Manufacturing Innovation Insider Newsletter

Who Killed Joe Bass?

Stopping the fish kill "crime wave" with solar- powered water circulators that improve dissolved oxygen supply in eutrophic ponds and lakes.

Who killed "Joe Bass?" Solving this case and preventing its recurrence has become more pressing lately, as increasingly rampant fish kills not only affect anglers and nearby residents, but anyone else who uses the water for recreation. Economic consequences to private owners and public parks and recreation departments can include lost revenue due to decreased numbers of visitors and tourists, declining property values, and millions of dollars in expenses to restore and maintain the water.

While the public and the occasional fisherman probably haven't a clue as to what happened to all the fish in their favorite boating or swimming spot, environmental experts and professional pond and lake managers usually know full well who the usual suspects are. More often than not, eutrophication (over enrichment) and the resultant lack of dissolved oxygen ranks at the top on the list of perpetrators. Yet, one budding technology that promises to stop the crime wave wreaked by eutrophication involves the use of solar-powered water circulators that are not only environmentally friendly, but cost effective since they virtually eliminate the use of costly chemicals and the inordinate expense of dredging lake bottoms.

"After installing these circulators, our lake had a full water column of oxygen within a week," says Walt Wilson, Manager of Endangered Species at the game fisheries of Camp Pendleton Marine Corp Base, California. "The lake has remained oxygenated for two years now, with no fish kills and no major algae blooms."

The use of a SolarBee circulator in the tidal area of the Bald Eagle Creek and Torquay Canal near Rehoboth Beach, Delaware resulted in a minimum of toxic algae, no major fish kills, improved numbers of crabs in the lagoon system, and an improved overall appearance of the waterway.

Eutrophication — the main culprit

While seasonal algal blooms occasionally cause fish kills, it is the process of eutrophication that is increasingly leaving its fingerprints all over the "crime scene." Loosely defined as the progressive over-enrichment of water bodies by nutrients such as nitrogen and phosphorus, eutrophication leads to uncontrolled blooms of harmful blue-green algae (cyanobacteria) that take hold in warm, sluggish waters.

While alive, these blue-green algae often contain hazardous toxins, rendering them inedible to zooplankton and fish. When the bloom dies, the algae release these toxins as they settle to the bottom. Furthermore, the act of decomposition consumes oxygen, creating an oxygen-deficient environment that is harmful to fish

and causes release of phosphorus that becomes available for future algal uptake, reinforcing an unhealthy cycle.

Research shows that tens of thousands of lakes and ponds in North America suffer from this harmful condition that can result in: fish kills, reduced biodiversity, noxious gas, murky and undrinkable water, repulsive odors, deep bottom muck, surface scum, impaired bird populations and a variety of ailments for swimmers.

Dead-end attempts to arrest the cause

Although chemicals such as copper-based compounds have been effective in killing blue-green algae in the past, their use racks up an increasing number of drawbacks. For example, treating water with copper sulfate during prolific blue-green algae blooms may lead to a sizable release of acrid odors and toxins that can affect fish adversely. Resorting to copper sulfate can also become inordinately expensive, as after many years of treatment the blue-green algae develop a resistance. Ultimately, the water is still enriched with new nutrient loads and the offending organisms proliferate again.

"One of our goals was to stop these treatments," explains Rick Archbold, general manager of the lake committee at Hidden Valley Lake, a prestigious community north of San Francisco. "Not only was it expensive, but we recognized that continually dumping chemicals into the water was not a good idea. The lake is the jewel of this community, and we were very concerned about its future."

At Camp Pendleton's 125-acre fishery, the situation was just as grave.

"The only apparent solution when I arrived here three years ago was to dredge out the sediment buildup from 124 years," says Wilson, the fishery's biologist. "That would cost several million dollars and still would not prevent future problems."

Enter the new crime fighter: water circulation

An increasingly popular method of overcoming eutrophication, as well as "accomplices" such as blue-green algae and aquatic weeds, is the use of water circulators. These are devices that pump water up from deeper parts of the lake and spread it across the surface. The gentle non-turbulent nature of the flow allows it to travel for long distances and mix large volumes of the lake. The principal effect of the mixing is to allow the beneficial microscopic algae to out-compete the blue-green algae for the nutrients. The beneficial algae are then eaten by the zooplankton which in turn are eaten by the fish. The end result is that the nutrients from eutrophication are pushed up through the food chain to create bigger and healthier fish instead of being stuck at the level of producing blue-green algae. Other results are better water clarity and higher dissolved oxygen due to elimination of massive algae die-offs.

Emery Lake, California (SolarBee circulator in the background) has seen an increase in catfish, bass and red-eared sunfish.

Whereas some early aeration systems have been known to cause unwanted entrainment (streaming) of nutrients from the sediment, the controlled water intake depth of solar circulators allows for uniform mixing without pulling nutrients from the sediment. At Camp Pendleton, Wilson decided that was the most desirable solution

"I felt that the SolarBee system would keep entrainment under control and offer all the benefits I was looking for," says Wilson.

Wilson had three SolarBee units installed at the Camp Pendleton fishery in June of 2002.

