

Farm Pond Volunteer Water Quality Monitoring Program – Cyanobacteria, Green Algae, and Related Observations, Summary Report covering 2020, 2021, and 2022.

Rev_1-30-23

Introduction:

A volunteer water quality monitoring program has been characterizing the general state of Sherborn's premier 126-acre kettle pond since the program's inception in 1998, under the auspices of the Town's Farm Pond Advisory Committee (FPAC). Over the past three summer seasons (2020-2022) a noticeable deterioration of the general water quality (primarily water transparency) has been observed. Concurrent with the water clarity changes, the first appearance of much larger concentrations of phytoplankton (microscopic, single-celled photosynthetic organisms that live suspended in water), which may include both the potentially harmful blue-green cyanobacteria (capable of producing cyanotoxins) and the different organism class, green algae. Surface blooms (HCBs) have now been observed at Farm Pond.

2020 Season – First Farm Pond Cyanobacteria Blooms Ever Reported

Although large surface HCBs have occurred in lakes and ponds throughout the Northeast during the last several years, Farm Pond in Sherborn has not been subject to such activity in recent decades. However, a homeowner on Farm Pond reported on the morning of July 18, 2020, an exceptionally large area of the



lake off his property "covered in what looks like green paint" – a HCB bloom (July 18, 2020), and took the photo shown here. The bloom was not visible the following day. A water sample from the bloom was taken by the resident and identified (Prof Marianne Moore, Wellesley College) by optical microscopy, as primarily *Microcystis*, a common genus in HCBs in New England.

Photo 1 - Northern side of Farm Pond, morning of July 18, 2020. Large HCB bloom visible.

The following day (7-19-20) this HCB bloom was no longer visible, and the FPAC water quality volunteers conducted a regular testing event at the center of the lake. At that time, a Secchi disk transparency depth of 7.2 meters (23.6 ft) was observed.

At the Sherborn Yacht Club (SYC) dock a month later (8-19-20), multiple small (1-2 ft) green surface patches were observed, photo #2. This time the same volunteer identified the cyanobacteria by microscopy as *Dolichospermum* (formerly called *Anabaena*).

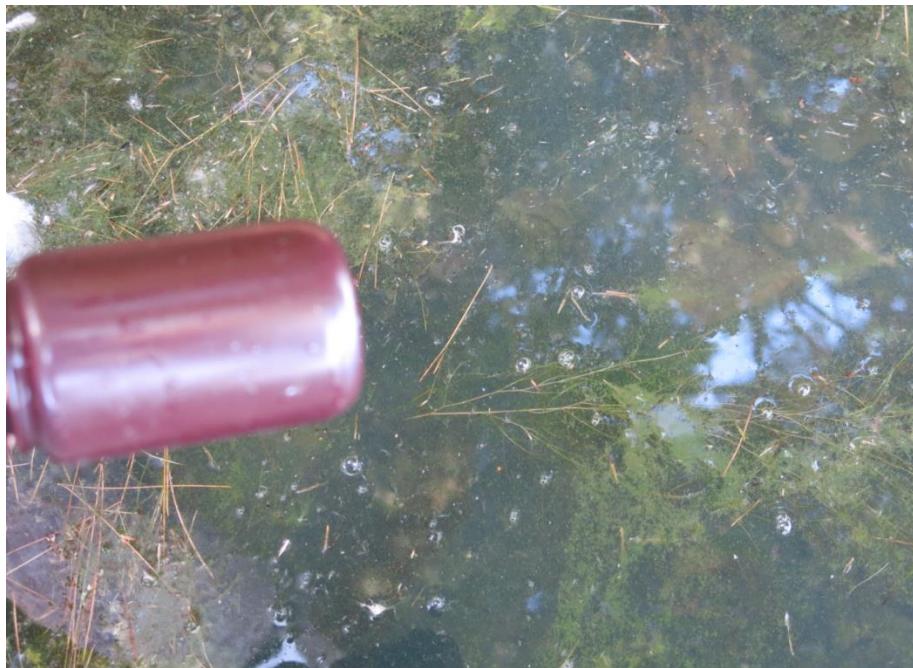


Photo 2 – sampling of surface HCB on 8-19-20, SYC dock.

