Northeast Aquatic Research

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February 20th, 2026
Revised April 6th, 2026

TO: Crystal Pond Association
ATTN: Elizabeth Murphy & Rick Bray
Re: Crystal Pond 2025 aquatic plant and water quality results

Background

The Crystal Pond Association volunteers collected in-situ water quality data from Station 1 (site of deepest water), weekly from April 25th to October 18th, 2025. The volunteers also collected water samples from the top, middle, and bottom at Station 1 for nutrient analysis. Water samples were collected on June 1, July 31, September 5, October 4, and November 7. Phytoplankton and zooplankton samples were collected on the same dates as nutrient samples.

No water samples were collected from the inlets in 2025.

Lake status is assessed using CT DEEP's categorization of the trophic state of Connecticut lakes (**Table 1**). This scheme uses total phosphorus (TP) as the lead parameter with others following the TP concentration. Phosphorus is typically bound in the landscape but is released by human activity. Higher TP allows for greater plankton numbers so Chlorophyll increases. More plankton causes the water to be cloudier so the Secchi disk depth decreases. The goal for Crystal Pond, as with all lakes, is to have the lowest possible TP concentration, ideally less than 10ppb in the epilimnion during stratification and the whole lake in early spring.

Northeast Aquatic Research (NEAR) conducted a comprehensive aquatic plant survey on September 4th, 2025. One invasive species was found: Mudmat (*Glossostigma cleistanthum*).

Table 1. Connecticut DEEP Trophic Categories and Ranges of Indicator Parameters.

Category	T. Phosphorus (ppb)	T. Nitrogen (ppb)	Secchi Depth (m)	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 +

2025 Water Quality Results

Water Clarity

The water clarity (Secchi disk depth) roughly followed the running average for the last three years. There were no exceptional readings or any that were unusually poor (**Figure 1**). Clarity was better than 6m for a short period at the end of April and May, but clarity has been better at that time in recent years. Clarity remained better than 5m through to the end of June, when in 2021 and 2022 clarity was near 4m. The clarity hovered around 4m throughout July and August, with poorest clarity of 3.4m on August 22nd. In 2025, clarity generally decreased from the first sampling to August 22nd. Clarity improved In September but showed decreases in October.

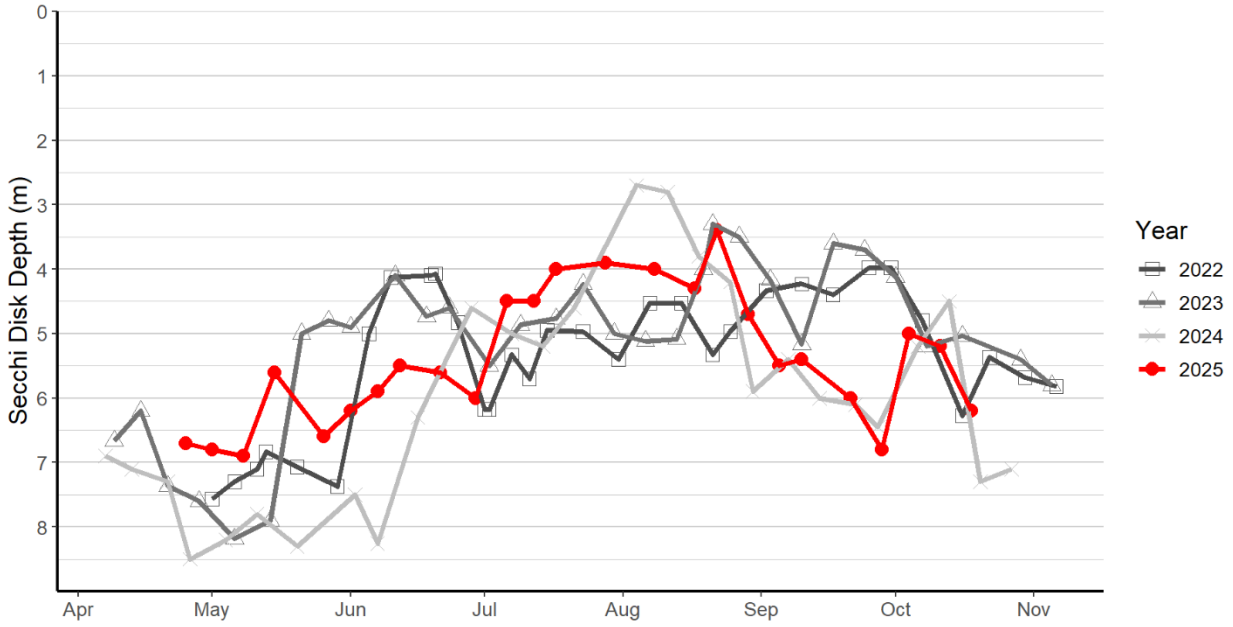


Figure 1. Secchi disk depths (m) measured in Crystal Pond 2022-2025.

Water Temperature and Dissolved Oxygen

By the time of the first sampling on April 25th, the pond showed signs of stratification with a differential of 3.5°C between top and bottom. The pond was stratified two weeks later, on May 8th (**Figure 2**). There was a brief cool down at the end of May when we experienced a cold snap. The pond was fully stratified between June 1st and October 1st. Warmest water, >25°C, occurred between July 1st and Aug 15th. During that time, the warm upper mixed layer (Epilimnion) extended down to a depth of 4m. Beginning on August 15th, the epilimnion gradually extended into deeper water, 6m by the end of August and 8m by the end of September. October data show the lake to be isothermal and cooling uniformly until the date of last sampling in October. The white line shows the location of the anoxic boundary. The anoxic boundary rises from the bottom through June and July while the lake is stratified, but is pushed down when the lake mixes down in September.