Manufactured by SolarBee Division of Pump Systems, Inc. of Dickinson, North Dakota, the SolarBee device is a floating, solar powered, high-flow circulation machine that draws water from lower levels in a lake or estuary and distributes it radially across the surface, exposing the water to the atmosphere and sunlight. Circulating water, naturally enriched with dissolved oxygen through surface renewal and algal photosynthesis, accelerates healthy biological processes throughout the lake.

The device requires no electricity because its three solar panels provide enough energy to pump up to 10,000 gallons of water per minute for up to 24 hours a day. As it requires no infrastructure changes to install, it can be rented for temporary use without disruption.

Hidden Valley Lake, California, utilized four SolarBee units. "After they had been in the water for about two-and-a-half months the algae problem was basically gone, and the fish are definitely happier," says Rick Archbold, general manager of the lake committee.

Apprehending the perpetrator

"I was really amazed at the results — we haven't had any fish kills since the units went in the water," comments Wilson. "I started to see oxygen in the water column the next day. As the week went on I observed oxygen down to two meters. Of course, for a while there was still a high chemical demand for oxygen down at the bottom of the lake, which has an average depth of 18 feet. But now there has been dissolved oxygen almost to the bottom for almost two years."

Wilson adds that blue-green algae production was reduced by approximately 98%.

"There used to be all three nuisance species of blue-green algae in the lake," notes Wilson. "Although there may probably still be some in the water, we now have only two or three major blooms a year, and they are an aphanizomenon-specific type."

A beneficial result that Wilson had not expected is that the lake sediments appear to be shallowing, at least in the vicinity of the SolarBees.

"Before we installed the circulators, the sediment was so soft that you couldn't tell where the bottom actually was," recalls Wilson. "Three months after we put the SolarBee units in I did a round of manual soundings right beneath them. The sounding pole went right to the bottom and stopped as if I had struck rock, so there is evidence that the system is gradually altering sediments by increasing pH. This is one of the benefits professed by Pump Systems, but I had my doubts. However, there appears to be some validity to it, and the chemistry behind it is proven. In any case, the 'shallowing' effect may take some time to bear out."

Cancellation of the "all points bulletin"

The use of solar-powered water circulators to stop fish kills is increasingly proving itself throughout the country.

"We were having fish kills, and it had gotten to the point where the water was murky," says Gwen Nichols, the lake-maintenance chair at 40-acre Emery Lake in the gold mining territory of central California. "The lake had also become contaminated with watershield [a heavily rooted plant] that bothered residents and visitors to the lake."

Nichols says that she and her husband Dana, president of the homeowners association, were in favor of finding a long-term solution for keeping the water clean rather than scraping out the lake bed.

"We installed a SolarBee circulation system this

past spring, and it is already evident that it has made a wonderful difference in the quality of the water," says Nichols. "We now have lots of fish — catfish, bass and red-eared sunfish, with much spawning on the sanded beaches. I'm convinced that the SolarBee system is the best thing for the long-term care of the lake."

At Hidden Valley Lake, the ecology of the 104-acre freshwater lake was slowly deteriorating. The Lake Committee of the homeowners association was spending over $50,000 per year in chemicals and lake treatment services to battle unwanted blue-green algae blooms and aquatic weed growth. With a depth of 70 feet in some spots and approximately 300 million gallons in volume, the lake represented a potential nightmare of expenses.

"There was a concern that if the ecology got bad enough, we could never recover it," explains Archbold, general manager of the lake committee. "Our committee realized that a long-term solution was required to protect the lake and preserve property values."

"We ultimately decided to purchase four SolarBee units," continues Archbold. "After they had been in the water for about two-and-a-half months the algae problem was basically gone. The fish are definitely happier. Some of that improvement may have been due to late season temperatures, but I believe the majority of it was due to the circulators."

Although the Solar Bee circulators are being used primarily to heal and maintain freshwater lakes and reservoirs, they are proving equally effective within saltwater estuaries.

At Bald Eagle Creek and Torquay Canal near Rehoboth Beach, Delaware, solar-powered water circulators have been installed since 2003 to help eliminate anoxic water conditions that caused large periodic fish kills attributed to high concentrations of hydrogen sulfide caused by decaying blue-green algae. Among the findings recently reported: no major fish kills, improved numbers of blue crabs in the lagoon system, a minimum of toxic algae, and improved overall appearance and aroma of the waterway.

"We now have water clarity down to three feet, depending on the tide, and the fish are jumping and we have lots of sea birds around all the time," says Al Goldfarb, Secretary-Treasurer of the Committee for the Betterment of Bald Eagle Creek & Torquay Canal.

Case closed

No longer a "cold" case, solar-powered water circulators are providing an affordable, long-term solution to successfully protecting aquatic life, as well as restoring the aesthetic and recreational appeal of lakes, reservoirs and estuaries throughout the country. The fish doesn't have to die, after all.

For more information, contact SolarBee at 530 25th Ave E, Dickinson, ND 58601; 866-437-8076 or 701-225-4494; fax 701-225-0002; solarbee@solarbee.com; or visit www.solarbee.com

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