In photo # 2 here, taken from the SYC dock section close to the shoreline, the green surface streaks are mixed among floating pine needles and a few white goose feathers. The brown sampling bottle shown is about 3 inches in length, and the HCB blooms extended a foot or two outside the frame of the photo. On 8-23-20 more similar sized surface

patches were observed by another homeowner on Farm Pond, also along the northern shoreline. This time water samples were taken and were shipped to Northeast Labs in Berlin CT. The results of the lab water testing revealed cyanotoxin levels below MA DPH guidelines for recreational waters (< 1 PPB Microcystins toxin per Abraxis 520022 method, recommended by MA DPH for public beaches). Two HCB genera were identified by this lab, *Anabaena* and *Microcystis*.

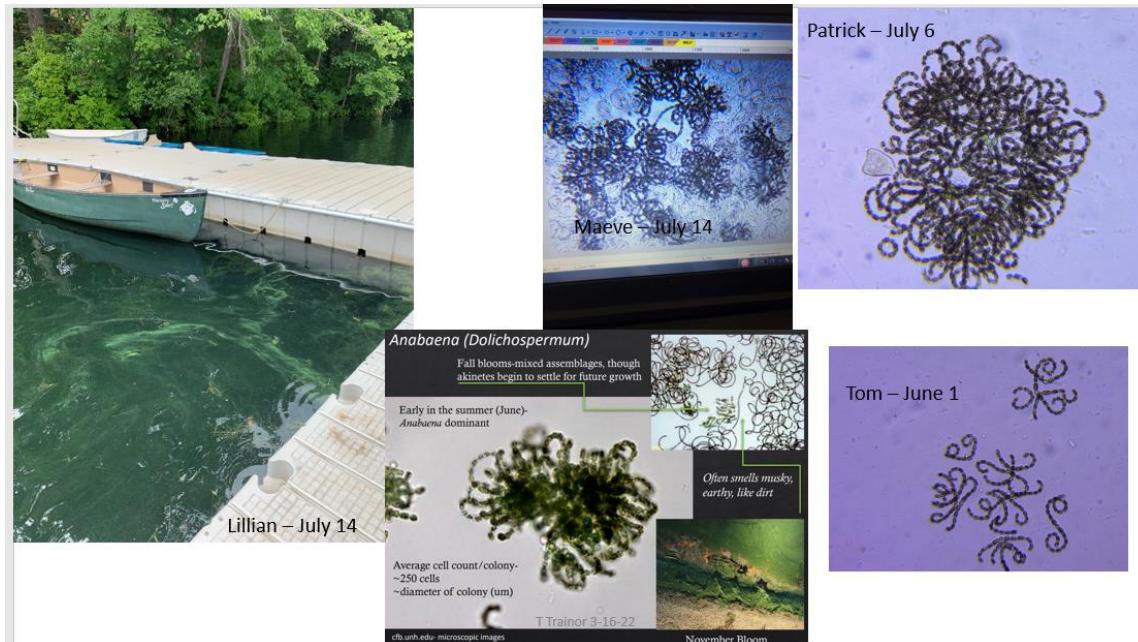
2021 Season – Continuation of “Mini” Cyanobacteria Blooms, CyanoScope, Worcester Collaborative.

During the 2021 season the FPAC volunteers initiated several new activities to better monitor the lake for cyanobacteria. The Town purchased for the efforts a “CyanoScope” kit (<https://cyanos.org/>) from Lim-tex (<http://lim-tex.com/>, Andover MA) comprising of an optical 200X microscope with digital camera, a 50 um mesh plankton sampling net, and associated supplies. In addition, FPAC joined a regional cyanobacteria monitoring program led by the City of Worcester, the Worcester Cyanobacteria Monitoring Collaborative, WCMC, (<https://www.worcesterma.gov/sustainability-resilience/recreational-waters/cyanobacteria>) which provided additional sampling supplies and monthly cyanobacteria Saturday microscope identification workshops in Worcester.

