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In This Issue:

Oyster Restoration in the Chesapeake Bay: *Looking Back, Looking Forward*

Don Meritt, Shellfish Specialist
Merrill Leffler, Communications Specialist

Commercial oyster harvests in the Chesapeake Bay have been at all time lows for nearly a decade now. During the preceding half century, Maryland watermen harvested some 2 to 3 million bushels a year; since the late 80s, they've only been able to bring in a reported 100,000 to 300,000 bushels annually. The decline of the fishery, once the nation's most prosperous, has impacted processing houses and supporting businesses throughout the Bay's waterside communities, especially on the Eastern Shore. A more subtle impact has been the increased fishing pressure on blue crabs as some watermen have been forced to extend their harvesting season for crabs in order to make a living that they would ordinarily have made from oysters.

The major cause of oyster mortalities over these recent years has been parasitic disease, especially Dermo *(Perkinsus marinus),* and in years of higher salinities in Maryland waters, MSX *(Haplosporidium nelsoni).* There is good evidence now from Eugene Burreson and his colleagues

at the Virginia Institute of Marine Science that MSX is a non-indigenous species, inadvertently introduced to the east coast by planters and others who years ago brought in the Pacific oyster, Crassostrea gigas.

Oysters feed by filtering algae from the water; in doing so, they sequester nutrients (nitrogen and phosphorus) that algae have taken up. Nutrients, however, have been overwhelming Bay waters, as they have estuaries throughout the world. Coming in by way of land runoff, waste treatment and industrial plant discharges, and airborne sources, especially automobile and industrial exhausts, they can cause extensive blooms of algae. With fewer and fewer oysters left to feed on the algae, uneaten cells eventually die and descend through the water column – in concert with the Bay's physical circulation patterns, natural microbial processes that break down the dead algae deplete oxygen in bottom waters, thus killing hosts of organisms that dwell there, including oysters.

In 1988, Roger Newell of the University of Maryland Center for Environmental Science (UMCES) Horn Point Laboratory made some rough estimates of what the oyster's filtering capacity could mean for the uptake of algae, and by inference water quality (e.g., dissolved oxygen), in the Chesapeake. According to Newell's calculations, which were based on several generalizing assumptions, oyster populations in the 1880s could have filtered the entire Bay in less than six days; in 1988, the Bay's much depleted oyster populations would have taken more than 300 days to do the same.

While Newell's numbers are subject to dispute, his argument about the function of oysters in the Bay system has been instrumental in focusing discussions about the oyster's ecological importance. Meanwhile, other studies, in the Chesapeake and elsewhere, have been examining the role of oyster reefs, the three dimensional structures that once were a feature – and sometimes a navigational hazard – of nearshore Bay waters.

The growing recognition of the oyster as a keystone species in the Chesapeake ecosystem has been having a major influence on oyster policy in Maryland and Virginia. For example, Maryland DNR's goals now include increasing sustainable oyster populations not only to improve and strengthen the oyster industry, which has been damaged economically and socially, but to help reverse the Bay's decline in water quality. A decade ago it was not.

Though the specter of disease continues to hang heavily over oyster restoration projects, recent advances in controlling disease – for example, producing oyster strains that have some resistance to MSX and Dermo – hold promise for the future. Many of these advances have resulted from research supported by the Oyster Disease Research Program, a federally funded program overseen by the National Sea Grant College Program. There is also increasing investment by federal and state agencies in restoration. In the next decade, the federal government is contributing $50 million aimed at achieving a 10-fold increase in oysters over a 1994 baseline; the state of Maryland is contributing another $25 million. This funding is in addition to special federal appropriations and other programs that have underwritten projects already underway. Projects include restoration efforts by the Maryland Department of Natural Resources, work by the Oyster Recovery Partnership, a non-profit organization that enlists watermen, aquaculturists, environmentalists and educational institutions in restoration efforts, and community organization projects. The Partnership implements the Maryland Roundtable Action Plan, which sets out guidelines for oyster restoration. A key element in all of these efforts is the hatchery at the University of Maryland Center for Environmental Science (UMCES) Horn Point Laboratory, which has been producing both eyed larvae as well as disease-free oyster seed.

