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MARYLAND COOPERATIVE EXTENSION
UNIVERSITY OF MARYLAND
COLLEGE PARK • EASTERN SHORE

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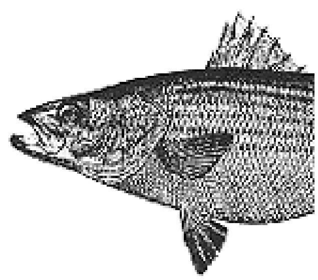
MARYLAND SEA GRANT EXTENSION•4321 HARTWICK ROAD, SUITE 300•UNIVERSITY OF MARYLAND•COLLEGE PARK, MD 20740•(301) 403-4220

Issue 2000-01 **Winter, 2000**

In This Issue:

Managing Dinoflagellate Blooms in Estuarine Aquaculture Ponds

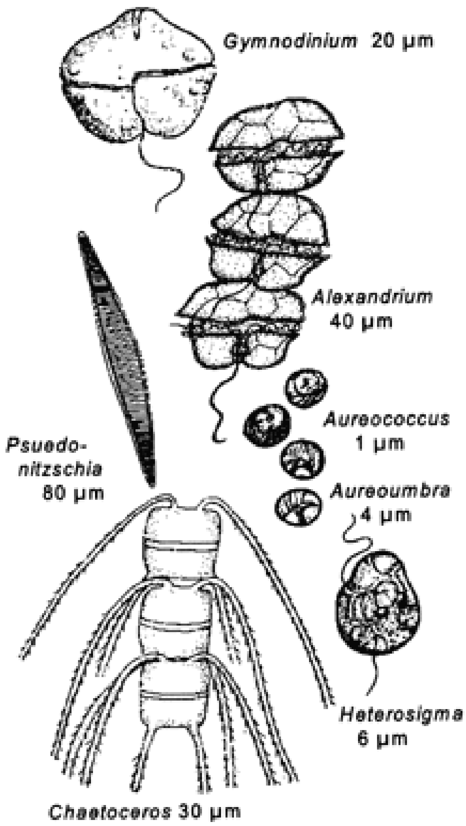


Daniel Terlizzi, Sea Grant Water Quality Specialist

The research program on dinoflagellate blooms at Hyrock Farm on Maryland's Eastern Shore is beginning to show that these blooms, which have been associated with striped bass mortalities since 1996, can be managed and perhaps even predicted. Dinoflagellates are microorganisms that have features linking them to both plants (photosynthesis, cellulose walls) and animals (ingestive nutrition. There have been suggestions that the environmental conditions of aquaculture facilities, in particular high nutrient loading, might be responsible for the "triggering" of dinoflagellates and other harmful algae blooms. Hyrock Farm may well prove to be the "petri dish for the Bay" as owner Tony Mazaccarro describes it since dinoflagellates associated with fish stress and mortality were observed in Hyrock ponds before the widely publicized fish mortality events linked to Pfiesteria piscicida occurred in the summer of 1997.

The problems of dinoflagellate blooms may be particularly acute in estuarine pond systems because of the extremely high or hypereutrophic conditions coupled with fish in close proximity at high densities. G.M. Hallegraeff noted in a recent review article in Phycologia that "aquaculture operations act as sensitive bioassay systems for harmful algal species and can bring to light the presence in water bodies of problem organisms not known to exist there before. "(Also see "Are Toxic Dinoflagellates a Threat to Aquaculture in the Chesapeake Bay," Maryland Aquafarmer, www.mdsg.umd.edu/Extension/Aquafarmer/Spring98.html).

