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UNIVERSITY OF MARYLAND COLLEGE PARK • EASTERN SHORE

MARYLAND AQUAFARMER ONLINE

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In This Issue:

Managing Crab Shedding Operations

Don Webster, Eastern Shore Area Agent

Whoever wrote, "Summertime, and the livin' is easy..." never worked in aquaculture.

Fish farmers are spending their nights. . .and days. . .worrying about dissolved oxygen and phytoplankton blooms and crashes. Shellfish farmers are setting oysters and moving large numbers of animals from setting tanks to nursery areas while trying to control predators. Even those with tank systems are fretting about power outages from increased electrical use and the legendary Bay area thunderstorms. Soft crab producers are right in there with them.

Crab shedding has long been a staple of Maryland's seafood production. Peelers, crabs which are going to molt their shells to grow, are placed in tanks or floats and held until they shed. Then they are removed and either sold live or cleaned and frozen. The business has expanded to include overseas markets.

Recirculating Systems and Biofilters

While crab shedding used to be carried out in overboard floats, today most production is in shore side tanks - the most common are those which pump Bay water through and out ("flow though" or "single pass" systems). During the past decade, however, recirculating technology for soft crab production has been gaining in popularity. These systems have distinct advantages because they give the operator better control over water quality and don't require expensive shore side property for water access.

Recirculating systems use biofiltration in various forms in order to purify the water. By far the most common has been the trickling biofilter. While not as efficient as some others, these are easy to construct and operate. In crab shedding, as many other businesses, simplicity is often a useful feature in equipment.

Biofilters, no matter what type, are designed to provide a lot of surface area for bacteria to grow. These bacteria take waste products which are highly toxic to crabs, in this case ammonia and nitrite, and convert them into non-toxic nitrate. But biofilters do have some drawbacks. First of all, they take quite a long time to get started -- frequently three to six weeks depending upon how new they are, what the water temperature is, and how much ammonia and nitrite they have to utilize.

They also take time to get back on line in the event of a "crash", where the bacteria die off and have to be restarted. We do not currently have a "magic pill" to pop into a crashed biofilter in order to get it back on line overnight. The classic solution is to dump and replace water in the system until the filter gets back on line, a time consuming and tiresome solution.

Another feature of biofilters is that, like a diesel, they run best under a continuous load. Of course, in the crab business, where the peeler runs fluctuate with the phases of the moon, this is a frequent problem with system loads going up and down every few weeks. In order to figure out what is going on in your system, you must do a few very simple but extremely important water tests in order to keep track of problems.

Keeping Track of Water Quality

Temperature can easily be measured with a thermometer kept in the tanks and checked every few days or at least once a week. While it is not usually possible to adjust temperatures, keeping the water reservoir in the ground or shaded can usually maintain the temperature around the 80¡ F mark.

Salinity should be kept within 5 parts per thousand of the waters the crabs were harvested from. If your system is filled with Bay water, you should try to take it from the general area where you caught the crabs. If you are making up your own sea water, you will need to calculate the amount of sea salt needed to get the required salinity. Never use iodized salt and be careful of using municipal water since it is frequently chlorinated. The salinity can be measured with a simple hydrometer available at an aquarium or pet supply. Maryland Sea Grant Extension Specialists can provide you with charts for using these or for calculating salt needed to make up system water.

Oxygen is a critical feature in any aquaculture system and should be measured weekly in the shedding tanks, in the reservoir, and as the water comes out of the biofilter. Remember, not only do the crabs need oxygen but the bacteria use it in detoxifying your water be sure that there is enough to keep the system operating properly. Readings should be at or above 5 parts per million in the shedding tanks and no less than 2 parts per million coming out of the biofilter. Oxygen can be measured with electronic meters or with chemical test kits. While meters are more convenient, the good ones necessary in a commercial operation will usually cost over $500. Chemical test kits are a bit more time consuming but much cheaper and are usually the right choice for crab shedding operations.

