Northeast Aquatic Research

Crystal Pond
2019 Monitoring Report

Prepared for the Crystal Pond Association
April 2, 2020

2019 Monitoring Results

In 2019, Northeast Aquatic Research made 3 visits to Crystal Pond.
1. June 10th to conduct water quality sampling
2. July 2nd to conduct water quality sampling
3. August 27th to conduct water quality sampling and perform an aquatic plant survey

Water Clarity

Water clarity measurements varied greatly over the three sampling dates, ranging from 6.6 meters in June to 3.3 meters in August. The June clarity reading was similar to the long-term average, and the July clarity was better than the long-term average. In August, the Secchi disk depth was 3.3 meters, which is worse than the long-term average and also the worst clarity measurement recorded in the pond since 2012. At the time of the August sampling, the water was noticeably green, likely due to substantial amounts of cyanobacteria and algae.

2019 Secchi disk depths (m) and historical averages for Crystal Pond.

	2019	**Historical Avg.**
June	6.6	6.7
July	5.4	4
August	3.3	4.2

Secchi disk depths at Crystal Pond, 1990-2019.
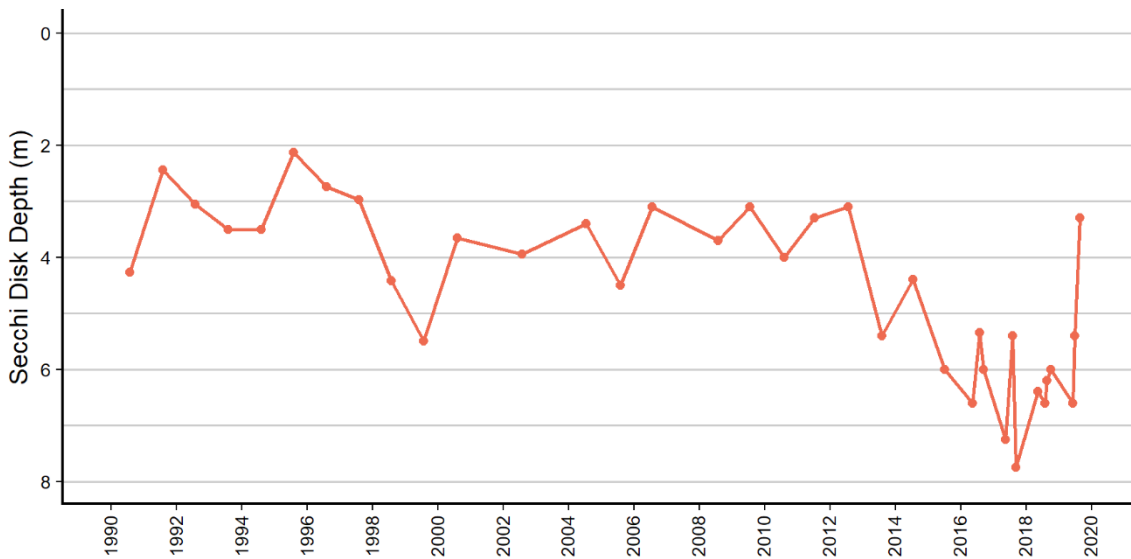
Nutrients

Total phosphorus (TP) concentrations in the water column in 2019 were similar to or slightly higher than the historical averages from 2010 – 2018. In all three months of sampling (June, July and August), the water at the bottom of the deep spot was anoxic, meaning devoid of oxygen (see dissolved oxygen profiles in Appendix at end of report). In the absence of oxygen, the sediment at the lake bottom releases nutrients through the process of internal loading. Due to this nutrient release, TP in the bottom water was slightly elevated. Total nitrogen (TN) was generally good in 2019, remaining below 300ppb for the three sampling visits. TN concentrations in 2019 were similar to or lower than the historical averages in all three months and at all three sampling depths.

2019 Total Phosphorus (TP) ppb concentrations and historical averages for Crystal Pond.

	2019			Historical Avg. (2010-2018)		
	June	July	August	May/June	July	August
Top	10	12	12	15	10	10
Middle	9	19	13	12	14	12
Bottom	23	24	35	17	23	24

2019 Total Nitrogen (TN) ppb concentrations and historical averages for Crystal Pond.

	2019			Historical Avg. (2010-2018)		
	June	July	August	June	July	August
Top	238	206	251	238	274	250
Middle	188	226	269	216	306	264
Bottom	236	211	293	247	343	360

Phytoplankton

Cyanobacteria were present in all three samples collected from Crystal Pond in 2019. Numbers were low in June but steadily increased over the season. August 27th had particularly elevated numbers, likely causing the poor clarity on that date. This was the last sampling of the season, but cyanobacteria numbers likely continued to increase through September and October.