While there is a good deal of optimism about the future of oyster restoration in Maryland, unfortunately there is a lack of coordination among the many projects currently underway in the state. Without some consistency in monitoring protocols, for example, with regard to oyster strains, growth, disease incidence, mortality, reef structure, salinity, it will be difficult if not impossible to make comparisons of restoration success and failure among different sites. Equally important, there is a need for continuing dialogue, and coordination among researchers, resource managers, and watermen who harvest oysters. A willingness to share information and resources by all interests, including Maryland citizens, who rely on healthy oyster populations will mean improved water quality and a stronger fishery for the years ahead. If we are to have a realistic chance of meeting the 10-fold increase a decade from now, we need to begin such coordination now.

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Oyster Production at the Horn Point Laboratory, 1994-2000

Don Meritt, Shellfish Specialist

The oyster hatchery at the University of Maryland Center for Environmental Science (UMCES) Horn Point Laboratory has a long history of producing oyster larvae and seed oysters for use in research, extension, education and restoration projects. Over these last seven years, we have increased our efforts and our production significantly to meet the needs of expanding programs in each of these areas. The growing recognition that oysters and oyster reef habitats play a key ecological role in the Chesapeake Bay has spurred a variety of restoration activities. In 1994, a gathering of scientists, resource managers, watermen, aquaculturists, legislators and representatives of non-governmental organizations convened to address innovative methods to deal with the declining stocks of oysters in the Bay. An important component of the resulting "Action Plan for Oyster Recovery in Maryland" was the use of hatchery-produced seed as a tool for rehabilitation of oyster reefs. The plan called for planting disease-free seed oysters in specially designated Oyster Recovery Areas (ORAs). Consequently, oyster larval production was stepped up in 1995 and increasingly since then to supply expanded spat setting operations at Horn Point and at the Department of Natural Resources Piney Point facility in Southern Maryland.

The seed oysters have gone to oyster recovery areas, to community plantings – in conjunction with the Maryland Department of Natural Resources, the non-profit Oyster Recovery Partnership, the Chesapeake Bay Foundation (CBF) and the Living Classrooms – to aquaculturists, and to a growing number of oyster gardeners, including individual citizens and school groups under a program developed by CBF. Maryland Sea Grant has teamed up with CBF, the Oyster Recovery Partnership and the UM Center for Environmental Science to form The Oyster Alliance – its goal is to coordinate oyster activities of the member organizations, to reduce duplication and more efficiently use their collective resources, and to educate participants in the gardening program.

The UMCES Horn Point hatchery increased larval production from 82 million in 1994 to over two billion in 2000. Depending on the year, a large percentage of the larvae produced at this hatchery has been used by other organizations to produce spat on shell for restoration activities. The largest single recipient of this sort of activity has been Maryland DNR, which during 1997 and 1998 produced the majority of their spat from larvae spawned at the Horn Point hatchery. Production increases are a direct result of more funding, greater participation by other organizations and expansion of our facilities for growing the algae that larval oysters themselves need to grow. Larvae feed on algae for two weeks before they become "competent" to set. In the hatchery, we place bagged shells in setting tanks for larvae to attach to.

Currently, the Horn Point hatchery facility spawns and rears some 90 percent of the oyster larvae produced in the state of Maryland. These are used to set oyster spat on shells for restoration activities, for research on a range of oyster-related studies and for use in programs for watermen, oyster culturists, students and the public. Scientists at the UMCES Horn Point Laboratory and Chesapeake Biological Laboratory also work closely with researchers from other states on projects aimed at solving the problems that plague oysters in the region, for example, eyed-larvae and spat are used in conjunction with oysters produced by hatcheries in other states in cooperative programs on oyster disease.

A new Aquaculture and Restoration Ecology Laboratory at Horn Point is scheduled for completion in 2003. This new facility will greatly expand the capacity for oyster production and will provide quarantine and controlled environmental facilities to advance oyster culture and disease research.

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Reflecting on Maryland's Oysters: An Essay

Don Webster, Eastern Shore Marine Agent

Old timers in the Chesapeake Bay used to say "Once ya git arster mud on ya, ya'll nevah git it off." They meant that working with oysters is addictive – and they were right. Since 1974, when I moved to Maryland's Eastern Shore as a Sea Grant Extension agent, I've worked on many Bay issues – but I have enjoyed nothing as much as I have in working on oysters. That has meant the commercial fishery, aquaculture, hatcheries, policy and the many folks whose lives have been affected by the changing fortunes of the Chesapeake's oyster populations. The year 1957 signaled one of those major changes – that's when MSX first appeared in the high salinity areas of the lower Chesapeake and starting killing oysters.