Ammonia and **nitrite** need to be monitored daily in the shedding tanks and after the water exits the biofilter. This lets you know how the bacteria are doing in removing the loads. Total ammonia should be kept below one part per million (mg/L) and nitrite below one half part per million. Note: Crabs "busting" and backing partly out of the shell before dying are a classic symptom of nitrite poisoning. The measurements for ammonia and nitrite can be done with simple chemical color comparator test kits. They are inexpensive and refills can be purchased to keep them current.

pH is the measurement of the acid/base relationship of the water and should be measured at least weekly and the range kept between 7.0 and 8.0. Remember that this is a logarithmic scale and a one point shift in pH is actually ten times as great! Remember that high pH and high ammonia readings will result in a lot of un-ionized ammonia which is deadly to crabs. If your ammonia readings are high and the pH is low, the animals will probably survive. If ammonia and pH are high, you will have a lot of dead crabs on your hands. pH is easily measured with chemical test kits, test strips, or pocket meters that have become very affordable.

Alkalinity, an indicator of carbonates in the system, should be measured weekly. Alkalinity helps to "buffer" the pH, preventing wide swings which can stress the animals. When you use a trickling biofilter, with substances like oyster shell and dolomite, alkalinity is usually not a problem. It should be kept above 100 parts per million and is easily measured with a chemical titration test kit.

Test Kits and Records

Test kits, meters, and other equipment for crab shedding are available through any supply house

that serves the industry. The two major manufacturers of test kits are LaMotte of Chestertown, Maryland and Hach, which is located in Loveland, Colorado. Both make color comparator and titration kits for the tests mentioned in this article. For further information contact any Sea Grant Extension Specialist.

Remember, if you don't test your system and don't keep the data in written form, it's very hard to figure out what has gone wrong if you start to experience problems. Keeping your information from year to year will give you a better idea of how you are doing and let you maximize the performance and, more importantly, profit from your business.

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Use of Single Application, All Season Fertilizer in Maryland Farm Ponds

Don Webster, Eastern Shore Area Agent and Reginal Harrell, Finfish Aquaculture Specialist

Fertilizing ponds in order to enhance phytoplankton blooms is a management method that has been used for many years. The resultant bloom is used to increase phytoplankton production of sport fish populations. It can also result in decreasing the amount of sunlight that reaches the bottom in shallow areas of ponds, thereby assisting in shading out unwanted vegetation.

For several years the Sea Grant Extension Program has been working with John Hall, Agriculture Science Agent at the Kent County Extension Office and a local farmer, Carl Plummer, by using his ponds for teaching and demonstration. Carl has allowed his ponds to be used for programs each Fall. In prior years he has limed his pond according to Extension soil test results and has used weed control strategies in order to control unwanted vegetation in one of his two ponds.

This year it was decided that one of Plummer's ponds might benefit from fertilizer applications. In order to minimize the labor normally involved in a constant fertilization program, the use of a single, all season product was tried. The Scotts Company has introduced a product under the name of Pondmaster(tm). Recommended application rates are 35 pounds per acre. The application is in a time release formula which provides nutrients throughout a full season. This cuts down on the amount of labor that is needed to treat ponds and, in the case of recreational ponds like Carl's, can save the pond owner a lot of time during the summer when he would otherwise have to maintain a fertilization schedule.

The pond that is being treated is two surface acres in size. It is the smaller of the two on his farm, is also the newer, and is nicely balanced with introduced sport fish populations of bass and bluegill. Alkalinity was increased to 80 ppm through the application of 2,000 pounds of ground agricultural limestone during 1995.

Carl's other pond has presented many problems over the years. It was built some time ago and has significantly filled in throughout its range. Kent County is also in one of the prime wintering areas for Canada geese and the nutrient input from the large flocks which normally spend time there has been very heavy. The nutrients, coupled with the shallow water, have caused a significant problem with filamentous algae infestation. Filamentous and duckweed normally present the two greatest aquatic weed problems in this area. At the present time, no strategies are planned for this older pond since the most logical one is to renovate it, which could only be done at significant expense to the owner.

The ponds will be featured in a demonstration of pond management techniques this fall in late September or early October. If you would like to find out more about how to manage your ponds and see how the single application fertilizer worked in this area, be sure to watch for an announcement in the Fall issue of the Maryland Aquafarmer. You can also contact a Maryland Sea Grant specialist.