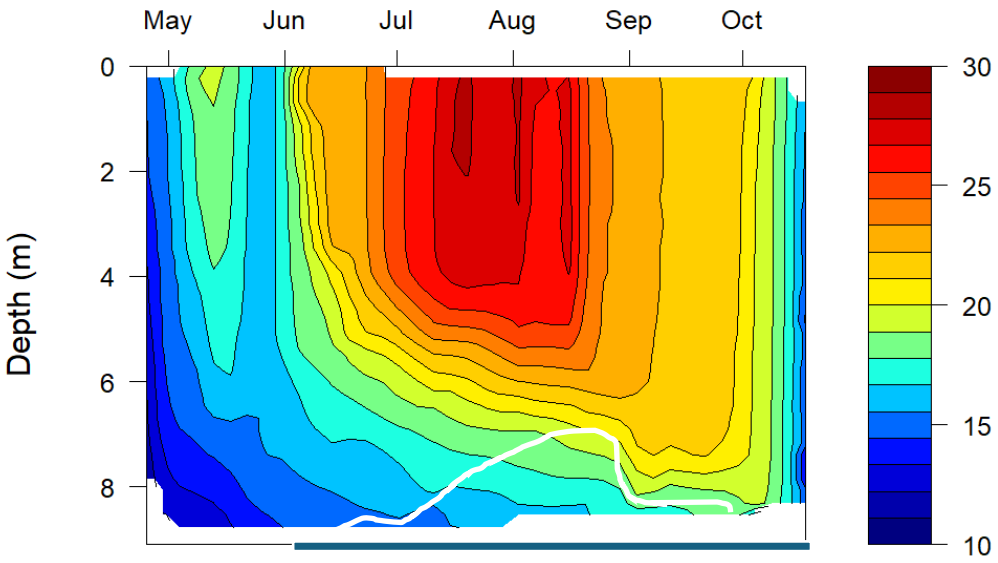


Figure 2. 2025 water temperature (°C) isopleth.

Dissolved oxygen (DO) concentrations were good to very good down to 8m in May and October and down to 6-7 meters in the summer and fall months. A slight deep water oxygen maximum occurred in June at 5 meters. Water at the very bottom lost DO and became anoxic (< 1mg/L) in mid-June. Beginning in July, anoxic water increased at a steady rate of 50 kg of DO lost per day until reaching a peak on August 8th, when the lake had lost 2,600 kg DO. The anoxic boundary reached maximum ascent of 6.5m on August 22nd, 2025, consistent with the long-term average of 6.86m. Deep water DO was rapidly replenished during September (**Figure 3**). This is a better scenario than last year when the lake lost a total of 3,600 kg DO by August 4th, 2024, and the anoxic boundary reached 5.5m from the surface on August 18th, 2024.

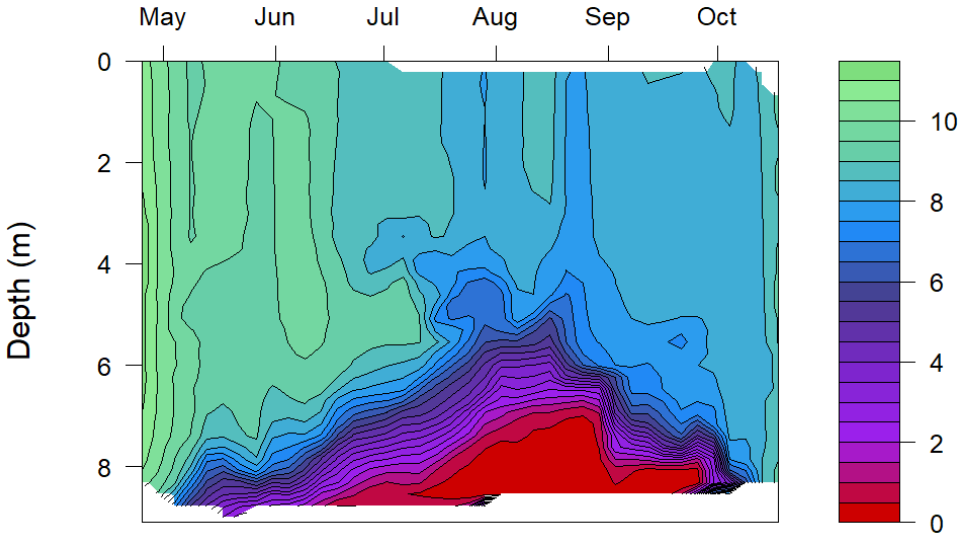


Figure 3. Distribution of dissolved oxygen (mg/L) in Crystal Pond during 2025.

Nutrients

Total Phosphorus

Total phosphorus (TP) concentrations in the top waters didn't exceed 10ppb in 2025 (**Table 2**). TP concentrations in middle waters ranged from 7ppb to 17ppb. Bottom water TP increased from June to September when anoxia was increasing, then decreased slightly by October 4th and considerably by November 4th (**Figure 4**). Bottom water TP in 2022, 2024, and 2025 reached peak concentrations of between 64 and 75 ppb, roughly 15 to 25 ppb higher than historical observed annual maximum of between 40-48ppb (**Figure 5**). The September 5th concentration of 69ppb was the second highest bottom TP recorded since 1992. It should be noted that from 1992 – 2012, monitoring was generally limited to once per year, usually in late July/early August. It is very possible that higher nutrient levels occurred during this period but were not recorded. The highest concentration of 75ppb was measured on October 16th, 2022. However, the June and November bottom TP concentrations in 2025 were lower than most years.

