

LAA Newsletter

Special Health of the Lake Edition



Photo by Peg McCluskey

Letter from the LAA President

Be Curious About the Lake

The Lake Anasagunticook community is very fortunate to have Tom Hamilton monitoring the health of the lake on a consistent basis for over 25 years. At the Lake Anasagunticook Association's (LAA) request, Tom has written a report detailing the changing conditions of the lake water. The report is divided into six sections: a preface, clarity, dissolved oxygen, phosphates, water temperature and general conclusions.

Is the lake at a tipping point to bloom with smelly algae? It is known that warmer water is more susceptible. Tom's water temperature chart shows a trend. Also, phosphates levels caused by many factors may be of concern. Please be curious about the condition of the lake and ask what you can do to help.

Biff Atwater
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Reminder

Please pay your 2017 dues, if you haven't already. Send \$10 to:

LAA
 PO Box 411
 Canton, ME 04221

Announcement

At the Annual Meeting in August, the LAA membership voted to raise the LAA dues to \$15 per person. This takes effect on January 1, 2018. Thank you.

Upcoming Events

The LAA has updated its calendar! Click on <http://lakeanasagunticook.org/events/> to see what's on the schedule.

The Water Quality and Health of Lake Anasagunticook

by Tom Hamilton

As I write this “water quality report,” I am sitting on my porch on a bright clear day, with a gentle wind from the north bringing wonderfully clean, dry air. Although the air temperature is 67°F, I still look forward to a late afternoon dip in the lake. Life is indeed good!

Often when I have returned to the shore after doing my bi-monthly water monitoring, it is not unusual to be asked: “Well, how’s the lake?”. The question strikes me as the kind of greeting commonly used when we first meet a person: “Hello, how are you?” We usually answer with a simple “Fine” or “I’m good,” followed by “Yourself?” We all know the question is simply a courtesy and not a request to know all about the pains or minor ailments that afflict us through living.

But to answer the question: “Well, how’s the lake?” begs a more nuanced answer than simply “Fine” because there are many things happening in and around the lake, most of which are unseen and subtle, with long-term consequences.

For more than 25 years, I have been monitoring four important attributes of Anasagunticook: Clarity (Secchi); Dissolved Oxygen; Temperature; and Total Phosphate. What follows is a report that covers these attributes. I hope you find it useful. (Forgive me in advance for using too many graphs, but it is an easy way to present data and explain some implications for what I have found.)

Let’s start with a little terminology....

Lakes in Maine fall into one of three categories:

1. **Oligotrophic** - low biological activity, sparse vegetation, high dissolved oxygen, low organic content, low nutrients, clear water.
2. **Mesotrophic** - intermediate level of biological activity, clear water, emergent vegetation, medium level of nutrients.
3. **Eutrophic** - high biological activity, very high levels of nutrients, especially nitrogen and phosphorus, abundance of aquatic plants and algae, often turbid.

