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In This Issue:

The Environmental Finance Center
Helping Communities Balance Economics and the Environment

Dan Nees, Environmental Finance Center

For some years, the Delaware community of South Bethany has been struggling with major problems of pollution in its distinctive system of canals. Located north of Ocean City, Maryland, South Bethany is squeezed between the Atlantic Ocean on the east and inland bays on the west. The 32 bayside canals divide the town into small, relatively isolated watersheds – today, these canals have been subject to noxious agal blooms, the result of nutrients running off developed land, that eventually deplete oxygen levels. Though there is recreational boating here, fish and shellfish populations are depressed. South Bethany with a year-round population of 250 – it rises to some 6,000 during the summer – is not unique among small coastal towns in trying to deal with the problems of pollution, especially as costs rise and funding diminishes.

Dealing with pollution can require the improvement or construction of new sewage treatment facilities, the control of stormwater runoff, the installation of sewer systems or the replacement of

septic systems. Financing such large public works projects often means developing innovative approaches that include securing funding that may be available from different government and non-government sources. Many small and even larger communities lack the expertise for examining financing alternatives or developing a multidimensional plan.

The Environmental Finance Center (EFC) at the University of Maryland Sea Grant College was established in response to such local and regional needs. The Maryland EFC focuses its work in the Chesapeake Bay watershed; it is one of a network of centers around the country, each aiding communities in their region. Sponsored in part by the US EPA's Environmental Finance Branch, the nine university-based centers that make up the Environmental Finance Center Network have the objective of strengthening the capacity of all levels of government and non-governmental organizations in analyzing environmental financing efforts, and facilitating the formation of partnerships among various levels of government and private sector organizations.

A key technique that the EFC offers local decision makers and stakeholders is the charrette process. The term charrette derives from the intense final effort that architectural students make to complete solutions to a given architectural problem in an allotted period of time. In the EFC's usage, a charrette describes a gathering of various groups of people in a community to resolve common problems with the assistance of outside experts.

The 20 charrettes that the Maryland EFC has conducted for such communities as South Bethany, Delaware, Federalsburg and Port Deposit, Maryland, York, Pennsylvania and Cape Charles, Virginia have been forums for problem solving through frank discussions between local officials and experts about financing, planning and design, and other environmental issues.

Community leaders from South Bethany first contacted the EFC seeking assistance on developing funding strategies for controlling the runoff problem. In organizing the charrette, the EFC brought together watershed experts, engineers and community leaders in a daylong session. "The reason we went into the charrette" a community leader said, "is because we had a major problem with storm drainage and storm management. If we had heavy rains, water would flood the streets and would flow directly into the canals. We had to solve the storm drainage problems." The charrette recommended the need for the community to first reach a consensus concerning water quality goals, specifically goals for water quality improvement in the canals. The charrette also recommended the formation of a Citizen Monitoring Group, which would include town volunteers and assistance from local universities; this group could develop reports to help characterize the sources and composition of stormwater inputs.

In Federalsburg, Maryland, wastewater management has been a serious concern; like many communities in the Chesapeake Bay watershed, Federalsburg is struggling to balance renovations to a deteriorating infrastructure with the need to keep city taxes and public debt competitive with surrounding jurisdictions. Although a thousand workers are employed in Federalsburg, most do not live within the town's corporate limits, denying the town of needed income tax revenues and a broader base over which to spread infrastructure costs. The EFC organized and conducted a financing charrette for Federalsburg community leaders, which resulted in a strategy for the community to improve its deteriorating infrastructure, thereby promoting a sustainable local economy.

One of the most effective tools the Center provides is rate modeling and training workshops that focus on developing innovative and equitable rate structures within communities. The EFC advocates full-cost pricing of services, such as water and wastewater systems, so that communities can free up funds for other needs. The EFC recently aided the town of Cape Charles in Northampton, Virginia, in their efforts to develop and implement more effective user utility rates. The EFC training coordinator is using a software program called RateMod to analyze the rates that Cape Charles is charging for wastewater and drinking water services. The results of the study will be presented to the town council as they work to better serve their citizens.

