LAPA - West

Lakes and Ponds Association of Western Massachusetts

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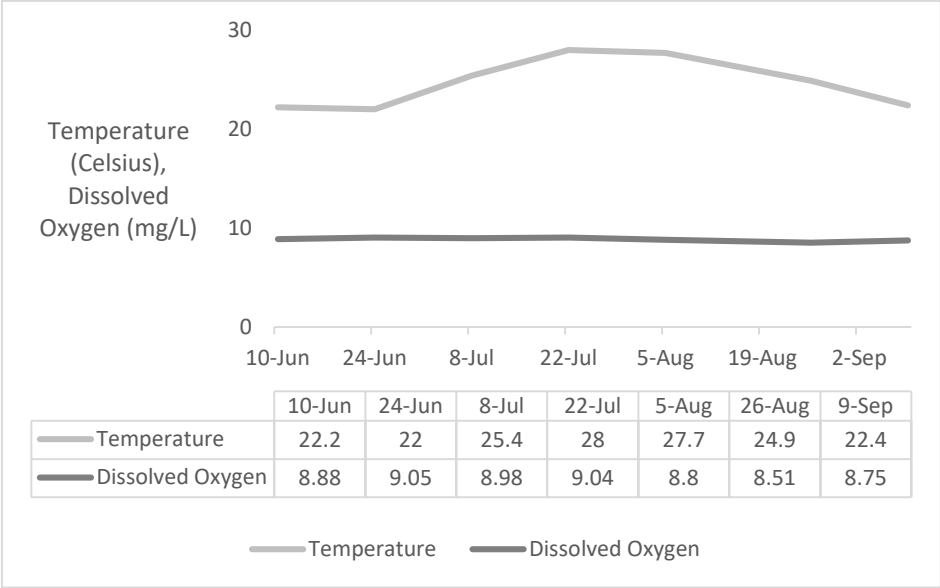
Wildwood Ponds Final Water Quality and Cyanobacteria Report 2022

Wildwood Ponds, Cranberry and Otter Pond, were sampled from June to September approximately every two weeks for the summer of 2022. For each sampling time, two samples were taken, one at the surface at the main beach and one from the depths. As part of the testing, both ponds were also assessed for water quality. The water quality testing consisted of temperature and dissolved oxygen readings in the deepest part of the pond. For Cranberry Pond, the deepest part was at 22 feet and for Otter Pond, the deepest part was at 11-12 feet.

Cranberry Pond

At the surface, the temperature steadily increased from the end of June to the end of July where it was at its highest at 28°C then slowly dropped the rest of the sampling period. The dissolved oxygen at the surface was consistent throughout the whole summer (Figure 1). The temperature is consistent throughout the summer from the surface to 10 feet. At 15 feet, the temperature increased throughout the summer while at 20 feet it steadily increased. By the end of August, the pond was about the same temperature from the surface to the bottom of the pond (Figure 2). The first 10 feet had consistent dissolved oxygen throughout the summer. At 15 feet, the dissolved oxygen was up down throughout the summer and 20 feet was below 3 mg/L until August 5th then steadily increased. On the last sampling of September 9th, the dissolved oxygen was about the same for the surface to the bottom. August 5th, the pond was anoxic from 15 feet to the bottom of the pond (Figure 3).



	10-Jun	24-Jun	8-Jul	22-Jul	5-Aug	26-Aug	9-Sep
Temperature	22.2	22	25.4	28	27.7	24.9	22.4
Dissolved Oxygen	8.88	9.05	8.98	9.04	8.8	8.51	8.75

Figure 1. Surface temperature and dissolved oxygen for the summer. The surface temperature continuously changed throughout the summer while the dissolved oxygen also continuously changed throughout the summer.

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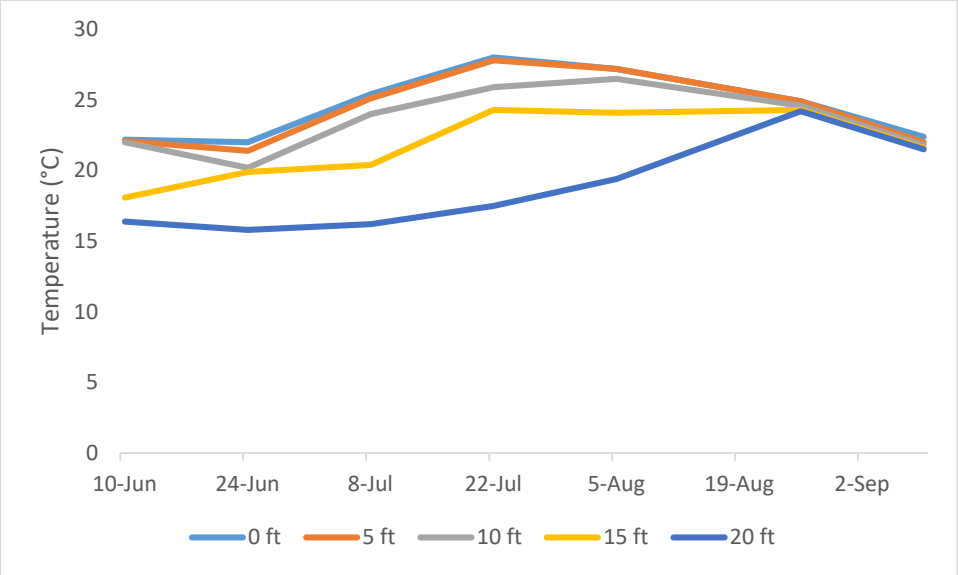


