



# CANDLEWOOD LAKE AUTHORITY

P.O. BOX 37 • SHERMAN, CONNECTICUT 06784-0037 • (860) 354-6928 • FAX (860) 350-5611

## Minutes of Regular Meeting August 14, 2019

### Attending:

P. Schaer	Sherman
G. Linkletter	Sherman
D. Cushnie	Sherman
C. Robinson	Danbury
B. Licht	New Fairfield
J. Main	New Fairfield
J. Wodarski	New Milford
M. Toussaint	New Milford
S. Kluge	New Milford
D. Rosemark	Danbury (electronic)
J. Murphy	Brookfield
W. Lohan	Brookfield
M. Gaffey	Brookfield

### Absent:

J. Archer	New Fairfield
E. Siergiej	Danbury

M. Howarth, Executive Director  
J. Neil Stalter, Director of Ecology and Environmental Education  
F. Frattini, CLA Administrative Coordinator (electronic)  
R. Barnard – CLAMP Chief of Marine Enforcement

Recorder: J. Neil Stalter

Guests: three members of the public

Chairman, Phyllis Schaer, called the regular meeting of the Candlewood Lake Authority to order at 7:32 P.M. at Brookfield Town Hall Brookfield, CT. She welcomed the guests

**Public Comment:** None

**Secretary's Report:** *Secretary, Jerry Murphy made a motion to accept the minutes of the July 10, 2019 meeting as written, seconded by Joe Wodarski; motion was voted with all in favor. Motion carried and minutes have been accepted as written.*

**Candlewood Lake Authority Marine Patrol:** Chief Ron Barnard advised all is going well. There have been complaints about activity on Sand Island and the patrol has been addressing this. He noted that a number of infractions have been written for illegal boating activity in the area. It was noted that this issue is being addressed with the CLA

office, contacting FLPR to see how this issue may be resolved. Mrs. Schaer asked that a formal letter be sent by the Executive Director to FirstLight.

Chief Barnard advised that there will be extra patrols out for Labor Day weekend and that they have been observing a number of unpermitted buoys popping up in the lake, DEEP has been contacted about this.

Joe Wodarski asked Chief Barnard to advise the delegates about the incident with the Jet Ski – during a lightning storm Chief Barnard and his crew found and transported the occupants of a stalled PWC, Mr. Wodarski commended the Chief and his crew for a job well done in light of personal risk to help the stranded boaters.

Mrs. Schaer asked if Chief Barnard would help with letter to FLPR regarding the issues on Sand Island.

**Chairman's Report:** Chairman Phyllis Schaer reported items from the Executive Committee meeting noting that at the time of the meeting there was no update on the SMP. But since, the SMP has been approved as submitted. She asked Neil Stalter to review the approved SMP. Mr. Stalter did so and noted that FERC still maintains oversight of any changes, they will also be on the FERC docket so all will see any modifications and may comment. Also, the fees in the SMP are set during the six years of this SMP. FERC noted the requirement for photos of the buffer activities in addition to the descriptions is to be included. Mr. Stalter noted that there were no major modifications and the new SMP is now in effect. (It can be found on the CLA website) She advised that she will be attending the August Sherman Board of Selectmen's meeting to discuss the SMP and the Nuisance Plant Monitoring/Mapping and she advised that several of the Towns are supportive of having CAES do the report for 2019 and they would pay for the work. She believes that New Fairfield, Brookfield and Sherman are supportive of this and she will be contacting New Milford and Danbury. CAES has done the weed mapping since 2007 this would keep the methodology and reporting consistent.

Mrs. Schaer noted that Marianne Gaffey has been appointed to the Public Awareness committee and that the members of the Lake Management Plan Sub-Committee are Steve Kluge, Chairman and Bill Lohan, Jeff Main, Mark Toussaint and Joan Archer, members.

She advised that the Ad-Hoc Human Resource Committee of Doug Cushnie, Bill Lohan, Bill Licht, Frances Frattini, Mark Howarth and Phyllis Schaer will meet on Thursday August 15<sup>th</sup> to discuss the positions of and Operations/Facilities Manager and Admin Coordinator.

