Is sustainable control of toxic algae a reality for catfish aquaculture?

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Toxic algae, especially some blue-green algae, pose serious and sometimes fatal consequences for the health of cultured catfish. Some algae are also associated with the production of compounds, such as geosmin and methylisoborneol (MIB), that can make fish fillets taste earthy (off-flavor). Such problems add additional costs and headaches to an already overburdened industry.

Given that algal blooms often occur during warm temperatures and excess nutrient loads, i.e., typical conditions for catfish aquaculture ponds in Alabama and Mississippi, algal bloom management is a necessary component for all aquaculture farms. A variety of bloom control approaches exist, including physical (e.g., mixing, sonication), biological (e.g., herbivores), and chemical (e.g., algaecides). Chemical treatments, such as copper sulfate and potassium permanganate, are the most commonly used because they are usually effective at quickly killing algae. However, their effects on the algal community are short-lived and tend not to promote other, harmless algae, such as green algae. Consequently, harmful algal blooms quickly recur, thus requiring regular chemical treatments to maintain algal abundance at reduced levels.

Another often overlooked problem with algal bloom management in aquaculture is that not all algal blooms are harmful or toxic to farmed fish. In other words, green water doesn't necessarily mean toxic algae. In fact, only a handful of blue-green algae species are capable of producing toxins while other non-toxic algae can help utilize fish waste products and promote overall pond productivity. The use of an inexpensive compound microscope would allow a pond manager to quickly determine if the dominant algae present in a pond are potentially toxic. If the pond is dominated by harmless algae, chemical treatment could actually harm the water quality of the pond by resetting the system and allowing harmful algae to dominate. We can offer algal identification tools and training to support farmers, and suggest that aquaculture pond managers consider using microscopy to track dominant algae in their ponds throughout the growing season.

Although less utilized, biological control of toxic algal blooms in aquaculture ponds may provide a cheap, sustainable, and efficient alternative to chemical and physical controls. Currently, most to all catfish aquaculture ponds have other fish species in addition to catfish. Often times, these non-target fish are small planktivores, such as shad, green sunfish, and bluegill. Anecdotal reports suggest that shad control algal blooms, so farmers rarely try to remove these fish. However, planktivorous fishes, including shad, actually promote algal growth by consuming zooplankton, which eat the algae. Removing shad and other planktivorous fishes should promote larger, more abundant zooplankton that could control algal blooms in catfish aquaculture ponds. The removal of planktivorous fish from catfish ponds, when possible, may result in some benefits as far as long-term management of algae.

A new project funded by the USDA-NIFA and led by Drs. Alan Wilson and Luke Roy from Auburn University's School of Fisheries, Aquaculture, and Aquatic Sciences aims to test the role of food web manipulations (called biomanipulation) as a sustainable method for controlling algal blooms in catfish aquaculture ponds. Based on recent data that show that *Daphnia*, a large-bodied zooplankton able to control highly toxic blue-green algae, Wilson and Roy will conduct whole pond experiments where *Daphnia* are added to catfish aquaculture ponds (with and without planktivorous fishes), and water quality dynamics will be studied during the growing season. The *Daphnia* are expected to reduce algal abundance to low levels, based on recent, smaller-scale lab and field experiments. Since the *Daphnia* produce resting eggs that fall to the sediment and hatch later as part of their life cycle, we expect that the *Daphnia* will return each winter/spring as long as planktivorous fish are not abundant.

As part of this new USDA-NIFA project, Wilson and Roy are looking for collaborators at commercial catfish farms to allow regular (biweekly to monthly sampling) water quality pond monitoring. They are also looking for access to recently drained and refilled ponds where planktivorous fish were removed for *Daphnia* inoculations followed by regular water quality monitoring. These collaborations will provide excellent background data about typical water quality dynamics in commercial catfish aquaculture ponds as well as the potential for *Daphnia* treatment to control toxic algal blooms. If you are interested in participating on this project, please reach out to Alan Wilson (wilson@auburn.edu; 334-246-1120) or Luke Roy (royluke@auburn.edu; 334-624-4016).

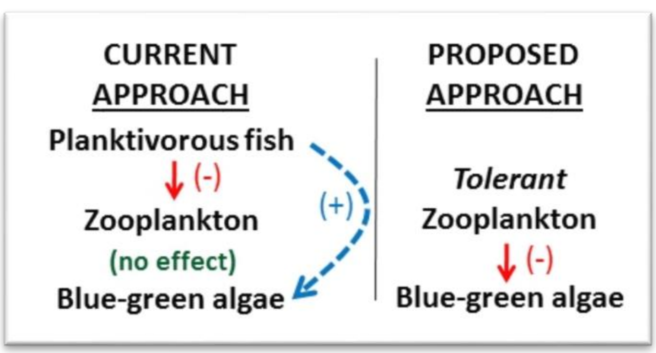

Figure 1. Conceptual model of the new USDA-NIFA project focused on using cyanobacteria-tolerant zooplankton, specifically *Daphnia pulicaria*, to control harmful algal blooms in catfish aquaculture ponds. Red lines show negative (-) interactions and the dashed blue line shows a positive (+) interaction. The current aquaculture approach of having high densities of planktivorous fishes likely promotes blue-green algal blooms since these fish consume large zooplankton. Without planktivorous fish, we contend that *Daphnia* can get abundant and significantly reduce blue-green algae to low levels.