Figure 2. Lake stratification is the different thermal layers in the water column: epilimnion (top), thermocline (middle), hypolimnion(bottom). The graph above shows the temperature throughout the summer. The temperature is consistent throughout the summer from the surface to 10 feet. At 15 feet, the temperature increased throughout the summer while at 20 feet it steadily increased. By the end of August, the pond was about the same temperature from the surface to the bottom of the pond.

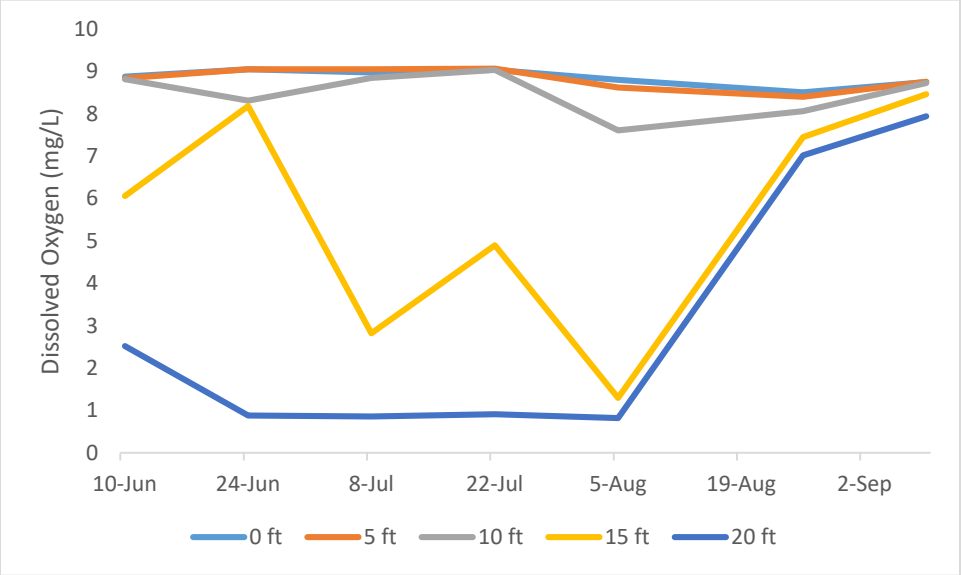
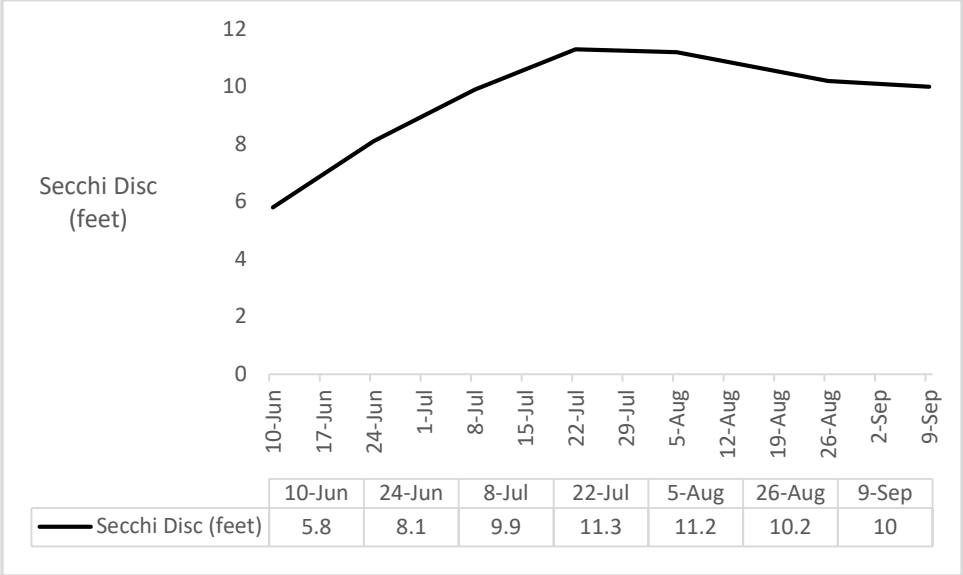


Figure 3. Lake stratification for dissolved oxygen throughout the summer. The first 10 feet had consistent dissolved oxygen throughout the summer. At 15 feet, the dissolved oxygen was up down throughout the summer and 20 feet was below 3 mg/L until August 5th then steadily increased. On the last sampling of September 9th, the dissolved oxygen was about the same for the surface to the bottom. August 5th, the pond was anoxic from 15 feet to the bottom of the pond.

