

Auburn University and USDA/Natural  
Resources Conservation Service

Alabama Aquaculture  
Best Management Practice (BMP)

## Managing Ponds to Improve Quality of Overflow Effluent

BMP No. 9



### Definition

Mechanical aeration is the primary means of maintaining good water quality in ponds. Aeration maintains adequate dissolved oxygen concentrations and mixes pond water, but it does not prevent stratification entirely. Proper mechanical aeration and discharge from pond surfaces can enhance effluent quality.

### Explanation

Mechanical aeration is a highly successful procedure for maintaining adequate dissolved oxygen for fish, but aeration provides several other benefits. Water circulation caused by aeration mixes pond water, provides more homogeneous water quality, and prevents strong thermal stratification. Dissolved oxygen introduced by aeration minimizes the occurrence of anaerobic (oxygen-depleted) zones in pond bottom water and soil. The presence of dissolved oxygen favors efficient oxidation of organic matter by bacteria and lessens the likelihood for potentially toxic concentrations of nitrite, sulfide, and other metabolites. The conversion of ammonia to nitrate by nitrifying bacteria is stimulated by enhanced dissolved oxygen supplies from mechanical aeration. Ammonia is potentially toxic to aquatic organisms while nitrate is not. Thus, nitrate is not as undesirable in effluents as ammonia. The amount of aeration used per acre of ponds has increased during recent years. Nevertheless, aeration is still not used in sufficient amounts on all catfish farms.

Livestock on watersheds produce manure that may wash into ponds. Manure is a source of

nutrients and it decomposes to exert an oxygen demand. Thus, water often tends to be better in catfish ponds that do not have livestock on watersheds.

Water quality in ponds tends to be better in the upper 3- to 4-foot layer than in the bottom 1- or 2-foot layer even when mechanical aeration is applied. Most ponds overflow from their surface into a standing drainpipe that passes through the bottom of the embankment. However, some ponds have deep-water overflow structures, and discharge in response to storm overflow originates at or near the bottom. Deep-water discharge is less desirable than surface discharge because bottom water usually is of lower quality than surface water. Bottom water discharge structures should be modified to discharge near the surface.

### Improvement of quality of overflow

#### Practices

- *Apply mechanical aeration with the objective to maintain adequate dissolved oxygen concentrations. The higher the dissolved oxygen concentration of the effluent, the better for in-stream water quality.*
- *Do not have deep water overflow structures in ponds.*
- *The practice of rearing livestock on farm watersheds and allowing livestock to walk on embankments and enter ponds should be discouraged.*

## Implementation notes

Mechanical aerators should be efficient in transferring oxygen, and aeration should be applied at rates great enough to maintain dissolved oxygen concentrations above 4 ppm at night. The nighttime decline in dissolved oxygen concentration increases with increasing feeding rate and phytoplankton abundance. In order to prevent low dissolved oxygen concentration, phytoplankton abundance should not restrict Secchi disk visibility below 12 inches. The most effective way of preventing excessive phytoplankton is to use good feeding and fertilization practices (See BMP Nos. 7 and 8). In ponds where Secchi disk visibility often decreases to 12 inches or less, mechanical aeration should be applied at 2 hp/acre or more with efficient aerators. The 10-hp electric paddlewheel aerators commonly used in catfish farming are highly efficient. Aerators should be operated whenever dissolved oxygen can be expected to fall below 4 mg/L. Aeration should be positioned in ponds as explained in BMP No. 4.

In many ponds, it is necessary to operate aerators from midnight until 8 am almost daily from late May until late September. A nighttime dissolved oxygen-monitoring program is necessary to determine if aeration is maintaining

dissolved oxygen concentrations within a desirable range for fish growth.

Because the worst quality water in a pond is near the bottom, structures for storm overflow that take in water from near the pond bottom should not be installed in new ponds. These structures also should be replaced in existing ponds. (Check with NRCS for the correct size trash rack to use.)

## **References**

- Boyd, C. E. and T. Dhendup. 1995. Quality of potential effluents from the hypolimnia of watershed ponds used in aquaculture. *Progressive Fish-Culturist* 57:59-63.
- Boyd, C. E. and C. S. Tucker. 1998. *Pond Aquaculture Water Quality Management*. Kluwer Academic Publishers, Boston, MA.
- Schwartz, M. and C. E. Boyd. 1994. Effluent quality during harvest of channel catfish from watershed ponds. *Progressive Fish-Culturist* 56:25-32.



Auburn University is an equal opportunity educational institution.

"The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, sex, religion, age, disability, political beliefs, sexual orientation, and marital or family status. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD).

To file a complaint of discrimination write USDA, Director, Office of Civil Rights, Room 326-W, Whitten Building, 14th and Independence Avenue, SW, Washington, DC 20250-9410 or call (202) 720-5964 (voice or TDD). USDA is an equal opportunity provider and employer."