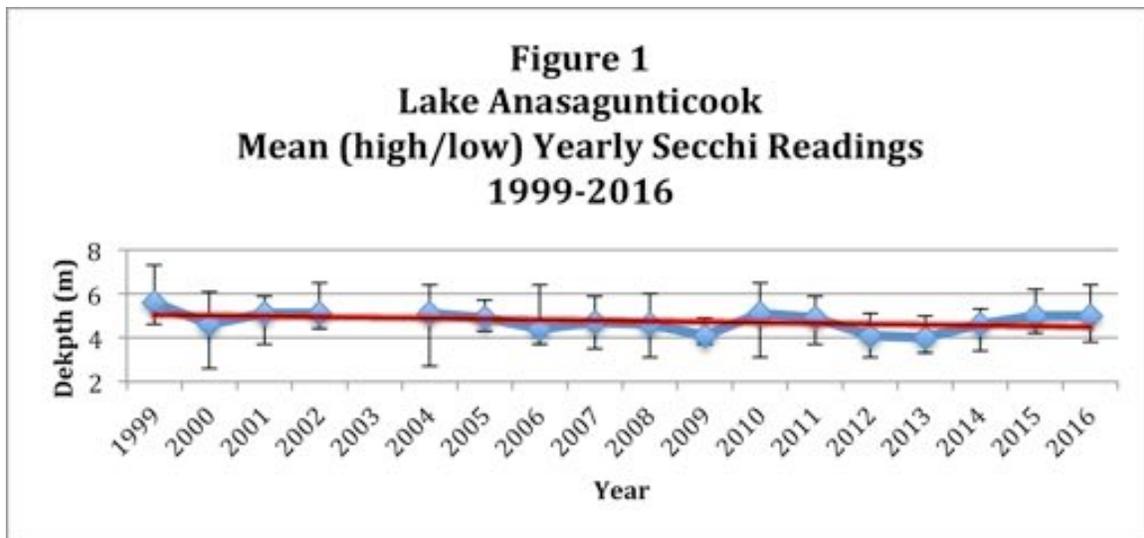
If you have ever done some hiking and come across a crystal-clear alpine pond, you probably have seen an oligotrophic lake. A pond with a layer of green “scum” and most likely with a pungent odor is a eutrophic lake. I have seen a few lakes in this trophic state and they were not pretty.

We are blessed that Anasagunticook meets all the criteria of a mesotrophic lake and may it ever be so. However, the factors that make Anasagunticook a mesotrophic lake can change and there is always the danger that these controlling factors may make the lake take on the undesirable characteristics of a eutrophic lake. Lakes change over time, but simply looking at a lake cannot tell one why or in what way it is changing.

And now for the four attributes....

Clarity

Clarity is the most obvious (but in some ways not the most important) attribute of a lake and certainly has an impact on a lake's recreational value, as well as the monetary value of lakefront real estate. Clarity is affected by suspended particulate matter such as silt, floating algae, dissolved minerals and organic matter, zooplankton, and sunlight. I measure clarity by measuring the depth through which light penetrates the water by suspending a black-and-white disk in the water to the point where it just disappears. This is called a Secchi measurement and is a common standard measure (in meters) of water clarity. Figure 1 (below) shows the average Secchi readings for each year since 1999. The vertical bars represent the range of readings for that particular year, and the sloping line represents the general trend. There were no readings in 2003 because the lake monitor was off walking in the woods.



Secchi readings can be used to track changes in water quality over time. Transparency values in Maine vary from 0.2m (8 inches) to 21.27m (70 ft.), with the overall average being 4.83m (15.8 ft.).¹ As you can see in Figure 1 (above), the clarity value for Lake Anasagunticook is approximately 4.8 meters.