Green algae made up the rest of the phytoplankton community and also showed a gradual increase over the season. Green algae numbers were relatively low on all three sampling dates. However, the highest numbers were in August, similar to cyanobacteria.

Other phytoplankton groups were scarce in 2019, though if sampling were performed during spring or fall we expect that Diatoms would also be present.

2019 phytoplankton counts.

Group	10-Jun	2-Jul	27-Aug
Cyanobacteria	1,633	6,910	11,297
Greens	190	1,050	1,385
Diatoms	0	0	29
Chrysophytes	29	583	29
Dinoflagellates	0	0	0
Cryptophytes	0	0	0
Euglenophytes	15	0	0
Total	1,866	8,542	12,741

Aquatic Plants

NEAR conducted a full-lake aquatic plant survey of Crystal Pond on August 27th, 2019. No invasive species were found in the lake during this survey.

26 native aquatic plant species were present in the lake. The same five species have remained dominant in the lake in all ten surveys conducted by NEAR (2004, 2011-2019). *Potamogeton robbinsii* (Robbin's pondweed), *Potamogeton amplifolius* (Largeleaf pondweed), and *Potamogeton gramineus* (grassy pondweed) are consistently present at frequencies near or above 20%. *Vallisneria americana* (tapegrass) and *Sagittaria graminea* (grassy arrowhead) were present at frequencies near 14% and 13%, respectively. The State-listed Special Concern species, *Bidens beckii* (water marigold) was present at 11%, scattered throughout the littoral zone.

Aquatic plant species present in Crystal Pond during the August 27, 2019 survey.

Scientific Name	Common Name	Frequency	Avg. Density
Potamogeton robbinsii	Robbin's pondweed	63	59
Potamogeton amplifolius	Largeleaf pondweed	44	29
Potamogeton gramineus	Grassy pondweed	21	53
Vallisneria americana	Tapegrass	15	73
Sagittaria graminea	Grassy arrowhead	13	19
Bidens beckii	Water marigold	11	18
Eleocharis acicularis	Needle spikerush	6	38
Nitella	Stonewort	6	38
Utricularia purpurea	Purple bladderwort	6	19
Potamogeton epihydrus	Ribbon-leaf pondweed	5	20
Filamentous algae	Filamentous algae	4	36
Fontinalis	Aquatic moss	2	27
Phragmites	Common reed	2	NA
Ceratophyllum echinatum	Spiny hornwort	2	5
Chara	Muskgrass	2	13
Elatine	Waterwort	2	55
Typha	Cattail	2	NA
Utricularia macrorhiza	Common bladderwort	2	13

Brasenia schreberi	Watershield	0.8	40
Elodea nuttallii	Waterweed	0.8	5
Emergent sparganium	Burreed	0.8	20
Najas gracillima	Slender waternymph	0.8	50
Nuphar variegata	Yellow Lily	0.8	30
Nymphaea odorata	White Lily	0.8	50
Utricularia geminiscapa	Hiddenfruit bladderwort	0.8	10
Utricularia minor	Lesser bladderwort	0.8	5

