Brawley Consulting Group, LLC

Land Conservation and Management Services

Memo

Date: June 23, 2024

To: Ball Pond Advisory Commission

From: Brawley Consulting Group

Re: Results of Lake and Cyanobacteria Monitoring of May and June of 2024

Dear BPAC Members:

On May 11th and June 22nd, the Brawley Consulting Group visited Ball Pond to conduct monthly water quality and cyanobacteria monitoring as part of the ongoing lake management program. We are grateful for the on-the-water assistance graciously provided by George Buck on May 11th and Frank Yulo who piloted Mr. Buck's boat on June 22nd (Fig. 1). The data and sample collection methods were described in previous memos.

Figure 1. George Buck (left) and Frank Yulo (right) on May 11, 2024, at the State Boat Launch on Ball Pond.

Summary: Cyanobacteria cell concentrations in the open water were very low on May 11th and low on June 22nd. Conditions in the water column did change between the two dates with the high concentration of cyanobacteria at 4 to 5 meters in May not observed in June and likely a contributor to the shoreline bloom conditions reported by the community since mid-June. Open water conditions did not pose a public health threat, but the shoreline bloom conditions did.

Water Column Conditions

Total depth at the sampling site was measured at 14.5 meters in May and 14.9 meters in June. Secchi disk transparency is a surrogate for the level of organic (e.g. algae) and inorganic (e.g. silt or clay) material suspended in the water column. Between May 11th and June 22nd, Secchi transparency decreased by 38 centimeters, i.e., from 2.25 meters on May 11th to 1.87 meters by June 22nd.

On May 11th, water temperatures from the surface to 3 meters of depth were between 15 and 16°C. Below the thermocline, situated between 3 and 4 meters of depth, temperature quickly decreased to 8.3°C by 6 meters of depth (Fig. 1). Below that, temperatures gradually decreased to 6.5°C by 14 meters of depth.

Above and just below the thermocline, dissolved oxygen concentrations were high and above 10 mg/L. From 5 to 9 meters of depth, oxygen concentrations decreased from 6.5 mg/L to <1 mg/L. All concentrations below 9 meters were <1 mg/L, i.e., anoxic.

On June 22, temperatures from the surface to 2 meters were between 25°C and 28°C. Temperatures precipitously decreased with depth down to 7 meters of depth where a measurement of 7.8 °C was recorded. Temperatures decreased by <1°C from 8 meters of depth to the bottom of the water column. The metalimnetic boundaries were between approximately 1.5 meters and 6.5 meters and the thermocline was situated between 4 and 5 meters of depth.

Oxygen concentrations in the top 2 meters of the water column were high in June but decreased precipitously between 3 and 5 meters of depth. Concentrations below the thermocline to the bottom were <1 mg/L. This marked loss of oxygen below the thermocline indicated a high biological oxygen demand resulting in anoxic conditions throughout much of the water column very early in the season.