During the beginning of summer, the secchi disc readings were at the lowest at 5.8 feet and steadily increased throughout the summer. The clarity or amount of light increased throughout the summer. The sunlight can reach two to three times the recorded amount with the secchi disc, leading to the light to be able to reach the bottom or near the bottom of the pond (Figure 4).



	10-Jun	24-Jun	8-Jul	22-Jul	5-Aug	26-Aug	9-Sep
Secchi Disc (feet)	5.8	8.1	9.9	11.3	11.2	10.2	10

Figure 4. Secchi disc readings in Cranberry Pond. The clarity or amount of light increased throughout the summer. The sunlight can reach two to three times the recorded amount with the secchi disc, leading to the light to be able to reach the bottom or near the bottom of the pond.

From the data collected, the dissolved oxygen levels were below 2 mg/L at 20 feet for part of the summer. On July 8th, the dissolved oxygen levels were below 2 mg/L at 20 feet. A dissolved oxygen reading of less than 2 mg/L (an anoxic environment) allows for the nutrients (phosphates) to be released which causes a bloom. However, there can be high phosphates with no bloom because the nitrates/nitrites are not low enough. It's when there is an imbalance of nitrogen to phosphate that causes a cyanobacteria bloom to occur along with other factors such as sunlight, warmer waters, etc which was seen on July 8th.

Samples were collected to be analyzed by Microbac for phosphates in the beginning of the summer, the middle of the summer (I am missing this result sheet, sample was taken August 5th), and the end of summer. The ideal range for phosphate levels are 0.01 mg/L or less. Anything over 0.01 mg/L is of some concern but over 0.02 mg/L is concerning and can lead to increased cyanobacteria blooms. The samples taken at the surface were over the ideal range of 0.01 mg/L while the depth samples were over 0.02 mg/L which is too high for the nutrient levels (Table 2).

It should be noted that this summer had substantial drought because of the lack of rainfall. However, when a rain event did occur it was substantial in the amount that fell (Table 1). In Figure 5 and Figure 6, the precipitation levels are recorded for the sampling dates. The

significant rainfall that occurred 72 hours before sampling for phosphate indicated that the phosphate levels increased after the stormwater runoff from the rainfall occurred. In order to confirm that it is stormwater runoff that is increasing the amount of nutrients in the pond samples should be taken 24 hours after a significant rainfall. If the increase in nutrients is due to stormwater, then testing should happen in areas where the stormwater is flowing into the pond from. Once areas are identified as potential sources of external nutrient overloading then ways to prevent it can be approached.

Table 1. Total precipitation amounts for 24, 48, 72 hours prior to sampling. The precipitation data was collected from one website https://www.weather.gov/wrh/climate.

DATE	24 hour	48 hour	72 hour
6/10/2022	0	1.25	0.31
6/24/2022	0	0.26	0
7/08/2022	0.01	0	0.16
7/22/2022	0	0	0.04
8/05/2022	0.01	0.19	0
8/26/2022	0.29	0.04	0.01
9/09/2022	0	0	0

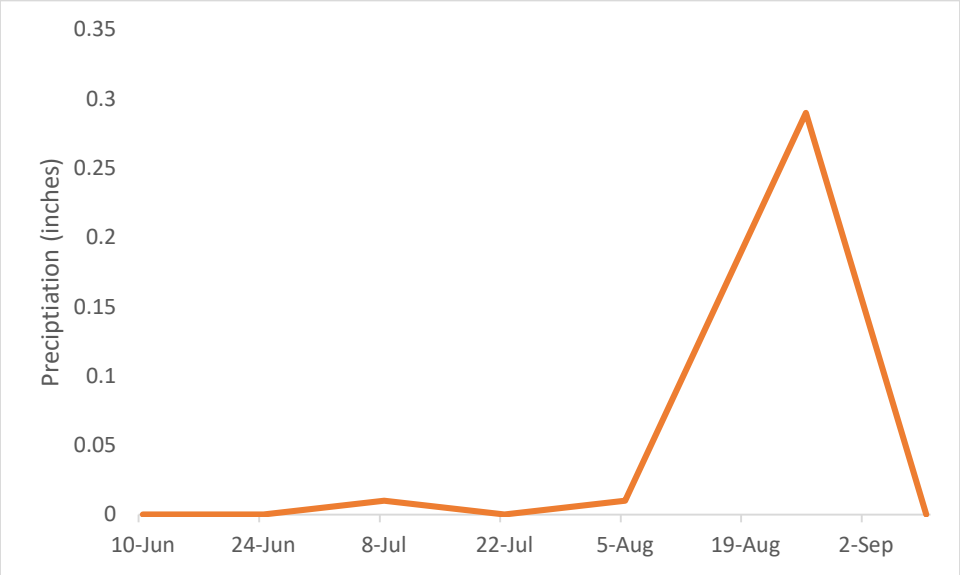


Figure 5. Precipitation totals in a 24-hour period prior to sampling dates as was recorded by the National Oceanic and Atmospheric Administrations. Data found in the table are the sampling dates.

