Preparing for Lagoon Turnover

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It's getting to be that time of year again. Trees are budding, robins are returning, and lagoons are starting to smell a little funny. All three are signs of spring. The communities of organisms living in your lagoon change with the seasons just like larger plants and animals.

Seasonal change in lagoons is driven by soil and air temperatures, solar radiation, and temperature gradients in the lagoon. Figure 1 shows how lagoons warm during sunny days in early spring. The top three feet (1 m) of the lagoon heats up during the day. At night the lagoon cools, and heat is redistributed throughout the liquid. The next morning, the whole lagoon is a little warmer than the day before, and the upper layer is still a little warmer than the bottom. Lagoon temperatures go through an annual cycle. Figure 2 shows early morning temperature at the top and bottom of the old OSU Swine Farm lagoon measured (almost) every day for two years.

When the top of the lagoon is warmer than the bottom, we say the lagoon is in "summer". When the bottom is warmer than the top, it is "winter". Twice each year, the upper and lower temperatures approach each other, and this is when the trouble starts.

When a liquid is warm, it is lighter or less dense, than when it is cooler. Because of their different densities, the two lagoon layers do not mix much in summer and winter. But, when the top and bottom temperatures approach each other, a good wind can make the whole lagoon turn upside down -- bringing the smelly stuff from the bottom to the surface. Lagoons do not have a single "turn over day" as deeper lakes do. They go through periods of instability in the spring and fall, and the lagoon is liable to turn over many times.

Why do lagoons smell worse in the spring than in the fall? Here's where the living organisms come in. Look at Figure 2. The time when the top (red) and bottom (blue) temperatures come together in spring is also the time they both cross the 10^{o}C line. Microorganisms become active at about 10^{o}C (50^{o}F). During winter, the lagoon has been acting like a refrigerator, storing up food. And, just when the microorganisms are ready to eat all the manure you have fed for the last two or three months, the lagoon layers become unstable.

Table 1 gives approximate dates for lagoon seasons in Oklahoma. You can stretch winter out a few weeks in the Panhandle and shorten it a few in McCurtain County.

So what can you do to reduce the chance of smell this spring? Try these three options:

Reduce loading on the lagoon by keeping liquid level up.

You cannot cut down the amount of manure going into the lagoon – after all, the pigs need to keep eating -- but you can reduce its effect by keeping the lagoon's volume up. Unless it is about to overflow, delay removing effluent from the lagoon until mid May.

Do not irrigate until the lagoon is stable.

This is really just saying the first option a different way. By delaying irrigation until mid May, you will reduce the chance of spreading less pleasant smelling effluent on soil and crop surfaces. No matter what time of year, remove effluent from the upper three feet of the lagoon. Holding effluent longer also allows you to hit the prime nitrogen uptake time for warm season grasses, which in Oklahoma occurs in May and June.

Avoid adding fresh manure when the lagoon is turning over.

If you have a pull plug system and can hold off pulling for a day or two, try to skip the days when the lagoon is turning over. These days are hard to miss. Looking across the lagoon, you will see less smooth liquid and more mats of grey colored sludge floating on the surface when it is turning over.

Table 1. Seasonal Variation in Lagoons Located at 36°N (from Hamilton and Cumba, 2000).

Season	Duration (months)	Approx. Start and End	Thermal Stability	Biological Activity
Winter	2	Dec 16 – Feb 15	Stable	Inactive
Spring	3	Feb 16 – May 15	Unstable	Increasing
Summer	4	May 16 – Sept 15	Stable	Active
Fall	3	Sept 16 – Dec 15	Unstable	Decreasing