After the first and most dramatic fish kill at Hyrock in 1996 — 20,000 hybrid striped bass only weeks away from harvest were lost in a bloom that consisted primarily of Gyrodinuim galatheanum and Pfiesteria piscicida — Maryland Sea Grant Extension organized a research program in collaboration with Pat Glibert and Diane Stoecker, researchers at Horn Point Laboratory, part of the University of Maryland Center for Environmental Science. The first goal was to prevent further fish losses resulting from dinoflagellates — consequently we initiated a regular monitoring of pond



phytoplankton and began looking for relationships between dinoflagellates and nutritional features of Hyrock's pond waters. With research support from Maryland Sea Grant and the University of Maryland Agricultural Experiment Station, we sampled Hyrock production ponds biweekly over two production cycles in 1997 and 1998 to determine phytoplankton species composition and concentrations of inorganic and organic nitrogen and phosphorous. Although this information has not been fully analyzed, preliminary findings may have implications for both management and prediction of harmful dinoflagellate blooms, namely that dinoflagellates are correlated with higher occurrences of urea, a form of organic nitrogen—for example, 75 percent of the time the dinoflagelles were present, urea concentrations of ponds were elevated. (For more information on organic nitrogen and algal blooms, see "Uncommon Blooms: The Nitrogen Factor" in Maryland Marine Notes, www.mdsg.umd.edu/MarineNotes/May—June98)

Because of regular monitoring of production ponds for dinoflagellates, followed by permanganate treatment when dinoflagellates were observed, fish mortalities have been reduced substantially. Though this approach is effective, it is still reactive; furthermore some dinoflagellate blooms may still occur rapidly as a result of excysment of dinoflagellate cysts, which may be common in the sediments. Dinoflagellate blooms at Hyrock Farm appear to originate by either direct introduction from the estuarine intake water or from cysts accumulated in sediments from previous dinoflagellate blooms.

To try and prevent dinoflagellate introductions from the Bay, a method for treating intake water was needed that could effectively remove organisms as small as 10 microns. With research support from the Maryland Industrial Partnerships program of the University of Maryland and the Rural Development Center at the University of Maryland Eastern Shore, we installed an ozone system for the first time during the 1999 production season. Research is currently underway to determine the effects of ozonation on nutrient chemistry of incoming water; our expectation is that changes in nutrient chemistry by ozone might influence the phytoplankton successional patterns early in the grow—out phase of hybrid striped bass, before pond chemistry is dominated by fish excretion. Over time we hope to prevent "re—seeding" of sediments with dinoflagellates from the Bay by coupling ozonation with monitoring and permanganate treatment.

The problem of harmful dinoflagellates in estuarine aquaculture ponds is by no means fully resolved — to a great extent, our current management techniques are the aquatic equivalent to using duct tape on leaking pipes. New questions continue to emerge, for example, in May 1999 a bloom of Gyrodinium galatheanum resulted in a loss of 5,000 hybrid striped bass fingerlings. This bloom which occurred two months before those we have previously observed for this species, was likely associated with higher salinities resulting from drought.

For more information on fish health and *Pfiesteria pisicida,* with links to web sites on harmful algal blooms, visit www.mdsg.umd.edu/fish—health

Editor's note. For copies of the following article contact Maryland Sea Grant at (301) 405—6376 or connors@mdsg.umd.edu

Glibert, Patricia M. and Daniel E. Terlizzi. 1999. Coocurrence of elevated urea levels and dinoflagellate blooms in temperate estuarine aquaculture ponds. Applied and Environmental Microbiology 65(12): 5594—5596.

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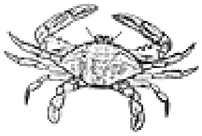
East Coast Fisherman's Show



Seminars at the East Coast Commercial Fishermen's Trade Show and Aquaculture Expo will highlight issues related to managing blue crab harvest, shellfish aquaculture, business planning for commercial fish and aquaculture operations, and information access via the internet for aquaculturists and commercial fishermen (see Upcoming Conferences).

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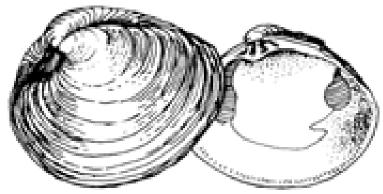
Keeping an Eye on Clam Disease
An Interim Report



Don Webster, Eastern Shore Marine Agent and
Don Meritt, Shellfish Aquaculture Specialist

QPX, or Quahog Parasite Unknown, is a disease that affects the hard clam Mercenaria mercenaria. While it has been identified in quahog clams in several locations along the east coast, QPX is not known to present a significant problem to clam populations in the mid Atlantic; nonetheless, there is a potential for its occurrence, which should be kept in mind when considering entering the clam aquaculture business.