The solutions to the problems that communities face are as diverse as the communities and the problems themselves. That is why the EFC approaches finance from a whole-systems perspective, preferably on a watershed basis. While watershed-based management requires coordination between governments and non-governmental organizations, it promotes a seamless network of environmental protection initiatives, creating a self-sustaining watershed community. The EFC promotes a "community quilt" concept of financing, where government programs plus innovative financing techniques can be brought together to help achieve desired results. By "piecing together" funding from various governmental sources as well as equitable user-based rate structures, a community, or several communities, can "knit together" a comprehensive financing package for environmental protection.

For more information on the EFC at the University of Maryland, or any of the other Centers in the Network, please call 301-405-7500, or visit the website at www.mdsg.umd.edu/EFC.

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Creating Oyster Habitat: What Makes a Good Site?

Don Meritt, Sea Grant Shellfish Specialist

Oysters and their reef habitats are critically important to the ecological health of the Chesapeake Bay and other estuaries. In addition to filtering algae, oysters provide the hard substrate that many other animals and plants colonize, thus creating diverse and complex communities. Oyster restoration in the Bay region is at an all time high with many citizen and community groups participating in efforts to rebuild once-productive reefs and to create reefs where none previously existed. While it is natural to want a healthy oyster community close to where we live, especially if we are active in helping to grow the oysters that will be planted there, not all areas are suitable for restoration. This article will address some of the basic issues that need to be considered in choosing sites for oyster restoration.

Spat – Natural or Planted?

In planning construction of a reef, it is important to first determine if the site under construction is in an area likely to receive natural spatfall. If it is, then perhaps the placement of shell as a base is all that is needed and Nature will do the rest. This build-it-and-they-will-come scenario is common in waters greater than 10-12 ppt (parts per thousand) salt. Unfortunately, this situation is not common in many of the Maryland portions of the Bay. In areas where natural spatfall is not likely, then it may be important to supplement the reef with spat. Spat can be obtained from other regions of the Bay where spatfall occurs naturally or from hatcheries.

Salinity

Perhaps the most important factor for oysters is salinity. Oysters can survive in salinities from under 5 ppt to full strength ocean water and more (ocean water is around 35 ppt). The closer to these low or high salinity tolerances, the poorer the oyster is likely to perform, primarily because extremely low or high salinities can cause of physiological stress. Unless your site is in a fresh water or ocean region, salinity will vary from season to season and year to year. Sites that have salinities well suited for oysters in the late summer or fall (especially during drought years) may be unsuitable during the spring or winter (especially during wet years). A good indicator of a site's suitability is live oysters nearby, though the absence of live oysters is not in itself a reason to remove it from consideration.

Dissolved Oxygen

Since oysters spend their lives on or near the bottom of the Bay, it is important that they be deployed at sites where there will be adequate oxygen. Historically, oyster reefs existed in many areas 30 feet or more in depth. With degradation of Bay water quality over these decades, much of this deeper water is of devoid of oxygen. This absence of oxygen, or anoxia, occurs in the summer

months when bacteria that metabolize decaying organic matter consume dissolved oxygen in the water. Winds, currents and plant activity (photosynthesis) as well as direct transfer from the air to the water all contribute to adding oxygen to the water. Locating oyster reefs in areas with good circulation, where the water is well mixed from top to bottom, should eliminate mortalities due to amoxia. This means in most regions of the Bay, sites should be limited to depths of less than 20 feet.

Disease

Oysters in many prime growing regions are under attack by the parasites Haplosporidian nelsoni, which causes MSX disease, and Perkinsis marinus, which causes Dermo disease (neither MSX of Dermo pose human health problems). These microorganisms are also influenced by salinity. MSX is only found in areas where salinities are moderately high, above 14 to 16 ppt; it is possible to remove oysters infected with MSX parasites and deploy them in low salinity waters to relieve them of disease pressure.

Dermo disease is better able to survive in lower salinity waters. Unlike MSX, Dermo will not be "purged" from oysters if they are taken from high to low salinity waters. While the parasites may become less virulent, and less likely to spread, they typically remain within the oyster and can become damaging and cause death if salinity rises. For this reason, it is not wise to transplant infected oysters into low salinity waters as they could then serve as a reservoir for parasites if salinity increases (a result of low precipitation).

Predation

While the oyster is wonderfully adapted for thriving in a wide range of conditions, it is still vulnerable to attack not only by disease but by predators such as Styllochus, a worm that feeds voraciously on spat, boring sponges, as well as crabs. Consider predator and parasites that may invade the oyster reef you are planning to construct. In other words, try to locate reefs at sites where predatory organisms are less likely to be plentiful – at least as much as practical.