Table 2. Total phosphorus concentrations (ppb) in Crystal Pond in 2025.

Water Depth	Jun 1	Jul 31	Sep 5	Oct 4	Nov 7
Top	7	8	7	10	8
Middle	12	11	7	17	10
Bottom	5	18	69	51	7

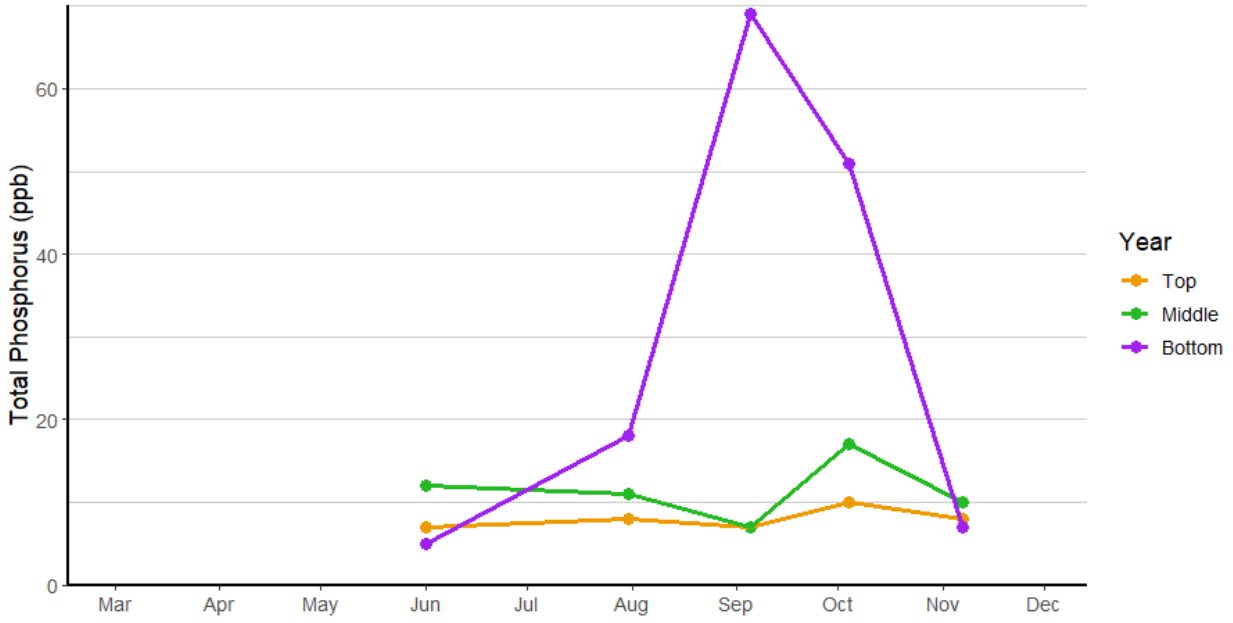


Figure 4. Total phosphorus concentrations (ppb) in Crystal Pond in 2025.

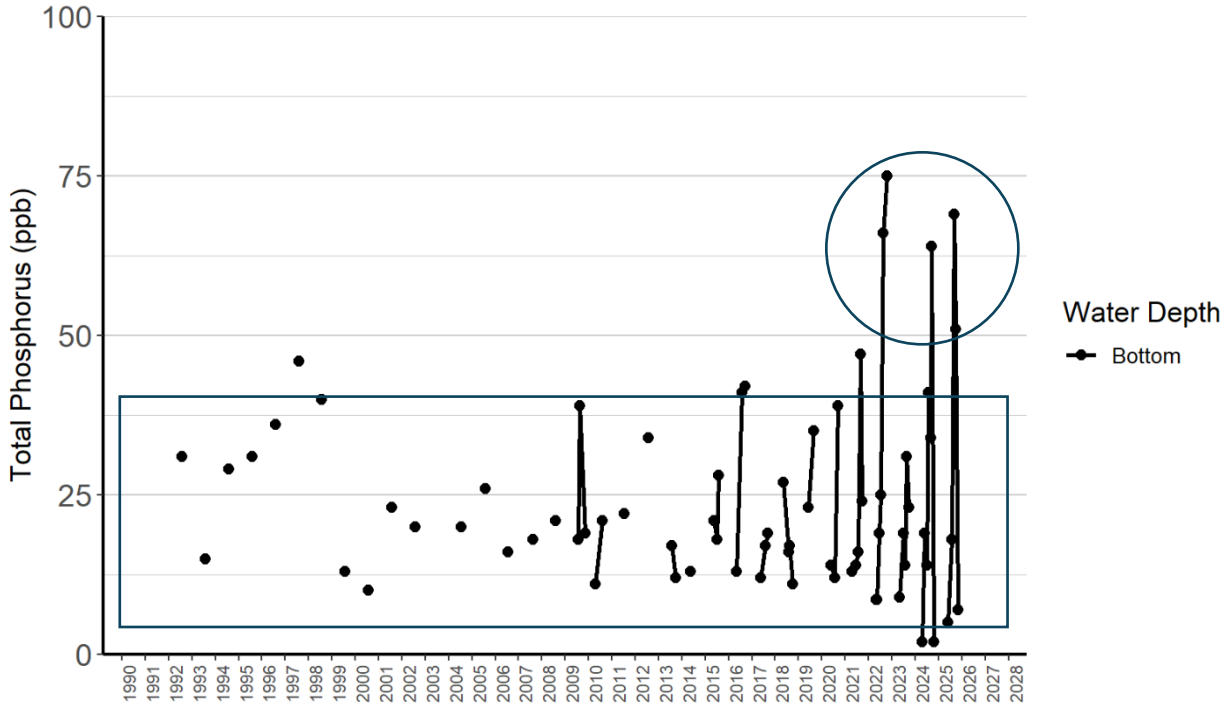


Figure 5. All historical bottom total phosphorus (ppb) concentrations, 1992-2025.

