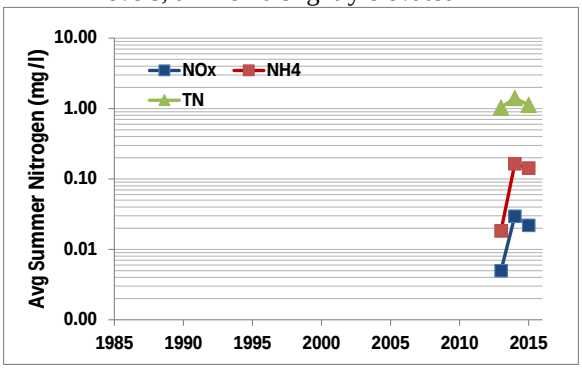
Long Term Trends: N:P Ratio

- Variable ratios
- Most readings indicate phosphorus limits algae growth



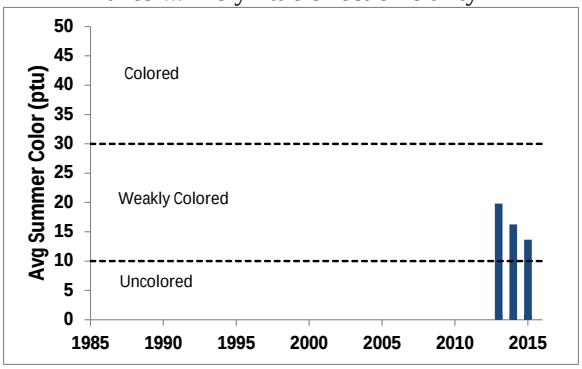
Long Term Trends: Nitrogen

- Change in N forms consistent last 3 years
- TN elevated, consistent with high algae levels; ammonia slightly elevated



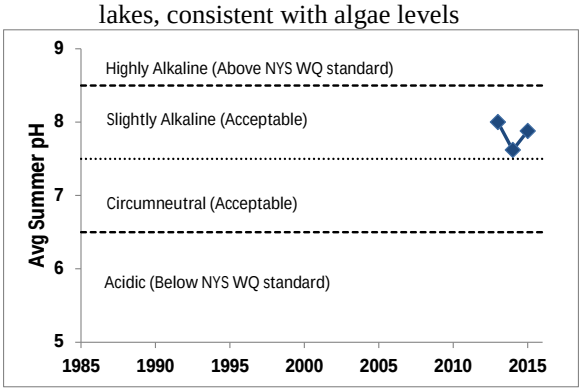
Long Term Trends: Color

- Decreasing color consistent with ↑ clarity
- Most readings typical of *weakly colored* lakes w/likely little effect on clarity



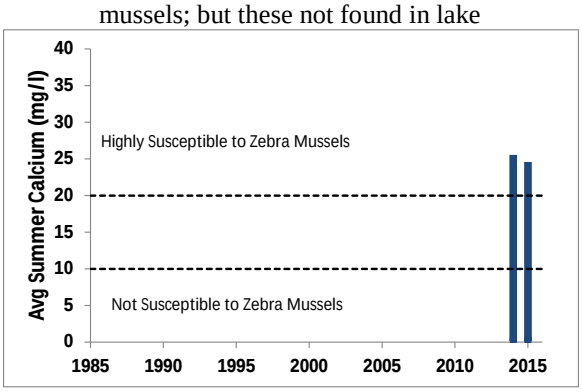
Long Term Trends: pH

- Variable pH last three years
- Most readings typical of *slightly alkaline* lakes, consistent with algae levels



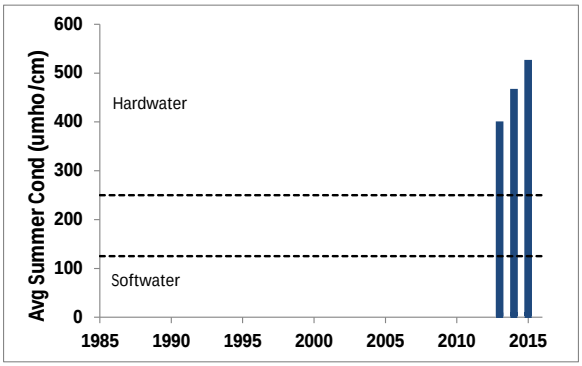
Long Term Trends: Calcium

- Slight drop in calcium in 2015
- Readings indicate high susceptibility to zebra mussels; but these not found in lake



