

Seeking new kind of green technology

Written by Patricia Waldron

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Autumn is a lovely time of year when pumpkins dot doorsteps, the weather is warm and clear, and leaves change from green to red. It's also the time of year when the levels of toxic algae in Watsonville's Pinto Lake skyrocket, stimulated by those same sunny days.

For decades, Pinto Lake has experienced a seasonal population explosion of single-celled organisms called blue-green algae, or cyanobacteria. They flourish in the spring and summer in the warm, shallow waters. Some types produce deadly liver toxins that can sicken people and kill pets and wildlife. The toxin levels are often low, but they are also highly variable, spiking in the fall. Though the problem is ongoing, the lake recently set records for its toxicity and is bringing Watsonville national attention.

"We've got the poster child for cyanobacteria," said Robert Ketley, senior utilities engineer for the city of Watsonville. "We've got the highest levels seen in the entire state."

The algae thrive on the high nutrient levels in the lake water. A collaboration of local researchers and officials has identified the main source of the problem as high levels of phosphorus, a common ingredient in fertilizer and some cleaning agents. Though a preliminary study has identified the sources of phosphorus and a variety of potential solutions, it will likely require expensive water treatments to clean up Pinto Lake, and a coordinated community response to keep out excess nutrients in the future. Cleanup strategies that are successful at Pinto Lake may be applicable to algae-contaminated waterways around the world.

In 2010, the lake received wider attention when the city's toxin monitoring data showed that the water quality violated the Federal Clean Water Act. The Water Resources Board secured a federal grant that funded the preliminary studies to identify sources of phosphorus and ways to remove or immobilize the nutrient.

The initial studies found that to control the algae, officials must first control the phosphorus. The nutrient is highly mobile, and moves with the groundwater by hitching a ride on particles of dirt.

It also lurks in the sediments on the bottom of Pinto Lake, so when the water column mixes each fall, the phosphorus rises to the surface. The combination of warm water, plentiful sunshine and excess phosphorus creates the perfect environment for cyanobacteria to bloom.

About 60 percent of the phosphorus in Pinto Lake leeches into the water from sediments on the bottom of the lake. One potential solution to the algal problems is to add chemicals to the lake that keep the phosphorus locked in those sediments. When a mineral called alum is added to the water, it attaches to the phosphorus and to bacterial cells so that they clump up and settle out of the water column.

Ketley applied to the Water Resources Board for a \$750,000 grant to treat the lake with alum. He envisions Pinto Lake as a "laboratory-sized lake" where researchers can try different solutions. Successful treatments can then be scaled up at larger algae-contaminated waters, such as Clear Lake and the Copco and Iron Gate reservoirs in Northern California.

But lake sediments are not the only problem. The rest of Pinto Lake's phosphorus comes from tributary groundwater that picks up phosphorus from a variety of human activities.

"There is a lot of agriculture around the lake and septic systems that can be sources of phosphorus," said Pete Osmolovsky of the Central Coast State Water Resources Board. Even road run-off, landscaping projects and soap from curbside car washing can contribute to the problem. "There is a sense that controlling those sources be useful in the long term," he said.

It is likely that Watsonville will need to attack the Pinto Lake problem on multiple fronts.

"The best strategy is adaptive management where we try several things and see what works," said Marc Los Huertos, an ecologist at California State University, Monterey Bay.

Los Huertos performed water quality analysis as part of the preliminary studies, and tested the effectiveness of using alum to lock up phosphorus. He said that people deal with harmful algal blooms worldwide, but scientists have yet to find one perfect solution. He said he believes that a cost-benefit analysis will be necessary before the town starts any long-term projects.

Community involvement will also be important for keeping additional phosphorus out of Pinto Lake.

"It can't just be the scientists presenting data," said Patricia McQuade, the Pinto Lake Park manager.

Local homeowners approached McQuade about six months ago and asked her to found a community action group which she called Friends of Pinto Lake. The group's goal is to raise awareness about the lake's problem and to apply for grants pay for the clean-up.

The city of Watsonville is also partnered with the Resource Conservation District of Santa Cruz County to reach out to local farmers, especially Spanish-speaking growers, to help them with erosion control and to fund improvements that will reduce runoff.

One unusual strategy that Watsonville has implemented to combat phosphorus levels is a fishing program that pays people to fish for invasive carp called Carpegeddon. Since carp are bottom feeders, they stir up the sediments on the bottom of the lake, which then releases more phosphorus into the water. Ketley reports that though the program has removed about half a ton of carp from the lake, it has not made a significant dent in the population. If Ketley can secure funding, then electrofishing will take place in the spring, when the carp move into the shallows to spawn.

Now that the preliminary studies have finished, the Central Coast Water Resources Board will start a Total Maximum Daily Load study, which will ultimately yield a plan of action for the lake.

"We're just in the incipient phases of the TMDL," Osmolovsky said.