Total Nitrogen

Total nitrogen (TN) concentrations fluctuated between 264 ppb and 299 ppb in upper water, and 252 ppb and 352 ppb in middle waters (**Table 3**). Bottom water TN was low in June and July despite anoxic water during those months. Total nitrogen in bottom water nearly doubled by September but ammonia, the typical form of nitrogen in anoxic water, remained at a very low concentration. TN increased in bottom waters slightly in October followed by a decrease back to background levels in November as bottom water became fully oxygenated (**Figure 6**).

Table 3. Total nitrogen concentrations (ppb) in Crystal Pond in 2025.

Water Depth	Jun 1	Jul 31	Sep 5	Oct 4	Nov 7
Top	272	295	271	299	264
Middle	270	352	252	282	305
Bottom	224	331	829	905	273

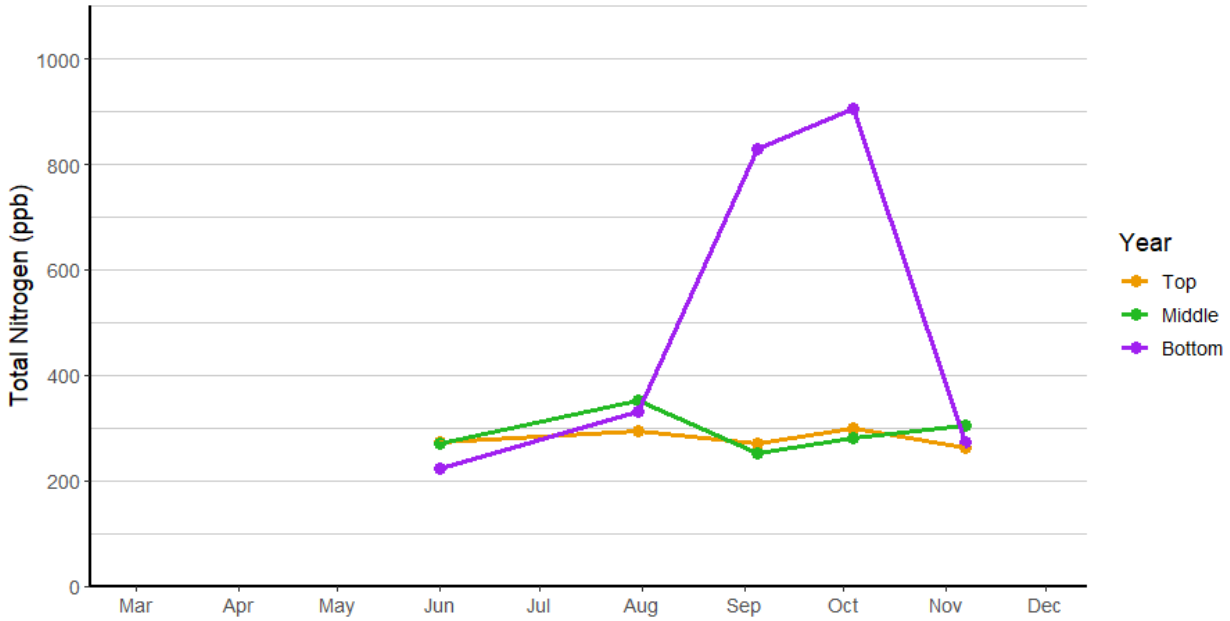


Figure 6. Total nitrogen concentrations (ppb) in Crystal Pond in 2025.

Ammonia Nitrogen

Ammonia (NH_3) was only measured at the bottom to detect release from sediments. Ammonia concentrations were very low in June, July, September, and November (**Table 4**). Ammonia is typically released rapidly from anoxic sediments; however, in Crystal Pond, this release appears to be minimal. In 2025, ammonia concentrations remained low throughout the season, increasing to 305 ppb only in October. While the exact cause of this limited release is unclear, it likely reflects low rates of organic nitrogen mineralization in the sediments. Because ammonia is produced through the breakdown of organic nitrogen, low sediment nitrogen availability would limit its production. Although sediment nitrogen has not been directly measured, the consistently low ammonia concentrations in anoxic bottom waters suggest that sediment nitrogen levels are likely low.

Table 4. Ammonia-nitrogen concentration (ppb) in Crystal Pond in 2025. ND= Not Detected, sample below detection limit.

Water Depth	Jun 2	Jul 31	Sep 5	Oct 4	Nov 7
Bottom NH_3	ND	3	8	305	5
Bottom TN	224	331	829	905	273
NH_3 *% of Total*	--	*0.91*	*0.97*	*34*	*1.8*

Phytoplankton

The phytoplankton population in Crystal Pond in 2025 was quite small, reaching a maximum total of just 4,723 cells/mL in July (**Figure 7**). The community was dominated by Cyanobacteria in July and September, but the numbers were low with regards to the risk of health impacts (**Figure 8, Table 5**). In June and July, the most dominant Cyanobacteria species were *Dolichospermum*. In September, *Microcystis* dominated. Both species of Cyanobacteria can produce toxins that are harmful to humans, pets and wildlife. But again, the numbers were low.