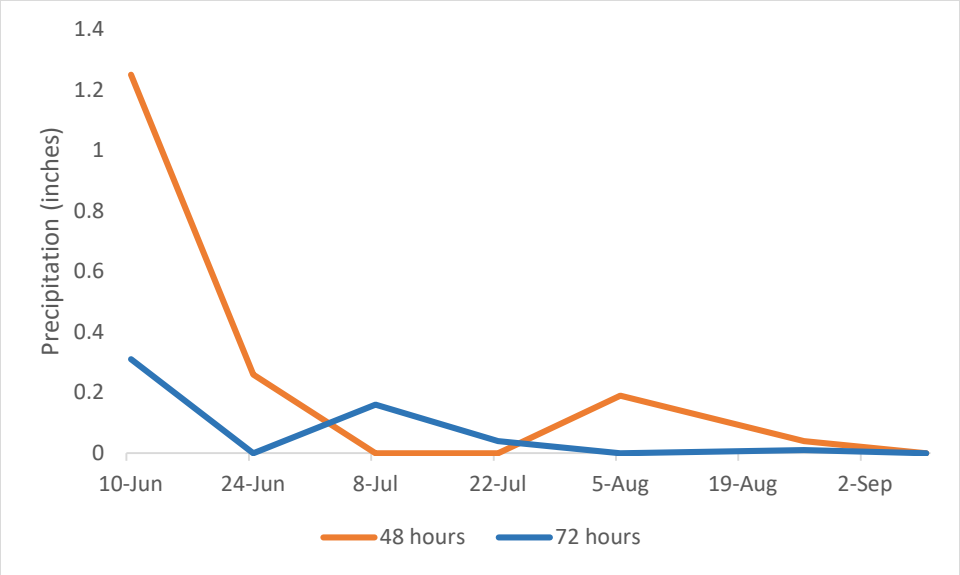
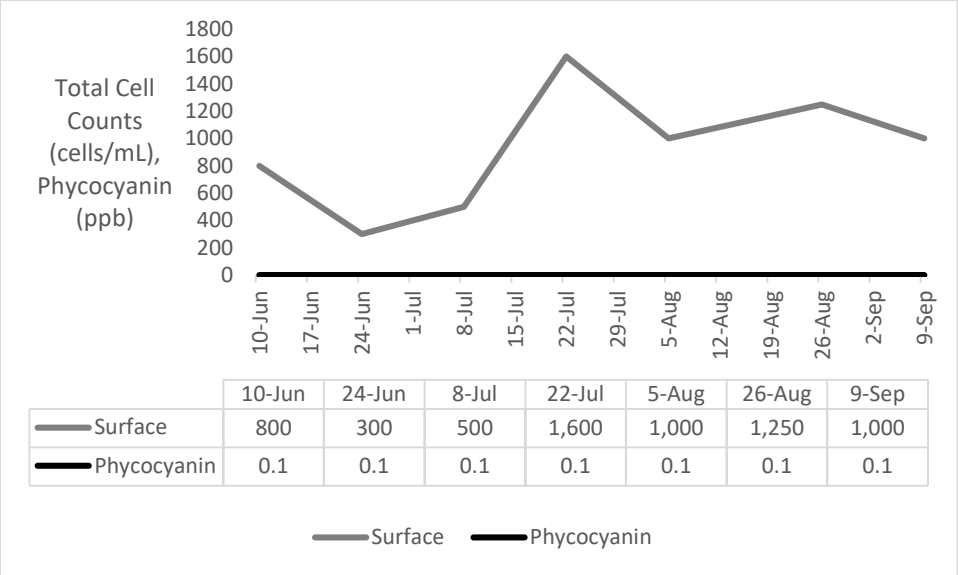


Figure 6. Precipitation totals for 48-hour and 72-hour periods prior to sampling dates as recorded by the National Oceanic and Atmospheric Administrations. Data found in the table are sampling dates.

Table 2. Phosphate analysis results analyzed by Microbac.

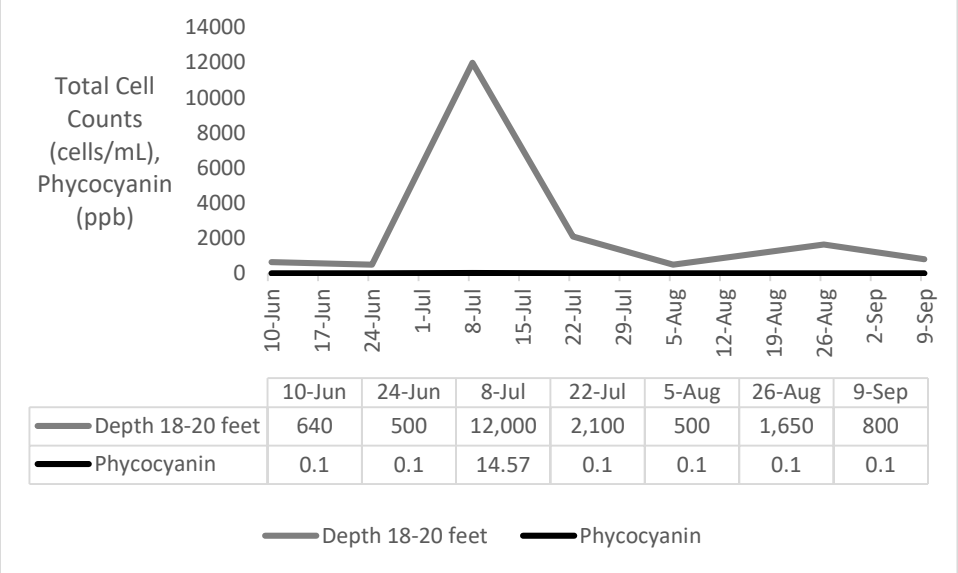
Date	LOCATION	mg/L	LEVEL OF CONCERN
July 8	Surface	0.0181	Some
	20 feet	0.0255	YES
September 9	Surface	0.0106	No
	20 feet	0.0117	Some