Bottom Characteristics

Oysters grow best on hard substrates. In most cases in the wild, new generations of oysters attach to older generations; this is how reefs are formed.. However, it is possible to jump start reef development by establishing a hard substrate suitable for oysters to attach to. Think of an oyster reef as the foundation of a house: no one would consider building one on mud – it would simply sink until it encountered a bottom solid enough to hold up the rest of the structure. The foundation of a reef must be strong enough to keep the oysters from sinking into the ground and strong enough to withstand storms and other forces – particularly waves and heavy current surges – that could tear it apart.

While almost any bottom type can be made suitable for an oyster reef, it is often difficult and expensive to accomplish. Most waters in the Chesapeake that would be good for oyster growth are in areas where the bottom is not very conducive to reef construction. Consider that it takes over 2,000 bushels of oyster shell (or other materials) to cover an acre of bottom one inch deep. It would take almost 10,000 bushels of shell to stabilize the bottom that could sink four or five inches under the weight of a reef; with current rates of deploying oyster shells in the range of $0.50-1.00 per bushel, costs are easy enough to estimate.

Because it is less expensive to select a site where a minimum of shell material will be needed for stabilization, the best sites are usually existing or buried oyster reefs. These reefs had developed naturally because conditions favored oyster survival; it makes sense to seriously consider this type of site for reef restoration. Other sites where the bottom is firm – stones, hard clay or where other stable conditions exist – are also reasonable candidate sites. Sand, mud, or other soft or shifting substrates are difficult to deal with and should be avoided, as should areas where there is excess sedimentation.

Exposure: Physical and Human

Exposure to external forces is an important consideration in siting an oyster reef: heavy wave action, for example, can actually lift oysters and shells and transport them to locations far from where they were originally placed. This is especially true in shallow water areas. Any reefs in water less than six to twelve feet deep should not be located in areas where severe winds will

cause heavy wave action. Even if the force of the waves does not move the oysters, it may stir up sediments, that could bury them. Exposure to runoff that carries toxic substances should also be avoided. Luckily, in most areas where oysters grow this will not be a problem.

Exposure from unwanted harvest is also an important consideration in planning an oyster reef. Place reefs not designed for harvest in areas that are away from commercial activity when possible. Check regulations that are in effect for any potential site. It is also desirable to have the reefs located in areas where they are easily observed by citizens or others who will be able to call attention to any unauthorized activity. In addition, there may be property owners or recreational boaters who do not want an oyster reef built near their property – the more we respect individual rights, the more we can avoid conflict and the greater chance there is that a reef restoration project will be successful. Get as many stakeholders on board a reef restoration project as you can. Take the time to air potential conflicts before the reef goes into the water. It's better to relocate a reef before it is built than to fight over it after all the personal effort and money that have been spent in constructing one.

Oyster reefs have different purposes – not all restoration is for ecological purposes: some may be for commercial harvest; some for limited commercial harvest; and some for private oyster farming. Also there is increasing interest in making broodstock sanctuaries that will stimulate increased natural recruitment. Each of these restoration goals may dictate different factors to consider when constructing the reef.

In summary, there is a good deal to consider in building a successful oyster reef. Planning is essential if you want the greatest possibility for success. In constructing a reef, you are attempting to build a home for oysters and other organisms and their requirements must be understood if there is to be any realistic chance for success. Do your homework, talk to others that have experience with oysters in the areas you are considering, and do not rush into any project without being well prepared. Taking more time on the planning end of a reef building project will pay off in the long run.

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Lessons About Oyster Gardening

Don Webster, Eastern Shore Marine Agent

The third Maryland Oyster Forum was held in Annapolis on March 3, 2001; a program of The Oyster Alliance, the forum provides continuing educational experiences for the corps of oyster gardeners in Maryland who raise spat for restoration projects. The Oyster Alliance, an informal partnership of the University of Maryland, the Oyster Recovery Partnership (ORP), and Chesapeake Bay Foundation, brings together the unique expertise of each group to focus on restoring Bay oyster resource through joint programs and activities.

