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Issue 1998-02 **Spring, 1998**

In This Issue:

Striper 2000: Research Advances on Striped Bass and Its Hybrids

June 6-7, 1998
Inn and Conference Center
University of Maryland
College Park, Maryland

Plan to attend Striper 2000, a forum for researchers, producers, extension specialists and others to discuss state-of-the-art research in striper culture and the potential for increased production.

Please visit the STRIPER 2000 web site for more information.

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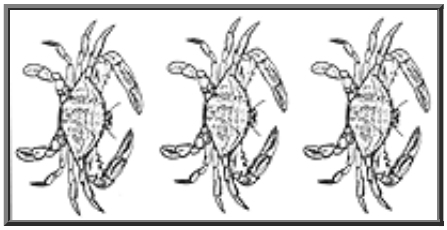

Getting Ready for Soft Crab Shedding Season

Don Webster, Eastern Shore Area Agent

It's spring tuneup time. But while you are getting your boat and gear ready, take some time to think about ways to improve your soft crab production. Time spent on maintenance now can pay off later in increased shedding success and improved profits.

Crab season is around the corner and before long the peelers will be running. We had a mild winter in the Chesapeake Bay area so we should have had good survival of overwintering crabs;

in addition, our increasing water temperatures may give us some early harvest activity. Now is the time to get your shedding system in condition for the 1998 season and, if that old one wasn't producing quite right, consider redesigning and rebuilding it for the upcoming season. Here are some tips to consider.

Pumps. If you are using a flow-through system, in- spect your pumps. Make sure they will stand up through another season and, if necessary, rebuild them or purchase new ones. You do not want to have a pump breaking down at a critical time. We all know they only do that when the floats are full of peelers and when the local distributor is closed for a long holiday weekend.

Piping. Check out all of your piping. Since the development of PVC, it has been very easy to build systems and replace valves and pipes. Remember that over time, the ultraviolet rays in sunlight will cause those plastic pipes to become brittle, making them easy to break. This may be the year that you consider replacing some or all of the piping before you have your system operating.

Recirculating and Flow-Through Systems. If you didn't have good success shedding in a flow-through system last year, you may want to consider putting in a recirculating system. While it will give you better control over your water quality, it does cost more to install, operate, and manage. The result, however, should not only be greater control over water quality, but more convenient location of your operation, higher survival of your crabs, and a bottom line of increased profit.

Monitoring Water Quality. One of the most important aspects of running a recirculating system is keeping up with water quality monitoring. This is the most important aspect to success in closed system crab shedding and we cannot stress its value too much. You wouldn't think of running your truck or boat engines without working gauges so don't even consider running a crab shedding operation if you're not going to invest in equipment to measure water quality. Remember, you can't know what your biofilters and other components are doing if you do not have accurate numbers. The filters are the "engines" of your shedding system. Without the"gauges" that test equipment provides, you won't know if they are having problems or where those problems are if you need help solving them.

Monitoring Equipment. The test kits and electronic meters that you use for monitoring need maintenance also. Replace the reagents in your test kits for the start of the new year. If you are using a color comparator that is several years old or is used outdoors most of the time, you might consider investing in a new one to ensure that the colors have not faded. Otherwise you will get false readings. And while you're at it, don't forget to have a pair of safety glasses or goggles available when you do the testing. Many of the chemicals used in the kits contain harmful materials such as acids. You need to protect your eyes in the event of a splash or other accident with reagents.

New Recirculating System Designs. If you already have a recirculating system there are some new designs you might want to incorporate that can help you control toxic materials that can affect your crabs. One of these was developed at the University of Maryland Eastern Shore for fish culture systems. It consists of three protein skimmers connected in series with air supplied by a high volume aerator. These are mounted so that they are "side streamed" from the reservoir tank rather than in a continuous loop through the floats and biofilters. Industry tests during last season resulted in very high quality water in shedding systems and greatly increased crab survival.

These protein skimmers are constructed of 8-inch PVC sewer pipe connected by 4-inch PVC between the units. If desired, the individual skimmers can be capped and the foam can be piped off to a container for later disposal. These units tend to "polish" the water very nicely, removing proteins and other harmful substances efficiently while adding oxygen to the system. Remember, in a recirculating system oxygen is consumed both by the crabs in the shedding floats and by the bacteria in the biofilter that purify the potentially toxic substances in the nitrogen cycle. Sufficient oxygen is necessary to ensure proper operation of all these components.