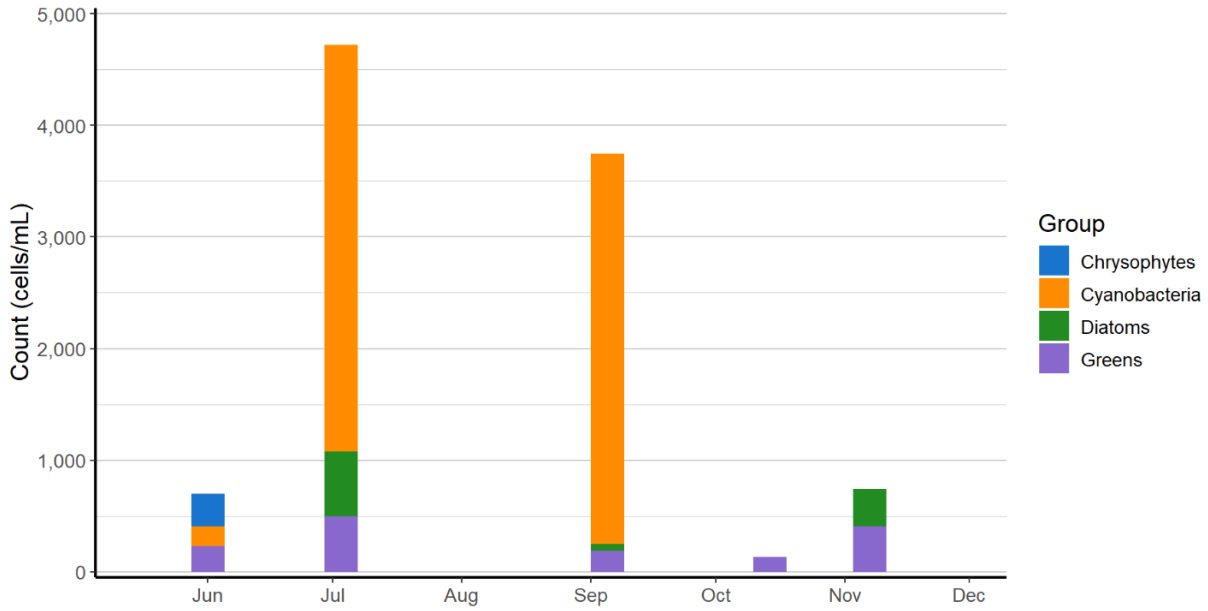


Figure 7. Phytoplankton numbers by Group in Crystal Pond in 2025.

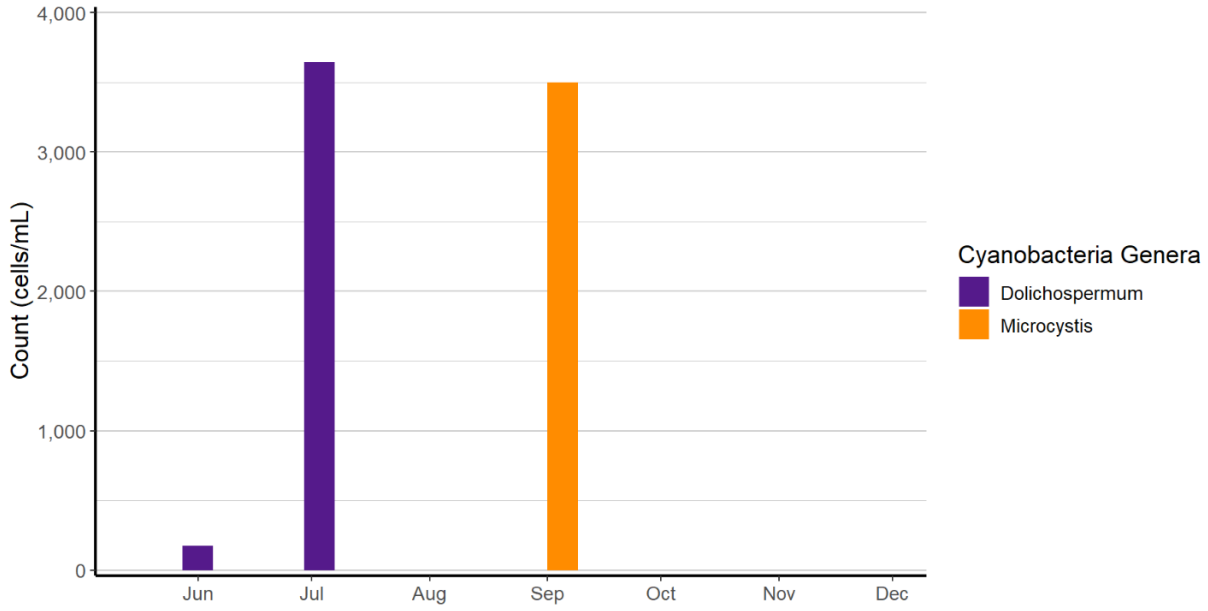


Figure 8. Cyanobacteria numbers by Group in Crystal Pond in 2025.

Table 5. WHO guidance values for the relative probability of health effects resulting from exposure to cyanobacteria.