She thanked Jeff Main for all his work on the Pollinator Garden project; Mr. Main reported that he would be working on such a garden at the New Fairfield Town Park. The volunteer banner for use when a private pontoon boat may be used for CLA business has been ordered by Phyllis Schaer.

**Vice-Chairman's Report:** Vice Chairman, Mark Toussaint, noted he had nothing at this time.

**Treasurer's Report:** Treasurer Bill Lohan advised that we have the annual Audit. He advised that for the Audit for Fiscal year ended 6/30/2019 is complete, he reviewed the report noting that it is a clean report and has no discrepancies. He noted that the

Authority ended the year in a positive position and continued to review the report. He advised that the Auditor suggested that the CLA set a policy to agree on a more definitive number to have as the unassigned balance to cover expenses and unexpected expenses possible of 6 months to one year's expenses. The Board needs to make this determination and he added that it should be something that the CLA is comfortable with. There was one question: Mr. Linkletter asked what does the unspendable number include – Mr. Lohan advised “that is the merchandise”. With no further questions Mr. Lohan asked: Is it necessary to have the Auditor present the audit at the September meeting? It was noted that it would not be necessary and *Mr. Lohan made a motion to accept/approve the audit for the year ended June 30, 2019 as presented, seconded by Mrs. Schaer and voted with all in favor.* Audit has been accepted and will be sent to the Towns in a timely manner.

Mr. Lohan reported on the Budget vs. Actual for July 31, 2019 noting that funds have been received from all five Towns Brookfield, New Fairfield, New Milford and Sherman paid in full and Danbury paid the first quarter and also some merchandise sales put revenue at 67% of budget, and expenses year to date are Admin at 13% of budget, Equipment/Facilities 3% of budget, Public Safety 18% of budget, Public Awareness 7% of budget, and Watershed Management 5% of budget, making overall expenses 10.2% of budget. *Mr. Lohan made a motion to accept the report of Profit and Loss Budget vs. Actual for the month ended July 31, 2019 be accepted as presented, seconded by Mark Toussaint and voted with all in favor. Motion carried and report has been filed for audit.*

**Executive Director's Report:** Mark Howarth advised his report is attached to these minutes and then noted the highlights.

- State of the Lake
- Sherman Base updates
- Posting Admin position – 50 resumes received
- Leadership Danbury
- Village Fair Days – very successful
- Thank you to Doug Cushnie for securing donations of two Jet Ski docks for the PWCS for the patrol
- Senator Murphy visit – good topics covered. Thank you to First Selectman Steve Dunn for arranging the Brookfield Town Park location for the meeting.
- 2019 Resident Boat Count

He reminded the delegates that the September meeting location has been moved to Sherman Town Hall in Sherman after the tour for delegates and staff only of FLPR facilities, which is being arranged with FLPR.

**Director of Ecology and Environmental Education:** Neil Stalter noted his report is attached to these minutes. Highlights from his report are:

- Water Quality Monitoring – looking good, Blue Green Algae have been good, all below the State limits.
- It has been a busy month; he was at the same events that Mr. Howarth noted.

- He did join in the Sand Island “wellness” check and there are some concerning issues there.
- Drafted letter to stakeholders regarding the Lake Management Plan process and asking them to select a representative to work with the CLA during this process

Steve Kluge noted that with his Secchi Disk he has seen an improvement in water clarity over the past few weeks and reported on a program that can track the information – anyone interested should contact him for details.

**Committee Reports:**

**Public Safety Committee:** Joe Wodarski nothing to add

**Equipment/Facilities Committee:** Doug Cushnie reported that he and Ed Siergiej used ARK II to help remove the Danbury Town Park Swim floats as they have closed for the season due to lack of lifeguards. He as been keeping busy helping with some day-to-day activities.

**Public Awareness Committee:** George Linkletter, Committee Chairman noted that they are still working on the Drone Video and are waiting for Spring Lake Garden Design to advise the properties on the lake that have agreed to participate. They also discussed having Coffee and Conversation during the off-season. September 7<sup>th</sup> is New Fairfield Fair Day and the CLA will participate.