Keep in mind that the warmer the water is in the summer, the less oxygen it will naturally hold. While we are breathing air that has approximately 200,000 parts per million oxygen, water at 70¡ F (and 10 parts per thousand salinity) will be saturated at about eight and a half parts per million. At 80¡F that will drop to about seven and a half. If you're trying to keep your crabs at or above five parts per million dissolved oxygen and have enough to effectively operate your biofilters, you can see that you will not have a lot of "headroom" in maintaining proper levels in your system.

Many of the systems that we have looked at over the years have significant dissolved oxygen problems. It is an important factor that needs to be considered in designing your system. High water temperatures and low dissolved oxygen levels are a primary cause of heavy mortality in flow-through systems in the summer. Even if your crabs aren't killed directly by low oxygen, it can

stress them enough to cause disease and high mortality while they are shedding.

If you have questions about your shedding system or need information on water quality testing and monitoring, contact your Sea Grant Extension Program Specialists. We can provide you with assistance on your system as well as information on proper testing procedures and ranges that your recirculating system should be operating within.

Editor's Note: Don Webster wrote about "Managing Crab Shedding Operations" in the Summer 1997 Maryland Aquafarmer. In the September-October 1997 issue of Maryland Marine Notes, Maryland Sea Grant's bi-monthly newsletter, Michael Fincham wrote, "Banking on Blue Crabs," an article featuring Eastern Shore waterman John Barnette, who built a recirculating system based on a design by researchers at the University of Maryland Eastern Shore.

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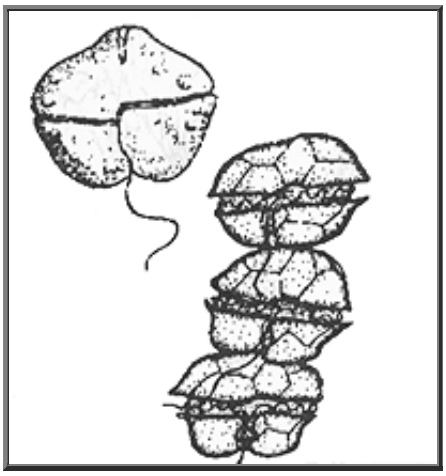
Are Toxic Dinoflagellates a Threat to Aquaculture in the Chesapeake Bay?

Dan Terlizzi, Water Quality Specialist



Researchers learn early in their careers about the fine line between cautious explanation and avoidance; this is especially so when it comes to the demand for simple answers to complex scientific questions. Harry Truman is reputed to have said - after listening to his scientific advisors propose a well-argued hypothesis, then escape from it with an "on the other hand" - that he could solve the world's technical problems if he could just find a "one handed" scientist.

When it comes to the issue of toxic dinoflagellates like *Pfiesteria piscicida,* most scientists agree that they are a major concern in the Chesapeake Bay. On the other hand, there is no way to be certain at this time about the extent or magnitude of the *Pfiesteria* and harmful algal bloom problem in the Bay. With regard to aquaculture, though, I believe that we are dealing with a problem of potentially large magnitude. In this case, numbers can speak: last year we lost as many fish in one aquaculture facility as we have in the rivers on Maryland's eastern shore.

On a global scale, harmful algal blooms appear to be increasing in frequency in coastal waters, the consequence of increasing eutrophication (i.e., overenrichment of nutrients), according to many scientists. Other explanations have been advanced to account for increasing blooms, among them, the growing impact of aquaculture and the inadvertent discharges of exotic algal species in the ballast water of international tankers. Some argue that we are also doing a better job of actively hunting for harmful algal blooms.

The problems with dinoflagellates this past summer in the Chesapeake have been attributed to nutrients from the soils of the lower eastern shore, nutrients that are enriched with poultry litter. If a clear cause-and-effect relationship has not been demonstrated in the Bay, the evidence for a link between heavy nutrient loading and harmful algae in estuarine aquaculture systems is, in my opinion, circumstantially very strong. Explaining this link, however, is not so simple.

There is growing evidence that the type of nutrients available to dinoflagellates or other algal species may be more important than the amount of nutrients that is available - or to use the familiar expression, quality versus quantity is what matters. Research at the University of Maryland Center for Environmental Science (UMCES) by Dr. Pat Glibert at the Horn Point Laboratory shows that certain types of organic nitrogen favor the growth dinoflagellates. Studies conducted at Hyrock Hybrid Striped Bass Farm indicate a strong relationship between the concentration of components of organic nitrogen and dinoflagellate blooms - these findings suggest that organic nitrogen levels

could provide an early warning system for the potential blooms of harmful dinoflagellate.