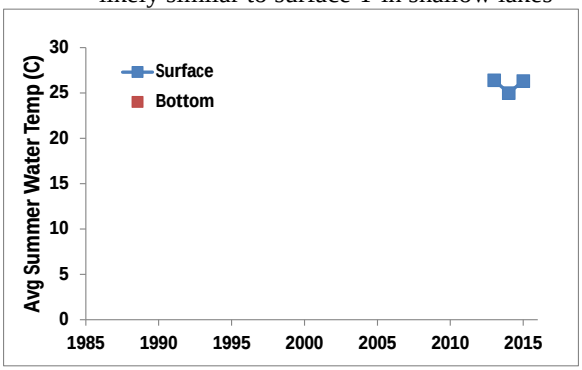
Long Term Trends: Conductivity

- ↑ conductivity last three years
- Most readings typical of lakes with *hard water*



Long Term Trends: Water Temperature

- Slightly variable T last three years
- No deepwater temperature data available; likely similar to surface T 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 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.

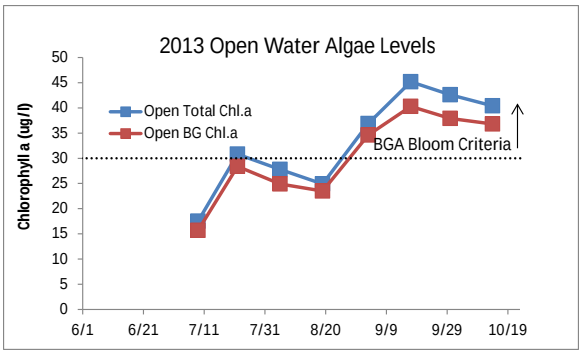


Figure D1:
2013 Open Water Total and BGA Chl.a

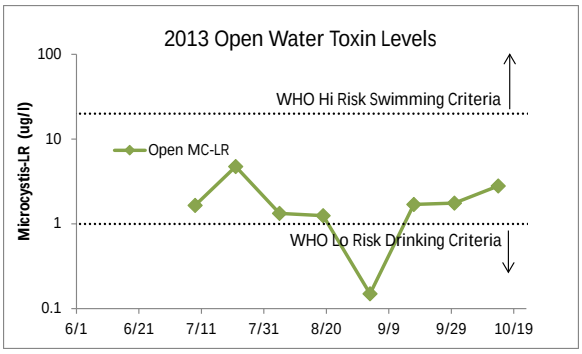


Figure D2:
2013 Open Water Microcystin-LR