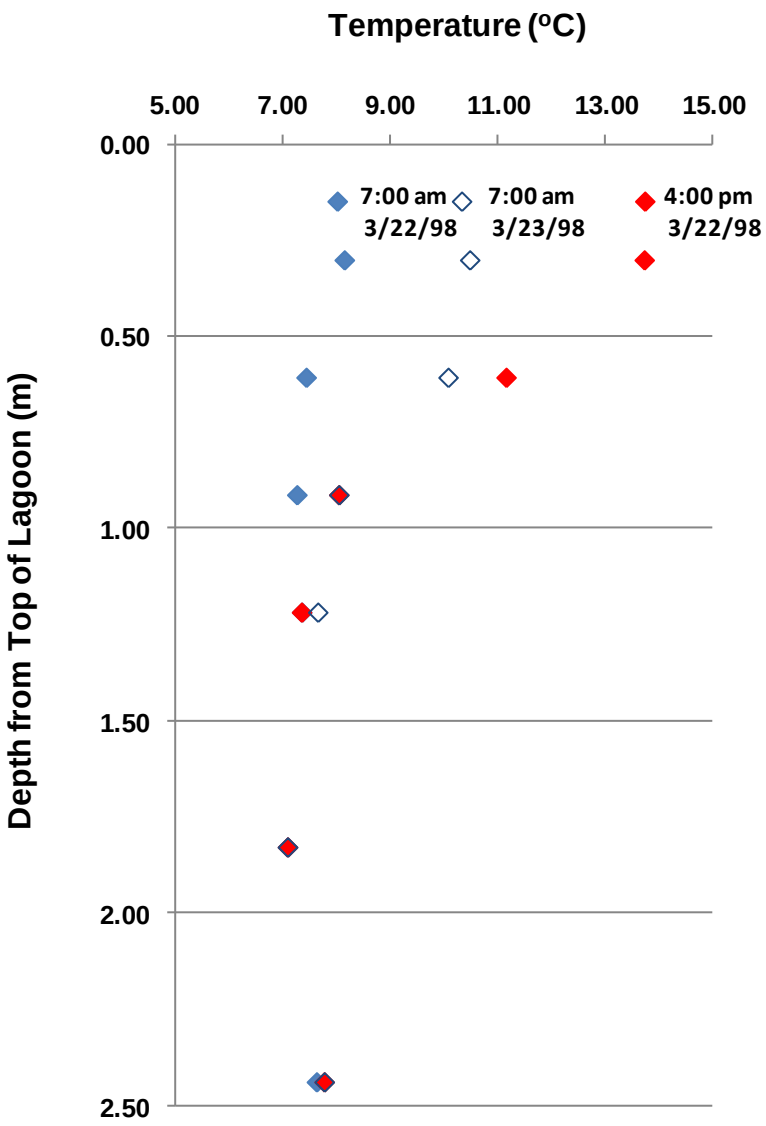

Figure 1. Typical Lagoon Heating Pattern on a Sunny Day in Early Spring

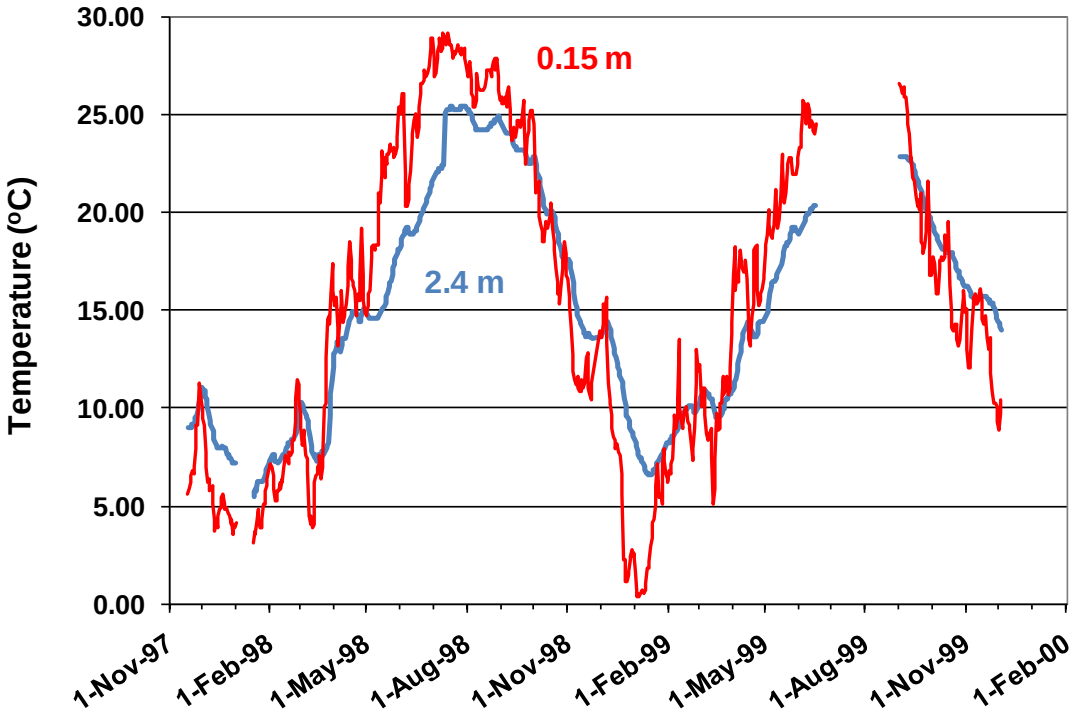

Figure 2. Lagoon Temperatures Measured at 0.15 m and 2.4 m depth at 7:00 am

References:

Hamilton, D.W., and H.J. Cumba. 2000. Thermal phenomena in animal waste treatment lagoons. in, *Proceedings of the 8th International Symposium on Animal, Agricultural, and Food Processing Wastes,* p 672-678. ASAE: St. Joseph, MI.