All dinoflagellates are not created equal and a relatively small number of species are known to cause fish stress and mortality through toxin production or other means. Our research suggests that some dinoflagellate blooms in the estuarine ponds at Hyrock were stressful and may have led to the deaths of 20,000 hybrid stripers in summer 1996 and 8,000 hybrids during the 1997 growing season. These blooms include dinoflagellate species common in the Chesapeake, in particular, *Prorocentrum minimum, Gyrodinium galatheanum, Gymnodinium nelsonii.* Though not regarded as toxic in the Chesapeake, they have been observed to be toxic elsewhere, according to Dr. Harold Marshall, a scientist at Virginia's Old Dominion University, who has been studying phytoplankton in the Bay for over three decades.

Why are such species toxic elsewhere and not in the Chesapeake? Though a number of answers have been proposed, the simple answer is we don't know.

The problems associated with such dinoflagellate species may be particularly acute in estuarine pond systems because of the coupling of extremely high nitrogen conditions with high densities of fish. In a recent review of harmful algal blooms and their apparent global increase, Hallegraeff writes 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." To say that our experiences at Hyrock support this view is an understatement.

Defining a problem is the first step in solving it. In my view we have not reached that level of clarity for the problems experienced in the Pocomoke, Chicamacomico and Kings Creek this past summer. The problem seems clearer in estuarine aquaculture facilities: high summer temperatures together with extremely high nutrient levels favor dinoflagellate blooms that lead to fish stress and mortality. Solving the problem will be a large challenge.

During the summer of 1997, regular microscopic examination of Hyrock production ponds indicated when dinoflagellate numbers were increasing to a level of concern. Currently, the only reliable treatment is the application of permanganate, an expensive solution and a temporary one: once dinoflagellates appear in a pond they will reappear within several weeks of a permanganate treatment.

To better manage dinoflagellates in estuarine impoundments, we will need to understand the nutritional and environmental "triggers" that favor their growth. The relationship between organic nitrogen sources and dinoflagellates we have observed at Hyrock may provide part of the solution. A grant from the University of Maryland Agricultural Experiment Station will enable us to examine the causes of dinoflagellate blooms in estuarine aquaculture ponds more closely, along with their prediction and treatment. Such research is critical to the development of finfish aquaculture in the Chesapeake and the entire mid-Atlantic region. Growers (let alone investors) need to be confident that it is possible to deal with environmental challenges to their systems - they also need to have the tools for successfully managing their operations.

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Pfiesteria White Paper Now Available

Molecular Technologies and *Pfiesteria* Research: A Scientific Synthesis

The University of Maryland Biotechnology Institute's Center of Marine Biotechnology (COMB) and the Maryland Sea Grant College have published a consensus report on the priorities for developing molecular tools to detect *Pfiesteria* species and their toxins.

Unlike other harmful algae that often reveal their presence in the water by red or brown pigmentation, *Pfiesteria* species give no early warning signal. The first signs that toxins have been released generally are fish with deep lesions, fish that often succumb to this "ambush" predator. The report is based on an October workshop that brought together prominent scientists and scientific managers involved in research on *Pfiesteria* and other harmful algal blooms.

Copies are available from Maryland Sea Grant (4321 Hartwick Road, Suite 300, University of Maryland, College Park, Maryland 20740) or on the worldwide web: http://www.mdsg.umd.edu/pfiesteria/biotech_rpt/

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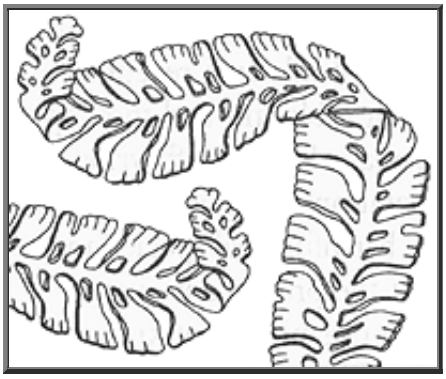
Is Seaweed Aquaculture a Potential Industry for the Chesapeake Bay?



Dan Terlizzi, Water Quality Specialist

Concern over possible impacts that aquaculture can have on water quality in the Chesapeake Bay - together with objections based on sociological and economic factors - has created a paradoxical situation in Maryland aquaculture: there is a greater interest in raising fish in fresh water and recirculating systems than in the Bay itself, one of the world's most productive estuarine systems.