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Aquaculture in the Mid Atlantic Joins with Interstate Seafood Seminar

November 6-7, 1997

Ocean City Sheraton Hotel
Ocean City, Maryland

Don Webster, Eastern Shore Area Agent

Aquaculture in the Mid Atlantic is a familiar program to many readers. It has been the longest running aquaculture educational program in the region. In recent years "AMA" has co-sponsored its meetings with other groups, such as Aquaculture Expo and the U.S. Trout Farmers Association. That tradition continues for 1997 with a program that will mean a lot to shellfish producers in the mid-Atlantic. In November, the program will join with the Interstate Seafood Seminar to produce an educational event with a lot of impact. Co-chairmen for the conference this year are Mike Oesterling of the Virginia Institute of Marine Science, Gef Flimlin of the Rutgers Sea Grant Advisory Service, and John Ewart of the Delaware Aquaculture Resource Center.

The Interstate Seafood Seminar is a longtime annual conference for seafood health officials. They have always included a lot of information on the Interstate Shellfish Sanitation Conference (ISSC) and have usually incorporated culture issues into their program. At the joint meeting, shellfish producers and health officials will be able to discuss common concerns in the area of production and quality assurance.

The program will be held at the Ocean City Sheraton in Ocean City, Maryland. On Thursday, November 6, the two groups will come together to discuss topics such as human and environmental health issues that primarily affect the industry in the region from New York through North Carolina. Speakers include the Virginia Institute of Marine Science's Mark Luckenbach, long known to Delmarva growers.

On Friday, November 7 the groups will split and Aquaculture in the Mid Atlantic will feature production topics for growers. These will include sections on algal and nursery culture for commercial shellfish producers. Topics and speakers are:

- "Cultured Microalgal Feeds for Shellfish" by Gary Wikfors, Research Microbiologist, National Marine Fisheries Service, Milford, Connecticut
- "Use of the Continuous Bag Method for Commercial Algal Production" by John Bayes, Seasalter Shellfish (Whitstable) Limited, Whitstable, Kent, England
- "Continuous Algal Production Using Turbidostat Technology by Kelly Rusch, Louisiana State University, Baton Rouge, Louisiana
- "Preparation and Use of Algal Pastes for Shellfish Hatchery Operations by Garry Baptist and Don Meritt, University of Maryland Center for Environmental Science, Cambridge, Maryland
- "In-Water Shellfish Nursery Systems by Gregg Rivara, Cornell Cooperative Extension, Southold, New York
- "Field Nursery Culture of Hard Clams" by Gef Flimlin, Rutgers Sea Grant Advisory Service, Toms River New Jersey

The program is being offered on an "a la carte" basis, that is, attendees may register for any day and either or both seminars as well as meal service. Opportunity will be given to purchase tickets for the famous ISS Seafood Banquet which is held during the conference. For registration information and to receive a brochure about the program, please contact your local Sea Grant Extension Program specialist.

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Oyster Disease Research and Aquaculture

Merrill Leffler, Sea Grant Extension
Communications Specialist

That parasitic disease in the Chesapeake Bay - Dermo (*Perkinsus marinus*) and MSX (*Haplosporidium nelsoni*) - has had a devastating toll on oyster stocks for nearly a decade is not new news. The new news has to do with research progress on understanding disease for developing techniques that can benefit oyster populations in the Bay - and, in the long run, benefit commercial harvesters and oyster planters as well.

The research effort on oyster disease, legislated by Congress in 1989, and now administered by the National Sea Grant College Program, has the following goals.

- Optimize ways for managing around disease, both for aquaculture and restoration of wild stocks
- Develop molecular tools for detecting and monitoring the onset of disease and certifying disease-free spat
- Develop disease-resistant strains of oysters
- Determine the processes of parasitic infection
- Improve understanding of the oyster's immune response, with a focus on means for improving disease resistance or reducing parasite virulence.