Recent surveys of M. mercenaria in Virginia carried out by the Virginia Institute of Marine Science (VIMS) were expanded to both wild and cultured clams in the seaside bays by the University of Maryland Sea Grant Program. Our initial survey was in the spring of 1999, with follow up sampling in November. We had the assistance of commercial clam harvesters in sampling clam populations throughout the Maryland portion of the seaside bays, from north of the St. Martins River to the Virginia border. The survey included 25 animals in the 1.5 to 2.5—inch size range. These were sent to the Virginia Institute of Marine Science for analysis. The spring samples revealed no instances of QPX; fall samples are still being processed.

Though these tests have indicated no apparent incidence of QPX in Maryland's seaside bays, we need to remain watchful. We want to hear from clam culturists and harvesters about mortalities or abnormalities. There are a number of signs that indicate potential problems. Clams that die quickly in storage may signal that they have been stressed; meats of potentially diseased clams may have nodules or lesions ("sores"), or they may be spotted; more sand than normal in the mantle could imply a weakened clam that can't clear itself through normal pumping. If you are aware of any of these problems please contact Don Webster at (410) 827-8056 or by e-mail: webster@mdsg.umd.edu.

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Basic Research on QPX Disease

While quahuag or hard clams (Mercenaria mercenaria) are harvested commercially in waters from Canada to Virginia, they are also spawned in hatcheries for farming on privately—held grounds. In the last several years, aquaculture operations have also started up in Maryland's coastal bays. In recent years, hatchery—reared clams in the northeast have been impacted by QPX—mortalities of up to 80 percent have been seen on some lease sites. As Don Webster and Don Meritt report, QPX has not been detected in clams in the mid—Atlantic though there is concern that its presence may just be a matter of time. However, little is known about the disease, for example, how QPX attacks clams, under what conditions, and how the clam's immune system reacts. Because of the lack of fundamental knowledge about the dynamics of clam disease, it is nearly impossible to develop informed management strategies to mitigate against its impact. In order to develop such an understanding, Maryland Sea Grant is supporting Robert Anderson of the University of Maryland Center for Environmental Science to undertake the first systematic study of Mercenaria's defense system. Anderson's focus is on cellular mechanisms — working with Sharon McGladdery of the Gulf Fisheries Centre in New Brunswick, Canada, his goal is to uncover the factors that enable QPX to proliferate so extensively in clam tissue. His findings should lead to insights for developing strategies to manage around the disease. Anderson's work could also provide information to enhance selective breeding and disease resistance protocols for future control measures. For information on clam aquaculture in seaside bays, see "Hard Clam Potential for Maryland," Maryland Aquafarmer, www.mdsg.umd.edu/Extension/Aquafarmer/Winter99.html.

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Aquaculture Production in Maryland, 1998

The Maryland production figures by species are now in for 1998 — the farm gate value totaled $17.1 million, according to the Maryland Agricultural Statistics Service. This represents a decline from the 1997 value of $21.4 and the 1996 value of $19.3 million. While tilapia production doubled, reaching nearly $4 million, the average price declined from $2.20 to $1.69 a pound. Hybrid striped production rose to nearly 300,00 pounds, more than 30 percent over 1997 production; while sales increased, the average price per pound was down slightly. Soft crab production at facilities surveyed by the Maryland Department of Agriculture continued a downward trend. Production was down in 1998, as was the average price per dozen. Aquatic plants, ornamental fish and other aquatics continue to account for more than half the value of aquaculture sales in Maryland, though the figures do not account for all producers because of individual restrictions on the release of data.