The bulk of the Bay oyster harvest shifted from Virginia's private leaseholds to Maryland's public bars. Maryland watermen were harvesting around 2.5 to 3 million bushels a year, though in years of low rainfall, the ocean's high salinity waters pushed further up the Bay into Maryland, which enabled MSX to survive and cause oyster mortalities. Then Dermo appeared in the Chesapeake. While Dermo's killing efficiency waxes and wanes with salinity, it can better tolerate lower salinities than MSX and has been the major cause of oyster deaths in Maryland. Its spread was further exacerbated because of resource management programs that move oyster spat from seed-beds to public bars throughout the upper Bay. As a consequence, Dermo-infected oysters were transported over the years throughout the Bay system where it hadn't been before. The results were disastrous for oyster populations and, of course, for commercial harvesters and processing houses.

Though private oyster culture has traditionally played a small role in Maryland – some 9,0000 acres compared with more than 200,000 acres of public reefs – oyster leaseholds were far more productive than public grounds. About the time I arrived in Maryland in 1974, the Department of Natural Resources placed a moratorium on the leasing of Bay bottom for growing oysters. The aim, which was to redefine those areas that would be available for private culture, was in effect a continuation of the century-long battle between those who wanted to farm oysters privately and those who wanted to hunt them on public grounds. The presence of Dermo and MSX throughout the Bay has tended too make the argument moot today, since heavy mortalities occur before oysters reach harvestable size.

In 1974 there were still a lot of oyster houses operating around the Bay Some were seasonal while others like the H.B. Kennerly Company in Nanticoke had developed a year-round demand for high quality shellfish. The Nanticoke was an anomaly in Maryland: over 25 percent of the total leased ground in the state was located in the area, much of it owned by small planters who also worked the public bars during the winter months. They would place oysters on their leases during the winter and take them up during spring and summer, when prices were higher. Because of the constant supply, the Kennerly Company had developed an excellent national reputation and regularly sold oysters throughout the nation. The company did this while others in the seafood industry said it couldn't be done – apparently few in Maryland had ever taken the opportunity to see how well a properly functioning oyster industry could do. As Dermo and MSX spread in the 80s, however, oysters in the high salinity Nanticoke area were among the first in the state to be hit by the devastation. Today, most Maryland oyster houses are gone while the few still in operation have filled out their production with oysters from other areas.

Twenty-five years ago, there were around 35 skipjacks working the Bay. The sailing vessels were striking to the eye as they harvested oysters by dredge; they were also one of the prime examples of legislated inefficiency in fisheries management. Although I feel fortunate enough to have sailed on several and still treasure the experience, they were more romantic to an observer than they were to crew members. As I've heard more than one say, "Anybody who thinks skipjacks is purty ain't never worked on one, I'll tell ya!" Most of the skipjacks sailing at that time had been built in the early 1900s. For a time, as the oyster industry picked up near the end of the 70s, several new ones were built. When the collapse hit, these dredge boats were among the first casualties. The age and expense of keeping them up made them uneconomical. While some were sold out of the working fleet to become private craft, others were just abandoned and left to "die" on mudbanks. While we will always have examples in museums for our children to see, what will be lost is the "technology" of dredging under sail. The captains that I've known and sailed with are pretty special people and I hope that they will keep sailing – even if it means taking students and tourists out as they have

been doing in recent years.

In 1992, watermen, processors, scientists, regulators, and environmentalists came together to form the Maryland Oyster Roundtable – this was a unique venture in trying to restore oysters through a broad consensus. A key element, different from many other attempts in the past, was to finally focus on the oyster as a "resource" rather than solely as an "industry." All parties found that they had to give up some things to ensure that they ended up with others. The meetings weren't always pretty or efficient. While it hasn't totally succeeded, the actions of the Roundtable have certainly helped move us down the road to recovery.

Spurred by an interest in the renewed prospects for recovery of oysters for their ecological importance, citizens have become involved in restoration efforts. Led in Maryland by the Chesapeake Bay Foundation, individuals, community groups and schools are raising oysters to be planted on newly-created reefs. Most of these efforts are in lower salinity areas that do not currently have high levels of disease. There is a growing appreciation of these oysters reefs as important in other respects. Torn down by many years of commercial harvest, and then smothering by runoff, their restoration is seen as critical for leading to oyster sustainability and attracting a host of organisms up and down the food chain.