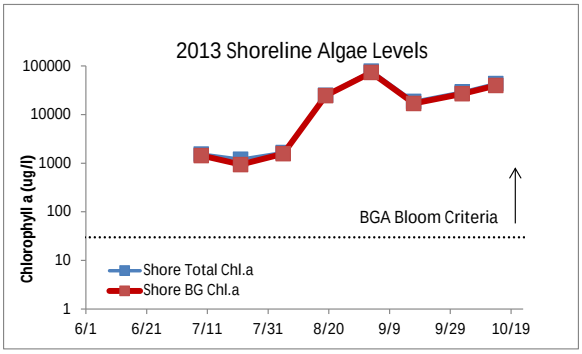


Figure D3:
2013 Shoreline Total and BGA Chl.a

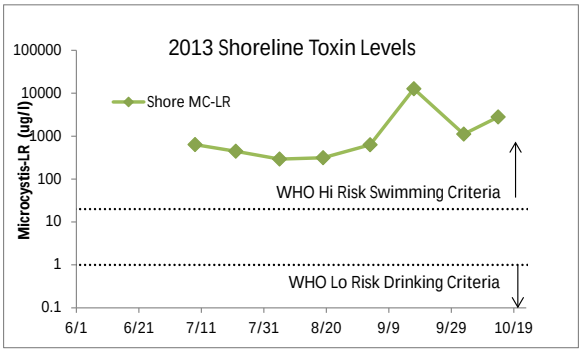


Figure D4:
2013 Shoreline Microcystin-LR

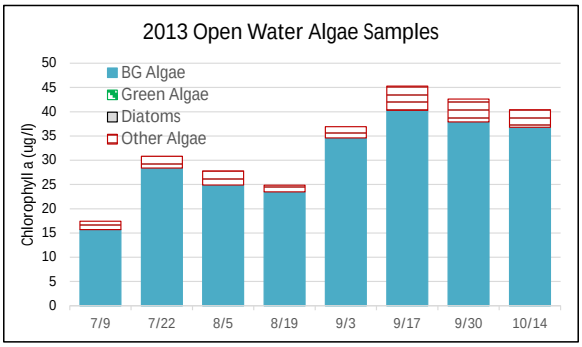


Figure D5:
2013 Open Water Algae Types

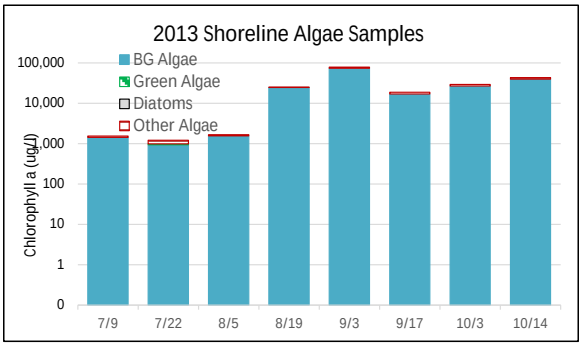


Figure D6:
2013 Shoreline Algae Types

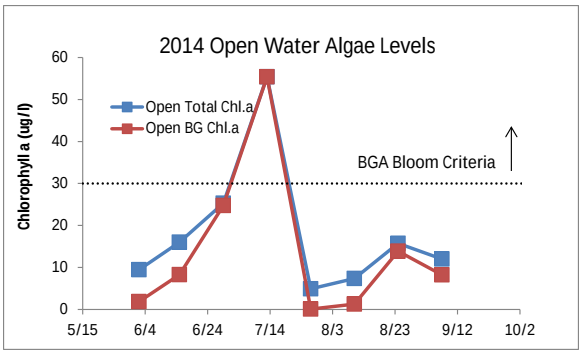


Figure D7:
2014 Open Water Total and BGA Chl.a

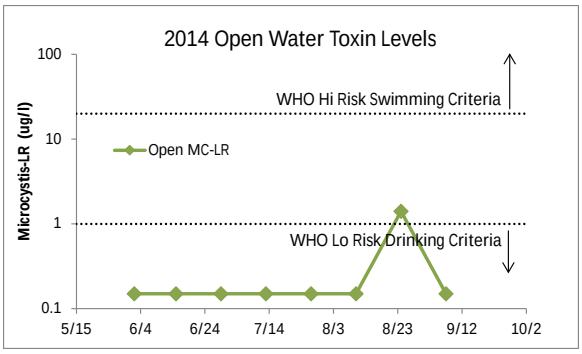


Figure D8:
2014 Open Water Microcystin-LR

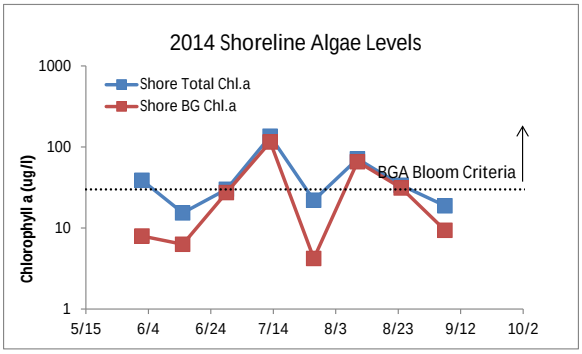


Figure D9:
2014 Shoreline Total and BGA Chl.a

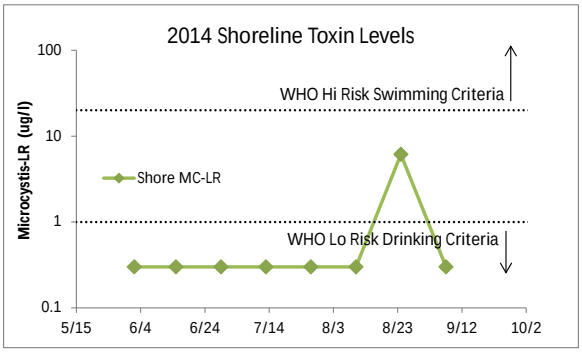