The concern over farming fish in the Chesapeake stems from the potentially heavy nutrient loads that dense concentrations of fish could help create - nutrient overloading has been related to numerous impacts on Bay waters that begin with massive growth of phytoplankton, depletion of oxygen, loss of submerged aquatic vegetation and, now, fish mortality as a result of toxic dinoflagellates like *Pfiesteria piscicida.*

In fact, nutrient reduction of 40 percent has been a key goal of the Chesapeake Bay Program, a consortium of states, federal agencies and legislative interests. It has been a major catalyst, for example, in changing agricultural practices in the region and is viewed positively by many in the agriculture community. Because intense fisheries production in the Chesapeake could increase nutrients, there has been little enthusiasm for investigating innovative techniques that might minimize nutrient loading, while taking advantage of the Bay's rich organic production. One such technique, however, is macroalgal or seaweed aquaculture systems that could utilize nutrients discharged by fish held in netpens.

Macroalgal aquaculture in the Chesapeake Bay could offer an environmentally sound method of nutrient removal, whether from netpen fish culture itself or as the result of land runoff. Furthermore, seaweed aquaculture could be economically viable in the Chesapeake, independent of its capacity for waste removal in netpen systems through the production of plant materials for industrial chemicals and human consumption.

Globally algal aquaculture accounts for a quarter of the annual value of aquaculture production. For example, the annual value of the edible alga, nori (*Porphyra* spp. used as sushi wrappers) alone exceeds $2 billion dollars; the U.S. nori market is $ 25 million annually with 12 -15 % annual growth. Current North American production of macroalgae is minuscule (<.001%) compared with Asia, which account for 99.7 % of total global production.

Algae production is centered in Asia because of the demand for algal products in human nutrition. Increasing demand for algal components in the chemical industry as well as for consumption has led to the development of algal aquaculture operations in North America, notably in the Pacific Northwest, Maine and the maritime Provinces of Canada. Temperate estuaries comparable to the Chesapeake are currently engaged in the economically successful and environmentally sustainable cultivation of macroalgae. Besides their economic value, macroalgae are beneficial in aquaculture effluent management and have been used in recirculating and open culture systems. Macroalgae are capable of absorbing ammonia and nitrate simultaneously, in contrast with phytoplankton and many vascular plants, making them potentially more useful in biofiltration applications.

The aquaculture potential of the Chesapeake may never be realized unless nutrient removal strategies are developed in parallel with pilot netpen systems.

Chesapeake Bay Program efforts to reduce nutrient inputs to the Bay through improvements in waste treatment and nutrient management programs in agriculture are examples of "supply side" solutions to nutrients. Some have suggested that the restoration of oyster populations in the Bay will filter out excess algae, removing the nutrients and reducing the problem of oxygen depletion - an example of a "demand side" solution. (This suggestion does not speak to the impossibly immense prospect of Bay oyster restoration.) Another demand side option that appears to have significant potential would be the use of nutrients directly in producing valuable seaweed products. With support from the University of Maryland Agriculture Experiment Station and the Maryland Sea

Grant College Program, I will be doing a feasibility study over the next year to assess the potential of seaweed culture in the Chesapeake. This work is being done collaboratively with Chris Standing, a graduate student in the University of Maryland Marine Estuarine and Environmental Science.

The Bay is Maryland's most valuable aquatic resource - if seaweed culture proves to be successful as a nutrient removal strategy near points of discharge like netpen aquaculture facilities for striped bass production, it may be possible to facilitate aquaculture development while keeping nutrient additions to a minimum. Stay tuned.

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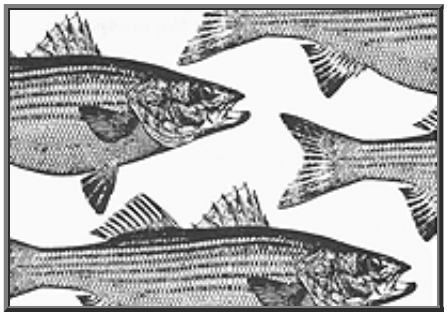
1997 Aquaculture Price Summary

Doug Lipton, Marine Economic Specialist



The Maryland Department of Agriculture's Aquaculture/ Seafood Program has been collecting wholesale prices of farm raised products since 1992. This has been a valuable service to the industry, particularly for planning and understanding the volatility of seafood prices. While the report covers many products, those produced in Maryland and outside of this region, the following discussion focuses on hybrid striped bass and tilapia, two species for which there is significant production and interest.

A separate accounting is kept for the market for live products. Live markets have been an important high-value niche for Maryland producers. For live tilapia, 1997 proved to be another strong year with an average live price of $2.11. This is an 11% improvement over the average live price in 1996. For striped bass, the story was not as good: prices fell 2% in 1997 to $3.14 from the $3.20 level in 1996. The premium for live versus whole fresh fish is much more significant for tilapia than it is for striped bass. The $0.55 more the grower gets for live tilapia represents a 35% premium over the whole fresh fish. The premium for live striped bass is only $0.25, and only 9% greater than the whole fresh fish price.