FPAC partnered with the staff at the Sherborn Yacht Club to site the microscope kit at the SYC shed located on Farm Pond for the 2021 summer. A FPAC volunteer trained three college student SYC staff members (Lilian Briggs, Maeve Clifford, and Patrick Whitaker) on the HCB sampling techniques and

microscopic HCB identification and documentation tasks. Training guides were written specific to FPAC/SYC incorporating the WCMC sampling and microscope identification procedures.

In terms of HCB bloom activity, the 2021 season brought on several mid to late summer sightings of the small (1 to 3 ft by 3 to 6 inch or so) “mini-blooms” on the water’s surface, primarily along downwind shoreline locations around the lake. Some example photographs, along with corresponding microscope HCB images are shown here:



Above photo taken from SYC dock, western side of Farm Pond.

Farm Pond – July 15, 2021 – kayak survey



Northern side of Pond



Grab sample, northern side of Pond



Boat Ramp

Besides gaining more HCB microscopy and identification skills, the connection to the WCMC also afforded, at no cost to the Town other than volunteers time and efforts, additional HCB testing information on samples taken at Farm Pond and analyzed by City of Worcester staff on their lab's more sophisticated instruments. A summary of the 2021 Farm Pond WCMC results is shown here:

2021 Farm Pond HCB Results - Worcester Cyanobacteria Monitoring Collaborative (WCMC)		
Date	Flurometry, Aus	FlowCam, pls/ml
6-19-2021	ND	284
7-17-2021	16	74
8/21/2021	11	74
9/25/2021	not sampled	448
10/16/2021	ND	6
ND = none detected, < 8 Aus		
Flurometry - detection of Phycocyanin, chemical marker for blue-green cyanobacteria.		
Aus values > 50 suggestive of HCB bloom occurrence.		
FlowCam - particle size counter, particles 2 to 100 um in size, per ml.		

For the WCMC work three types of samples were taken, all from the Farm Pond western shoreline area (public boat ramp or SYC dock, both located just north of the public beach):

- 1) **NET sample** – plankton net approx. 10 ft horizontal draw, just below water surface, in water depth of about 1 meter location. NET samples (500 ml) were used for microscope identification.
- 2) **IT sample** – 1-meter integrated tube, capturing a vertical water column sample (tube held at surface so sample from surface to 1 m depth was collected, 500 ml), and was used for the fluorometry/phycocyanin analysis.
- 3) **Grab sample** – Surface sample (500 ml), used for the FlowCam particle counter.

Of the 22 lakes and ponds that participated in the 2021 WCMC program, Farm Pond consistently exhibited some of the lowest levels of Phycocyanin and particle counts. A summary compilation of all the WCMC participants' 2021 results is available at the WCMC website.

Green Algae Bloom – Oct 3, 2021

For the first time at Farm Pond a large green alga submerged filamentous mass was observed near the Farm Pond Reservation public boat ramp (western edge of lake), in about 3 to 4 ft of water, just below the water surface, with a total mass size of about 15 x 4 feet (see photos copied below). A microscopy sample identified it as *Mougeotia*, a very common green filamentous alga. Others described the mass as appearing like “floating green cotton-candy”. It had dissipated within a week and did not seem to re-appear. This species is most often found in warm, shallow, high nutrient ponds and wetlands throughout the northeast.

Photos of 10-2-21:



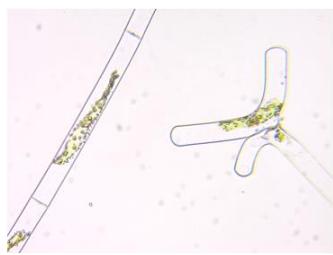
"Hi. FYI, I was on the pond today and rowed over a massive growth. Maybe 15' long. It is between the boat ramp and SYC, in about 4' of water"



Lat 42.232299,
Long -71.350338



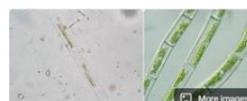
Microscope ID of concentrated grab sample:



Farm Pond grab sample, 50X magnification
(10X lens, 5X digital camera)



Tentative ID: Mougeotia



Mougeotia

Algae

Mougeotia Agardh 1824 is a genus of conjugating filamentous algae of the order Zygnematales, phylum Charophyta (previously allocated to Chlorophyta). The genus comprises 174 confirmed species (Guiry & Guiry, 2017) and is widespread in freshwater habitats worldwide (Johnson, 2011). Feb 1, 2018

<https://link.springer.com/article/10.1007/s00118-017-1530-0>
There to stay: invasive filamentous green alga Mougeotia in ...