Figure D10:
2014 Shoreline Microcystin-LR

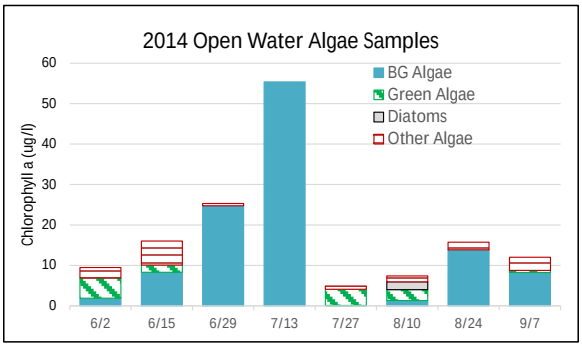


Figure D11:
2014 Open Water Algae Types

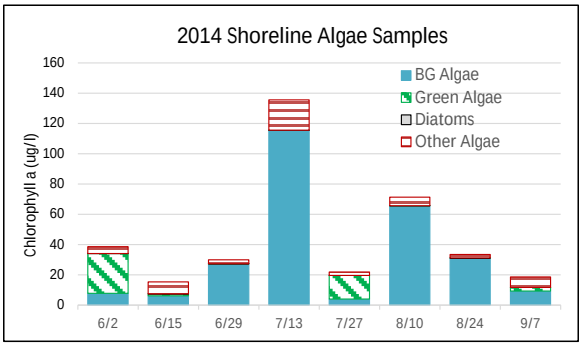


Figure D12:
2014 Shoreline Algae Types

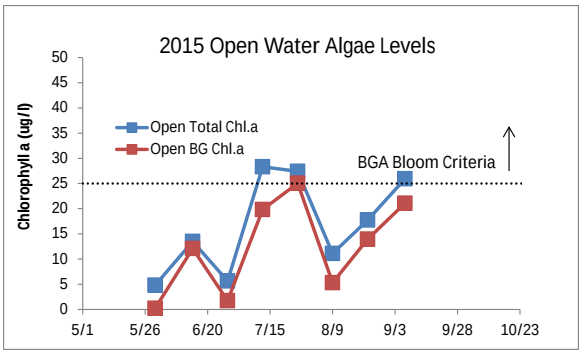


Figure D13:
2015 Open Water Total and BGA Chl.a

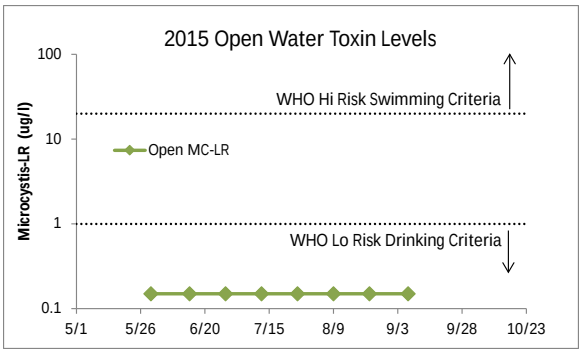


Figure D14:
2015 Open Water Microcystin-LR

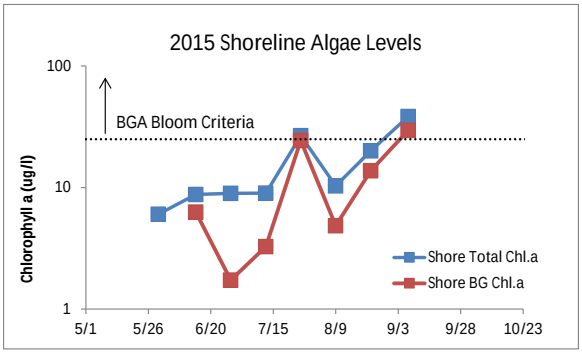


Figure D15:
2015 Shoreline Total and BGA Chl.a

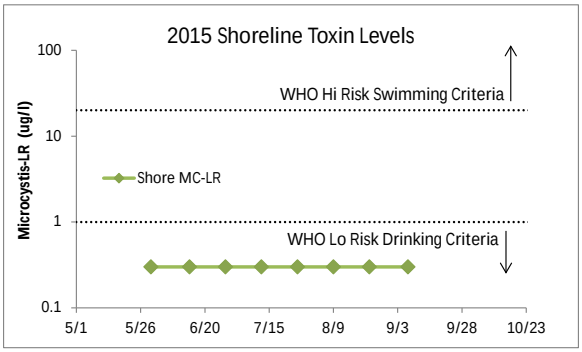


Figure D16:
2015 Shoreline Microcystin-LR

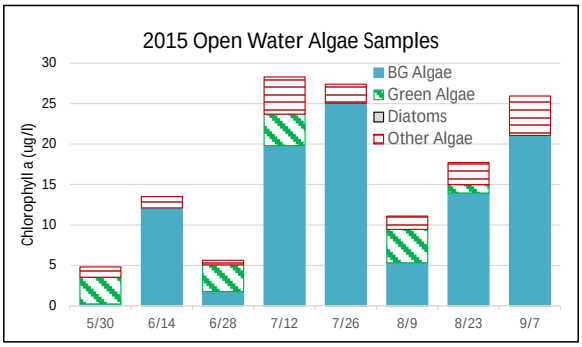