Microcystis was the most common genus of cyanobacteria found on the lake both at the surface and in the depth samples. The surface cells counts were consistently low throughout the summer (Figure 7). July 8th had the highest cell count at 18 feet deep which there was an abundant amount of phosphorus available (Table 2, Figure 8), also had enough light to reach the bottom of the lake (Figure 4), and a dissolved oxygen reading of less than 2 mg/L (Figure 3). There was also a significant amount of rainfall 72 hours prior to sampling which most likely is from external overloading (Table 1, Figure 6). On July 8th, Cranberry Pond had all the essential conditions for a bloom to occur, luckily it never came up to the surface.



	10-Jun	24-Jun	8-Jul	22-Jul	5-Aug	26-Aug	9-Sep
Surface	800	300	500	1,600	1,000	1,250	1,000
Phycocyanin	0.1	0.1	0.1	0.1	0.1	0.1	0.1

Figure 7. Total cell count for the surface. The surface had low cell counts and 0.1 ppb of phycocyanin consistently throughout the summer.

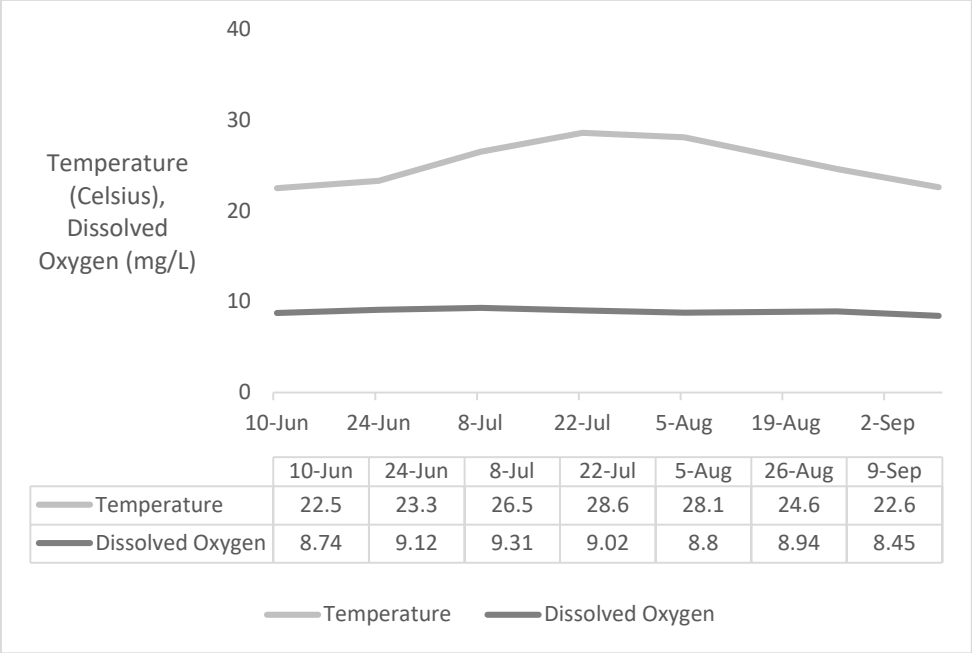


	10-Jun	24-Jun	8-Jul	22-Jul	5-Aug	26-Aug	9-Sep
Depth 18-20 feet	640	500	12,000	2,100	500	1,650	800
Phycocyanin	0.1	0.1	14.57	0.1	0.1	0.1	0.1

Figure 8. Total cell count for the depth taken between 18-20 feet in Cranberry Pond. *Microcystis* was the dominant genus present in the pond. July 8th had the highest cell count with 12,000 cells/mL recorded.

Otter Pond

At the surface, the temperature steadily increased throughout June to mid-July where it was at its highest temperature of 28.6°C. From mid-July to the beginning of September the temperature decreased. The dissolved oxygen at the surface was consistent and ranged from 8.45-9.31 mg/L (Figure 1). The temperature for the surface to the bottom of the pond for the whole summer was consistent at 20-28°C depending on the month. July was the warmest with a consistent 28°C from the surface to the bottom (Figure 2). The dissolved oxygen was consistent from June- September for the first 5 feet. At 10 feet, the dissolved oxygen decreased throughout June- the beginning of August then increased through September (Figure 3).