Aquaculture Production — Reported Sales 1997 and 1998

Species	1997 Reported Production	1997 Reported Sales	1997 Average Price	1998 Reported Production	1998 Reported Sales	1998 Average Price
Hybrid Striped Bass (lbs.)	177,988	507,266	2.85	297,144	794,940	2.68
Catfish (lbs.)	55,723	110,889	1.99	105,275	181,669	1.21
Trout (lbs.)	52,400	157,200	3.00	30,960	75,600	2.44
Tilapia (lbs.)	1,146,516	2,522,335	2.20	2,335,020	3,948,022	1.69
Ornamental Fish (fish)	10,734,500	966,105	0.09	13,926,506	2,405,521	0.17
Aquatic Plants (plt)	1,188,000	7,959,600	6.7	335,329*	1,933,300	5.77
Soft Crab (doz.)	147,450	3,538,800	24.00	105,850	2,147,250	20.29
Oysters (ea.)	8,305,200	1,338,780	0.16	4,490,000	87,700	0.02
All other aquatics**	1,003190	4,294,352		10,219,563	5,521,579	
Total		21,395,327			17,095,581	

* Includes baitfish, freshwater fish, crawfish and (micro) algae
** Because of a change in survey methodology, comparisons with 1997 are not valid

For more information contact the Maryland Agricultural Statistics Service (410) 841&-5740 and on the web at: www.nass.usda.gov/md

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Oyster Education and Restoration in Southern Maryland

Jackie Takacs, Regional Marine Specialist

Maryland Sea Grant Extension and the Maryland Department of Natural Resources recently received funding from the Chesapeake Bay Trust to plant 1.5 million oysters on a reconstructed reef in St. George's Creek, in St. Mary's County. This restoration effort differs from those currently underway throughout the state in two ways, the participants, namely young students, and their numbers — 1200, of them.

In St. Mary's County's the focus on environmental education in the seventh grade is A Study of the Eastern Oyster. The program's goal is to promote an understanding of ecology by involving students in hands—on, career—based learning situations that will elucidate (1) events having already occurred or are occurring in an oyster bar community, (2) far—reaching implications of these events, and (3) how we as individuals and members of a larger group and community have influenced and will continue to influence these events.

This project is designed to couple the county's seventh grade environmental education curriculum with the hands—on restoration of an oyster bar. Specifically, the project will provide the venue for students to participate in oyster restoration and education activities; provide the necessary material and supplies to perform restoration activities; provide 1.5 million oysters to seed a new oyster reef in St. George's Creek.

The program will begin in the fall of 2000, with approximately 50 classes. Students will be involved in day—long oyster restoration activities; they will study the importance of the oyster to Chesapeake Bay from both a habitat and community perspective (via examination of the oyster bar community and water quality) and from an individual species perspective (via dissections, filtering studies, disease screening). They will also participate in bagging of shells, which newly spawned oyster larvae will attach to in hatchery tanks; loading shells into the tanks; and then, after oysters have set, moving the bagged seed oysters from the tanks to boats. Students will then board Jack Russell's skipjack, the Dee of St. Mary's, and sail to an oyster bar that the Maryland Department of Natural Resources has created in St. George's Creek for educational and restoration purposes. They will seed this bar with the newly set oysters and collect various water quality measurements. At the end of the project, the seventh grade students will have planted some 1.5 million oysters over a one—acre site.

For more information about this and other education programs, contact Jackie Takacs at (410) 326-7356 or takacs@cbl.umces.edu

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Snapshots: Oyster Gardening and Cooperatives in Maryland

Christine Keiner, Johns Hopkins University

Oyster gardening appears to be catching on throughout Chesapeake Bay — according to a recent article in Maryland Marine Notes, private citizens, educators and students are raising oysters on small plots for a variety of restoration projects as well as for home consumption. It may surprise many participants to learn that such efforts have a long history, and that larger group efforts, including commercial cooperatives, have also been tried in Maryland.