Speakers this year covered aspects of new oyster reef siting. Charles Frentz of ORP, who moderated the session, provided an update on the activities of his group, which has become a significant player in the field of oyster restoration. Don Meritt of the Sea Grant Extension Program spoke about the important considerations that must be made in choosing sites on which to place oysters. (See "Creating Oyster Habitat" by Don Meritt). CBF Chief Scientist Bill Goldsborough brought information on the plantings that the Foundation has carried out in the Bay as well as updates on how they are doing. Chris Judy, who is in charge of oyster programs operated by the Maryland Department of Natural Resources (MDNR), gave the perspective of the management agency in the siting procedures and permitting, as well as updates on the repletion program that supports commercial oyster grounds.

A panel of oyster gardeners gave "Tricks and Tips," which was a great hit as it has been in past years. Joining the CBF gardeners for the first time were representatives of the Surfrider Foundation (SF) and the Assateague Coastal Trust (ACT), who have expanded oyster gardening to the coastal bays. Randy Meyer of SF and Ron Pilling of ACT provided excellent accounts of the activities of their groups, as well as the problems that they face in trying to construct new oyster reefs in areas where the placement of shells is a very expensive procedure. CBF representatives brought information on ways in which they had modified growout gear in order to make it easier to clean, as well as the efforts that they had in building coalitions of other citizens in oyster production.

Stephanie Reynolds, CBF head for oyster gardening, provided updates on the number of gardeners and their production over the years. She also has provided data for the Sea Grant

sponsored oyster gardening web site so that individuals can see what growth, survival, and mortality has been by river system throughout the Bay.

Ken Paynter, one of the University of Maryland's principal researchers working on oyster disease and restoration, provided information on the nature of the diseases affecting oysters in the Bay and what is being done to manage the populations in the face of continuing mortality in many areas.

After a demonstration of information available on the internet, participants took part in a series of training modules. A "Shucking Station" demonstrated how to open oysters. "Up Close and Personal" consisted of touch containers that held oyster parasites and commensal organisms that gardeners will find in their floats. A video camera brought real-time projection of the feeding activity of an oyster to the "big screen," with participants spending time watching this fascinating part of oyster life. Another station on "Data Collection" showed gardeners how to properly measure the growth of their animals. The final station on "Volunteer Opportunities" brought new ways for participants to help with oyster restoration.

For more information on Oyster Gardening, contact the Chesapeake Bay Foundation at (410) 261-0481. For "Oyster Gardening for Restoration & Education," a publication of The Oyster Alliance, see www.mdsg.umd.edu/oysters/garden/index.html.

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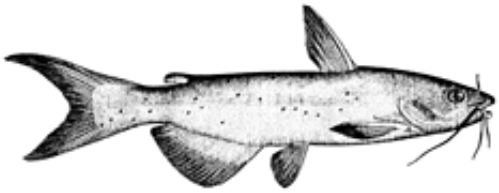
Marketing Maryland Aquaculture Products

Charles Petrocci

We ordinarily associate aquaculture with farmed fish in ponds and recirculating systems or shellfish that are tended on leased bottom or in floating containers. In Maryland, however, pond-reared fish account for a relatively small portion of the industry, as does oyster farming, which until recently seemed a dead end, largely because of disease.

Commercial aquaculture in Maryland is much more diverse. While its largest application is for restoration, currently the state industry is based largely on ornamental fish and small farm businesses that produce soft crabs, oysters, striped bass hybrids, crawfish, catfish, tilapia, trout, aquatic plants and various other species.

Increasing numbers of such small businesses could well be the future of an expanding Maryland aquaculture industry that produces products for specialty or niche markets. As productivity develops, opportunities may arise for accessing larger outlets. Some entrepreneurs in Maryland have been innovative in selling their products, taking advantage of their capabilities and market demand. For example Rich Peltz of Circle C Oyster Ranchers Association has persevered through the hazardous waters of state permitting agencies to create a business that now includes cooperative growers and associates. He has plans to expand into other states with this concept.

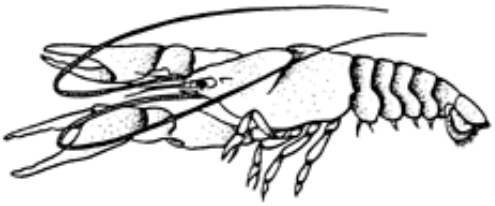


Though there are general principles for marketing seafood and aquaculture products, (see sidebar, Basics of Seafood Marketing), the diversity of enterprises in the state means that different sectors need to assess their strengths and tailor their marketing strategies. This is especially important as new businesses start up, for instance, oyster farming, small farmed-fish enterprises and fee fishing operations.