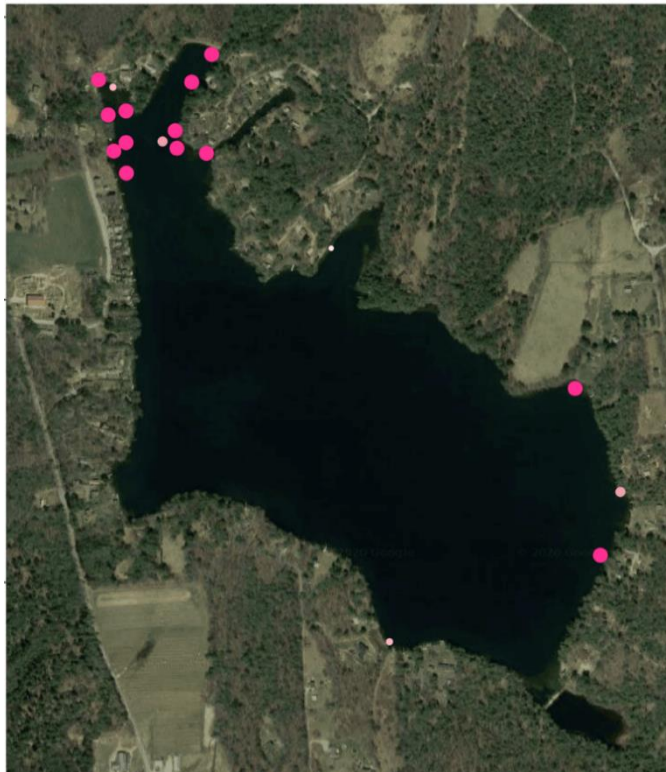*Locations and densities of aquatic plant species of interest during August 2019 survey.*

Crystal Pond August 27, 2019 Survey: Potamogeton robbinsii
Northeast Aquatic Research, LLC

Species Density
- Very Sparse
- Sparse
- Medium
- Dense
- Very Dense
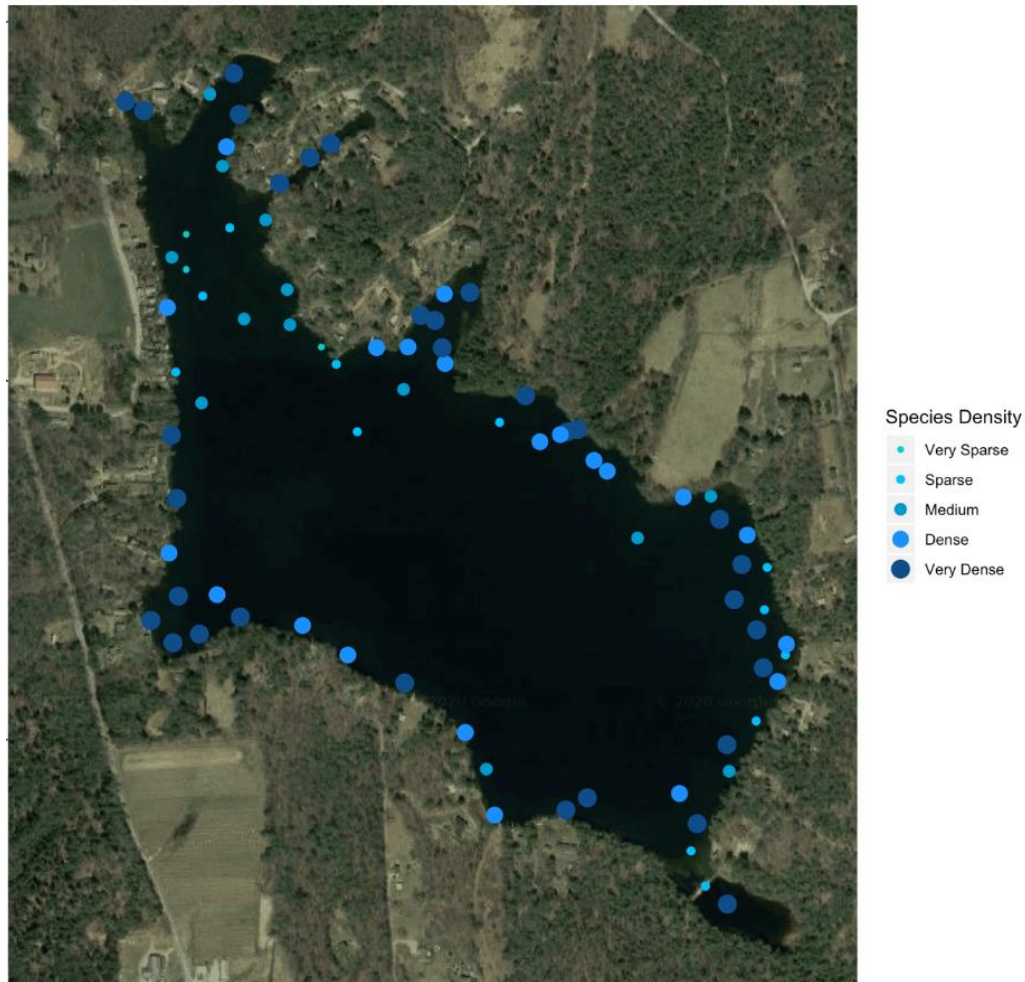
Crystal Pond August 27, 2019 Survey: Potamogeton amplifolius
Northeast Aquatic Research, LLC

