



Optical Brighteners, Septic Systems and Lakes

Maine Lake's Wednesday Webinar – May 20, 2020

Questions and Answers Recap – Ben Peierls, Lakes Environmental Association

Can you define optical brighteners and where we can find them?

OBs are chemicals added to some detergents and paper products. The chemicals adsorb to the surface of clothes or paper causing a whitening effect due to their fluorescence properties.

Do all detergents contain optical brighteners?

No, not all do (you can find them with a quick online search). If no one uses detergents with OBs, then our survey will depend on OBs in toilet paper.

Can the optical brightener help trace specific locations on a lake with septic system failure, or does it disperse too quickly?

I wish I had an estimate of OB dispersal rates. I assume that when we find OBs, it is a region where septic systems have connected to a lake via ground water or surface. It would be difficult to tie it to a specific system with certainty. Dilution, photobleaching and adsorption to particles should reduce concentrations with distance from the source, but we haven't done the fine scale spatial and temporal sampling to test how far that is.

It seems like this test method would only indicate failing systems are present, but not which ones - would that be a correct assessment?

Yes, our current assumption is that it is not specific enough to identify which system is failing and that some ground water or surface runoff has transported OBs to the lake. We still can't rule out that some OBs are released from working septic systems as well, which is why we would like to add the E. coli indicator.

Could this technique be used to check on specific systems?

I think it would be difficult to check specific system with the technique unless there was direct connection between the septic and lake and there was a good input of material with OB. Single systems are usually tested with by adding larger quantities of fluorescent dye to the waste stream (permission needed).

Do you believe this would detect a failing septic system if there was no washing machine, just the brighteners from TP?

I don't know for sure, but I think it is possible since TP breaks down very quickly in water and would release the OBs. I have seen a reference that says some handwashing and dishwashing detergents also contain OBs, so those might add to the signal.

If you identify a failed septic system what can be done about it?

That can be a touchy subject. For now, we don't believe we can identify specific systems, so all we have done is alerted municipal officials to the possibility of problems and left it in their hands. If a failed system is identified, it needs to be repaired or replaced, which can be an expensive undertaking.

What type of public outreach are you doing around these results?

We have written articles for our newsletters and web page, shared the results with the volunteers, and sent reports to municipal officials in the surveyed areas (and talks like this webinar.)

Is 5 ppm the Limit of Detection (LOD)?

The measurement technique was not designed to determine an LOD, just presence or absence. In the graph I showed, the lowest concentration of OB (0.5 ppm) was above the threshold of detection. I can see how that might be considered the LOD, but I did continue testing smaller concentrations to the point of no detection. Also, that result was specific only for Moose Pond organic matter content. If I had used another lake with more colored organic matter, the results would be different.

Is anything known about the rate at which OBs disperse throughout a lake, compared to the rate at which E. Coli and other contaminants disperse? Does OB have the potential to identify the locations in a lake that are possible origins of OB coming through septic systems?

I have not seen data on OB dispersion in lakes, though it has been shown to be persistent in ground water. Once it enters the lake, dilution, photobleaching and adsorption to particles will reduce our ability to detect it. E. coli probably disperses similarly, though maybe with the particle adsorption. Yes,

the idea is that locations in the nearshore lake zone where we collect samples positive for OB are places where septic system effluent containing OB (and maybe bacteria and nutrients) is transported by ground water or surface runoff.

Do you have specific lakes in mind to test?

Our focus has been on the more populated (meaning more septic systems) lakes in LEA's service area (seven towns around and including Bridgton). Lakes that have few septic systems in the shoreland zone would not likely yield positive results.

What is the number of times in a year should a lake be tested?

There is no recommended testing frequency for this technique. We tested twice and picked high-use times of the year, but that was not enough to give us a good idea of temporal variation. We hope to sample more frequently in the future to learn more.

For bacteria sample collection on other projects, would using whirlpack bags on the end of a sampling pole be useful?

Yes, that is a good (sterile) technique and one could use the sample for both E. coli and OB measurements.

Is there training required to gather samples?

We did a very short training session with our volunteers – the current sampling method is very simple.

For the lake water samples, did you just collect surface grab samples? Or did you concentrate the samples in some way?

I should have been more specific – I had the volunteers collect water samples in shallow waters and as close to the bottom as possible without collecting sediment. The protocol was to submerge a closed centrifuge tube and then open and cap the tube underwater. The samples were not concentrated.

Are “perk tests” how we determine soil type that is good for septic?

Yes, I believe engineers or contractors use percolation tests to identify the suitability of local soils for septic systems, or how to modify systems to account for any percolation deficiencies.

How can we translate this information into conversations with lakefront homeowners so they feel empowered?

Since the method is not definitive without the addition of E. coli measurements, our results are still preliminary. However, I think the message is that septic systems do connect to lakes (eventually) and that to help maintain good water quality it is imperative for systems to function properly (and be regularly checked and cleaned).

When might this technique be available to the average Lake Association?

I suppose it is available now with the cost of a fluorometer (\$2K-3K) and UV light (and time). It might not be ready for "prime time" quite yet until we can make sure what OB presence means.

How can a lake go about getting into the testing program?

This project was specific to LEA and our local community and lakes, so it is not a general program at this point. Also, there are still uncertainties that need to be addressed. Until then, and when we have the resources, we might consider expanding our capacity to other lakes.

Would frozen lake samples be suitable for measuring OB?

I have not tested whether freezing affects the OB signal (something I should do) and I do not know for sure, but I can't think of a reason why the test couldn't be done on frozen samples (after thawing, of course).

Are we saying the motivation to add OBs by the manufacturers was to make things brighter, and it turns out to have a secondary benefit of our being able to see it in our lakes? Are OBs an unexpected and unplanned plus for us?

Yes, the benefit is that it (might) help us trace problematic septic systems and the resulting dangers to water quality.

What was the cost of this research? Is there still grant funding available?

The grant has ended and we do not have funding for this project moving forward. We already had a fluorometer, so costs were mostly for plastic containers and time. Fluorometers can cost several thousand dollars or more.

Can the amount of OB detected (estimated) reflect the magnitude of a septic issue?

Remember that the technique I used only specified presence or absence, so I was not estimating amount. There are many variables at play here (amount of OB being added to the system, residence time in system before entering lake, etc.), but I suppose a stronger signal might correlate with greater loading of wastewater.

I have a neighbor who feeds ducks that defecate in the lake and on our lawn. We cannot swim in the lake because of this. Is there any info I can share at our neighborhood meeting in a week as to how feeding ducks affect the environment and our health?

Duck waste, like waste from other wildlife, farm animals and humans can impact the water quality of lakes by acting as a fertilizer for algae and plants, by adding organic material that lowers oxygen when it breaks down, and by adding potential pathogens. Feeding ducks will just encourage them to congregate and make the impact worse - I would discourage it. A healthy lake ecosystem with a mix of aquatic plants, insects, crustaceans, mollusk, and fish should provide all the food waterfowl need.

We would love to get China Lake involved.

We would love to be able to test many more sites, but our resources are limited and we are still working out what the uncertainties in what the results can tell us.

If you have additional questions for Ben, please feel free to reach out to him by email at ben@mainelakes.org.