



Issue 1999-02

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Using Chemical Start Up for Crab Shedding

Don Webster, Eastern Shore Area Agent

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Recirculating crab shedding operations have become very popular over the years. In Maryland, we estimate that there are now between 500 to 700 units. Watermen have learned that they not only have better control over water quality, they don't need expensive or hard-to-obtain waterfront property - they can shed crabs on land.



Biofilters

The key to all recirculating systems is the biological filter or "biofilter." It consists of "media," materials that provide a surface area for bacteria to grow on. Bacteria use the toxic ammonia that crabs excrete, first turning it into nitrite, which is also toxic, and then to nitrate, which crabs can tolerate at quite high levels.

Filter media can consist of materials that provide a lot of surface area. Many watermen use oyster shell and pea gravel. The oyster shell is inexpensive and has the added

benefit of providing carbonates to the system which can help "buffer," or even out, swings in the pH. If you use oyster shell, it needs to be at least a year old and totally free of any decaying oyster meat or other organisms like barnacles. Fresh shell will cause your system to have many problems and probably lead to severe mortality of crabs.

There are also commercial plastic biofilter materials that are quite useful, although more expensive; they do provide the benefit of knowing exactly how much surface area is provided per cubic foot of material. For example, one such filter material may represent 100 square feet of surface area per cubic foot. There are trade-offs, however. While smaller particles in the biofilter may have more surface area per volume, the filter can clog more quickly and be hard to clean. We have seen many materials used as biofilter media over the years, including pink plastic hair curlers bought in bulk from the manufacturer!

There is a fact of life with all biofilters, however, and that is they all take time to get in condition and grow the bacteria that will purify the water. When new, they will frequently take more than a month to get ready. Even old ones must be started at least three weeks before the first run of crabs comes on. In "the old days" we recommended putting fish or turtles in the system to provide an ammonia source for getting the biofilters conditioned. The problem with this technique is that you do not really know how much ammonia is in the system, so it is difficult to measure and figure out how well the filters are coming on line. You can do a better job by using chemical fertilizers and testing the water to check your filters as they start.

Chemical Conditioners

Ammonium chloride, ammonium sulfate, ammonium hydroxide, or ammonium nitrate can be used in measured amounts to provide a known amount of ammonia for your system. You then measure how much is left after a 12- or 24-hour period to judge how much is converted by your bacteria and, therefore, how advanced the populations are to handle a load of crabs. These fertilizers are usually available at local farm supply outlets.

In getting a biofilter conditioned, it is not necessary to use the total water capacity available for the system, nor is it necessary to run the water through any other components of the system. You can design your system with a "start up loop" that will just run the water through the pump and back into the biofilter. If you have a large water capacity, you can fill it partially and dilute it after you get the filters conditioned and ready for crabs.

Let's look at an example of chemical conditioning (understand that "milligrams per liter" and "parts per million" are the same), in which we'll use ammonium chloride for a 1,000-gallon system. We know that it takes 0.0113 grams of the fertilizer per gallon of water to get an ammonia concentration of one part per million. We want to put 5 parts per million in our system to start out. Multiplying 0.0113 grams by 1,000 gallons gives 11.3 grams for a one part per million mix. We multiply 11.3 grams by 5 parts per million, which gives 56.5 grams of ammonium chloride. The easiest way to do this on a continuing basis is to mark a cup with the amount you require to get one part per million intervals and then just take the amount needed with your customized measuring cup.

In starting a system with a chemical you would add your ammonium source to maintain 5 milligrams per liter (parts per million) of concentration in the system and monitor the water for ammonia, nitrite, and pH daily. You will want to keep the ammonia level less than 10 milligrams parts per million at all times and keep the nitrite levels to less than 5 parts per million at all times. Dilute the system water as necessary in order to keep concentrations within range and be sure to maintain the desired salinity in the system. Salinity should be matched to within 5 parts per thousand of the water that the crabs

came from. Gradually increase the ammonia addition by 2 parts per million, up to a total daily dose of 15 parts per million, which should be added in several dosages throughout the day rather than all at once. Your start-up should be complete in 21-30 days and your system ready to handle that first run of peelers.

The ammonia dosages of the recommended ammonia based fertilizers in order to reach 1 part per million of concentration are:

- Ammonium Chloride - 0.0113 grams per gallon
- Ammonium Sulfate - 0.0135 grams per gallon
- Ammonium Hydroxide - 0.0135 grams per gallon
- Ammonium Nitrate - 0.0169 grams per gallon

Remember that these fertilizers are chemicals and may be caustic or otherwise unsafe if handled improperly. Always use rubber gloves and wear safety glasses when handling them.

Starting your system early and properly can ensure that you will have strong survival of your crabs throughout the season without the high mortality that we frequently see in systems that are not properly conditioned. Remember dead crabs can kill your business!