Maryland producers begin with an advantage in that the state already has a reputation for producing quality Chesapeake Bay seafood. For well over 100 years, Maryland has been synonymous with oysters, crabs and striped bass – and aquaculture businesses can draw on this reputation and enhance their product identity.

Developing realistic marketing strategies will be the difference between success and failure for most ventures. A solid marketing plan is essential and must be an integral part of the overall aquaculture business plan. Cultured products can be sold by a variety of methods, each requiring

a different level of investment and involvement by the producer/grower. Production output, cash supply, and business expertise of the grower should all be factors when developing the marketing plan for product sales and distribution to ensure venture success. Too often, marketing takes a back seat to technology transfer and other aquaculture initiatives.



From such a perspective, several factors can influence the development of Maryland's aquaculture industry. These include U.S. supply of seafood from both domestic landings, foreign imports and competitive cultured products from other states. For example, the success of efforts to rebuild natural striped bass stocks on the East Coast is having significant impact on the hybrid bass business, as harvests from wild stock landings flood regional markets. If farmed striped bass operations are to have a competitive chance, they need to plan their marketing during those seasons when striped bass are off limits to harvesting. At the same time, marketing plans will need to make a case for the high quality of a farmed product.

Farmed hardshell clams on the east coast are an example of how aquaculture can fill a gap, then expand, especially through marketing. (See "Clam Aquaculture in Maryland" and "Clam Aquaculture in Virginia," *Maryland Aquafarmer,* www.mdsg.umd.edu/Extension/Aquafarmer/Winter01.html)

Farm raised seafood has advanced from being a substitute for ocean caught fish to a highly regarded premium product. Witness the examples of salmon, the U.S. catfish industry and hard clam operations. As consumers adapt to new food items, whether in the home or restaurant, it is important that the product be of the highest quality for customer retention and repeat sales. Aquafarms can provide this quality assurance effectively and consistently perhaps more than many other fishery products because of harvest control by the farmer. Small-producing aquafarmers have several sales options to market their products, giving them some leverage in dealing with fluctuating harvests, price changes, seasonality and consumer behavior.

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Basics of Seafood Marketing

Charles Petrocci

Wholesale Markets. Wholesale markets enable aquaculture producers to concentrate time, effort and cash resources into fish production. The wholesaler is responsible for having available refrigerated trucks and product storage equipment; they also pay for insurance, taxes and maintenance costs. Wholesalers have a broad customer base, which allows them purchasing power of a single species resource. They are also in the business of buying seafood products at low price ranges in large volume; thus the producer may receive lower prices than expected.

To remain competitive, producers may have to supply wholesalers with quality products of consistent size and weight and at uniform prices. For such reasons, well-planned production efforts and aggressive sales that assure acceptable cash flow are critical.

Retail Markets. Aquaculture products have become highly visible and an important part of most fresh seafood markets across the country. Retail sales offer direct product sale contact with the customer. Direct sales to small independent grocers, franchise markets and area restaurants can be very profitable market outlets. Other options are to market products to middlemen, who serve as smaller seafood distributors with access to larger wholesale markets, distribution chains, retail stores, or food supply businesses.

Establishing a cooperative, if feasible, among smaller growers with similar cultured species may be one avenue to follow when trying to market products. A collective marketing approach can lead price leveraging opportunities.

Direct Sales. Direct sales to consumers allow the producer to cut out the "middleman" and realize

a greater profit. Costs usually accrued to pay to a wholesale shipper are saved by the producer, thus increasing profit margins. Selling directly can offer a degree of independence not possible when dealing with a wholesaler. Also if marketing your own product line by name, you can establish a recognizable product identity.

Sales and product movement to prepared products such as those used for festivals or live fish stocking are also considered a form of direct sales in aquaculture. They would also include pondside fish sales to consumers, fee fishing, roadside stands or established farmers markets.

Direct sales allow the producer to have more control over product price, harvesting schedules and product distribution. Disadvantages include limits on only having one species of fish to market and not having the selling leverage that a larger wholesaler enjoys. Those willing to buy a single species of product may not take large volume and the grower must ensure other smaller accounts to absorb the total production.