Science has helped us move along to brighter prospects for oyster restoration. Over the years, hatchery technology has advanced greatly. Millions of oysters being placed in the Bay for restoration efforts are coming from the University of Maryland Center for Environmental Science (UMCES) Horn Point Laboratory, as Don Meritt writes in "Oyster Production at the Horn Point Laboratory." Advances in handling the vast quantities of materials necessary to make an actual difference in a system as large as the Bay have taken place. Breeding and selection to develop disease-resistant strains is becoming a reality through the cooperative efforts of the CROSBreed (Cooperative Regional Oyster Selective Breeding) Project, which has been supported by the Oyster Disease Research Program, a federally-funded program overseen by the National Sea Grant College Program. CROSBreed involves several institutions and programs in the region, among them, University of Maryland Center for Environmental Science, the Virginia Institute of Marine Science, Rutgers University and Maryland Sea Grant Extension.

We've had our highs and many lows. The prospects look better now than they have in years. I'm looking forward to seeing where science, politics, public policy, and human initiative take us in the next five years – then ten. After that, I'd like to see where we are in twenty-five years. I promise to write an update for *Maryland Aquafarmer* then.

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Oysters and Dinoflagellates – Keeping Watch

Dan Terlizzi, Water Quality Specialist

Depending on your frame of mind, the trials that oysters face in the Chesapeake Bay can be read like those in the Biblical story of Job. Bay oysters have been severely impacted by parasitic diseases – MSX *(Haplosporidium nelsoni)* and Dermo *(Perkinsus marinus)* – and extensive loss of reef habitats, primarily from overharvesting and sedimentation. They must also contend with numerous predators, among them, crabs, boring sponges, Styllochus ellipticus, a small worm that can gobble up oyster spat with gusto, and now the Rapa Whelk, a non-indigenous gastropod that has no known predators and can drill holes in shellfish. The whelk has been doing a good deal of damage in the higher salinity Bay waters in Virginia. Now there maybe another antagonist, the dinoflagellate *Prorocentrum minimum,* a very common bloom-forming dinoflagellate. Over the past few years, it has been a cause of extensive mahogany-colored water in Bay and tributary waters, especially in the spring. Though *P. minimum* has not demonstrated toxicity in the Chesapeake, it has in other systems, which is reason enough to be watchful.

Why are such species toxic to fish and shellfish in other parts of the world but not in the Bay? A common reply has been that perhaps they are but we have simply not observed it. Recent oyster mortalities in an aquaculture operation on the Patuxent River now raise questions about *P. minimum* and at least the potential of its toxicity.

A large bloom of *P. minimum* in the Patuxent this past Spring led to low levels of dissolved oxygen, which were probably instrumental in fish kills. Around this time, Richard Pelz, owner of the Circle C Oyster Ranch, observed deaths of oyster broodstock, which are maintained in floats near the water surface. The floats held oysters of two size classes, two and five inches. Mortality of the smaller

oysters exceeded 95 percent, while larger oysters showed only limited mortality, probably not significantly different than normal. While low oxygen concentrations were clearly a factor in finfish mortality in the bloom area, we cannot attribute oyster loss to oxygen limitation as readily. First, oysters were near the surface where turbulence around the rafts would provide some oxygenation; second, oysters can withstand periods of anoxia by simply "closing up."

Although it is possible that the smaller (i.e., younger) oysters succumbed to low levels of dissolved oxygen because of physiological differences in their ability to survive oxygen stress, it is also possible that younger oysters are more sensitive to *P. minimum.* Although we have no conclusive proof that *P. minimum* is responsible for mortalities at the Circle C, there is laboratory evidence that suggests the potential for harm. Shellfish producers who observe mortalities in the presence of mahogany-colored water should contact a Sea Grant Extension specialist as soon as possible so that the necessary tests can be arranged.

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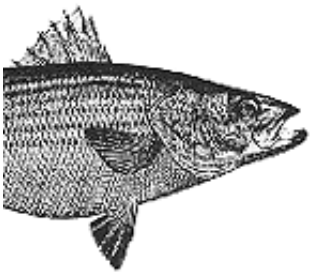

Aquaculture in Action

Adam Frederick, Education Specialist
Jackie Takacs, Regional Marine Specialist

The second Aquaculture in Action workshop was "on the road" again this summer, July 10-14, at the University of Maryland Center for Environmental Science (UMCES) Horn Point Laboratory, the University of Maryland Biotechnology Institute's Center of Marine Biotechnology (COMB), and South Carroll High School in Carroll County, Maryland. Fifteen educators from eight counties in Maryland attended.