Water Quality in Aquaculture: Testing and Treatment

Daniel E. Terlizzi, Water Quality Specialist

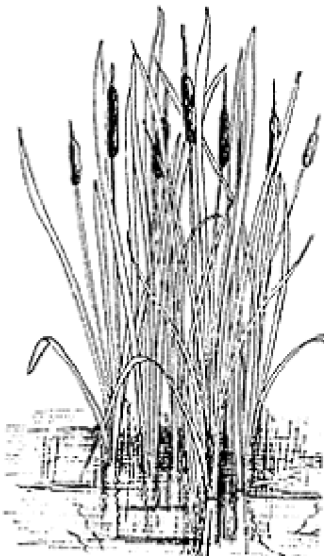
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Testing Is Critical

Fish depend on their aqueous environment to provide oxygen and nutrition to support respiration and growth. However, the water that supplies materials for growth is simultaneously receiving waste products like carbon dioxide and ammonia from the fish. Water quality management in aquaculture maintains the balance between the life support and waste disposal functions of water. To be a successful fish farmer, you must routinely determine if the water quality is suitable for fish culture and what treatments may be required to correct poor water quality.

A fish farmer's most valuable tool in water quality management is chemical testing. Routine testing helps prevent fish losses that result from poor water quality or stress induced disease that results from marginal water conditions. In addition, monitoring water quality provides the grower with valuable information about natural chemical cycles, daily and seasonal, that are operative in the system.

Chemical test kits provide simple, inexpensive analytical methods adapted for field use.



Manufacturers offer combination kits that can perform a complete water quality profile as well as single-function kits for special needs or more simplified testing requirements. Test kits vary in price, quality, and accuracy varying from semi-quantitative visual comparators and drop titrators to research grade electronic colorimeters, dissolved oxygen (DO) and pH meters.

In selecting a test kit, it is important to determine the level of accuracy you require and the number of tests to be performed daily. Whatever test kit you select, a complete water quality profile can usually be performed for less than a dollar per day in 15 minutes or less.

What to Test

Critical Chemistry. Includes chemicals that are most likely to cause fish mortalities.

- Dissolved oxygen (DO). Highly variable with temperature, wind activity, phytoplankton photosynthesis and night respiration.
- Ammonia. A direct excretory product of fish. The toxic unionized form increases with temperature and pH.
- Nitrite. An intermediate in the nitrogen cycle. Bacteria (*Nitrosomonas* sp.) convert ammonia to nitrite; nitrite may then be converted to nitrate (*Nitrobacter* sp.) which is not toxic.

Water Condition Factors. Chemistry that can indirectly influence toxicity.

- Alkalinity. Includes the bicarbonate concentration of the water. An indication of the buffering capacity or the water's ability to resist changes in pH.
- Hardness. The calcium and magnesium concentration of the water. Low calcium can interfere with development of some species.
- pH. The acidic or basic condition of water. A range of 6-9 is fairly common in low alkalinity ponds.

Some fish farmers may find additional testing is necessary. For example, at high fish densities, carbon dioxide can be a problem. In other cases, monitoring iron, chlorides or hydrogen sulfide may be necessary. Depending on the frequency of testing, many fish farmers find that electronic analytical instruments are helpful; for example, DO and pH meters can be invaluable in operations that require frequent testing of a number of ponds. In some fish farming operations, testing can be simplified. The trout grower using water from a limestone spring is less interested in alkalinity and hardness than the hybrid striped bass grower using a recirculation system so testing for these factors could be reduced or eliminated.

Frequency of Testing

How often you should test can vary with the aquaculture system. For example, a recirculation system supporting one pound per gallon of hybrid striped bass will require more frequent monitoring than an open pond system containing 1,000 pounds per acre of channel catfish. Components of critical chemistry should be monitored frequently. Under conditions where DO is likely to be limited (e.g., high water temperature, high fish stocking density, excessive algae growth), oxygen tests may be required several times during the night and day. It is advisable to check ammonia and nitrite levels daily during start-up or until the operator has gained some familiarity with the variation of nitrogen components in the system. Although pH in the range of 6-9 is not likely to be directly toxic to fish, pH levels determine the concentration of the unionized or toxic form of ammonia and should be measured at the same time.

The water condition factors alkalinity and hardness are less variable than the critical chemicals. At high alkalinity (100 ppm), pH is less variable due to the buffering capacity of bicarbonate. In open pond systems, weekly testing of alkalinity and hardness is sufficient; recirculation systems may require more frequent testing.

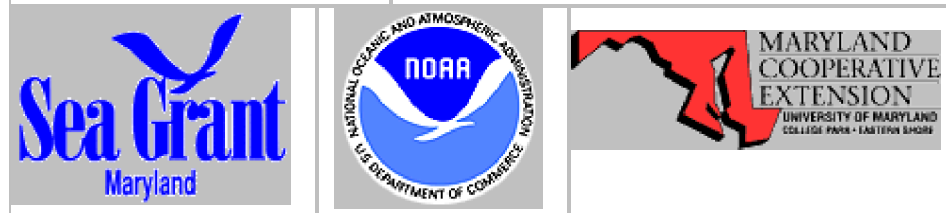
Treatments

Testing provides information that can be used to determine if water chemistry is unsuitable for fish culture and to determine the treatment necessary to correct water quality problems. A regular testing program and careful use of corrective treatments will minimize the risk of fish loss to poor water quality and secondary losses to stress induced disease.

Treatment chemicals suggested are commonly used in other agricultural applications. Check with your local farm supply store for availability and pricing.

For further information on water quality and treatment recommendations, contact the Sea Grant Extension Agent in your area.

Editor: Merrill Leffler, Editor Maryland Sea Grant College 0112 Skinner Building College Park, MD 20742 301-405-6376 Email: leffler@mdsg.umd.edu	http://www.mdsg.umd.edu/Extension/Aquafarmer/Spring99.html
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