Studies funded each year win support based on the quality of the science, ongoing progress and their potential for practical application. The results of some of this research are now being employed or tested in field trials. Here are some examples.

Diagnosing Disease. Current techniques for determining whether oysters have Dermo can take as long as a week and even then, very low levels of parasitic infection may not even be revealed. New molecular probes are enabling rapid diagnosis of disease and detection of extremely low levels. One molecular probe now being field-tested can detect a single Dermo cell in an oyster. Such capabilities could serve as an early warning for growers to move oysters into areas which are at lower risk for disease. These new molecular probes will also improve the ability to determine that oyster seed is disease free, reducing the risk of moving the parasite into areas that are presently free of disease.

To learn about research projects underway and those that have been funded since the beginning of the Oyster Disease Research Program, visit the National Sea Grant College web site at: http://www.mdsg.umd.edu/NSGO/ research/oysterdisease/projects.html

For recent articles on oysters from Maryland Marine Notes, including "A Question of Survival: Helping Oysters Overcome Disease," visit the Maryland Sea Grant web site at: http://www.mdsg.umd.edu/MarineNotes/index.htm

Developing Disease-Resistant Strains. A number of efforts are underway; they include traditional techniques for breeding oysters that are resistant to disease and evaluating oysters from other regions such as the Gulf of Mexico where oysters may have already developed improved resistance to Dermo. In addition, researchers are in the early, but promising, stages of developing potential therapeutants that could reduce the virulence of Dermo.

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Countdown to Federal Seafood Safety Program

By December 18, 1997, seafood processors nationwide must have in place a program to meet the requirements of a federal food safety program. Known as HACCP -- Hazard Analysis

Critical Control Points -- its goal is to protect consumer health by preventing human hazards from contaminating seafood.

HACCP will require processors to formally analyze potential hazards; identify critical control points in processing; establish preventative measures, monitoring procedures and corrective actions; maintain effective record keeping; and establish procedures to verify that the system is working.

The National Sea Grant Program is supporting a Seafood HACCP Alliance for training and educating processors across the nation. Sea Grant Seafood Specialists are working with Food and Drug Administration, the U.S. Department of Agriculture, the National Marine Fisheries Service, state agencies and other orgranizations to put on HACCP training workshops and to produce educational materials that can be directly applied to plant operations.

In this region the Sea Grant and Cooperative Extension Programs of the University System of Maryland, Virginia Sea Grant College Program and North Carolina are also publishing *HACCP Countdown*, bio-monthly bulletins on topics that should prepare processors for HACCP. To date, three issues have been published. Issue #1 highlights the prerequisites for implementing HACCP; Issue #2 addresses the monitoring of Sanitation Standard operating Procedures; and Issue #3 focuses on the first formal steps of HACCP identification.

Current and previous issues of *HACCP Countdown* are available on the web, along with more information on HACCP, at the Mid-Atlantic Sea Grant HACCP website: http://www.mdsg.umd.edu/Extension/HACCP/. For information about HACCP in Maryland, contact Tom Rippen.

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Aquaculture Fact Sheets

Maryland Sea Grant Extension produces a variety of materials for assisting in the aquaculture industry. Among the publications are fact sheets listed below. A web site currently under construction will make these available on the Internet. To order printed copies, write us at Maryland Sea Grant, 4321 Hartwick Road, Suite 300, University of Maryland, College Park, Maryland 20740. Single copies are free.

Finfish Workbooks

Fish Culture in Maryland: Weighing the Pros and Cons. R.M. Harrell, 4pp. UM-SG-MAP-88-05.

Cage Culture in Maryland. R.M. Harrell, 4pp. UM-SG-MAP-88-06.

The Culture of Striped Bass and Its Hybrids in Cages. R.M. Harrell, 4 pp. UM-SG-MAP-88-07.

Understanding Fish Pricing: From Production to the Table. D. Lipton, 4 pp. UM-SG=MAP-90-01.

Figuring Production Costs in Finfish Aquaculture. D. Lipton, R.M. Harrell, 8 pp. UM-

Oyster Workbooks

Producing Oyster Seed by Remote Setting. R.E. Bohn, D. Webster and D. Meritt, 11 pp. UM-SG-MAP-95-03.