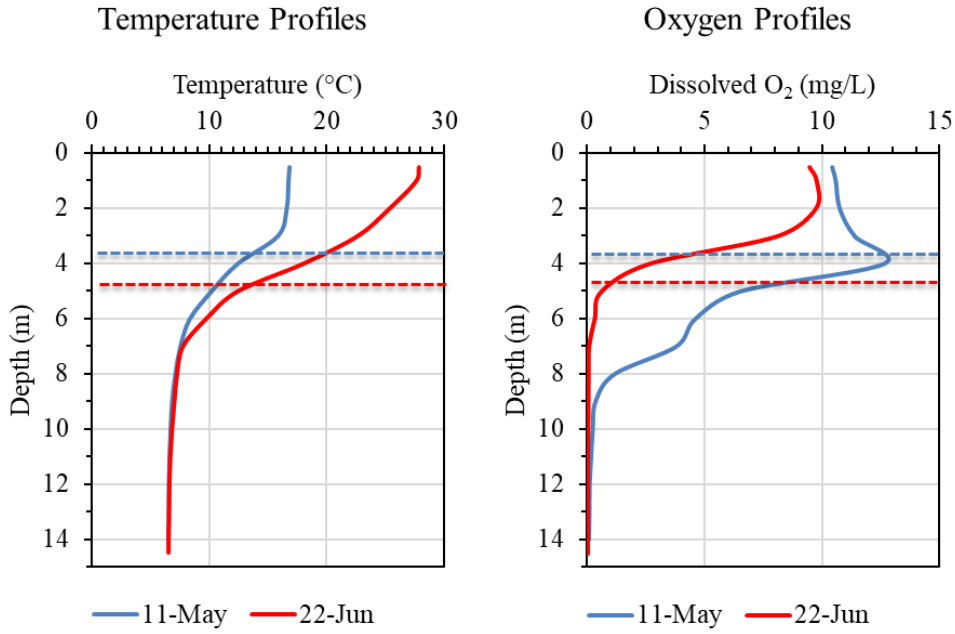

Figure 2. Temperature (left) and dissolved oxygen (right) profiles for Ball Pond on May 11, 2024, and June 22, 2024. Dotted lines represent the position of the thermocline and color corresponds to the date in the figure legend.

Algae and Cyanobacteria Community

May

On May 11th, a total of 15 algal genera were identified from the plankton net and whole water samples. The taxonomic group with the greatest richness (number of genera identified) were the Chlorophyta (aka green algae) and Chrysophyta (aka golden algae) at 5 and 4 genera, respectively. Five other taxa were represented by 1 or 2 genera.

Cell concentrations in the top three meters of the water column, where samples for algal counts are collected, were low at approximately 5,500 cells/mL. Just over half, or

approximately 2,900 cells/mL, were Cyanophyta (aka cyanobacteria or blue-green algae). Most of those cells were from the filamentous *Planktothrix spp*. The only other cyanobacteria observed was *Aphanizomenon spp*.

Much of balance of counted cells were green algae which comprised 32% of the total. Bacillariophyta (aka diatoms) and golden algae cells comprised approximately 6 and 4% of the total, respectively.

While cyanobacteria cell concentrations in the top three meters of the water column were low, there was a lens of high cyanobacteria relative biomass just below the thermocline at 4 to 5 meters of depth (Fig. 3). This was determined by measuring relative concentrations of phycocyanin throughout the water column with the fluorimeter in the water quality instrumentation. Phycocyanin is a photosynthetic pigment mostly unique to cyanobacteria.

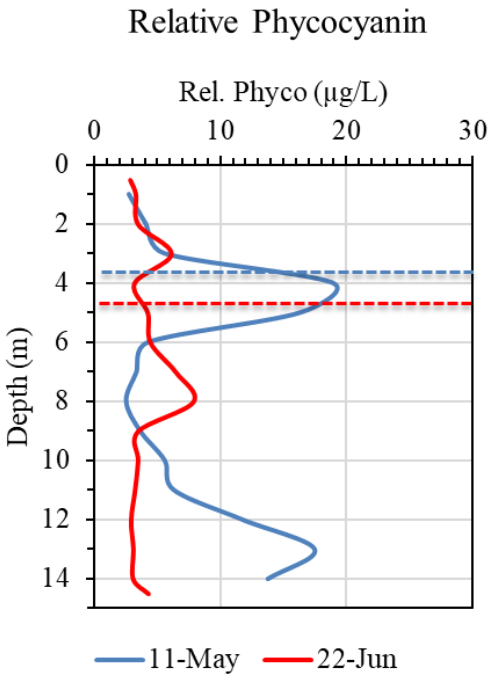

Figure 3. Relative phycocyanin profiles in Ball Pond on May 11, 2024, and June 22, 2024. Dotted lines represent the position of the thermocline and color corresponds to the date in the figure legend.

June

On June 22nd, the number of individual genera observed had increased to 31 with 19 of those from the green algae. A total of 5 cyanobacteria genera were observed in the samples. Five other taxa were represented by one or two genera.

Total cell concentrations in the June sample were nearly 21,000 cells/mL. Approximately 50%, or 10,348 cells/mL were cyanobacteria. The dominant cyanobacteria genera were *Dolichospermum spp*. and *Microcystis spp*. Both can regulate buoyancy, and both are considered toxigenic (CT DPH & CT DEEP 2023).

Figure 4. Cyanobacteria bloom reported on June 21, 2024. Photo credits: Lisa Marie Lisi.