**Watershed Management Committee:** Mark Toussaint Committee Chairman noted nothing to report it has all been covered.

**Old/New Business:** none

With no other business, *Joe Wodarski moved to adjourn the meeting. Seconded by Jerry Murphy. Meeting adjourned at 8:59 P. M.*

Respectfully submitted,

Jerry Murphy, Secretary

Frances Frattini, Administrative Coordinator  
r/b/mh

*These minutes are not considered official until they have been approved at the next regularly scheduled meeting of the Candlewood Lake Authority.*



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**August 14, 2019**  
**Executive Director**  
**Mark Howarth**

## Monthly Report:

- **State of the Lake:** We had a successful State of the Lake. The event, traditionally held in April, was held in July this year to allow summer residents a better opportunity to attend. We covered many environmental topics as well as public safety. Thank you to the New Fairfield Company A Volunteer Fire Department for allowing us to use their facility for our event and to Jeff Main for doing a special presentation that day on pollinator plants. Also, thank you to Chief Barnard and Sergeant Dunkerton for attending to speak with the attendees about Public Safety topics.



- **Sherman Office Upgrades:** As noted by the Fire Marshal after his inspection, the Sherman Office required some upgrades. We have completed them and have contacted the Fire Marshal to inform him that we have finished the necessary upgrades.
- **Admin Position:** We have posted the Admin job opening and have been receiving numerous applications. We will review them as we begin the hiring process.
- **Leadership Danbury:** Neil and I presented at the Danbury Chamber of Commerce's Leadership Danbury in July. Also present were Jerry Murphy, Steve Kluge and Bill Lohan. We enjoyed our time again this year, spending about an hour informing the members about the lake and the CLA, after which Steve and Bill took attendees out on a boat tour of part of the lake. Thanks Steve and Bill!

- **Village Fair Days:** We had a great time at Village Fair Days in New Milford again! We met many great residents, talked about the lake and our various water quality initiatives, as well as sold lots of great Candlewood merchandise.
  - Thank you to Bill and Anne Lohan, Steve Kluge, Doug Cushnie, Joe and Sui Wodarski - who joined us in the booth, as well as our Patrol Chief Barnard and Officer Olimpio who came by to meet with the public.



- **Operations Work:** I have been working closely with Doug Cushnie and between him and I we have been working to ensure that the work that needs to be done in the absence of an Operations Manager, is getting done. Many thanks to Doug for the additional volunteer hours he has been putting in to help make improvements and keep things running smoothly!

- **Senator Chris Murphy:** We were contacted by Senator Murphy's office that he wanted to meet with CLA staff and delegates, as well as others who are closely tied with Candlewood Lake to learn about the Lake and some of the challenges the Lake faces. We appreciate the Senator coming to Brookfield to hear more about the Lake.
- **Boat Count:** Neil and I have completed the Annual Boat Count. If you saw us out there in the early morning hours slowly cruising the shoreline, we were out counting boats. This annual count has been done for nearly 40 years! We will be tabulating the data and also plan to write a Boat Count Procedure for future use.



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**J. Neil Stalter**

**Director of Ecology and Environmental Education**

**Candlewood Lake Authority**

**Re:** August Meeting: Monthly Report

**Date:** 8/14/19

- **WQ Monitoring 2019:** The third water quality monitoring for the month of July occurred on Thursday July 25<sup>th</sup> for Candlewood and Tuesday July 30<sup>th</sup> for Squantz.
  - The results were on trend compared to previous years, showing a modest decrease in clarity along with increases in measurements of nutrient levels and chlorophyll-a. Measurements of cyanobacteria (blue-green algae) cell counts have been within healthy levels, and no zebra mussel veligers were found during analysis.
  - Thank you to our delegate Steve Kluge and Larry Marsicano for joining me out on the lake for monitoring!
  - After some experimentation, I was able to access all the old Lotus spreadsheet files for historical water quality measurements, which will make organizing our historical data easier.
  - The June water quality summary, explaining many of our findings with explanations and background information for anyone to read and enjoy is attached! These are posted on our website Water Quality Monitoring page.
  