For the first time, the workshop extended into the elementary level with participation from a team of teachers from Calvert County. Participants or teams were supplied with materials to construct a 210-gallon recirculating aquaculture system that will be used to enhance science education in their school. Aquaculture has provided a great "hook" for teaching science for Bob Foor-Hogue at South Carroll High School, and by hosting a part of the workshop in his classroom, educators were able to get first-hand knowledge of the potential applications for themselves. The week was full of "hands-on" experiences, guest speakers, new experiences, field work, visits to aquaculture research facilities, and much more.

The workshop kicked off at Horn Point with a background discussion from Maryland Sea Grant Extension Agent Don Webster. His talk presented the past, present, and future of aquaculture in Maryland and abroad. Participants toured the finfish and shellfish hatcheries, competed in a shellbagging contest against 7th grade volunteers, took oyster samples in the Horn Point oyster nursery ground, and finished the day with a traditional Eastern Shore crab cake dinner.

Day two of the workshop started with a trip to COMB in Baltimore where John Stubblefield gave participants a behind-the-scenes look at an urban aquaculture center and current research at the Aquaculture Research Center. Our intrepid group was then off to South Carroll High School for an introduction to the 210-gallon recirculating system that each participant would be constructing for their classroom.

The remaining days were packed full of lectures and labs on biofiltration, water quality, microbiology, and environmental assessment. Participants also heard a special talk from Kerri Bentkowski of the Chesapeake Bay Trust on how to write grants for environmental-based school projects. There was more! The portion of the workshop educators enjoyed most was constructing their school's 210-gallon recirculating aquaculture system. These systems are composed of a rearing tank (with window), sump tank, clear fluidized bed filter, and all the accessories necessary to raise fish. In total, 11 new systems were constructed for use in Maryland public schools. Some of the systems (along with supporting classroom materials) will join others already in classrooms; the remainder will be first-time attempts at aquaculture in the school, let alone the classroom.

Major strengths of the workshop are our two master teachers, Bob Foor-Hogue and Jim Gilford, both from Carroll County, who shared their years of classroom aquaculture experience. Coupled with the 10 teachers who participated in the program in 1998, they provide vast opportunities for partnerships among schools that would not normally interact with one another. These teachers will now join the group from 1998 as part of the Aquaculture in Action web network, a site devoted to

the support of data collection and communication between teachers and students using aquaculture in their classroom.

For more information on aquaculture in the classroom or to contact an educator in your area who is using aquaculture in their classroom, check out the network at:
www.mdsg.umd.edu/Education/AinA

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PONDering the Cold Season: Take Head

Jackie Takacs, Regional Marine Specialist

As fall and winter settle into our area, many of us are thankful to be done with weekends of gardening and yardwork – at least I know I am. For those of you with ponds, however, the cold season is a good time to get a jump on potential spring and summer problems. Here are a few activities you may consider:

Liming. The addition of lime to a pond is an accepted method of raising alkalinity and increasing productivity of a pond. Liming will not only help buffer a pond against wide pH swings that can occur during the summer which can potentially kill fish, but increased alkalinities will aid in the effective use of copper sulfate in the control of algae. The amount of lime needed will vary from pond to pond and can be determined by a soil test. Because agricultural limestone is the suggested product for pond use and needs several weeks to months to go into solution, it is recommended to apply it during the winter. Note that liming does not need to be done on a yearly basis – generally a single treatment can last for a number of years. For additional information on soil testing and lime application, contact your local Maryland Cooperative Extension office or find us on the web at: www.mdsg.umd.edu/Extension/pondmgmt.html

Drawdowns. The lowering of pond water in the early fall and held through the early spring, can be helpful in many ways. Drawdowns (1) aid in aquatic weed control by exposing plants to drying and freezing; (2) concentrate forage fish in open waters where they are easily preyed upon by bass (this will stimulate bass growth and help in balancing a pond that is dense with small forage fish); (3) allow for needed repairs to berms, dam, piers, etc.; (4) enable you to apply lime more easily; and (5) release nutrients bound in bottom sediments. Drawdowns should be limited to ponds that have reliable water control structures and an adequate water supply for refilling.