Live Markets. The potential for live fish marketing of aquacultured products has been growing. Once limited to ethnic groups such as the Asian community, the live market has expanded into white tablecloth and gourmet restaurants, supermarkets and various seafood markets and distributors throughout the U.S. New and previous underutilized species are now in demand for this growing market. Current demand is being filled by both wild caught species and cultured species.

Maryland along with other mid-Atlantic states has had a long history of shipping live shellfish to local, regional and international seafood markets. Several species of marine shellfish and crustaceans from both wild harvest and aquaculture production constitute the mainstay of live seafood shipments. Other notable live sales of cultured species include ornamental fish, aquatic plants, eels, trout and carp.

Niche Markets. Niche marketing is the technique used to satisfy customer needs with a new or different product or product form. Niche marketing is the method by which the producer finds a market that can absorb the product and offer a return that provides an acceptable profit. The high rate of return usually achieved in niche marketing provides many small producers with an opportunity to compete on a broader playing field. Niche markets are usually limited in size and in their ability to accept large amounts of product; examples include the sales of specific baitfish to anglers such as those targeting striped bass or sales of unusual fish to the aquarium trade.

Success in niche marketing usually depends on establishing long-term customer relations and publicizing the benefits of a unique product. Niche markets range from sole proprietorships, specialty stores or fine restaurants; direct mail is also another avenue for niche markets as a form of direct sales. To be successful a producer must be flexible and be able to accommodate customer needs and demands.

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Bacteria Research May Bring Faster Biofilter Startup

Don Webster, Eastern Shore Marine Agent

One of the most interesting papers presented at the World Aquaculture Society's Annual Conference in Orlando, Florida this year was by Dr. Timothy Hovanec. Following work published in the Journal of Applied and Environmental Microbiology, Hovanec reviewed investigations into differentiating species of bacteria, including those that we thought most responsible for nitrifying actions within biofilters. It now seems, we may have been looking at the wrong ones.

Those who are familiar with biofilters, whether for crab shedding or fish culture, understand that the bacteria we try to establish on the filter media breaks down toxic waste products as part of the nitrogen cycle. We had assumed that Nitrosomonas bacteria were converting the ammonia in the system to nitrite and that Nitrobacter were then converting nitrate to relatively non-toxic nitrate. Often, we would suggest that new biofilters be inoculated either with commercially available bacterial cultures, or that the operator take some garden soil, stir in a quantity of water, let the solids settle, then pour the liquid into the system. The attempt was to get some bacteria into the system that could then be cultured, bringing the system into full operation before it was loaded.

The work of Hovanec and his associates on the phylogenetics of bacteria that oxidize ammonia and nitrite has shown that other more effective bacteria may instead be at work. They suggest that

Nitrospira and Nitrosospira are in fact the groups that are far more suited to carrying out their task of nitrification in both seawater and freshwater systems. The results of this work have been very interesting. Hovanec argues that Nitrosomonas and Nitrobacter are actually soil bacteria and are not all that well suited for work in the liquid environment of a recirculating system biological filter. The fact that these bacteria are so prodigious in soil should reinforce that assertion.

Experiments by Hovanec and his collegues showed that when Nitrospira and Nitrosospira were placed in biofilters, they came on-line much faster than similar concentrations of Nitrosomonas and Nitrobacter. In fact, the difference was quite striking. The biofilters begun with cultures of Nitrosomonas and Nitrobacter took thirty days to fully develop; this is similar to what operators have noted for many years and what Sea Grant Extension faculty have been cautioning operators to expect as they brought their systems up to operational capacity. The new bacterial species, however, took only ten days for the biofilters to become fully operational.

For commercial operators, the application of this knowledge may be a great help. Using these cultures, an operator would be able to start a new system more rapidly, saving on the energy costs of running pumps, before the introduction of large numbers of animals, as the biofilters are brought to full load. We should also be able to recover from the inevitable crashes that occur with biofilters, which could eliminate some of the problems of diluting system water as the operator tries to cope with the inevitable increases in ammonia and nitrite while biofilter bacteria recolonize.

As the saying goes, however, "There's good news and there's bad news." The good news is that this research will have great application in the recirculating system industry. The bad news is that no company is yet raising these strains for commercial sale. It should not be long though before companies currently offering bacterial cultures for sale begin to turn out new products designed with the more effective bacteria. When that happens, recirculating system operators will be glad to have products that work faster and more efficiently to help them keep their animals in optimum conditions.