Species Density
- Very Sparse
- Sparse
- Medium
- Dense
- Very Dense
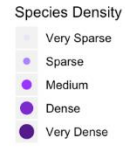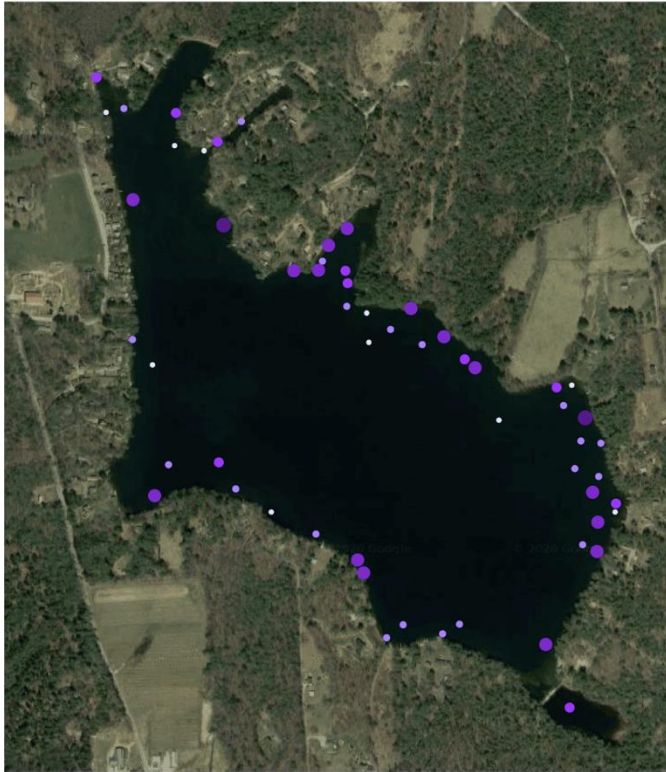
Crystal Pond August 27, 2019 Survey: Vallisneria americana
Northeast Aquatic Research, LLC

Species Density
- Very Sparse
- Sparse
- Medium
- Very Dense

Crystal Pond August 27, 2019 Survey: Potamogeton gramineus
Northeast Aquatic Research, LLC

Species Density
Very Sparse
Sparse
Medium
Dense
Very Dense
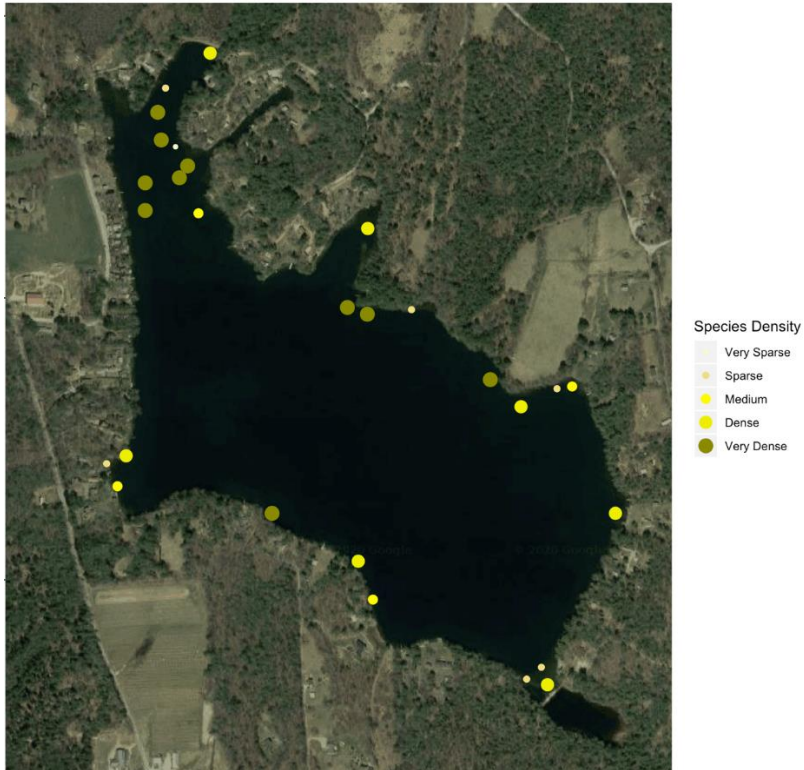
Crystal Pond August 27, 2019 Survey: Bidens beckii
Northeast Aquatic Research, LLC