Relative Probability of Acute Health Effects	Cyanobacteria Density (Cells/mL)
Low	< 20,000
Moderate	20,000-100,000
High	100,000-10,000,000
Very High	> 10,000,000

Zooplankton

The zooplankton populations were high in June, with many mid- to large-size Calanoids and mid-sized Cladocera. Numbers were lower during the summer and early fall but increased in November (**Figure 10**). There were plenty of large-bodied Calanoids and Cladocera throughout the season (>1mm) (**1**). Calanoids were the most abundant group, followed by Cladocera.

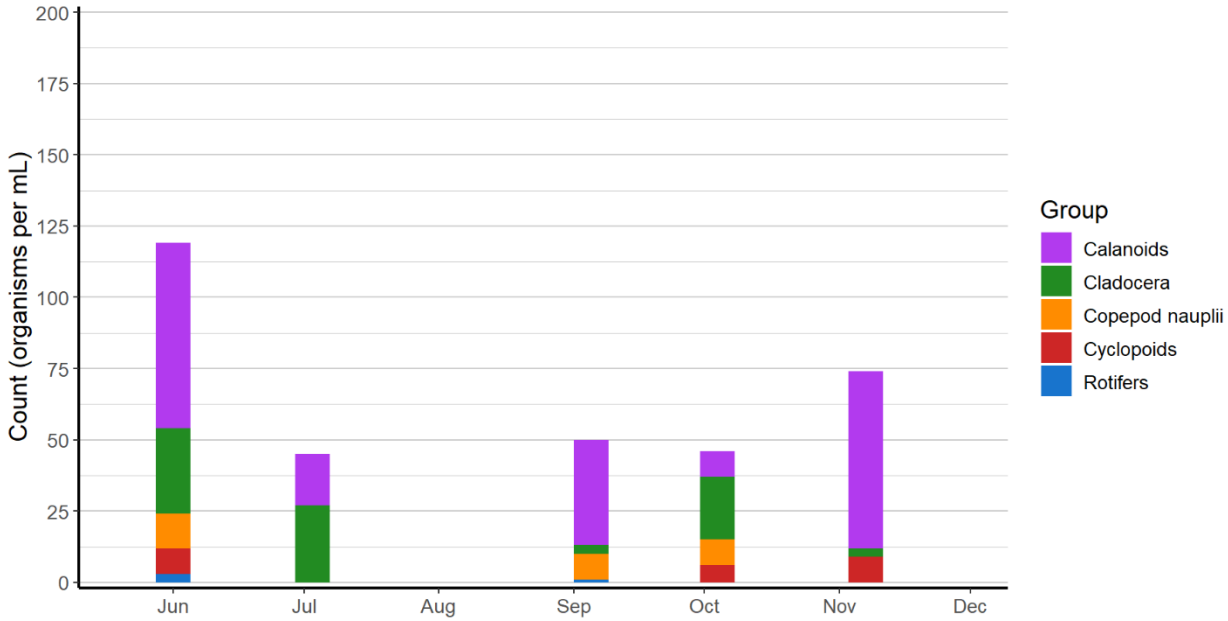


Figure 9. Zooplankton numbers in Crystal Pond in 2025.

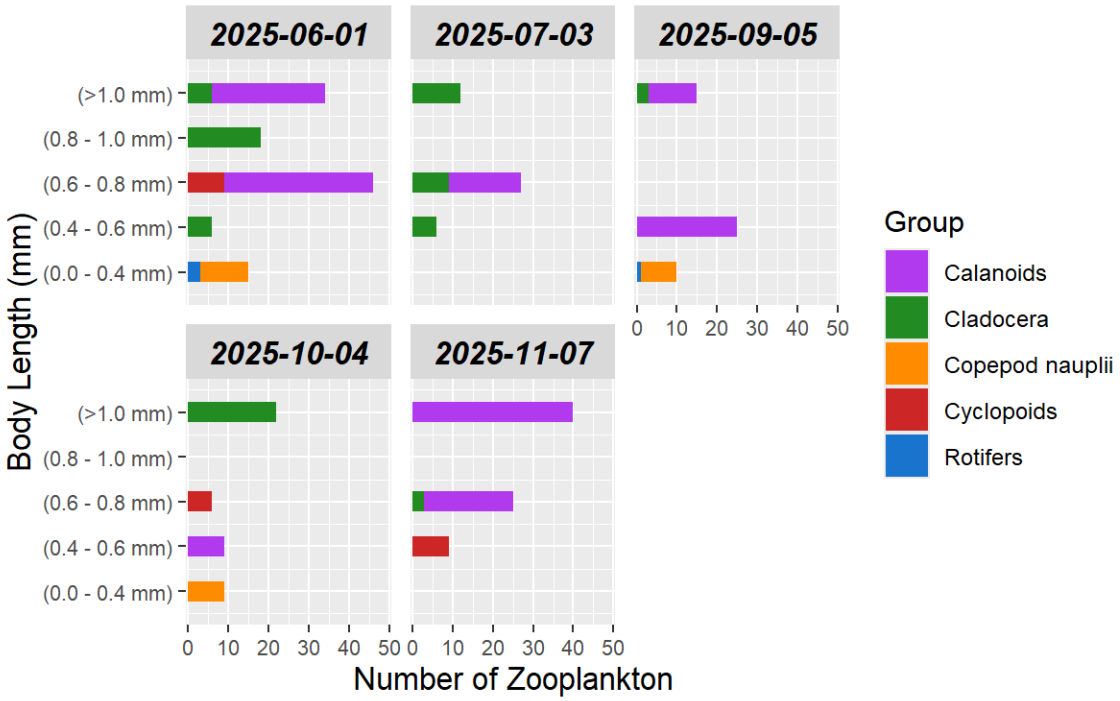


Figure 10. Zooplankton numbers by size classes in Crystal Pond in 2025.