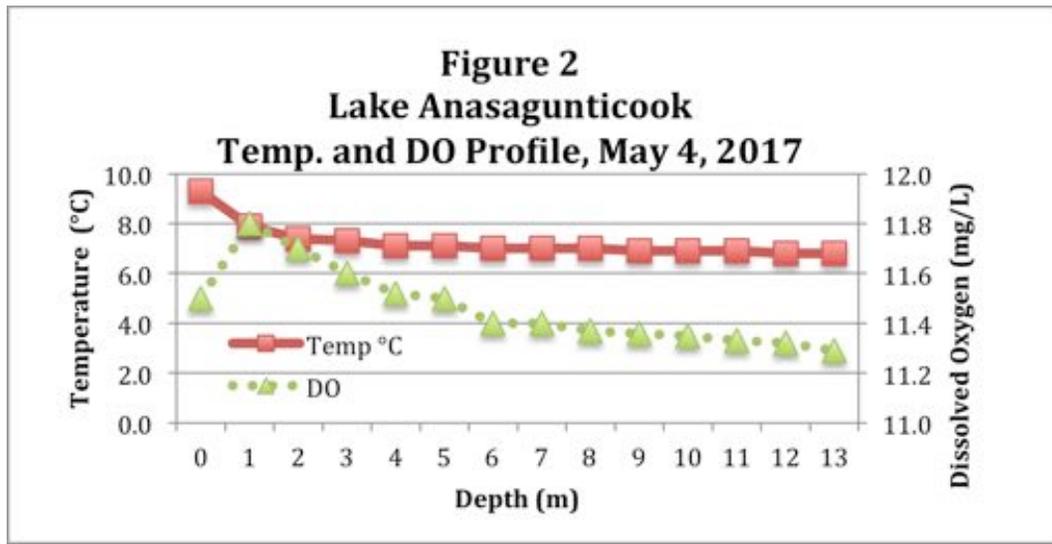
Dissolved Oxygen

Dissolved Oxygen (DO) is oxygen dissolved in the water. (The oxygen in H₂O is not the same as dissolved oxygen, O₂.) All organisms living in the lake (with few exceptions) need DO for cellular respiration. Low levels of DO put stress on many creatures and reduces the diversity of life in the lake and is particularly detrimental to cold-water fish. It is important to note that water with less than 1 mg/L (or one part per million) of DO is considered anoxic (no oxygen present); less than 5 mg/L of oxygen is generally considered so stressful that most cold-water fish will not survive under these conditions.²

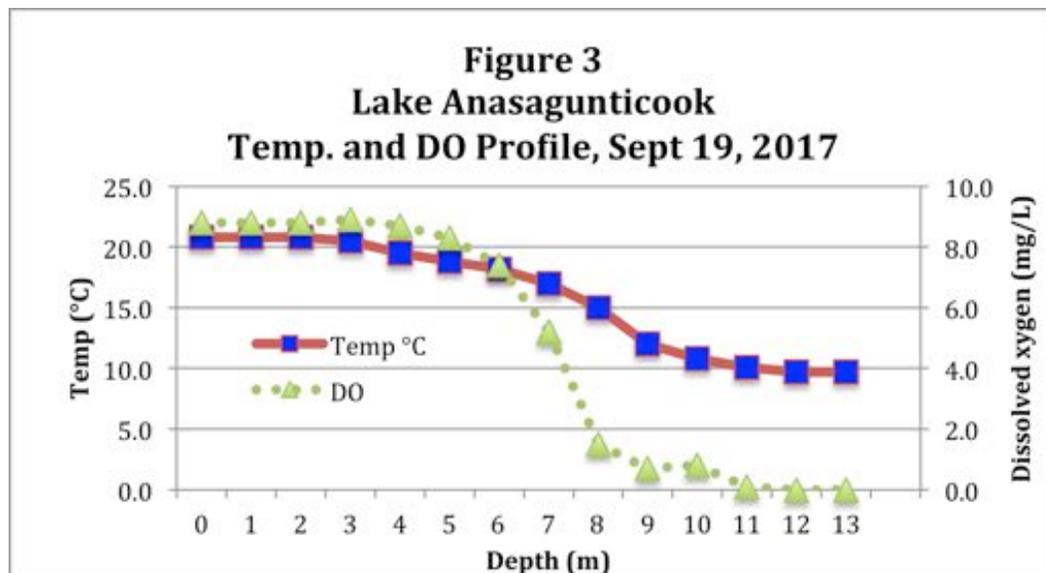
¹<https://www.lakesofmaine.org/data/Explanation%20of%20Individual%20Lake%20Water%20Quality%20Report.pdf>

²<https://www.lakesofmaine.org/data/Explanation%20of%20Individual%20Lake%20Water%20Quality%20Report.pdf>

There's more! Keep reading....



Compare the May water profile in Figure 2 (above) with the September profile in Figure 3 (below). Note the depth at which the level of DO decreases below 5 mg/L in Figure 3.



Phosphates

It is well known that anoxic conditions promote the growth of anaerobic bacteria, which will release phosphates as part of their metabolism. Total phosphates are usually measured in units of micrograms per liter ($\mu\text{g/L}$) or parts per billion (ppb). Phosphates are a major limiting factor for the growth of aquatic vegetation and algae in lakes and are in very low concentrations in oligotrophic (less than 10.0 ppb) and mesotrophic (10-35 ppb) lakes. High phosphate levels (above 35 ppb) in a lake will soon become eutrophic.³ (Note that 1.0 ppb or 1.0 $\mu\text{g/L}$ is comparable to one penny in ten million dollars.)