Dr. Timothy Hovanec's website, Topical Science, includes articles on biofilters and nitrospira: http://members.home.net/kevdone/AF/Topical_Science.html.

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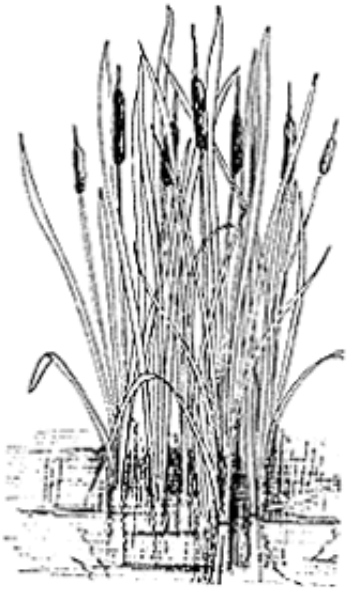
Spring Clean-up for Ponds

Jackie Takacs, Regional Marine Specialist



This is the time of year that most of us start venturing outdoors to determine where we begin our yearly yard work rituals. Where to start? Fertilize? Till? Mulch? Look over your pond? Yes, pond owners, get out there and look at your pond. Chances are if you had aquatic weed problems last year, you'll have aquatic weed problems again this year. Instead of being reactive, be proactive. Manually remove unwanted plants now, just as they are starting to grow and their numbers are low, rather than after they have taken over your pond – manual removal then would be daunting. Contact your local Sea Grant agent for more information on physical removal methods of controlling aquatic weeds. To ensure a successful (or less frustrating) pond season, here is a summary of some of the more commonly asked questions and misunderstood principles about pond management.

General Information

Ponds require regular year-round maintenance to retain their original characteristics and function. Record keeping enables pond owners to evaluate pond management decisions. Typical records include the application of lime, fertilizer or herbicide, addition or harvest of fish, and fish population analysis.

There are 4 areas of pond management: (1) pond and watershed management; (2) water quality management; (3) crop management; (4) pest management.

Pond and Watershed Management.

Understanding design and construction concepts and maintaining the watershed.

Prior to digging or re-digging a pond, landowners need to contact their county Natural Resources Conservation Service to obtain the appropriate permits. Surface water run-off into a pond is the primary source of pollutants (nutrients) to a pond. Some "Bay Friendly" landscape practices that can be used to minimize the run-off of nutrients to a pond include: minimizing paved areas, controlling water flow, maintaining lawns , not mowing up to the edges of the pond, planting flower/shrub beds and planting buffer strips.

Water Quality Management.
Understanding and manipulating the physical and chemical components of water.

Low oxygen levels are the primary cause of fish death in ponds. There are two sources of oxygen to a pond: diffusion (direct exchange of oxygen at the water/air interface) and photosynthesis (process by which plants manufacture food). The amount of oxygen in a pond and the ability of water to retain oxygen is influenced by time of day, weather, altitude, and water temperature. Low oxygen situations usually result from a turnover event (turnover is the mixing of temperature-stratified water layers in a pond). They naturally occur and can become problematic in warmer months when large oxygen-poor bottom layers are mixed with fairly shallow oxygen-rich surface layers, resulting in total pond oxygen levels that are too low to support aquatic life. Such events can be triggered by heavy winds and thunderstorms.

Signs that might indicate there is an oxygen problem in a pond include: fish congregating at the surface gulping for air, fish stopping their active feeding, animals crawling out of the pond and water turning gray or brown.

Crop Management.
Balancing fish populations for sustainable harvest.

Fish deaths that are thought to result from something other than low oxygen (i.e., disease, chemical toxicity) should be reported to the Maryland Department of the Environment at (410) 631-3000. Fish from rivers, streams or other ponds should not be used for stocking due to the possible introduction of disease or other undesirable organisms to the pond. Pond owners do not need a permit to stock channel catfish, bluegills, fathead minnows or golden shiners. Any other species of fish requires a permit for stocking (even in a private pond). Stocking permits, a list of certified fish vendors and information on the state's stocking program can be obtained by contacting Tammy O'Connell, Maryland Department of Natural Resources at (410) 260-8323.

Pest Management.
Controlling unwanted visitors to the pond.