- The first official sampling for the nuisance plant monitoring program was conducted by Steve and me and was very successful! No surprise species were found, but anecdotally, we found a healthy mixture of milfoil and coontail, illustrating that native species might be more able to compete with milfoil thanks to management strategies.



- Mark, Ron Barnard, Jeff Main, and I presented the 2019 State of the Lake on Saturday July 3<sup>rd</sup> to a great crowd!
  - We were able to discuss some of our new initiatives, as well as talk about limnology and public safety, while being able to focus on answering questions and addressing concerns of the community.
  - This was the first State of the Lake to be scheduled in the summer. Public Awareness will discuss the timing of the 2020 State of the Lake based on this year's attendance.

- Mark and I had the pleasure of presenting to the Greater Danbury Chamber of Commerce for their Leadership Danbury event a Down the Hatch about the CLA, some of our new projects, and what they should know about Candlewood Lake!



- Special thanks to Steve Kluge, Bill Lohan, and Jerry Murphy for joining us and volunteering their time to serve as boat captains to take members of the group out on the water.
- Senator Chris Murphy's office contacted us to meet about current lake issues. We had a great meeting with Senator Murphy where we were able to update him on current events.
  - Thank you to all the delegates, state legislators, municipal leaders, marina owners, and members of community organizations who were able to join us for this very successful and informative conversation.
- We had a great weekend at Village Fair Days in New Milford where we were able to reach many members of the community we do not normally reach and answer questions and educate watershed residents of best practices that they can implement at home to protect the lake.
  - People loved our new and old Candlewood Lake merchandise!
  - Special thanks to Steve Kluge, Bill and Anne Lohan, Doug Cushnie, Ron Barnard and John Olimpio, and Joe and Sui Wodarski for joining us in the booth!
- The 2019 boat count has begun, and results should be in by the end of the week.
- Mark, Ron, and I went out to conduct a wellness check of the islands and uninhabited shoreline to assess their status. We are in the process now of deciding the best course of action to clean them and protect them moving forward.



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**J. Neil Stalter**

**Director of Ecology and Environmental Education**

**Candlewood Lake Authority**

**Re: June 2019 Water Quality Observations**

**Details:** Sampling was conducted on June 24<sup>th</sup> (Squantz) and June 27<sup>th</sup> (Candlewood). **Secchi Depth, a measure of water clarity, ranged from a low of 2.85m in Squantz Pond, to a high of 3.78 in Danbury Bay.** Historically, June clarity results tend to be the highest, while the lowest measurements are often taken during September and October, sometimes May. In 2018, June secchi readings were slightly lower, ranging from 2.46m - 2.84m. However, much of this difference is likely due to the different sampling time frames, as sampling was conducted on June 7<sup>th</sup> in 2018. To assist in standardizing results, monitoring will be conducted within the final two weeks of every month to ensure comparisons can be made both month to month and year to year. Readings taken on Candlewood in late June 2018, taken by delegates separate from our monthly monitoring, were more comparable, ranging from 3m – 3.18m.

**This was the second month that we were able to use our new Chlorophyll-a sensor** (a fluorometer, which uses certain wavelengths of light to measure the relative concentration of chl-a). Because this is a new monitoring method, **we are using both the new sensor, as well as taking water samples for in-lab analysis of chl-a** so that we can ensure we know how to compare the new results to historic measurements. Chlorophyll-a measurements give us an understanding of how much algal material is in the lake. Below is a table comparing the chl-a results at 1m depth returned to us from the lab with the chl-a results using the new sensor (all measurements are in µg/l):

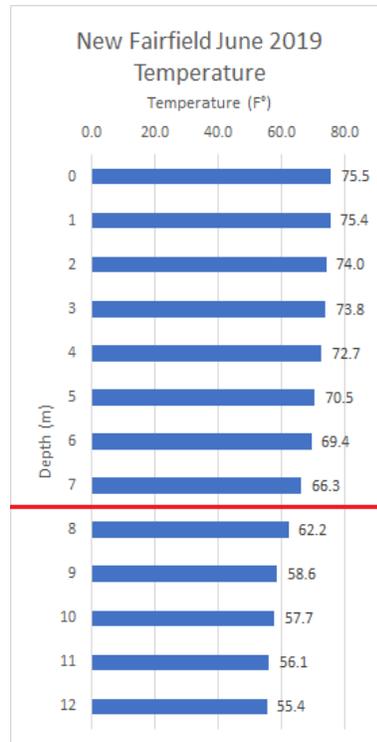
	<b>DB</b>	<b>NF</b>	<b>NM</b>	<b>SH</b>	<b>SQ</b>
<b>Fluorometry (New Sensor)</b>	0.97	0.92	1.17	1.10	2.07
<b>Spectrophotometry (Lab Analysis)</b>	3.71	1.75	2.22	3.67	2.88