Species Density
Very Sparse
Sparse
Medium

Crystal Pond August 27, 2019 Survey: Sagittaria graminea
Northeast Aquatic Research, LLC

Species Density
· Very Sparse
· Sparse
· Medium
· Very Dense

Species Density
· Very Spare
· Sparse
· Medium
· Very Dense

Crystal Pond August 27, 2019 Survey: Filamentous algae
Northeast Aquatic Research, LLC

Species Density
· Sparse
· Medium
· Dense

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Recommendations for 2020

At a minimum, monitoring should continue in May, July and August. However, it is likely the water quality in Crystal Pond worsens in September and early October, after the last sampling visit. September is likely to be the time of year with the worst internal loading and highest bottom-water TP and TN. Additionally, September and October likely have the largest phytoplankton populations, with the possibility of toxic cyanobacteria, as experienced in October 2018. Therefore, we recommend adding a fourth sampling date in late September to gauge water quality, determine the extent of anoxic water, and particularly to collect phytoplankton samples. It is important to monitor cyanobacteria levels in order to determine whether the water is safe for recreational activities.

An aquatic plant survey should be conducted in August to document changes in the native plant community and to search for potential new invasive species.

Appendix

Profile measurement in June, July and August 2019.

Date	Depth (m)	Temp (c)	Dissolved Oxygen	% O2 Saturation	RTRM	Conductivity
6/10/2019	0	22.9	9.03	105		91.6
6/10/2019	1	22.8	9.1	106	3	92.6
6/10/2019	2	22.6	9.07	105	6	92.6
6/10/2019	3	22.3	9.05	104	9	92.6
6/10/2019	4	21.7	9.44	107	17	92.1
6/10/2019	5	20.6	9.05	101	30	91.8
6/10/2019	6	19.7	8.75	96	23	91.2
6/10/2019	7	17.4	7.58	79	54	90.6
6/10/2019	8	15.1	3.39	34	47	94.1
6/10/2019	9	13.8	1.09	11	23	98.1
6/10/2019	9.5	13.5	0.34	3	5	99.3
7/2/2019	0	24.9	8.69	105		94.3
7/2/2019	1	25	8.7	105	-3	94.3
7/2/2019	2	25	8.69	105	0	94.3
7/2/2019	3	25	8.65	105	0	94.3
7/2/2019	4	23.9	9.16	109	34	93.2
7/2/2019	5	23	8.06	94	27	93.3
7/2/2019	6	21.8	6.61	75	34	92.9
7/2/2019	7	19	4.48	48	73	92.1
7/2/2019	8	16.4	1.05	11	58	94.8
7/2/2019	8.7	14.4	0.33	3	38	112.1

8/27/2019	0	23.7	8.68	103		96
8/27/2019	1	24.6	8.56	103	-28	95.7
8/27/2019	2	24.1	8.5	101	16	95.5
8/27/2019	3	24.2	8.44	101	-3	95.3
8/27/2019	4	24.2	8.09	96	0	95.2
8/27/2019	5	24.2	7.84	93	0	95.1
8/27/2019	6	24	7.2	86	6	95
8/27/2019	7	22.5	1.59	18	44	95.5
8/27/2019	8	19	0.42	5	93	109.3
8/27/2019	9	17.1	0.32	3	43	166

Connecticut DEEP Trophic Categories and Ranges of Indicator Parameters.

Category	T.P. (ppb)	T. Nitrogen (ppb)	Secchi Depth	Chlorophyll *a* (ppb)
Oligotrophic	0 -- 10	2 -- 200	6 +	0 -- 2
Oligo-mesotrophic	10 -- 15	200 -- 300	4 -- 6	2 -- 5
Mesotrophic	15 -- 25	300 -- 500	3 -- 4	5 -- 10
Meso-eutrophic	25 -- 30	500 -- 600	2 -- 3	10 -- 15
Eutrophic	30 -- 50	600 -- 1000	1 -- 2	15 -- 30
Highly Eutrophic	50 +	1000 +	0 -- 1	30 +