One of Maryland's most innovative leasing experiments was the Calvert County High School Student Marine Conservation Society, which consisted of twenty watermen's sons. In 1948, the Chesapeake Biological Laboratory (CBL) began sponsoring oyster—growing activities for the students on the theory that by demonstrating financial rewards of scientific, sustainable oyster farming, students would increase their appreciation of conservation and be persuaded not to forsake their heritage for higher paying jobs in the cities. On small tracts located in the Patuxent River at Solomons Island and in the Chesapeake Bay at Broome Island, the club members planted shells and seed oysters in the spring of 1948, 1949, and 1950; they harvested their first oyster crop in December 1950. In 1952, a Columbia University educator described the student conservation society as "the greatest advance in education in one hundred years".

The Calvert County boys' success inspired Talbot County Senator William Shehan to sponsor a high school oyster—farming bill during the 1951 General Assembly. The resulting act authorized the Department of Tidewater Fisheries to set aside five acres for each public high school for raising oysters. The next year, twenty students from Somerset County's Deal Island High School established an aquaculture club known as the "Future Watermen." With the assistance of CBL biologist Francis Beaven, packer Richard C. Webster, and several adult advisers, the students monitored spat catch, water conditions, parasite growth, and oyster development through two plantings and two harvests over the course of six years. No other high schools seem to have participated in the oyster cultivation program.

Watermen also practiced private oyster culture during the 1950s. The Smith Island Oyster Cooperative was the first effort by a group of Maryland watermen to farm oysters. It began in November 1949, when 30 Smith Islanders each applied to lease 25 acres in Tangier Sound and Twitch's Cove, a tributary of Tangier near Smith Island. Three Deal Island watermen soon filed protests in the Somerset County Circuit Court, arguing that the leased areas were natural oyster bars and thus not subject to leasing. In April 1950, between 300 and 400 oyster industry members packed the Princess Anne courtroom for three days of testimony. Biologist Francis Beaven testified that the bottoms were barren of oysters for all practical purposes. When thirteen watermen swore they had taken many oysters from the rocks in the previous five years, the state argued that they obtained their oysters from different rocks nearby. Agreeing with the Goldsborough rule, which defined a natural oyster bar as one from which a waterman had made a living anytime in the preceding five years, the jury required just half an hour to find that the bottoms were active natural oyster bars and thus not leasable. In December 1950, however, the Maryland Court of Appeals unanimously overruled the Somerset jury, ruling that the five—year test period ended the day a lease application was filed, and dismissing as inconclusive the Somerset oystermen's testimony that they had caught or seen oysters hauled up in the proposed co—op area.

By February 1952 the Smith Island Oyster Cooperative had leased 1,250 acres of bay bottom and spent about $15,000, virtually its entire income (which it raised by charging each members a five—dollar monthly dues and ten percent of his total sales), to plant 65,000 bushels of shells as cultch. The co—op oystermen's annual incomes had grown from about $1,800 to $5,000, though not through scientific oyster cultivation. Their incomes rose because as lessees they were allowed to use dredges and motorized boats on their oyster grounds. They practiced conservation by limiting each co—op member to ten bushels per day and requiring each to return shells and undersized oysters to the beds.

The co—op members were extremely optimistic about the future, especially the 1954 season, when their first crop would mature. As president Shafter Corbin told a Baltimore Sun reporter in February 1952, "The planters tell us that in a few years each and every one of us can, if he's of a mind to, own a Cadillac. But in January 1958, the cooperative dissolved and surrendered its 1,900 acres of oyster grounds to the state. The Evening Sun explained the reason as "starved for seed oysters and short of money to buy them and build up a crop."

At least one other group of watermen formed an oyster—farming cooperative. In 1951, several watermen from Shadyside each leased 25 or 30 acres of barren bottom in the West River for $1.00 per acre. Seed oysters were their greatest expense, as for all planters, because 300 to 500 bushels were needed to plant each acre, and seed cost about 90 cents a bushel. By 1957, the cost of seed had reached $1.75 a bushel, the result of poor spat sets in the St. Mary's River and because the Virginia Commission of Fisheries prohibited the export of James River seed oysters. In the words of Shadyside lessee Ed Nieman, "We took a hell of a gamble, especially for small operators like us."