Give It the Once Over. Now is the time to go out and inspect your pond for structural damage. Keep dams in good vegetative cover (grass or another groundcover), check for signs of rodents (muskrat and groundhogs will dig holes and weaken a dam), and clear all trash and debris from pipes. Should you find you have some structural damage to your pond, contact your local Natural Resources Conservation Office for information on how to start repairs.

A little time spent on your pond this winter may alleviate summer of headaches.

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Practical Tests of Soy-Based Diets for Tilapia

Steven G. Hughes, University of Maryland Eastern Shore

With the results of the last two years of experiments on feed diets in hand, the next concern for our research program on the culture of tilapia was the practical application of all plant protein feeds (i.e., containing no animal products). The use of these diets to raise fish from fingerling to market size had not been tested to date. It was also necessary to determine the full cost of these diets – $/unit weight gain – relative to feeds currently in use. The experimental soy-based diet developed in previous experiments maintained growth and feed conversion rates statistically equal to those of fish fed a practical control diet. The cost of the control feed when the results were converted to $/unit weight gain – $.32/kg gain and $.36/kg gain, respectively.

A second consideration in the use of soy-based feeds is how well or poorly the soy has been processed, particularly the heat treatment. Overcooking of the soy bean meal may lead to greatly reduced availability of many amino acids, particularly lysine, and result in less than optimal growth of animals fed these diets. Numerous studies in which soy bean protein was used as the primary protein source have indicated that varying levels of sensitivities to trypsin inhibitors exist in fish, but none of these studies were conducted with tilapia. Triplicate groups of fingerling tilapia (average initial weight of 35 grams) were fed one of three experimental diets which contained soybean meal that was either heat treated properly, under-heated or over-heated. Though variability in the growth performance rates of the various replicates prevented us from determining statistical differences in the treatments, it appeared that the fish were able to equally use all three soy sources. This study will be repeated in the near future, but if the current results hold, it will prove that tilapia may be able to utilize soy sources that other fish species such as trout, salmon, and striped bass cannot.

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

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Family and Consumer Sciences and Seafood Education

Gayle Mason-Jenkins, Seafood Specialist

Educators from Baltimore City, nine Maryland counties as well as staff from the University of Maryland Eastern Shore (UMCES) and College Park, recently participated in an intensive training related to food safety. With a $5,000 grant from the Maryland Cooperative Extension (MCE), the two-day training was taught by instructors from the Maryland Hospitality Foundation (MHEF) and certified Maryland Extension Educators. The program itself, ServSafe, was developed by the National Restaurant Association. MHEF is the food service industry's charitable foundation dedicated to increasing the professionalism of Maryland's foodservice, hospitality and tourism industries through many different educational programs. Program topics covered included the following:

- ***Understanding the Importance of Safe Food Handling and Challenges to Food Safety.*** Covered issues of food safety hazards and the safe foodhandler.
- ***Developing a Food Safety System.*** Introduced the HACCP system and how to adopt HACCP principles.
- ***Maintaining Sanitary Facilities and Equipment.*** Included issues on sanitary facilities and equipment, cleaning and sanitizing, developing an Integrated Pest Management program, and regulatory agencies and inspection.

With reported incidences of foodborne illnesses occurring in various ways and places, it is critically important that educators implement well-designed food safety programs that protect food handlers and customers. By partnering, MHEF and Maryland Cooperative Extension can more effectively bring standardized affordable food safety programs to all counties in Maryland and Baltimore City.

Extension educators who successfully completed the training program are certified to train individuals and food handlers, among them, workers in fast-food facilities and restaurants, occasional food handlers in churches, care providers in day care and senior centers, health professionals, consumers and media.

For those interested in earning a Manager's ServSafe TM Sanitation Certification, training is available through MHEF. Together, MHEF and MCE deliver basic safe food handling training in two forms: the two-hour Smart Staff course that has been designed for many different categories of food handlers, and the Smart Start, a written quiz and workbook that can be used as a refresher. As a follow up to the training, target audiences will be recognized for their participation in the commitment of their organization to food safety and will receive a Smart Staff Certificate of

Completion. For more information, contact Gayle Mason-Jenkins at (410) 651-6212 or gmjenkins@mail.umes.edu.

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Website Updates

Restoring Oysters to U.S. Coastal Waters–A National Commitment
www.mdsg.umd.edu/oysters/disease/index.html

This feature-style report on the Oyster Disease Research Program gives an overview history of oyster disease as well as how the federally-funded program is contributing to oyster fishery management efforts, for example, in breeding disease resistance in hatcheries, prospects for disease-free seed, computer modeling around disease, and new tools for diagnosing diseases. ODRP is coordinated by the National Sea Grant College Program. Copies are also available from Maryland Sea Grant.