As you can see, there are a number of differences in the two measurements, but the lab-analysis is consistently measuring modestly higher than the sensor analysis. **We will continue to measure chl-a using both methods until we can analyze any differences between the two methods statistically and ensure that we can compare any measurements going forward to historical measurements.** The ultimate goal is to statistically establish that the measurements are either similar enough as to be directly compared without losing any robustness in our data, or have the information needed to create a calculation that corrects the new measurements so that they can be compared to past measurements. One full year of double testing should give us the amount of information we need to decide.

One of the most important aspects of a lake system is temperature, and how that affects the ability of water to mix throughout the “water column” which is a term meant to describe the vertical column of water from the surface of the lake all the way to the bottom. As temperatures get warmer throughout the summer season due to increased sunlight and thermal (heat) energy the surface water gets warm pretty quickly, but the heat and energy from the sun cannot travel all the way through the water column easily and to move deeper, would require the water to mix. This mixing process also helps mix and move important nutrients and molecules like oxygen, phosphorus, nitrogen, and calcium. However, because **colder water is denser than warmer water**, the surface water heated by the sun forms a “layer” of warmer water that is less dense, and therefore sits on top of the colder, denser water toward the bottom. **These density differences make it hard for the water to mix effectively. This means that as the temperatures between the upper and lower layers diverge further, the “resistance to mixing” increases.** There is a formula that can be used to calculate how much each meter of water resists mixing with the meter below it, which returns a “relative thermal resistance to mixing” or RTRM value. The higher this RTRM value, the less able to mix that layer is with the layer below it. The formula to find RTRM is relatively simple:

$$RTRM = \frac{(Density\ of\ Upper\ Layer) - (Density\ of\ Lower\ Layer)}{(Density\ of\ water\ at\ 5^{\circ}C) - (Density\ of\ water\ at\ 4^{\circ}C)}$$

You only need to know the temperature of the water to find out what the density is – as the density of liquid water is a known value (1g/ml) that changes only due to temperature (and somewhat due to pressure, but you don’t have to worry about that unless you’re not on Earth, are at the very bottom of the ocean, or are doing an experiment in a lab). While technically the density of water is slightly *less* than 1g/ml, the reason it is given a value of 1 g/ml is because the original definition of a “gram” was actually the mass of one ml of water. **We can calculate the RTRM value at each meter depth for one of our sampling locations to give us an idea of two things: generally, how resistant to mixing the entire water column is, and at which depth specifically there is the most resistance to mixing,** AKA: the thermocline (Which is a word that describes the layer of the water column where temperature changes the most rapidly between meters).



The two graphs to the left show resistance to mixing and temperature (which is in Fahrenheit, even though the calculation is done using Celsius) for the New Fairfield location in June of 2019. The marked locations show where the greatest resistance to mixing is, or the “thermocline.” The significant temperature changes between 7m and 8m of depth is where the less dense, warmer, shallow water has the most trouble mixing with the denser, cooler, deep water. **Since it is still early in the season, it is likely that this resistance to mixing will increase, and the**

**thermocline will likely become somewhat shallower as the sun heats up the surface water even more during the hotter summer months.** Tracking where water can and cannot mix is one of the most important tasks for a lake manager and can begin to give us information necessary to answer certain questions about where blue-green algae blooms come from, how oxygen is being distributed in the water, and how nutrients are being transported throughout the lake.