For more information on current oyster gardening programs, see "Oyster Gardening in the Chesapeake Bay," www.mdsg.umd.edu/MarineNotes/Jul—Aug99/.

Christine Keiner is writing a book on the history of oyster conservation politics in the Chesapeake Bay, focusing on the relations among oyster scientists, watermen, legislators, and managers. She would like to speak with people who participated in or who protested oyster leasing projects such as those described in this article. Please contact her at Johns Hopkins University, HSMT Dept3, 400 N. Charles St., Baltimore, Maryland 21218—2690 or via e-mail at ckeiner@jhunix.hcf.jhu.edu.

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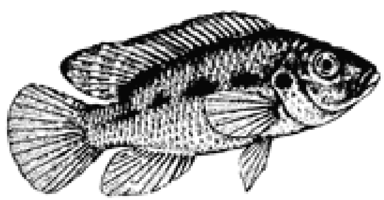
Supplementing Tilapia Diets: The Prospects of Soy Oil

Steven G. Hughes, University of Maryland Eastern Shore

While most commercial feed formulations for tilapia use fish oil to supply the lipid component, soy oil may prove to have a number of advantages — the fatty acid requirements should allow tilapia to utilize soy oil equally well if not better. Several studies, for example, have indicated that tilapia may require linoleic acid, which predominates in many plant oils including soy; linolenic acid, on the other hand, is the predominant family of fatty acids in fish oils. It is important to note that soy oil is more resistant to oxidative rancidity than fish oils, and its use may reduce the potential of negative impacts that have occurred in other fish species fed diets containing oxidized fats. Also of note is the lower cost of soy oil compared with fish oil.



In a research project study supported by the Maryland Soybean Board, a feed containing soybean meal as the primary protein source and fish oil as the primary lipid source was extruded and served as the experimental control diet. The weight gain and feed conversion efficiency of triplicate groups of ten hybrid tilapia (average initial weight 25 grams) fed this diet for ten weeks was contrasted with that of a second replicate group of fish fed a diet in which soy oil replaced the fish oil. Two other diets were modifications of the control diet in order to incorporate very high levels (14.1%) of either soy or fish oil.

Data from this study indicated that there was no statistical difference in the weight gain or feed conversion ratios of tilapia fed either of the diets containing 2% supplemental oil. The weight gain and feed conversion ratios of fish given the high soy oil feed were no different than those of the low oil diets, though the performance of the fish given the high fish oil diet was significantly reduced. These results appear to agree with the data of earlier researchers that high levels of linolenic acid (found in the high fish oil diet) depress growth. Though we are still waiting for completion of the carcass composition analyses, it seems reasonable to recommend that the amount of fish oil incorporated into tilapia feeds be restricted below 5 percent until further research in this area can be completed.

Another study supported by the Maryland Soybean Board continues to show the promise of using soy protein in tilapia feeds. This study assessed the organoleptic (taste) qualities of fillets taken from fish reared on all plant protein diets. Results from a ten—person taste panel indicated no difference in the flavor of the fillets obtained from the fish reared on the all plant protein diets, when compared to those of fish fed standard commercial diets containing at least some fish meal protein. Ongoing research will continue to assess the value of different forms of soy protein as major protein sources for fish.

For more information, contact Steven Hughes, (410) 651-7664, sghughes@mail.umes.edu.

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Pond Management Calendar — January through March

Dan Terlizzi, Water Quality Specialist

It is not too early to begin managing your pond for the upcoming summer season. Proper pond care is really a year round task and time spent early in the year can prevent serious problems such as algae blooms and fish kills during hot weather. In this article I present a pond management calendar for the next few months to help you plan and implement your management approach. I will follow up in the next few issues to cover management for the entire year.