Oyster Gardening for Restoration and Education
www.mdsg.umd.edu/oysters/garden/index.html

This publication from The Oyster Alliance – the Chesapeake Bay Foundation, Maryland Sea Grant, the Oyster Recovery Partnership and the University of Maryland Center for Environmental Science – provides basic information on setting up and maintaining oyster gardens in your area. Copies are available from Maryland Sea Grant.

Oysters in the Classroom
www.mdsg.umd.edu/oysters/oysclass.htm

These lesson plans and interactive laboratories provide teachers with hands-on activities to explore the biological and ecological impacts, external and internal anatomy, and scientific classification of the Eastern oyster.

Maryland Sea Grant School Network News
www.mdsg.umd.edu/Extension/msgsnn/index.html

This quarterly publication for Maryland educators focuses on local science education and information sharing. Copies are available from Maryland Sea Grant

Oyster Reef Restoration Projects
www.vims.edu/fish/oyreef/rest.html

This site from the Virginia Institute of Marine Science covers issues of general oyster reef restoration methods, specific projects and educational programs

Blue Crabs in the Chesapeake
www.mdsg.umd.edu/crabs/index.html

A comprehensive site, which includes basic information about the blue crab, including the publication Managing and Protecting the Blue Crab, and extensive links related to research, management and regulations, education lesson plans, articles and even crab recipes.

Preserving the Watermen's Way of Life
www.puaf.umd.edu/ippp/Fall97Report/preserving_the_watermen.htm

An essay combining enthnography and environmental ethics, from the Institute for Philosophy and Public Policy that aims to provide understanding of the waterman's way of life, the importance of his lifestyle, and the forces that threaten it. The essay is based on a Maryland Sea Grant-supported research project that included interviews and focus-group meetings in Calvert and St. Mary's counties.

Watermen's Gazette
www.marylandwatermen.com/index.html

The Maryland Watermen's Association writes and maintains this newsletter that includes articles on all aspects of the Chesapeake Bay.

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Recent Publications from Sea Grant

Managing and Protecting the Blue Crab. 4 pp. Produced for the Chesapeake Bay Commission's Bi-state Blue Crab Advisory Committee by the Maryland Sea Grant College.

Managing the Chesapeake Bay Blue Crab: A Meeting of Stakeholders. 23 pp. Prepared for the Bi-state Blue Crab Advisory Committee by the Institute for Environmental Negotiation at the University of Virginia and the Maryland Sea Grant College.

Toward a Contaminant-Free Bay. 8 pp. A joint effort of the Maryland Sea Grant College and the Alliance for the Chesapeake Bay, supported by the Chesapeake Bay Program's Toxics Subcommittee. UM-SG-ES-2000-05.

To order, contact Jeannette Connors, (301) 405-7500 or connors@mdsg.umd.edu

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Upcoming Conferences

East Coast Commercial Fishermen's & Aquaculture Trade Expo
February 2-4, 2001 Ocean City, Maryland

Check the website: www.mdsg.umd.edu/Extension/Aquafarmer/fishexpo01.htm

21st Milford Aquaculture Seminar
New Haven, Connecticut, February 26-28, 2001

Contact Blogoslawski, phone: (203) 579-7035 or walter.blogoslawski@noaa.gov
Check the Milford website for updates agenda: www.mi.nmfs.gov/seminarworkshop.html

Open Ocean Aquaculture IV: An International Symposium
New Brunswick, Canada, June 18-19, 2001

Open Ocean Aquaculture (OOA) IV invites presentations and discussion of the sustainable development - economic, social and environmental - of a truly open ocean aquaculture industry. The fourth symposium will convene for the first time internationally, in St. Andrews by-the-Sea, New Brunswick, Canada. Theme sessions include:

- Marine Policy: marine policy and regulatory challenges.
- Ocean Engineering: cage designe, feeding systems, mooring options and other logistical issues.
- Candidate Species for Offshore Aquaculture.
- Ocean Environmental: methodology and results of monitoring aquaculture impacts.
- Integrated Open Ocean Aquaculture: Practices to increase economic viability with fish, shellfish, seaweeds, sea urchings and innovative biotechnology integration.

For further information, see www.masgc.org/oac/ooa_iv.html.

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