Figure D17:
2015 Open Water Algae Types

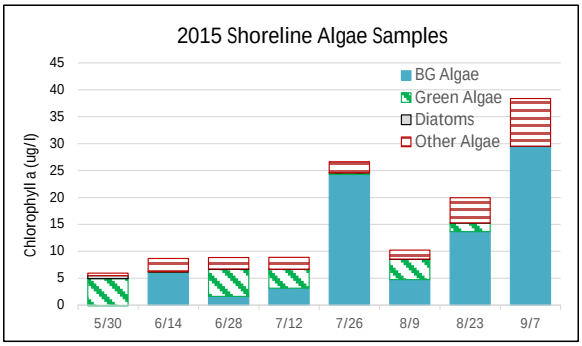


Figure D18:
2015 Shoreline Algae Types

Appendix E:
AIS Species in 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).

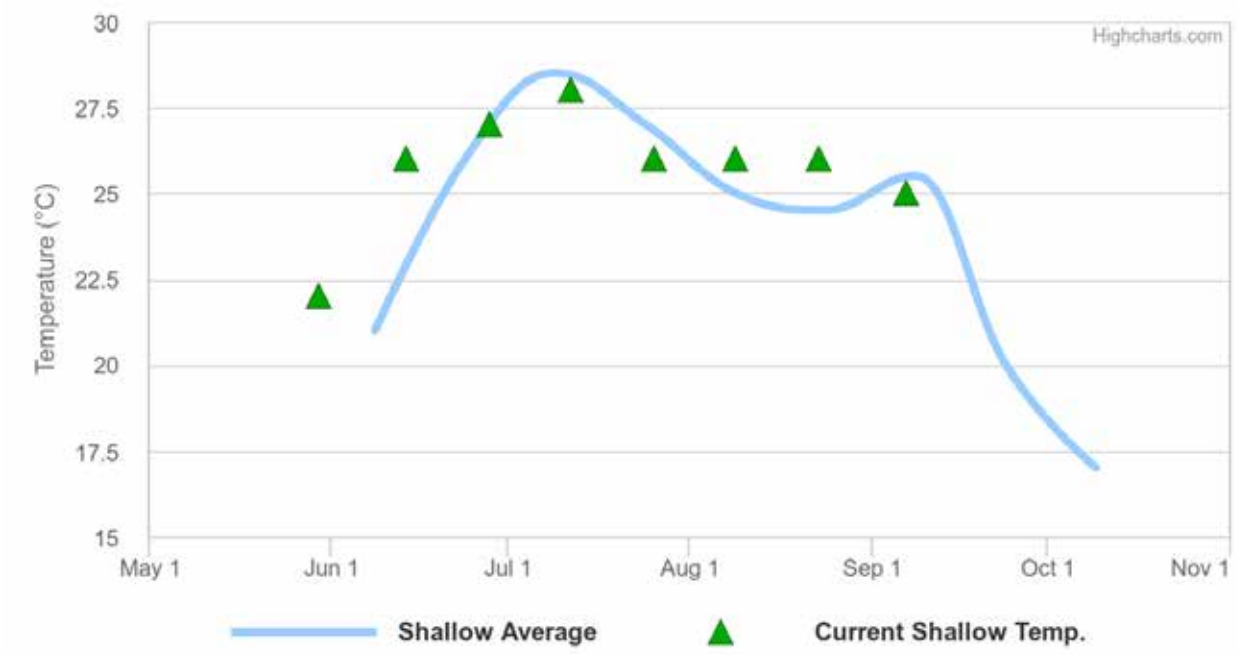
This list is not complete, but instead represents only those species that have been reported and verified within the county. If any additional aquatic invasive species (AIS) are known or suspected in these or other waterbodies in the county, this information should be reported through iMap invasives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