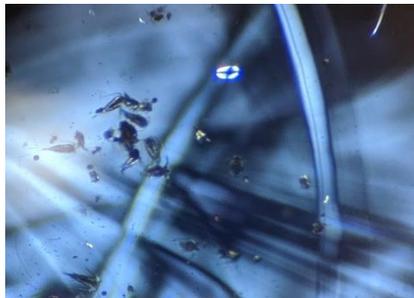
Nutrient loading (particularly the concentration of important compounds like nitrogen and phosphorus in the water) has important effects on lake health. High concentrations of these nutrients can lead to algal growth and blue-green algae blooms that can harm water quality, as well as lead to greater growth of nuisance plant species like milfoil. We take one measurement of nutrient concentration in each layer of the lake (so 3 samples at each of the 5 different sites; 15 times total). The table containing all of the results from the lab can be found below. Note that “n/a” means that sample was not tested for by the lab, and “ND” means “Not Detected”, which means the measurement was below the threshold that the lab can detect with their instruments so that the level can be assumed to be 0. Unfortunately, due to a laboratory error, the metalimnion and hypolimnion samples from Sherman for June 2019 were lost. **When compared to last year, it seems that phosphorus values have increased. However, this difference is likely due to the early timing of sampling in 2018.** As was stated in the May 2019 monthly summary, oxygen throughout the water column, and particular at the bottom of the lake, can help slow or prevent internal loading processes. Because the thermocline is weaker earlier in June (so the water is more able to mix); that means more oxygen can reach deeper depths. For this reason, in 2018 we saw higher oxygen and lower phosphorus values at the bottom layer of the lake, indicating less

internal loading. Sampling also followed some heavier rain events which might explain why the shallow “epilimnion” layer of the lake has higher phosphorus; along with the fact that it had more time to accumulate after a thermocline formed before sampling in 2019 compared to 2018.

(mg/l) unless otherwise stated	Potassium	Sodium	Alkalinity	Calcium	Chloride	Magnesium	Ammonia as N	Kjeldahl N	Nitrate	Nitrite	Total Phos. (ug/l)	Total N	pH (SU)	Chl-a (ug/l)
<b>Danbury</b>														
Epilimnion	n/a	n/a	64	n/a	n/a	n/a	ND	0.93	ND	ND	16	0.93	8.6	3.71
Metalimnion	n/a	n/a	68	n/a	n/a	n/a	ND	1	ND	ND	17	1	7.1	n/a
Hypolimnion	n/a	n/a	64	n/a	n/a	n/a	ND	0.92	ND	ND	23	0.92	8.7	n/a
<b>New Fairfield</b>														
Epilimnion	n/a	n/a	64	n/a	n/a	n/a	ND	0.59	ND	ND	19	0.59	8.5	1.75
Metalimnion	n/a	n/a	66	n/a	n/a	n/a	ND	1.07	0.05	ND	16	1.12	7.2	n/a
Hypolimnion	n/a	n/a	72	n/a	n/a	n/a	0.15	1.31	ND	ND	15	1.31	7.1	n/a
<b>New Milford</b>														
Epilimnion	n/a	n/a	68	n/a	n/a	n/a	ND	0.99	ND	ND	17	0.99	8.5	2.22
Metalimnion	n/a	n/a	76	n/a	n/a	n/a	ND	0.6	ND	ND	14	0.6	7.3	n/a
Hypolimnion	n/a	n/a	68	n/a	n/a	n/a	ND	0.55	ND	ND	14	0.55	8.5	n/a
<b>Sherman</b>														
Epilimnion	n/a	n/a	66	n/a	n/a	n/a	ND	0.99	ND	ND	20	0.99	8.4	3.67
Metalimnion	n/a	n/a	Lab Error	n/a	n/a	n/a	Lab Error	Lab Error	Lab Error	Lab Error	Lab Error	Lab Error	Lab Error	n/a
Hypolimnion	n/a	n/a	Lab Error	n/a	n/a	n/a	Lab Error	Lab Error	Lab Error	Lab Error	Lab Error	Lab Error	Lab Error	n/a
<b>Squantz</b>														
Epilimnion	n/a	n/a	32	n/a	n/a	n/a	ND	0.49	ND	ND	20	0.49	8.3	2.88
Metalimnion	n/a	n/a	34	n/a	n/a	n/a	ND	0.45	0.05	ND	18	0.5	7.1	n/a
Hypolimnion	n/a	n/a	44	n/a	n/a	n/a	0.68	1.17	ND	ND	24	1.17	7.1	n/a