Aquatic plants are an important part of the natural ecology of a pond but can become a nuisance when they deter from the natural use of the pond. These aquatic plants can be controlled mechanically, biologically or chemically. Though grass carp are legal biological controls in some states, it is illegal to possess them in Maryland. There are 12 steps that should followed when using an herbicide to control aquatic plants. Prior to applying an aquatic herbicide, pond owners need to contact their county Natural Resources Conservation Service to obtain the appropriate permits.

For more in-depth information on any of these topics, please contact your local Sea Grant office.

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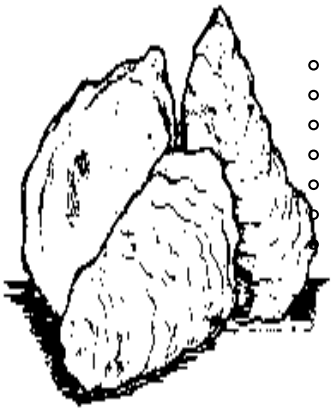
Oyster Institute

A Workshop for Environmental Educators in Maryland
June 10-12, 2001

Maryland Sea Grant, in partnership with the University of Maryland Center for Environmental Science (UMCES) and the University of Maryland Biotechnology Institute (UMBI), will conduct a comprehensive training workshop for educators who work with the public on oyster gardening, restoration and education programs.

The workshop will be held at the UMCES Horn Point Laboratory in Cambridge (evening of June 10, and June 11) and the UMBI Center of Marine Biotechnology in Baltimore (June 12) and will



cover the following topics:

- oyster biology and ecology
- oyster culture in the hatchery
- genetics
- disease
- predation
- restoration ecology
- history of oyster culture in the Chesapeake

Hatchery activities at Horn Point will include oyster spawning, larval rearing and shellbag production; labs at the Center of Marine Biotechnology will cover internal and external anatomy, ecology, oyster filter feeding, disease identification and the oyster immune system. The training workshop should be of great assistance to Maryland educators, providing them with the most current information on issues related to oyster restoration.

Registration is limited to 30 participants. (We may have to limit the number of participants from each organization or agency.) The $40 registration fee will cover two nights in a dormitory at Horn Point, meals, and materials. The Oyster Institute is supported in part by a grant from The Chesapeake Bay Trust. For an application form or more information, contact Maryland Sea Grant at (301) 405-7500, or write Jeannette Connors at connors@mdsg.umd.edu. Registration can also be done at www.mdsg.umd.edu/OysterInstitute.

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New Publications

Aquaculture As a Teaching Tool in the Classroom: A Proceedings

The New England Aquaculture Educators Network (AQUA) has published a proceedings of abstracts from the aquaculture education session at the Aquaculture America 2000 conference in New Orleans. AQUA, a program of the New England Board of Higher Education and funded by a grant from the Advanced Technological Education program of the National Science Foundation, was designed to train middle and high school teachers and college faculty on how to introduce aquaculture into existing programs. According to the proceedings, educators in the AQUA project from six New England states were given aquaculture instructional materials through a series of workshops. Forty-eigh schools participated in two one-week workshops, one in marine aquaculture and the second in freshwater recirculating systems. The project provided participants with aquaculture equipment or complete recirculating systems. At that time, AQUA had prepared more than 40 New England educators to teach the fundamentals of aquaculture in the classroom, to use aquaculture as a means to engage students in math and science education, and to prepare graduates for work in the aquaculture industry.

The proceedings, which includes summaries of numbers of case studies, is divided into six topics: (1) Aquaculture Networks: Industry & Educational Models, (2) Strategies for Implementing Aquaculture in the Classroom: The AQUA Model; (3) Instructional Materials Development; (4) Regional Educational Initiatives; (5) Future of Aquaculture Education; and (6) Poster Presentations. For more information, contact the New England Board of Higher Education, (617) 357-9620. Their website is www.nebhe.org.

Oyster Culture by George C. Matthiessen

George Matthiessen, president of Ocean Pond Corporation, discusses a range of issues in the brief space of this 150 page book. Beginning with a discussion of raising oysters in salt ponds off the coast of Connecticut in southern New England, he covers oyster biology, the early years of his own company, oyster culture throughout the world, issues of disease and managing around it, as well as limits to oyster production. Iowa State University Press is a Blackwell Science Company. The book sells for $79.95. For more information, contact the publisher at 1-(800) 862-6657 or write to Iowa State University Press, 2121 S. State Avenue, Ames, Iowa 50014-8300.

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