Despite the decrease in average price for live striped bass, whole fresh striped bass prices were up in 1997. In the Maryland and Washington, D.C. wholesale markets, the average price in 1997 was $2.77, up 5% from a year ago. The markets further north from Pennsylvania to Massachusetts were also up, with the average price for the year at $2.89, a 7% increase over 1996. The price differences for striped bass between the two regions has been examined by University of Maryland economists for many years and is attributed to transportation cost differences due to distance from New York's Fulton Market, which tends to be the price setter.

A survey of seafood specialty stores conducted by Maryland Sea Grant Extension and the Office of Seafood Marketing on the impact of fish kills related to the outbreak of *Pfiesteria* in the Pocomoke River, found on average, a 17 percent decline in sales. One of the surprises in our examination of aquaculture prices is that the seafood scare did not seem to have a significant impact on aquaculture prices.

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Maryland Sea Grant Schools Network

Adam Frederick, Sea Grant Education Specialist

With the increasing popularity of aquaculture education in Maryland high schools, the Aquaculture in Action educators workshop this summer (July 6-11) will go a long way towards training master teachers in counties throughout the state. The aim of the program is to equip teachers with the knowledge and technology they will need for working with students who will themselves design, construct and operate freshwater aquarium systems; students will then be able to conduct research on the fish they raise.

Working in collaboration with the South Carroll High School and Maryland Teacher of the Year Bob Foor-Hogue, Sea Grant is helping to put together a Schools Aquaculture Network that will provide state educators with a number of opportunities for starting "Raise and Release" aquaculture programs in their schools, developing an effective means for sharing information and activities, and improving the visibility of estuarine science, particularly in the Chesapeake Bay watershed.

In joining the network, schools will have access to the Maryland Sea Grant website and educational activities and will jointly produce a new quarterly newsletter about activities involving aquaculture, conservation, restoration and preservation.

For more information or questions concerning high school aquaculture programs in your county, contact Adam Frederick.

> Editor's Note: See "Aquaculture in the High Schools" for a discussion of the Aquaculture in Action Program in the Winter 1998 issue of Maryland Aquafarmer.

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Takacs Wins Extension Award

Jackie Takacs, Maryland Sea Grant Extension's Southern Maryland Regional Specialist, was given the "Rookie of the Year" Award by the Tau Chapter of Epsilon Sigma Phi, Extension's Honorary Fraternity, on April 1, 1998. She received this recognition at the Annual Conference of the Maryland Extension Service held at the Rocky Gap Conference Center in Western Maryland.

Takacs was recognized for her outstanding achievements in developing programs integrating aquaculture into youth education. An example of her effort was the very successful youth program she helped develop for the East Coast Commercial Fishermen's and Aquaculture Trade Expo in Ocean City in January.

Jackie has been with the Maryland Sea Grant Extension Program for a year and a half. She received her graduate degree through the Marine Environmental and Estuarine Science Program at the University of Maryland where she worked with finfish culture.

After graduation, she was instrumental in running oyster hatchery operations at the Horn Point Lab (part of the University of Maryland Center for Environmental Science) near Cambridge on the Eastern Shore. Her experience in these areas gave her the expertise to develop extension programs that have had a significant impact on the development of the industry in her region.

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Pond Management Program Gets Support

The Kent County Pond Management Program has won a $1,000 award from the Maryland Cooperative Extension Service to further develop and expand it as a teaching project. The funding will allow second year use of time-release fertilizer to increase productivity while minimizing labor as well as new aquatic weed control techniques. It will also enable the project to broaden its appeal to other pond owners in the Upper Shore area and provide teaching packets of information at the annual Pond Management Field Day this fall.

The project has been carried on in cooperation with Kent County farmer Carl Plummer and John Hall, Agriculture Science Agent in Kent County, Maryland, for four years. The project provides a comparison of two ponds with vastly different ages and problems. Soil tests have been used for liming recommendations, pH has been stabilized in one pond, and the ponds have been used for on-site programs that have drawn over a hundred interested citizens during the years.

According to Don Webster, Eastern Shore Area Agent, "This grant will allow us to expand our activities and audiences, providing a great demonstration project for our clientele." The on-site program will likely be scheduled for late September or early October and attendees will be able to see methods for successful pond management techniques.

Plummer and the Pond Management Project have been featured in past issues of the Maryland Aquafarmer.

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