**Phosphorus measurements in June of 2019 were modestly higher than June of 2018, as well as May of 2019, although compared to historic June measurements are normal or slightly lower.** Nitrogen levels increased significantly compared to May – which is a trend seen both in 2018 and 2017. **These nitrogen levels are on the higher end of normal, while being slightly lower than nitrogen measurements from June of 2018.** We will continue to monitor nitrogen levels closely to see what the trend looks like in the recent past, as we’d like to continue to see the modest decrease in total nitrogen levels that we’ve seen since the early 90s.

**Water samples from two net-tows near the pump-up station in New Milford were analyzed for zebra mussel veligers (larva), and none were found.** Below you can find a picture of an ostracod (left), which is a crustacean that exhibits the same “cross-polar” properties that Zebra Mussel Veligers (right) do (very bright under polarized light, and showing a dark “cross-pattern”). While they look similar, the difference can be determined by examining their shape and size. Ostracods are expected in samples of Candlewood Lake water, while Zebra Mussel veligers are not.



**Summary:** Water clarity was high in June, which is often the month with the highest clarity. The new chl-a sensor returned slightly lower readings than those measurements received from the lab, similar to the May measurements, but those numbers were closer than they were in May. Comparison of the results from these two methods will continue to ensure we can continue to compare new data to historical measurements. We are beginning to see anoxic conditions at the bottom of the lake, meaning that there is little to no oxygen, allowing more nutrient input from internal loading processes -- which is normal for late June into the rest of the summer. This is due in large part to the formation of discrete water layers and a stronger thermocline, which we can measure using RTRM values. Measurements of phosphorus are normal, if slightly higher than last year likely due to the earlier sampling date in 2018. Nitrogen levels are on the higher end of normal for Candlewood Lake, particularly when compared to May 2019's measurements, however they are lower than last year's measurements in June. No zebra mussel larvae were found during monitoring.



## Water Quality Monitoring: What You Need to Know

**Temperature:** Often measured in Celsius, different layers (surface vs. very deep water) of the lake often have very different temperatures! A larger difference between the temperature of shallow and deep water can mean that those two layers are less likely to mix, since colder water is denser and sits at the bottom. A diagram of the various lake layers is illustrated below!

**Dissolved Oxygen:** This is measured in milligrams per liter (mg/L) and is a measure of how much oxygen the water has, which many fish species and other organisms rely on.

**Total Phosphorus:** This is measured in micrograms per liter ( $\mu\text{g/L}$ ) which is the same as "parts per billion" (ppb). This measures the concentration of phosphorus in the water which can feed algae and aquatic plants.

**Total Nitrogen:** This is measured in the same way as total phosphorus, but instead measures nitrogen concentration, which can also feed algae and aquatic plants.

**pH:** This is a measure of how acidic or alkaline (basic) the water in the lake is by measuring hydrogen ions ( $\text{H}^+$ ). This is measured on a scale from 0-14, where zero is the most acidic and 14 is the most basic. Neutral pH is 7, and this measure is of singular importance to organisms living in the water, many of which require a pH that is slightly basic (7-9). However, higher pH can also allow more phosphorus (and other compounds) to dissolve in the water; potentially increasing total phosphorus measurements.

**Secchi Depth:** This is a method used to measure how clear and transparent the lake water is. It is measured by dropping a circular black and white disk on a rope into the water, and the depth at which the disk can no longer be seen is recorded in meters (m). Higher measures mean the disk could be seen longer, and that the water is clearer. This is illustrated in the diagram below!

**Chlorophyll-a:** This is measured in micrograms per liter ( $\mu\text{g/L}$ ) which is the same as "parts per billion" (ppb). Chlorophyll-a is the compound that makes plants green, and what they use for photosynthesis. This measure gives insight into how much green algae is in the water and can decrease transparency (and secchi depth).