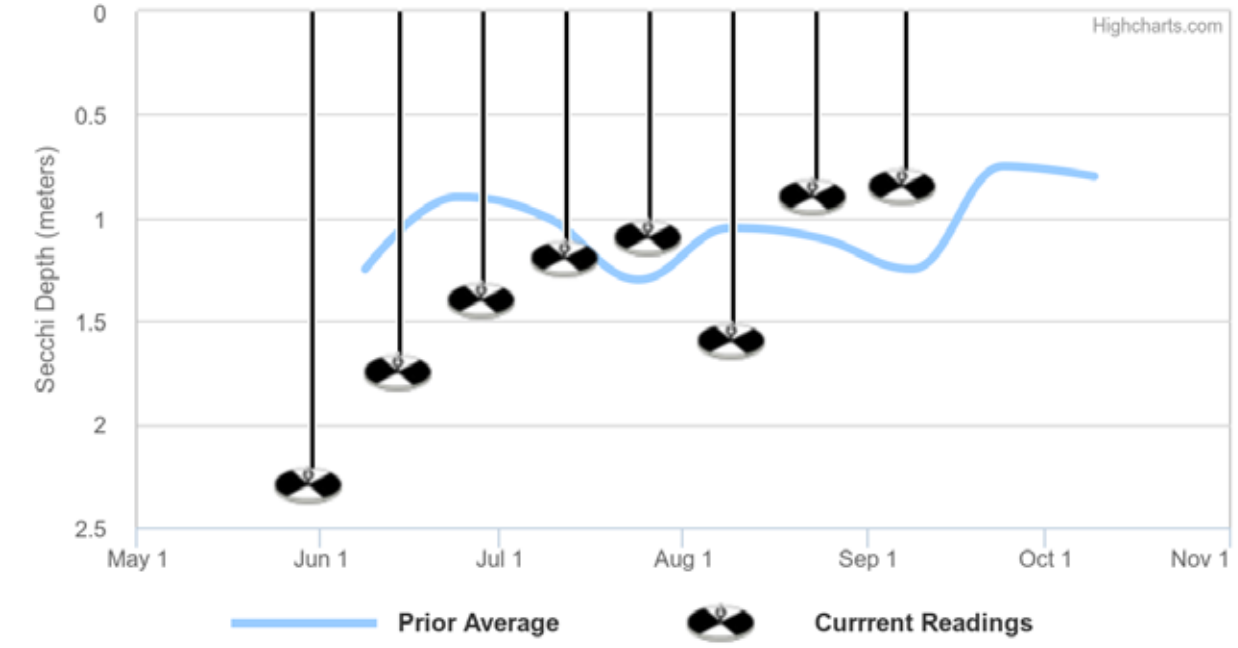
Appendix F: Current Year vs. Prior Averages for Putnam Lake