For comparison, the State's guidance document for municipalities with regards to beach closures due to harmful algal blooms uses a threshold 20,000 cyanobacteria cells/mL below which is considered not to present a risk to public health and consistent with Visual Rank Category 1 condition. Visual Rank Category 3 are observable blooms and characterized by cyanobacteria cell concentrations of >100,000 cells/mL. Contact with blooms should be avoided by people and particularly pets who might later ingest cyanobacteria while grooming themselves.

Visual Rank Category 3 conditions were reported by several members of the community in the week prior to the June sampling event (Fig. 4). Remnants of a small bloom were observed by Brawley Consulting on June 22nd at the State Boat Launch. A sample of that was collected and analyzed. The dominant cyanobacterium in the sample was *Dolichospermum spp*. Other genera included *Microcystis spp*. and *Planktothrix spp*. (Fig. 5).

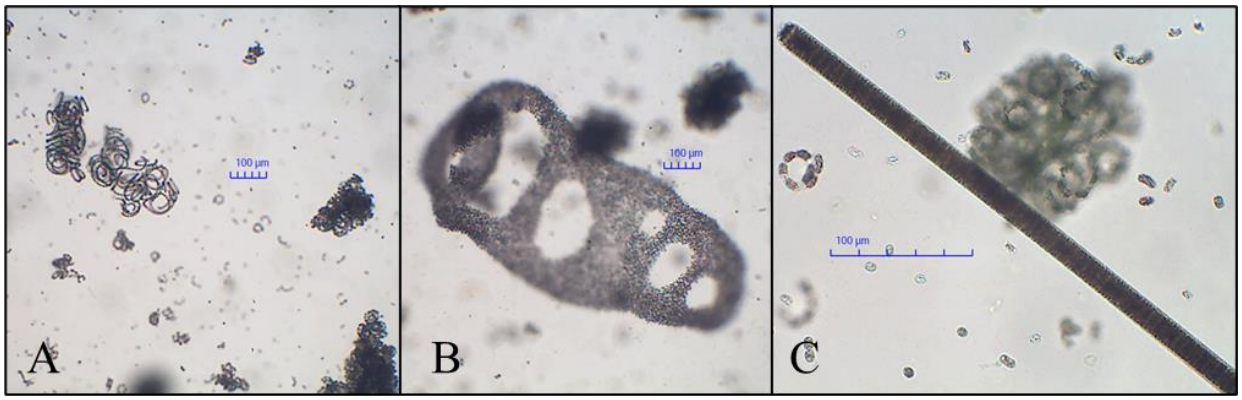

Figure 5. Cyanobacteria genera observed in the remnant cyanobacteria bloom at the State Boat Launch on June 22, 2024. A) Dolichospermum spp.; B) Microcystis spp., and C) Planktothrix spp. The two images to the left are at a total magnification of 100X. The image to the right is at total magnification of 400X.

It is worth noting that the relative phycocyanin profile in June was much different than that observed in May (Fig. 3). The lens of high cyanobacteria biomass from 4 to 5 meters observed in May was not observed in June. It is probable that much of the cyanobacteria that was concentrated at depth in May surfaced and contributed to the bloom conditions observed since mid-June.

Conclusions

Open water cyanobacteria levels were low and did not present a potential public health threat. However, shoreline blooms were photo documented just before our June 22nd visit. Caution should be used in near-shore areas and coves where cyanobacteria concentrations can be high and reach bloom-forming levels. Cyanobacteria blooms should be reported and documented, and contact with blooms should be avoided by people or pets.

The protracted period of anoxic conditions near the bottom of the water column results in the loading of phosphorus into those overlying waters. This may contribute to the maximum concentrations of cyanobacteria at deeper depths where they can take advantage of the elevated phosphorus levels.

Literature Cited

Connecticut Department of Public Health and Connecticut Department of Energy and Environmental Protection. 2023. Guidance to Local Health Departments for Blue–Green Algae Blooms in Recreational Freshwaters. See https://portal.ct.gov/-/media/dph/ehdw/blue-green-algae-blooms/guidance-to-lhd-for-blue-green-algaeblooms.pdf