	10-Jun	24-Jun	8-Jul	22-Jul	5-Aug	26-Aug	9-Sep
Temperature	22.5	23.3	26.5	28.6	28.1	24.6	22.6
Dissolved Oxygen	8.74	9.12	9.31	9.02	8.8	8.94	8.45

Figure 1. Surface temperature and dissolved oxygen for the summer. The surface temperature steadily increased throughout June to mid-July where it was at its highest temperature of 28.6°C. From mid-July to the beginning of September the temperature decreased. The dissolved oxygen at the surface was consistent and ranged from 8.45-9.31 mg/L.

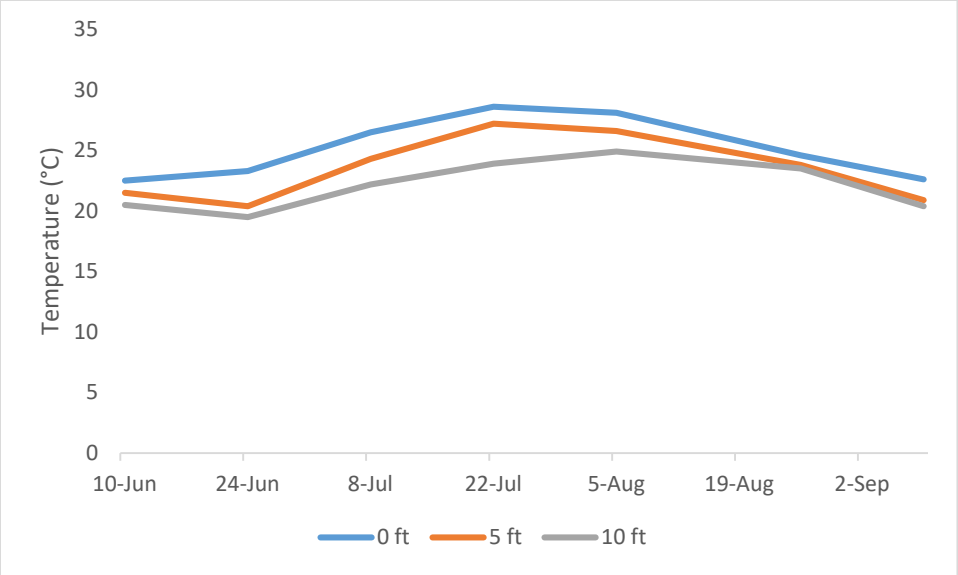


Figure 2. Lake stratification is the different thermal layers in the water column: epilimnion (top), thermocline (middle), hypolimnion(bottom) which for Otter Pond does not really follow the normal stata but it is a very shallow pond. The graph above shows the temperature throughout the summer. Temperature is consistent from the surface to the bottom of the pond throughout the summer.

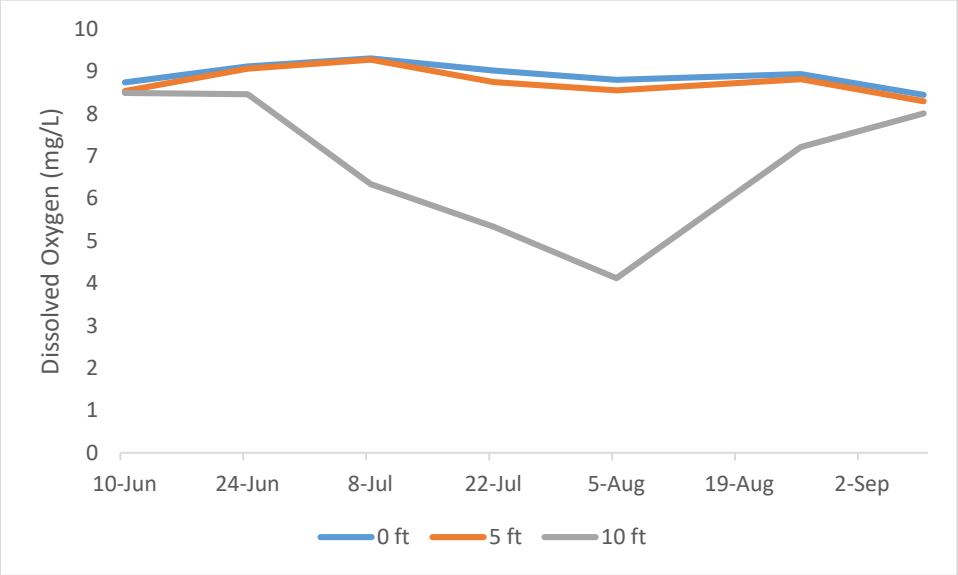
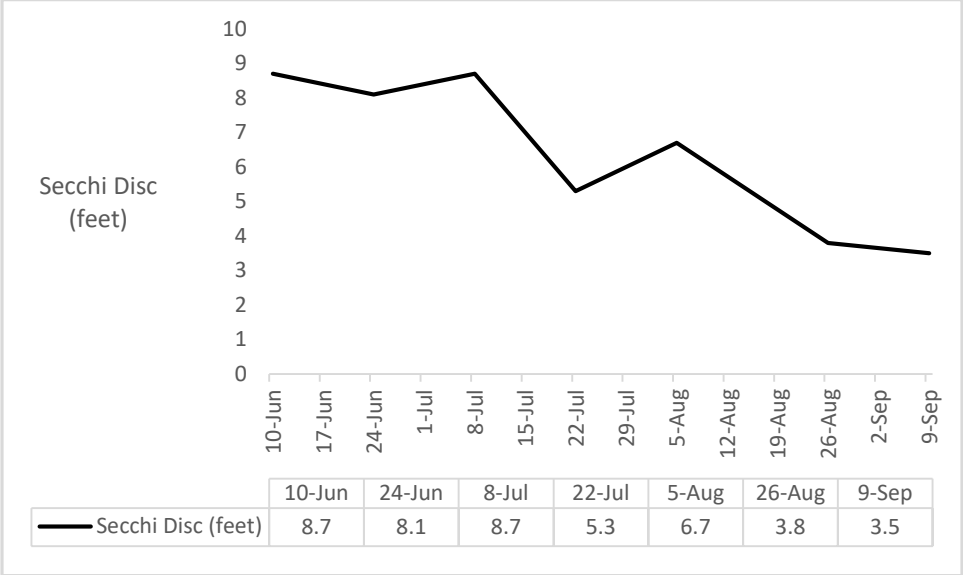