Many are not aware that winter is a good time to lime a pond. Ponds throughout the Mid—Atlantic region in areas with acidic soils and soft water are likely to benefit from liming. In general these ponds have less than 20 parts per million (ppm) alkalinity, a measure of lime content, and adjustment to 50 or 100 ppm will improve a pond's performance significantly. Application of agricultural lime to water provides the same benefits as liming soil. Agricultural lime or calcium, carbonate, dissolves in water to yield calcium, an important macronutrient for plant growth, and carbonate which reacts with water to yield bicarbonate. Bicarbonate is the most important component of a water quality factor called alkalinity while other chemicals contribute to alkalinity, among them, phosphate, hydroxides and organic substances bicarbonate is the most important.

Many aspects of pond water chemistry and biology benefit from liming. The presence of adequate alkalinity buffers the water in the same way that bicarbonate of soda or a Tums tablet soothes an upset stomach from high acidity. In ponds, the pH can vary a great deal over the course of 24 hours. During the night, pH decreases because respiration acidifies the water while during the day photosynthesis of algae and aquatic vascular plants raises the pH. It is not unusual to see fluctuations in pH of ponds with low alkalinity from 5 or 6 in the early morning to 10 by early afternoon. Aquatic plants and animals are tolerant of these fluctuations but will be much healthier in the pH range of 6 to 9. Buffering the pH with agricultural lime may also stimulate the growth of beneficial microscopic algae (phytoplankton) through increased availability of phosphorous.

One of the main concerns in winter pond management is ice cover and winter fish mortality, or winter kill. Winter kill is a result of oxygen depletion by high fish densities or the decomposition of accumulated organic material. Although the colder water temperatures of the winter facilitate the diffusion of oxygen into the water from the atmosphere, ice creates a barrier to oxygenation. Ice cover is fairly transparent and light penetration can support oxygen production through photosynthesis of phytoplankton. There is adequate light even with fairly thick ice cover. In the Antarctic, for example, a film of algae grows directly underneath ice layers, providing an important source of food for crustaceans. In iced—over ponds, fish mortalities often occur when snow cover blocks the light and eliminates photosynthesic oxygen production.

Aeration is also the solution to oxygen shortages that result from ice cover. Although it is possible to cut a hole in the ice to install an aerator, it is better (and much warmer) to anticipate the weather that will cause freeze over and to prevent its occurences with an aerator. The agitation caused by aeration will prevent complete coverage of the pond and allow the transfer of atmospheric oxygen to the water. The "Ice—Eater," one of the commonly used aerators in the aquaculture industry, was actually developed from a prop—based agitator for keeping marinas free of ice. It was observed that the "Ice Eater" was also very effective in oxygenating water; it's a product line for Power House Inc., a Baltimore—based company that provides aeration to the aquaculture industry world—wide.

So between now and early March consider liming your pond and installing an aerator. Both of these management strategies will be helpful now and and for the summer season.

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The Safety of Maryland Seafood

Thomas E. Rippen, Seafood Technology Specialist

Periodically we read about shellfish poisoning and other instances of seafood safety — such reports, may lead people to believe seafood can be too dangerous to eat. That is not so — let's look at some facts. Concerns related to shellfish growing waters are addressed by a federal and state cooperative program, the National Shellfish Sanitation Program (NSSP). State and federal agencies meet each year to review and update strategies to assure shellfish safety. In Maryland, shellfish control authorities exceed the requirements of the NSSP. Coastal waters are sampled and the shoreline routinely surveyed to identify and correct potential sources of pollution. Waters which may at times be unsafe for harvesting are closed to commercial fishing. In a coordinated program, processing facilities are inspected frequently by both state and federal agencies. This is a very large effort involving hundreds of inspections and thousands of samples each year.

We can agree that this government program is large — however is it effective? While some areas of the country experience periodic outbreaks of shellfish related illness, a review by the Maryland Department of Health and Mental Hygiene was unable to find evidence of even a single case of illness caused by eating shellfish harvested in Maryland waters. In addition to the NSSP and other conventional regulatory programs, the federally—authorized Hazard Analysis Critical Control Point system (HACCP) is now in place. HACCP is a mandatory industry and regulatory cooperative program designed to minimize food—borne illness. It is proactive, requiring of seafood operators a thorough analysis of every step involved with handling, processing and holding food. They must identify potentially critical areas, and then implement and document a set of control measures.