Purchasing Seed Oysters. D. Websterand D. Meritt, 4 pp. UM-SG-MAP-85-02.

Stabilizing Oyster Ground. D. Webster and D. Meritt, 6pp. UM-SG-MAP-88-04.

Soft Crab Workbooks

SG-MAP-90-02.

What is Aquaculture? R.M.Harrell, 4pp. UM-SG-MAP-91-01.

Liming Aquaculture and Farm Ponds in Maryland. R.M. Harrell, 4 pp. UM-SG-MAP-91-02.

Farm Pond Management: Increasing Production through Fertilization. R.M. Harrell, 8 pp. UM-SG-91-03.

Diluting Water Quality Samples for Soft Crab Shedding. J. Hochheimer. UM-SG-MAP-88-02.

Using Water Quality Conversion Tables for Soft Crab Shedding. J. Hochheimer, 7 pp. UM-SG-MAP-85-03.

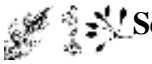
Water Quality Conversion Tables for Soft Crab Shedding. J. Hochheimer, 2 pp. UM-SG-MAP-85-01. Water Quality in Soft Crab Shedding. J Hochheimer, 6 pp. UM-SG-MAP-88-01.

Crawfish Workbooks

Crawfish Culture in Maryland. R.M. Harrell, 6 pp. UM-SG-MAP-87-02.

Aquatic Plant Identification and Management Workbooks

Series 1 and 2. *These fact sheets were written by R.M. Harrell and J.N. Hochheimer.*



Series 1

Muskgrass, UM-SG-MAP-89-03.
Filimentous Algae, UM-SG-MAP-89-04.
Planktonic Algae, Um_SG-MAP-89-05.
Duckweed, UM-SG-MAP-89-06.
American Lotus Water Lily, UM-SG-MAP-89-07.
White Water Lily, Um-SG-MAP-89-08.
Water Milfoil, UM-SG-MAP-89-09.
Coontail of Hornwort, UM-SG-MAP-10.
Redhead Grass, UM-SG-MAP-89-11.
Sago Pondweed, UM-SG-MAP-89-12.

Series 2

Alligator-Weed, UM-SG-MAP-92-02.
Arrowheads, UM-SG-MAP-92-03.
Bladderwort, UM-SG-MAP-92-04.
Bushy Pondweed, UM-SG-MAP-05.
Cattail, UM-SG-MAP-92-06.
Creeping Water Primrose, UM-SG-MAP-92-07.
Curly Leaf Pondweed, UM-SG-MAP-92-08.
Elodea, UM-SG-MAP-92-09.
Fanwork, UM-SG-MAP-92-10.
Hydrilla, UM-SG-MAP-11.

Series 3 and 4. *These fact sheets were written by R.M. Harrell and R.E. Bohn.*

Series 3

Bulrush, UM-SG-NAP-96-01.
Common Reed, UM-SG-MAP-96-02.
Giant Cutgrass or Water Millet, UM-SG-MAP-96-03.
Maidencane, UM-SG-MAP-96-04.
Pickerelweed, UM-SG-MAP-96-05.
Slender Pondweed, UM-SG-MAP-96-06.
Water Stargrass, UM-SG-MAP-96-07.
Water Wool or Pithophora, UM-SG-MAP-96-08.
Widgeon Grass, UM-SG-MAP-96-09.
Wild Celery, UM-SG-MAP-96-10.

Series 4

Brazilian Elodia, UM-SG-MAP-96-11.
Buttonbush, UM-SG-MAP-96-12.
Horned Pondweed, Um-SG-MAP-96-13.
Marsh Pennywort, UM-SG-MAP-96-14.
Sedges, UM-SG-MAP-96-15.
Smartweeds, UM-SG-MAP-96-16.
Soft Rush, UM-SG-MAP-96-17.
Spikerush, UM-SH-MAP-96-18.
Watermeal, UM-SG-MAP-96-19.
Water Pennywort, UM-SG-MAP-96-20.
Willows, UM-SG-MAP-96-21.

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