Aquatic Plants

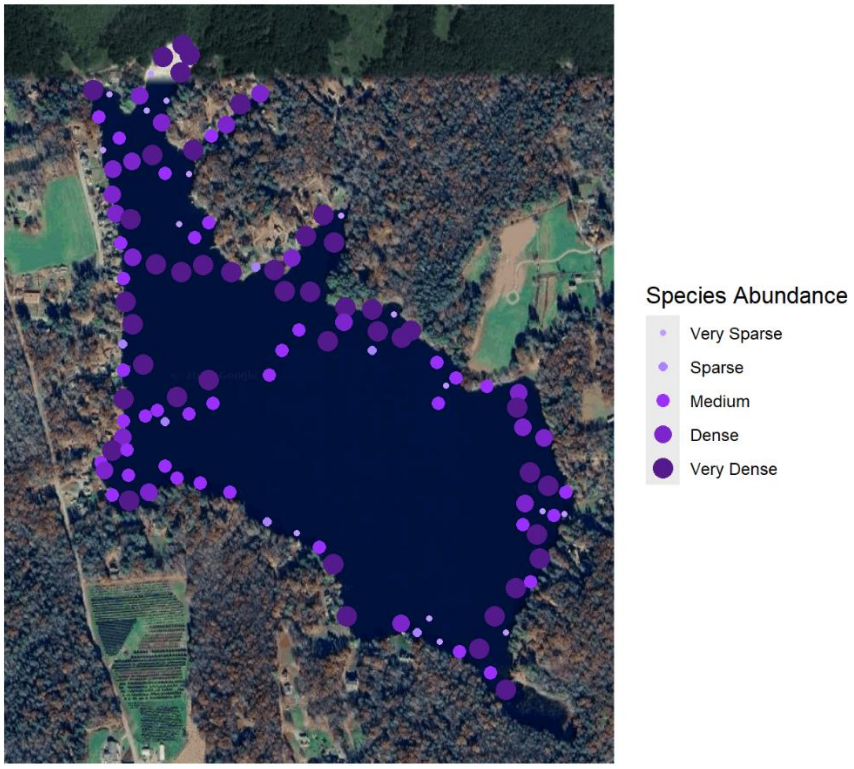
A total of 23 aquatic plant species were documented in Crystal Pond during the September 4th, 2025 aquatic plant survey, along with Filamentous Algae (**Table 6**). Three species were dominant, meaning they were present at greater than 20% frequency: Robbin's Pondweed (*Potamogeton robbinsii*) (**Map 1**), Large-leaf Pondweed (*Potamogeton amplifolius*) (**Map 2**), and Grassy Pondweed (*Potamogeton gramineus*) (**Map 3**). Tape grass, found this year at 14% frequency, has consistently been found at about a 15% frequency seemingly remaining in one section of the lake. Water Marigold, found this year at 11% frequency, has been found at up to 40% of sites in past surveys. The remaining 18 species are scarce with frequency of less than 10%, with 11 species being found at one or a few locations.

Water Marigold *(Biden's beckii*) is a state-listed special concern species with historical presence in Crystal Pond. Water Marigold was found in multiple locations in 2025, particularly along the west shoreline and in the coves (**Map 4**). In several locations Water Marigold was very dense.

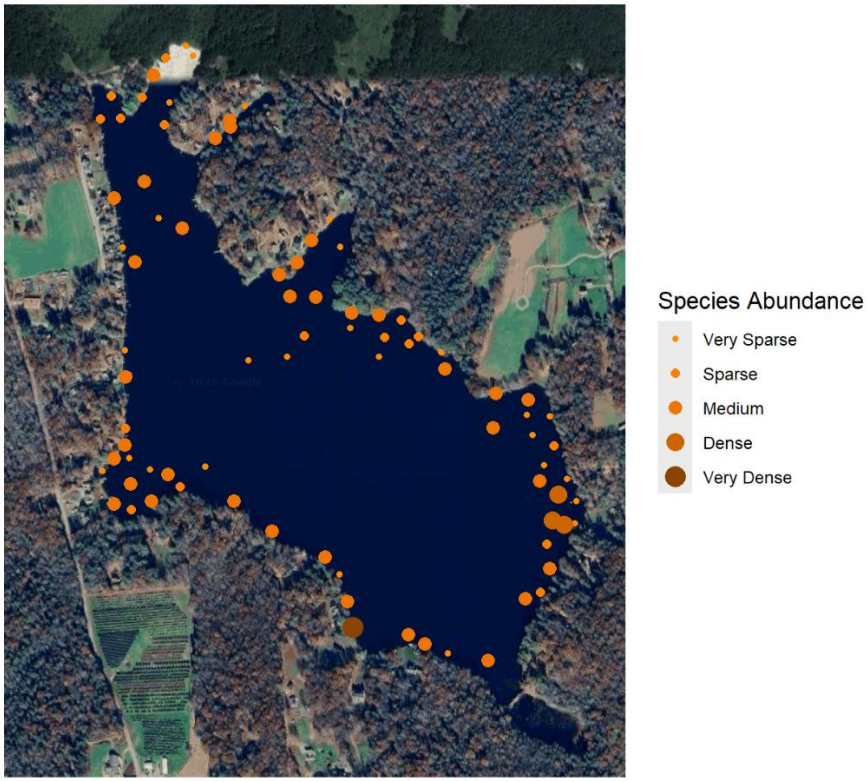
Mudmat *(Glossostigma cleistanthum*) is an invasive species that was first documented in Crystal Pond in 2022. Mudmat was found in 3 locations this year in very sparse or medium abundances (**Map 5**).