Current Year Water Temperatures vs. Prior Average

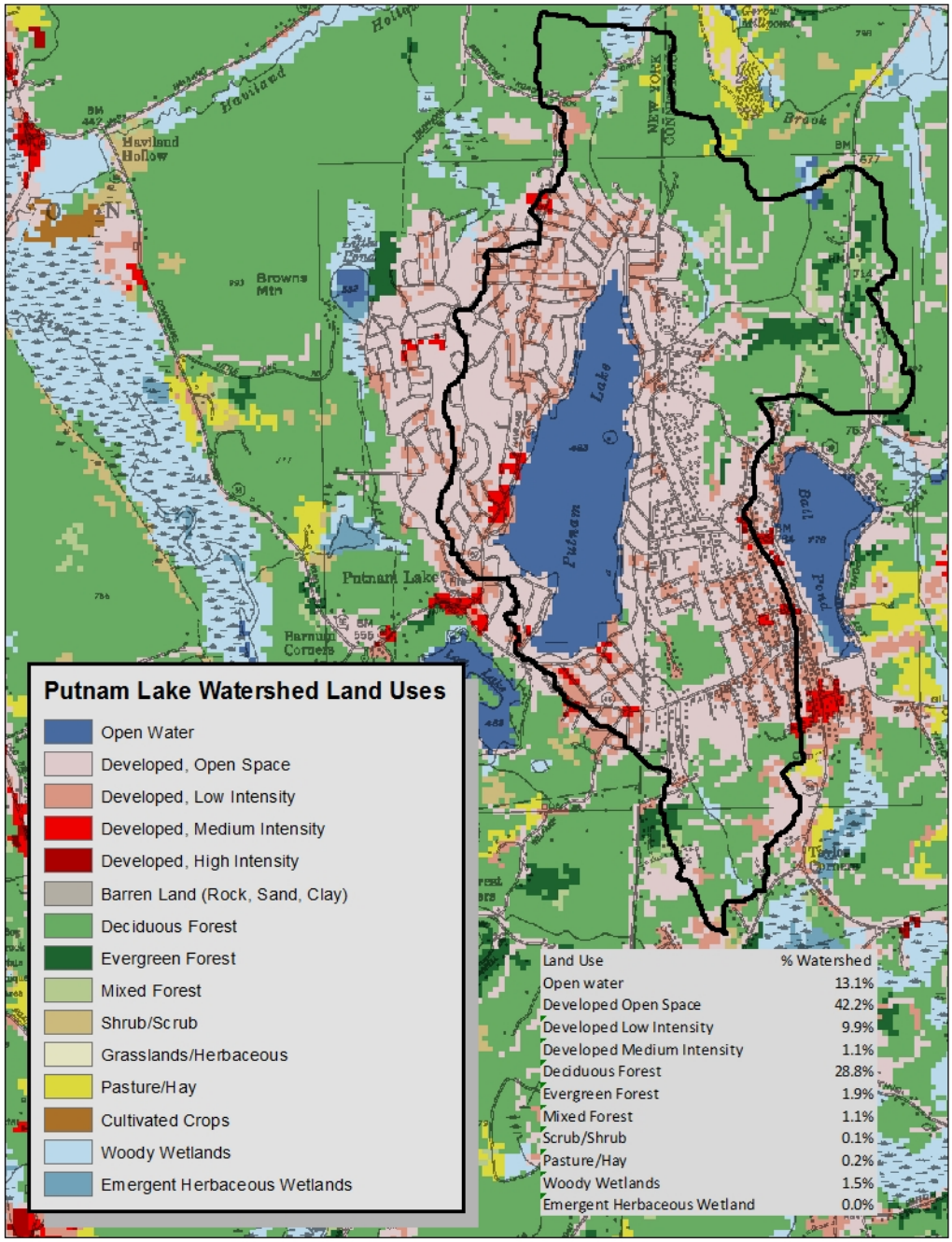


There are not enough shallow water sample temperatures to determine a trend for the current year when compared to the average of readings collected from 2013 to 2014.

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 2013 to 2014

Appendix G: Watershed and Land Use Map for Putnam 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.