Figure 3. Lake stratification for dissolved oxygen throughout the summer. Dissolved oxygen was consistent from June- September for the first 5 feet. At 10 feet, the dissolved oxygen decreased throughout June- the beginning of August then increased through September.

During the beginning of summer, the secchi disc readings were at the highest at 8.7 feet and steadily decreased throughout the summer to 3.5 feet. The sunlight can reach two to three times that of the secchi disc readings therefore, Otter Pond has an abundant amount of sunlight throughout the whole summer (Figure 4).



	10-Jun	24-Jun	8-Jul	22-Jul	5-Aug	26-Aug	9-Sep
Secchi Disc (feet)	8.7	8.1	8.7	5.3	6.7	3.8	3.5

Figure 4. Secchi disc readings in 11-12 feet of water in Otter Pond. The readings decreased throughout the summer.

From the data collected, the dissolved oxygen levels were never below 2 mg/L. However, the dissolved oxygen did significantly decrease in July at the bottom of the pond to 4.12 mg/L. Unlike Cranberry Pond, Otter Pond was not anoxic.

Samples were collected to be analyzed by Microbac for phosphates in the beginning of the summer, the middle of summer, and the end of summer. The ideal range for phosphate levels are 0.01 mg/L or less. Anything over 0.01 mg/L is of some concern but over 0.02 mg/L is concerning and can lead to increased cyanobacteria blooms. The samples taken at the surface were in the ideal range. The depth sample at 10 feet at the beginning of summer was over 0.02mg/L (Table 2). Even with the high phosphates recorded in the lake, there were no blooms this summer.

It should be noted that this summer had substantial drought because of the lack of rainfall. However, when a rain event did occur it was substantial in the amount that fell (Table 1). In Figure 5 and Figure 6, the precipitation levels are recorded for the sampling dates. The significant rainfall that occurred 24 and 72 hours before sampling for phosphate indicated that the phosphate levels increased after the stormwater runoff from the rainfall occurred.

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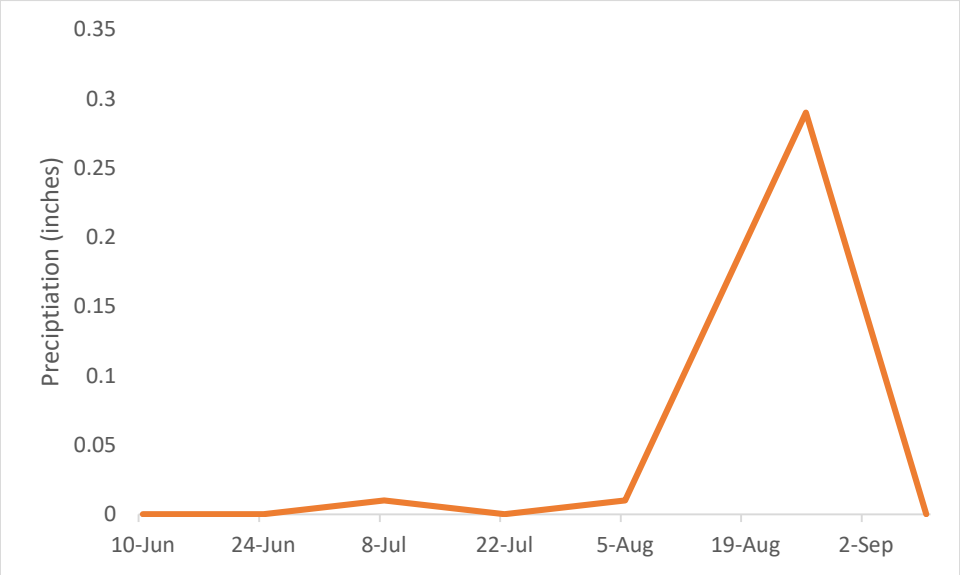