I have measured total phosphate levels in Anasagunticook only a few times because of the expense and the reality that these measurement must be made in a special laboratory.

³ C.F. Mason, Biology of Freshwater Pollution, 3rd edition, 1996, p. 107.

Table 1
Total Phosphorus for Anasagunticook (Surface Grab)

Year	July	August	September	October
2013		8 ppb	9 ppb	7 ppb
2015		4 ppb	5 ppb	6 ppb
2017	7 ppb	6 ppb	5 ppb	6 ppb

In Table 1 (above), note that the concentrations of total phosphorus are reassuringly low. May they always be so!

Water Temperature

This past year I have been asked if the lake water is warmer than usual. This is not an easy question to answer because defining “usual” depends on many variable such as the time of year, at what depth, air temperature, the number of bright sunny days, how much wind and rain has affected the lake, and how early in the spring was the celebrated “ice-off” date.

The temperature of the water in the lake can vary considerably. In Figure 2 (on Page 4), you can see that the water temperature on May 4th was about 8°C (46°F) all the way to the bottom, but in September the water at the surface was 21°C (70 °F) and 10 °C (50 °F) at the bottom, with a dramatic temperature change between six and eight meters. This is the area of the thermocline, which inhibits water below from mixing with the water near the surface. As the season progresses into late fall, the thermocline will disappear as water at the surface cools, becomes denser and moves to a greater depth, bringing with it dissolved oxygen. Eventually, the temperature of the water will cool to around 4°C (39°F) and ice will form at the surface.

In Figure 4 (below), I have graphed the early August temperature of the water one meter below the surface for the years 1999-2017. The trend line does indeed show a general pattern of slightly warmer water.