Of all food industries in the U.S., seafood was the first to implement HACCP, which the U.S. Food and Drug Administration requires and enforces. Although states are encouraged to adopt HACCP they are not mandated to do so. Here again, Maryland took the extra step and adopted the entire federal regulation as state regulation. The Maryland Department of Health and Mental Hygiene is responsible for its enforcement, and the seafood industry actively participates in HACCP. In fact, the industry requested HACCP, asking FDA to make it mandatory. HACCP not only provides extra assurance of food safety, it provides a record—keeping trail that substantiates every shipment is properly handled.

Two important health concerns related to fish are: histamine and ciguatera poisoning. Histamine poisoning (upset stomach, headache and/or hives) only occurs when susceptible fish are held without ice at elevated temperature. HACCP prevents histamine formation by requiring monitoring and periodic checks to confirm proper temperature control. Ciguatera only affects fish species associated with certain tropical reefs, not fish landed in Maryland; but ciguatera, too, must be determined and controlled by wholesalers who deal with tropical sources. Such checks are only in place for commercially harvested seafood. Buying from Maryland seafood markets and restaurants provides assurance that government and industry health programs are at work protecting all citizens.

For information on regulatory and shellfish monitoring practices in Maryland, See Maryland Marine Notes, "Seafood Safety in Maryland — So Far, So Good," www.mdsg.umd.edu/MarineNotes/Nov—Dec97.

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Upcoming Conferences

East Coast Commercial Fishermen's Trade Show and Aquaculture Expo January 28—30, 2000 Ocean City, Maryland

Blue Crabs

- An Overview of Stock Assessment and Management in the Mid—Atlantic — Panel Discussion, Representatives from New Jersey, Delaware, Maryland, Virginia and North Carolina
- Concepts for the Future — Doug Lipton, Maryland Sea Grant Extension

Shellfish Aquaculture

- CROSBreed Project — Don Meritt, Maryland Sea Grant Extension and UM Center for Environmental Studies and Tom Gallivan, Virginia Institute of Marine Science
- Cape May Harbor Oyster Production Demonstration Project — Stewart Tweed, New Jersey Sea Grant
- Practical Aspects of Purging Shellfish. Gary Richards, Delaware State University
- West Coast Shellfish Aquaculture, Where is the East Coast in Comparison? — Don Bishop, Fukui North America
- Oyster Culture Around the World — Standish Allen, Virginia Institute of Marine Science

Computers and Information Gathering for Commercial Fishing and Aquaculture

- Accessing Information on Aquaculture — John Ewart, Delaware Sea Grant
- Accessing Information on Commercial Fishing — Nils Stolpe, New Jersey

Fishing As a Business. Planning for Now and the Future

- Planning for Commercial Fishing and Aquaculture — Speaker to be announced
- Insurance for Commercial Fishing Businesses — Jack Devnew, Flagship Insurance
- Financial Planning, Easier Than You May Think — Diane Rowe, Maryland Cooperative Extension

In addition to seminars, there will be a Children's Marine Education Program on Saturday, January 29, coordinated by Jackie Takacs, Maryland Sea Grant Extension Program.

For further information, contact Don Webster, 410-827-8056 or webster@mdsg.umd.edu. Keep abreast of updates at www.mdsg.umd.edu

20th Milford Aquaculture Seminar
February 28-March 1, 2000
Quality Inn Conference Center, New Haven, CT
100 Pond Lily Avenue
New Haven, CT

Contact: Walter Blogoslawski, Phone: (203) 579-7035, Fax: (203) 579-7070

Aqua 2000: Responsible Aquaculture in the New Millennium
Joint Meeting of the European Aquaculture Society
and the World Aquaculture Society in the Year 2000
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