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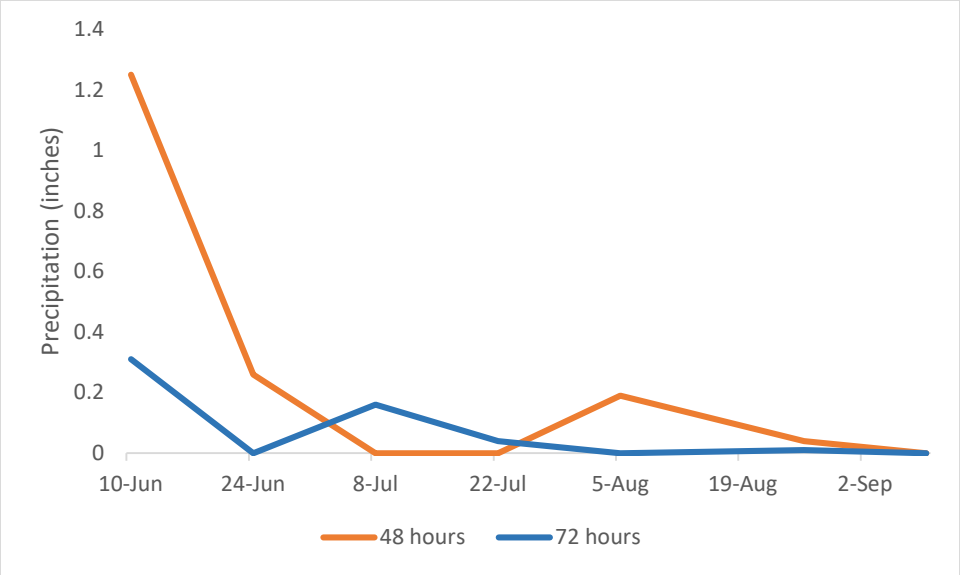

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Table 2. Phosphate analysis results analyzed by Microbac.

Date	LOCATION	mg/L	LEVEL OF CONCERN
July 8	Surface	0.0106	NO
	10 feet	0.0202	YES
September 12	Surface	0.0223	YES
	10 feet	0.0170	Some

Microcystis was the most common genus of cyanobacteria found on the lake both at the surface and in the depth samples. The dominant genus present at each sampling was *Microcystis*. Otter Pond had its highest cell count in the depths on July 22nd at 3,500 cells/mL. Both the surface and the depth samples were extremely low all summer. The phycocyanin levels were consistently 0.1 parts per billion (Figure 7).

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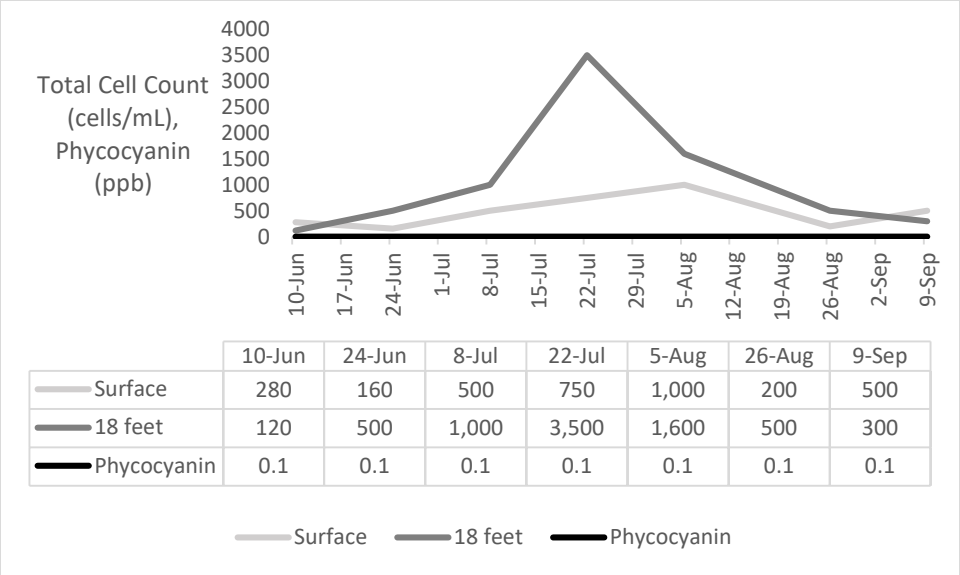

	10-Jun	24-Jun	8-Jul	22-Jul	5-Aug	26-Aug	9-Sep
Surface	280	160	500	750	1,000	200	500
18 feet	120	500	1,000	3,500	1,600	500	300
Phycocyanin	0.1	0.1	0.1	0.1	0.1	0.1	0.1

Figure 7. Total cell counts surface and depth for Otter Pond. The dominant genus present at each sampling was *Microcystis*. Otter Pond had its highest cell count in the depths on July 22nd at 3,500 cells/mL. The phycocyanin levels were consistently 0.1 parts per billion.

Recommendation for Summer 2023:

1) Test for phosphorus at the bottom of the lake at least in the beginning of and end of the summer. LAPA can provide this service.
2) Identify areas that may be contributing to the increase in nutrients and sample them after a significant rainfall event to confirm nutrient overloading.