2008 USDA-CSREES National Water Conference
Sparks, NV

Aquaculture Pond Water Mitigation and Management: Viability of a Freshwater Mussel (*Elliptio complanata*) as a Biological Filter

Gulnihal Ozbay, Jonathan F. McKenzie and Oluchi A. Ukaegbu

Abstract Text:

Many freshwater aquaculture facilities utilize earthen ponds for the growth of their commercial products. The production and livelihood of these facilities depend upon the increased growth of the species being harvested, which is usually supported by manufactured foods or increased feeding. In fish, only 30% of nitrogen and phosphorus are retained from feeding. This is of concern because of the possible algal blooms that nutrients can have on a system. Excess nutrients in the system can cause algal blooms which lead to the sudden die off of vegetation. This loss of plant life decreases oxygen in the water making it difficult for the pond to maintain other aquatic life. In both marine and freshwater systems, bivalves have been proven to be an inexpensive method for removing suspended solids, dissolved nutrients, and controlling algal growth through suspension feeding. Freshwater mussels have both an ecological and economical importance to the regions in which they are located. With 25% of the native U.S. freshwater mussel species under federal protection, their use in aquaculture ponds could lead to further propagation in controlled settings and to the restoration of their natural populations. Freshwater mussel, Elliptio complanata is the most abundant species in Delaware and it is additionally favorable because of its hardiness against environmental stress. E. complanata has also shown itself to be a successful species for this research, displaying 66% filtration efficiency. This study examines the possibility that biological filters such as E. complanata can replace expensive chemical and mechanical filtration regiments in aquaculture pond management. The twelve earthen aquaculture ponds located at the Delaware State University Aquaculture Research and Demonstration Facility in Dover, Delaware, three quarter acre and nine eighth acre ponds, were stocked with 1000 and 500 catfish (Ictalurus punctatus) respectively. E. complanata were collected from various watersheds around the Delaware area and brought back to the ponds. Four different concentrations (0, 75, 150, 300) of E. complanata were placed in three 1m x 1m trays suspended six inches below the surface of an aquaculture pond stocked with catfish (Ictalurus punctatus). These mussels were suspended in the water column for a period of nine weeks. Water samples were taken weekly during the course of the study. Each water sample was tested for nitrate, nitrite, ammonia, total nitrogen, total phosphorous, soluble reactive phosphorous, alkalinity, total suspended solids, and chlorophyll-a. Fish growth was measured biweekly and mussel growth was measured throughout the summer starting in May. Due to the control ponds showing unusually low numbers in all aspects of water quality we are looking at the differences between ponds containing mussels. This cleaner water could be due to the control ponds being twice the size of the treatment ponds, despite catfish density remaining constant. The lowest density of mussels showed the least effect on water quality from May to July showing increased total nitrogen (1.7-4.550 mg/L), ammonia (0.0567-0.240 mg/L), total phosphorous (1.4-1.15 mg/L), chlorophyll-a (0.121-1.575 mg/L), and total suspended solids (0.0123-0.00233 mg/L). The highest mussel density had a greater positive effect on water quality from May to July then did the lower density treatments: total nitrogen (0.4-3.767 mg/L), ammonia (0.0567-0.040 mg/L), total phosphorous (1.527-1.373 mg/L), chlorophyll-a (0.437-0.962 mg/L), and total suspended solids (0.0217-0.0167 mg/L). This study is still in the progress and will continue for an additional three months, but the initial results suggest that mussels have a positive effect on water

quality within aquaculture ponds. It is our hope that this study will provide a natural biological control for pond water improvement and effluent management.

Impact Statement: