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UNIVERSITY OF MARYLAND
COLLEGE PARK • EASTERN SHORE

MARYLAND AQUAFARMER ONLINE

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Aquaculture Conference, September 26-28, 1996

Don Webster, Eastern Shore Area Agent

AQUACULTURE IN THE MID ATLANTIC, the largest continuing aquaculture education program in this region, will meet with the U.S. Trout Farmers Association (USTFA) and the Pennsylvania Aquaculture Association (PAA) this fall for one of the best meetings yet! The two-day program will be held on September 26 and 27 at the Chateau Resort and Conference Center in the Poconos of Pennsylvania. A full day of tours will be held on Saturday, September 28, and will include stops at three commercial trout hatcheries.

A fish farming trade show will open at 8 a.m. on Thursday, September 26. At 9 a.m. the seminars will begin with remarks by Randy MacMillan of Clear Springs Foods of Buhl, Idaho, President of USTFA and Charles Conklin of Big Brown Fish Hatchery of Effort, Pennsylvania, President of the PAA. Educational topics throughout the day will provide a range of fish health and management information from such nationally known experts as Ken Cline of Cline Trout Farms in Boulder Colorado, Bill Klontz of Nelson & Sons, Inc., Moscow, Idaho, and Dr. Julia Oriani of the FDA's Center for Veterinary Medicine. Other speakers for Saturday will include Chuck Hicks of Missouri, who will speak on production and feeding rates and Dr. Julia Bebak from the University of Pennsylvania, who will talk about bacterial gill disease in young rainbow trout. John Cassidy of Perdue Speciality Feeds will give an update on world feed prices and Todd Powless of Ziegler Brothers will present a program on reducing production costs. There will be a reception in the evening in the trade show area.

Friday's program, September 27, features concurrent sessions in the morning and afternoon. A Recirculating Workshop will run from 9 a.m. until noon. Jeff Hinshaw will discuss production of trout fingerlings in recirculating water systems and will be followed by E.W. Wade, Steve Summerfelt, and Joe Hankins on economies of scale in recycling systems. B. Watten will provide an overview of the National Biological Service's Wellsboro research program; the session will conclude with T.J. McAdams, R.G. Reinhard, George Flick, George Libey, and S.A. Smith from Virginia Tech discussing the incidence of pathenogenic microorganisms in recirculating aquaculture systems containing rainbow trout. This program will provide an excellent update on the state of recirculation aquaculture technology.

Concurrent with the recirculation session will be a general session on the following: John Mitchell will discuss oxygen and production; Tom Tomsas will give a presentation entitled Birds, Birds, Birds, which will cover the bird depredation problem in the aquaculture industry. Kim Harrison, Executive Director of the Northeastern Regional Aquaculture Center, will give an update on currently funded research directed at industry problems. The session will conclude with Mike Willensky of Coastal Engineers, Inc., talking about the use of submerged cages for the growout of trout and a final session on solids removal in aquaculture effluent.

Two concurrent sessions in the afternoon will address critical topics for the industry. In a special workshop from 1 until 5 p.m., speakers from industry, academia, and government agencies will discuss the important topic of quality control and HACCP, in the trout industry, from production through processing.

The concurrent afternoon session will include a discussion of the National Aquaculture Development Plan by Dr. Hank Parker of USDA and an overview of national aquaculture legislation by Rich Bohn, Executive Director of the National Aquaculture Association. Pennsylvania topics will follow with presentations by a legislator and a representative of the Pennsylvania Fish Commission. After a short break, Greg Hanson from Penn State University will cover consumer profiles in fish marketing. This will be followed by a talk entitled Anti-trust: You Talk Price, You' re Dead Meat! by Associate Professor Dennis Corgill of the Widener University School of Law in Harrisburg, Pennsylvania. Non-traditional water resources for aquaculture will be presented by Joe Hankins of the Freshwater Institute in Shepardstown, West Virginia, and will wrap up the afternoon session.

On Saturday morning, September 28 at 8 a.m., the tour will leave and will include lunch during a stop at one of the three production facilities.

This special program agenda differs from previous meetings of AQUACULTURE IN THE MID ATLANTIC and is a must for those considering trout production, cold water aquaculture, and recirculating systems, or for those interested in fish health and nutrition issues. For more information, including registration, lodging, and a brochure on the program, contact any Sea Grant Extension staff. See back page for phone numbers and e-mail addresses. This program is open to all persons regardless of race, color, religion, national origin, sex, or handicap.

AQUACULTURE IN THE MID ATLANTIC began as a one day conference on shellfish in 1979 and has grown to an annual educational program sponsored by the Land Grant and Sea Grant Colleges, aquaculture associations, and agencies responsible for aquaculture development in the states of Maryland, Virginia, Delaware, Pennsylvania, West Virginia, and New Jersey.

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Pond Management Program At Wye Field Day August 22, 1996

Don Webster, Eastern Shore Area Agent

Reggie Harrell, Aquaculture Specialist, and Don Webster, Area Agent, with the Maryland Sea Grant Extension Program will conduct a program at the Wye Field Day on August 22, 1996. Using one of the research facilities freshwater ponds, they will cover the uses and design of impoundments to improve operational management. Ponds are used for sediment control, landscaping, irrigation, fire protection, livestock watering, swimming, and fish production. Often, several uses are combined into one pond. Proper design characteristics can minimize problems or enhance opportunities that develop over time.

Water quality management is the key to having a well managed pond with healthy populations of fish and minimal weed problems. Major factors will be discussed and test equipment will be displayed and demonstrated that can help to build a record of your pond's parameters. Soil testing for proper lime recommendations can help to buffer the water, preventing large fluctuations in pH which can stress fish populations. Fertilization techniques can also help to increase the aquatic productivity of your pond but must be carefully planned and carried out in order to prevent problems from occurring. The factors involved in carrying out a successful fertilization program will be discussed.

While aquatic plants are an important part of the aquatic environment, an imbalance can quickly

become a problem. Various types of vegetative problems found in the region will be covered, along with displays of control agents and a discussion of the techniques and tools available to control unwanted vegetation in your pond.

One of the most useful and widely practiced aspects of having a pond is for recreational and commercial fish production. The program will include information on proper species, stocking strategies, and management techniques for building successful populations of fish for recreational opportunities as well as use of ponds for commercial production of fish through aquaculture, a potential economic alternative to other agricultural crops.

We invite you to come to the Wye Field Day and enjoy a full day of interesting education programs on agriculture including field crops and soils, horticulture, and animal sciences along with the pond management program. Clinics will be featured during the morning and include landscaping for the Bay, the basics of composting using a low-cost aeration system, identifying home garden pests, basics of nutrient management, and worker protection standards for growers.

A buffet lunch will be held at noon and an afternoon crab feast will be held after events are over. Tickets for both meals will be available at the registration area. The program is open to all persons without regard to race, religion, national origin, sex, handicap, or age. We look forward to seeing you at the Wye Field Day 96. For further information and a brochure announcing activities at the Wye Field Day, contact your nearest Maryland Cooperative Extension Service office.

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Economic Impacts Of Aquaculture In The U.S.

Douglas W. Lipton, Marine Economic Specialist

A new report, *Economy-wide Impacts of U.S. Aquaculture* (from the Oklahoma Agricultural Experiment Station at Oklahoma State University), documents the linkages that aquaculture production has within the U.S. economy. The economic study was limited to the impacts of baitfish, catfish, crawfish, ornamental fish and trout production in 1992. Other species were not produced in significant quantities to justify the added expense in analyzing their impacts. This limitation left specific data about Maryland out of the analysis even though ornamental production in Maryland is significant.

Based on 1992 figures, the study found that approximately $5.6 billion of the U.S. gross domestic product and 181,000 full-time equivalent jobs were linked to aquaculture production. Economic impacts of production occur in two directions, downstream to the supplying industries, and upstream to the value-added industries. Most of the economic activity and jobs (69%) are related to the upstream or value-added segment of the industry, transportation, processing and marketing. Aquaculture producers purchase inputs such as feed from supporting industries, which generate income and other spending within those industries.

To demonstrate the linkages of fish production and processing to other sectors of the economy, it is interesting to examine where a dollar in expenditures goes. Using catfish as a representative species, Table 1 illustrates the distribution of expenditures. In contrast to production cost, where the bulk of the expense goes to feed, most of the cost of catfish processing is paid to labor as seen in Table 2 from the same study.

Table 1. Distribution of production costs.

Part of $1 cost that goes to:	Part of $1 Cost Catfish Production
Other Fish Operations	$0.13
Feed	$0.31
Ag. Chemicals	$0.05
Oil, Lubricants	$0.06
Banking, Finance	$0.11

Table 2. Distribution of processing costs.

Part of $1 cost that goes to:	Part of $1 Cost Catfish Production
Labor	$0.66
Paper Containers	$0.12
Repair and Maintenance	$0.09
Commercial Building	$0.07
Utilities	$0.07

Labor	$0.19
Farm Structure	$0.07
Repair and Maintenance	$0.03
Miscellaneous	$0.04
Other/Capital	$0.02

Only in the states of Mississippi and Idaho did aquaculture make a significant contribution to a state's gross domestic product (GDP), accounting for 2.5% of the GDP, 6.3% of the total employment in Mississippi; and 0.9% of the GDP, 2.3% of employment in Idaho. As production of other aquaculture species continues to grow, so will its contribution to regional economic activity as measured by industry output and employment.

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Water Quality Issues In Aquaculture: Ammonia

Dan Terlizzi, Water Quality Specialist

This is the first installment of a series on water quality issues that aquaculturists need to be concerned with.

The second -- on nitrite -- appears in the Winter 1997 issue.

Overview

In any aquaculture operation, whether it is a pond or recirculating system, water quality is your major concern -- successful rearing of fish begins with a healthy aquatic environment. Intensive culture, however, often taxes that environment: fish produce waste products, primarily ammonia, that unless converted to non-toxic nitrate can set into motion processes that lead, in addition to direct toxicity, to high bacterial counts, oxygen depletion, fish disease, and mortality.

Management of an aquaculture system begins with monitoring for important chemical properties and water conditions -- such chemical testing is the basis for remedial actions you may have to take. The more you know about the chemistry of your system, the better decisions you may be able to make when faced with a problem. In this and the next several issues of Maryland Aquafarmer, we will cover special topics of concern in maintaining healthy water quality, in particular the nitrogen cycle. The nitrogen cycle is the movement of nitrogen, in various forms, between the atmosphere and terrestrial and aquatic environments in response to biological and physical activity.

Introduction

Ammonia and nitrite two of the most toxic compounds (nitrite is the other), in the nitrogen cycle. This cycle begins with the direct excretion of ammonia by fish, a consequence of fish metabolizing protein and amino acids in their feed. Once excreted, ammonia can be absorbed by algae and aquatic vascular plants as their nitrogen source, or it can be oxidized by bacteria in a process called nitrification to the oxidation products nitrite and nitrate.

Because ammonia removal is dependent on natural microbial processes in most aquaculture facilities, changes in bacterial metabolism and population can produce increased ammonia levels and lead to fish stress or mortality. Such increases can occur rapidly because of the high feeding rates necessary to support product: high feeding rates lead to high waste excretion by fish. The protein level feed supplies may be as much as 40%; about 15% by weight of the protein supplied is ammonia. Feed not consumed by the fish or the protein and amino acids not used in growth and excreted can contribute to high ammonia concentrations.

Although fish excretion is the primary source of ammonia in aquaculture systems, other natural processes may contribute ammonia, for instance, the decline or grazing of algal (phytoplankton) blooms and denitrification processes in sediments.

Toxicity of Ammonia

Just how toxic ammonia is depends on the form it takes: the un-ionized form of ammonia, NH_3, is very toxic, while the charged or ionized form, NH_4^+, is generally non-toxic.

The form of ammonia depends on pH. As pH increases (becomes more basic), ammonia is converted to the more toxic or un-ionized form, NH_3, while at low pH or acidic conditions, ammonia is mainly the ionized form, NH_4^+.

Ionized	Un-Ionized
NH_4^+	NH_3 H^+
pH=6	pH=10
less toxic	more toxic

Ammonia toxicity, though not well understood, involves the movement of ammonia from the water into the gills of the fish.

How sensitive fish are to ammonia will vary with species, age, water quality, and acclimation to their environment. In general, ammonia levels above 0.5 parts per million at a pH above 8 may result in fish mortality.

Treatments for Ammonia

Methods for decreasing the risk of ammonia toxicity include direct reduction of ammonia concentrations and reduction of pH.

Reducing. Ammonia concentrations can be reduced by diluting your system's water with water from wells or from water storage. In recirculating systems, you can use biological filters which also remove ammonia by the action of nitrifying bacteria that sequentially oxidize ammonia to nitrate, then nitrate which is not considered toxic. Hydroponic systems have been used to remove ammonia while in some crab shedding systems and marine aquaria, algal biological filters have been used for the same purpose. In freshwater systems, ion exchange media such as zeolite clays can be used. The ion exchange process is the chemical "swapping" of a non-toxic charged chemical like sodium (Na^+) or potassium (K^+) for ammonium ($NH4^+$). These chemical filters can be recharged by flushing them with sodium chloride solutions to displace the attached $NH4^+$ by substituting Na^+.

pH manipulation. Maintaining a low toxic ammonia concentration by pH reduction can be accomplished in several ways. Because photosynthesis (the process by which chlorophyll-containing cells in green plants such as algae convert light to chemical energy and use inorganic nutrients to synthesize organic compounds and produce oxygen) increases pH, photosynthesis can be reduced by reducing algal populations. Another technique is by liming or adding bicarbonate to ponds which will buffer pH at about 8 and reduce daily pH fluctuations, which can be stressful at high ammonia levels.

Testing

Two methods are available for field determination of ammonia; both tests give a total ammonia reading but cannot distinguish between toxic and the ionized forms of ammonia. The Nesslerization method is widely used in fresh water ammonia testing. Sample pretreatment with zinc sulfate is often required to prevent interference by calcium, iron, magnesium and sulfide. The Nesslerization procedure is not considered suitable for use in salt water without modification. In saltwater testing the salicylate procedure is sensitive and rapid. Some testing kit manufacturers are adapting the salicylate procedure to freshwater testing because of the increased sensitivity and lack of interference.

Ammonia should be tested every day, particularly in high density aquaculture systems. Because of

the dependence of ammonia toxicity on pH, you should also perform tests to verify pH is at a safe level.

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New Publications & Newsletters From Maryland Sea Grant

For subscriptions or orders, contact Maryland Sea Grant, 4321 Hartwick Road, Suite 300, University of Maryland, College Park, Maryland 20740, tel. (301) 405-7500 or visit our electronic publication catalog

- **THE EASTERN OYSTER: *CRASSOSTREA VIRGINICA***
  Victor Kennedy, Roger I.E. Newell and Albert F. Eble, editors

  The most comprehensive synthesis on the biology of the eastern oyster in thirty years, this new book from Maryland Sea Grant, covers such topics as anatomy, the shell, larval biology, feeding, reproduction, genetics, predation, diseases and defense mechanisms, aquaculture and management. 734 pages, hard cover, 8 1/2 x 11 format, with 400 photographs, drawings and diagrams. Price $95.00. To order, send a check to: Publication Dept., Maryland Sea Grant, University of Maryland, 4321 Hartwick Road, Suite 300, College Park, Maryland 20740.

  For more information and to see sample pages, illustrations, and a complete table of contents, visit the special web page on The Eastern Oyster.

- **REMOTE SETTING OF OYSTERS: A NEW WORKBOOK**

  Now available: *Producing Oyster Seed by Remote Setting* by Richard E. Bohn, Donald Webster and Donald Meritt, Maryland Sea Grant Extension Program.

  This 12-page workbook, a joint publication by the Northeastern Regional Aquaculture Center (NRAC Bulletin No. 220) and Maryland Sea Grant Extension covers a range of considerations in putting together a remote setting operation. Among the topics are: selection of setting and nursery sites, cultch containers, water delivery, feeding oyster larvae, and nursery areas. To order a copy, contact NRAC at University of Massachusetts, Dartmouth, North Dartmouth, Massachusetts 20747 or Maryland Sea Grant.

- **SEA GRANT PROGRAM DIRECTORY, 1996-1997**

  Describes the Maryland Sea Grant Program with common language summaries of current research projects, overviews of the Sea Grant Extension Program, communication and education programs. 56 pages. Contact Maryland Sea Grant for a copy.

- **SEA GRANT PUBLICATIONS CATALOG**

  A complete listing of all publications and audio-visual materials available from Maryland Sea Grant. The catalog is now on-line and you can order publications directly at http://www.mdsg.umd.edu/Pubs.

- **MARINE NOTES**

  This eight-page bi-monthly newsletter features a "spotlight" article in each issue on marine science and policy issues and covers topics of significance to those engaged in research, business, management, policy and education in the Chesapeake Bay. Past spotlight articles, as well as other selected articles, are available on Maryland Sea Grant's World Wide Web at
  http://www.mdsg.umd. edu/MarineNotes/index.html

- **SEAFOOD QUALITY REPORT**

  A periodic report for the seafood industry, providing information to assist Maryland processors to produce the highest quality seafood products. The newsletter is part of a cooperative seafood quality assurance program among the University System of Maryland's Sea Grant Extension Program, Cooperative Extension Service and the

University of Maryland Center for Environmental Science' Horn Point Laboratory, the Chesapeake Bay Seafood Industry Association and the Maryland Department of Natural Resources. The Summer 1996 issue is now available from Maryland Sea Grant. For further information, contact Sea Grant Seafood Technology Specialist Tom Rippen at (410) 651-6636.

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Web Sites for Aquasurfers

In the last issue of Maryland Aquafarmer, we published a list of world wide web sites that should interest those in the aquaculture industry. Here are several more sites.

Mid-Atlantic Sea Grant Programs
http://www.mid-atlantic.seagrant.org

Sea Grant programs across the nation have individual and regional home pages. Visit the Mid-Atlantic region, which includes New Jersey, Delaware, Maryland, Virginia and North Carolina. You can customize searches and locate a wide range of aquaculture material. To reach other Sea Grant sites, you can begin with http://www.mdsg.umd.edu/NSGO/NationalSeaGrant.html.

Maryland Aquaculture Association
http://www.eaglenet.com/PaxP/maa/

The Maryland Aquaculture Association has set up this website as a service to its members. The purpose of the MAA and the web page is to promote Maryland aquaculture. The association will showcase members who produce and sell aquaculture products.

National Biological Service
http://www.epix.net/~libnbswe/

Learn about current and future projects associated with fisheries and aquaculture conducted by the National Biological Service at the Wellsboro Research and Development Laboratory, the Tunison Laboratory of Aquatic Science, and the Leetown Science Center.

Center for Tropical and Subtropical Aquaculture
http://lama.kcc.hawaii.edu/praise/

North Central Regional Aquaculture Center
http://ag.ansc.purdue.edu/aquanic/ncrac.htm

One of five regional aquaculture centers established by Congress and administered by the U.S. Department of Agriculture, NCRAC is an administrative unit that serves the states in the North Central Region: Illinois, Indiana, Iowa, Kansas, Michigan, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin.

Aquaculture Magazine
http://www.ioa.net/home/aquamag/

Includes feature articles from the magazine, articles by columnists, Aquaculture Outlook, back issue list and a good deal of other information.

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New National Sea Grant Director

Ocean scientist, educator and businessman Ronald C. Baird became the new director of the National Sea Grant College on June 3. NOAA administrator D. James Baker called Baird's selection "an exceptional choice." Baird will direct the National Sea Grant Program, a network of over 300 colleges, universities, research institutions and marine organizations that work in partnership with industry, the federal government and state governments to support marine and Great Lakes research, education and extension services. To find out more about the National Sea Grant College Program, visit its web site at http://www.mdsg.umd.edu/NSGO/index.html.

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Shellfish Restoration Conference, November 20-23

International Conference on Shellfish Restoration (ICSR '96), Hilton Head, South Carolina. This conference will gather those with a commitment to restoring degraded coastal ecosystems worldwide. This year's conference will focus on the restoration of molluscan shellfish anf their habitat. The conference should be of interest to government officials, resource managers, local residents, industry representatives and others interested in improving the health of coastal ecosystems. To request a conference brochure and registration information, contact : ICSR '96, South Carolina Sea Grant Consortium, 287 Meeting Street, Charleston, South Carolina 29401, phone (803) 727-2078, fax (803) 727-2080.

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