Higher classification: Zygnemataceae

Scientific name: Mougeotia

Rank: Genus

2022 Season – New Farm Pond lake-wide phytoplanktonic (sub-surface) bloom with extremely low late Summer/early Fall water transparency (Secchi Disk) levels.

The beginning of the 2022 season brought occasional small surface blooms, and the frequent identification by microscopy (SYC and WCMC) of two HCB genera at relatively low concentrations (*Dolichospermum* and *Microcystis*, NET samples). The 2022 WCMC data is summarized here:

2022 Farm Pond HCB Results - Worcester Cyanobacteria Monitoring Collaborative (WCMC)				
Date	Flurometry, Aus	FlowCam, pls/ml		
5/21/2022	ND	780		
6/18/2022	ND	188		
7/16/2022	ND	1026		
8/1/2022	ND	728		
8/27/2022	13	35		
9/12/2022	17	2066		
9/24/2022	30			
10/15/2022	ND	3990		
	ND = none detected, < 8 Aus			
Flurometry - detection of Phycocyanin, chemical marker for blue-green cyanobacteria.				
Aus values > 50 suggestive of HCB bloom occurrence.				
FlowCam - particle size counter, particles 2 to 100 um in size, per ml.				

(Note: FlowCam data not provided for the 9/24/22 sampling).

Compared to the previous 2021 season, the particle counts per ml have increased appreciably for Farm Pond in 2022 (values of 35 to 3,990 in 2022 vs 6 to 448 in 2021).

Visually, the lake started to show major sub-surface water clarity problems by mid-season, as shown by the Secchi disk transparency data taken at the FPAC mooring near the center of Farm Pond:

Date	SD, m	SD, ft
4/10/2022	6.6	21.7
5/1/2022	5.4	17.7
6/5/2022	5.8	19.0
7/9/2022	5.2	17.0
7/29/2022	4.3	14.1
8/18/2022	2.7	8.9
9/4/2022	1.5	4.9
9/16/2022	1.0	3.3
10/7/2022	1.0	3.3
10/22/2022	3.6	11.8

The measurements on 8/18, 9/4, 9/16 and 10/7/22 are the four lowest SD depths we have ever observed at Farm Pond within the past 24 years and were accompanied by a troubling murky-green phytoplankton water column bloom noticeable for at least the three months of August – early October across the entire lake. SD determinations at the Farm Pond Reservation public beach several times in September were also at the 1.0-to-0.9-meter levels, which is quite concerning as these levels were below the MA DPH safety guidelines of 1.2 m (4 ft) for public swimming facilities.

Early September 2022 brought on particularly alarming surface and water column bloom activity, as evidenced from the following two photos taken on 9-10-22 from the SYC docks. The first photo (below left) captures a “bluish” in color mini surface boom, while the second photo (below right) shows the general murky green water appearance in the shallow water between the SYC dock and shoreline.



Grab samples collected on 9-10-22 from both areas again showed presence of *Dolichospermum* and *Microcystis* HCB species. However, the cell densities

observed on the microscope slides were not particularly high, and in several cases only one cyanobacteria colony was found on a slide (1 drop of water from NET sample). Given the very low water clarity, and the relatively low phycocyanin (blue-green pigments) results, it may be the case that the lake was exhibiting a mix of both cyanobacteria and higher concentrations of green algae populations (green algae do not contain phycocyanin. Both organisms produce the green pigment chlorophyll). The watershed-based plan field work envisioned by FPAC in the 2023 season includes more detailed enumeration (identification) of phytoplankton constituents by the lakes consultant to aid in understanding this better.