Table 6. Aquatic plant species observed in Crystal Pond during September 4th, 2025 aquatic plant survey in order of decreasing frequency. CT state-listed species highlighted in blue. Invasive species highlighted in orange.

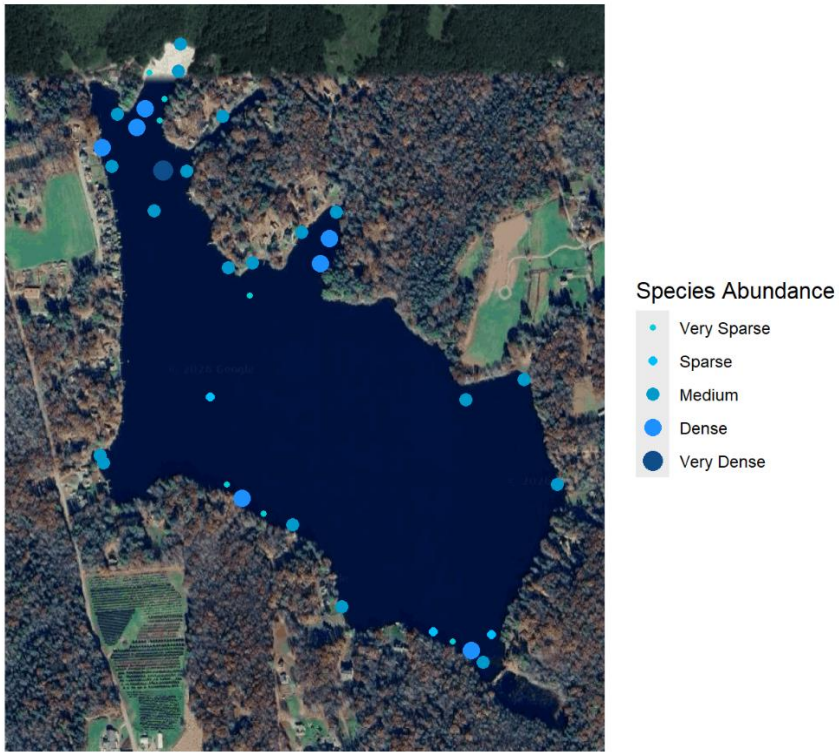
Scientific Name	Common Name	% Frequency	Avg. Density
Potamogeton robbinsii	Robbin's Pondweed	66	55
Potamogeton amplifolius	Large-leaf Pondweed	46	19
Potamogeton gramineus	Grassy Pondweed	22	33
Vallisneria americana	Tapegrass	14	36
Bidens beckii	Water Marigold	11	30
Spirogyra spp.	Filamentous Algae	7	19
Eleocharis acicularis	Needle Spikerush	3	7
Sagittaria graminea	Grassy Arrowhead	3	10
Brasenia schreberi	Watershield	2	26
Elodea nuttallii	Nuttall's Waterweed	2	10
Fontinalis sp.	Aquatic Moss	2	6
Glossostigma cleistanthum	Mudmat	2	18
Utricularia macrorhiza	Common Bladderwort	2	28
Ceratophyllum sp.	Coontail	1	5
Potamogeton pusillus	Small Pondweed	1	5
Stuckenia pectinata	Sago Pondweed	1	18
Utricularia radiata	Floating Bladderwort	1	23
Chara sp.	Muskgrass	<1	5
Lyngbya sp.	Benthic Cyanobacteria mat	<1	30
Nitella sp.	Stonewort	<1	NA
Nuphar variegata	Yellow Water Lily	<1	30
Nymphaea odorata	White Water Lily	<1	NA
Potamogeton bicupulatus	Snail-seed Pondweed	<1	30
Utricularia purpurea	Eastern Purple Bladderwort	<1	10



Map 1. Locations and abundances of Robbin's Pondweed during September 4th, 2025 survey.



Map 2. Locations and abundances of Large-leaf Pondweed during September 4th, 2025 survey.



Map 3. Locations and abundances of Variable-leaf Pondweed during September 4th, 2025 survey.

Map 4. Locations and abundances of state-listed Special Concern Water Marigold during September 4th, 2025 survey.

Map 5. Locations and abundances of invasive Mudmat (Glossostigma cleistanthum) during September 4th, 2025 survey.

Recommendations for 2026

- Collecting in-situ data weekly allows for excellent analysis of the functioning of the lake. We recommend continuing to collect water temperature, dissolved oxygen and water clarity measurements weekly in 2026. Water samples should be collected monthly from top, middle and bottom depths from April to November.
- The inlets should be sampled in 2026. Recommended sampling months are April, May, June, and October. Summer months are typically dry, but sampling months should be adjusted based on rain events and flow.
- The threat of invasive aquatic plants getting into Crystal Pond remains greater than ever with rampant spreading of Hydrilla. A comprehensive aquatic plant survey should be conducted in late August or early September 2026 to assess the aquatic plant community and search for invasive species. If any new invasive species are found, NEAR will immediately notify the CPA.
- We recommend holding a community-wide education program about Hydrilla and how to identify this plant.