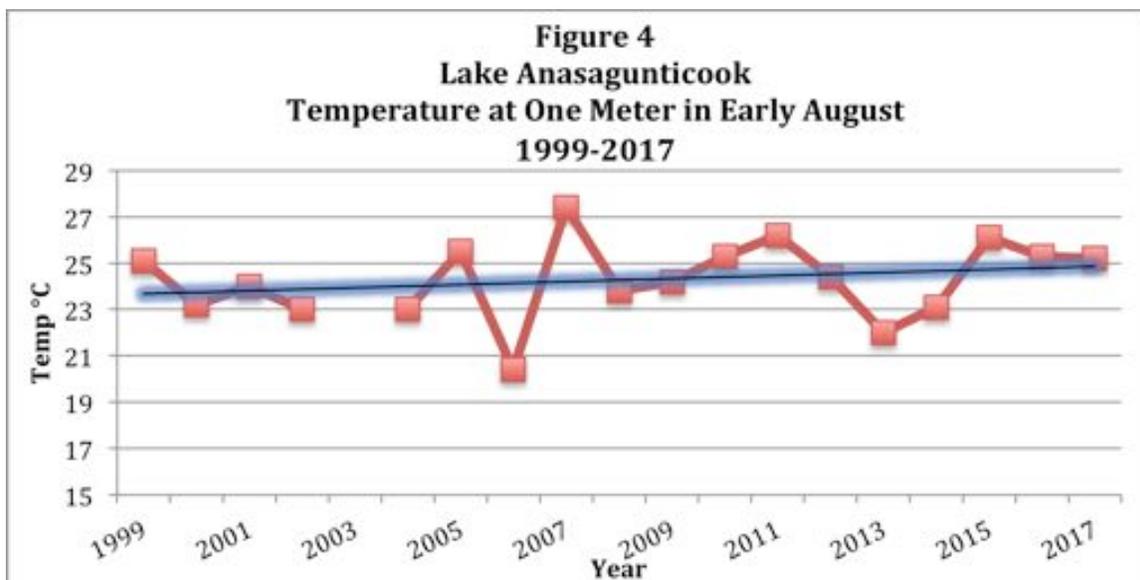
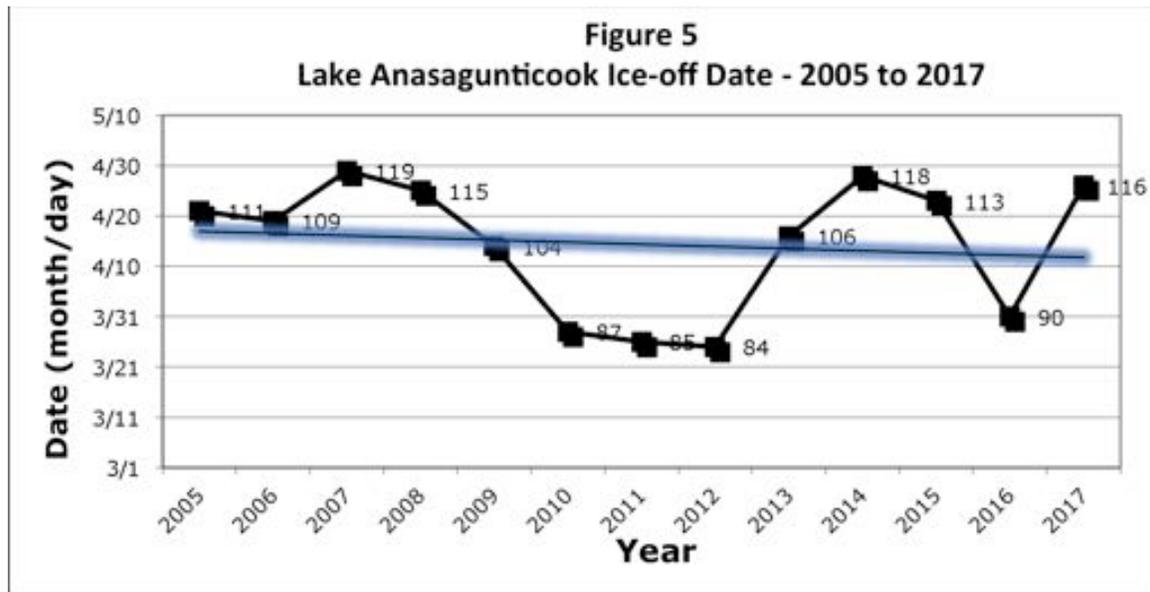


Figure 5 (on the following page) shows the ice-off dates for the lake. Note that there is a trend for the lake to be free of ice earlier in the year. This permits sunlight to penetrate deeper into the water and start the warming of the lake earlier. Ice-off dates were declared when there was no ice visible from the Canton Road Shore. (Thanks to Buzz Croston for some of these dates.)



General Conclusions

Now back to the original question: “Well, how’s the lake?” There are several clear trends that can be gleaned from the data I have collected over the last 25 years.

Clarity, which is most readily perceived and important to swimmers and boaters, has decreased slightly on average, but is highly variable from year to year and even month to month. The water is slightly warmer near the surface and this is probably a reflection of the general trend of earlier ice-off dates and perhaps, warmer summers. When the lake loses its ice cover earlier in the spring, sunlight can penetrate deeper and for a longer period of time. The phosphate level has remained low and this is good, but the extent of the anoxic area at the bottom of the lake should be of concern. Not only is low oxygen detrimental to fish life, it also allows the proliferation of anaerobic bacteria, which can release phosphates through their metabolism. As the lake water turns over in the fall, dissolved substances at the bottom of the lake can be brought to the surface, thus setting the stage for an algae bloom—not a good thing.

So how is the lake? In general, I would say the lake is in good shape, but the long-term health of the lake should always be of concern as “development” near the lake and in the watershed inevitably continues: more camps are built or expanded, while others are converted to year-round use; vegetation is removed close to the shoreline and tree harvesting continues in the watershed; septic systems age while camp roads and soil erode.

We should always remember that everything that happens in the lake’s watershed could have an impact on the long-term health of the lake, therefore, it is very important that we all try to find ways to mitigate the detrimental affect any of our activities have on the lake.

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