

MARINE NOTES



Michael W. Fincham

SPOTLIGHT ON FISHERIES

Banking on Blue Crabs

A Trial Run for Peelers

BY MICHAEL W. FINCHAM

Sunrise over Monie Bay is pale and patchy, hidden behind broken clouds, but for John Barnette that's enough light to start guessing what kind of crab run he's going to get today along the banks of the Wicomico River.

They show up every year in every river, but blue crabs are still a mystery to most Marylanders, even those who catch them for a living. When are they coming? How many? What's the best way to catch them? After all these years, these questions still keep watermen guessing. "There's only three things we know for sure about a crab," laughs Barnette, quoting a Smith Islander: "He comes in the spring, he goes in the fall — and the son of a bitch will bite you."

Squinting at the weak sun, Barnette skims his 17-foot skiff along the green marshes that border this quiet bay at the mouth of the Wicomico, then throttles down into neutral and glides his boat up against a tall, cage-like structure sitting in the shallows. Five-feet tall and four-feet square, the cage looms above the waterman sitting in the stern of his boat. It looks like the world's largest crab pot, but Barnette calls this contrivance a bank trap, and he's got 30 of them scattered along the shoreline around the bay and up north along the narrowing river.

There's a fourth thing most watermen know about crabs: with the winter fishery for oysters nearly gone and the spring fishery for rockfish now reduced, these spring and summer runs of blue crabs are their last best hope for making a living off the Bay.

Cutting his motor, he lashes his skiff to a wooden pole, then stands and swings a small boom out over the top of the cage. He deftly hooks the top of

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Crabs, continued

the trap and then, pulling hard, heaves the whole contraption up out of the water and bangs it onto the washboard of his boat. In the bottom of the trap are startled turtles, flopping fish and scuttling crabs. Flipping open a small door on the side of the trap, he dumps and shakes and bounces the whole wet load down into a wooden box in the bottom of his boat. There are more than 80 crabs in this haul.

Bank traps for crabs look a lot like pound nets for fish. Wire netting is strung along a row of wooden poles stretching straight out from the river bank. A shore-crawling crab hits the net, then follows the "leader" right into a heart-shaped pound. To get out of the heart, he heads through a small funnel and ends up caged in the "trap."

The targets for these traps are peeler crabs — blue crabs getting ready to moult. The traps are stuck along the shoreline because that's where peeler crabs head hoping to hide out from other crabs. Bank trapping in Maryland today is legal in only two counties: St. Mary's on the western shore and down here in Somerset County where it first became popular 40 years ago.

It's an old way of fishing, but it's new for John Barnette. After years spent trotlining for hard crabs, he seems, in his rookie season, to have mastered all the moves for bank trapping. Crouching over his catch, he quickly tosses turtles and fish overboard along with small hard crabs. He pitches a legal-size hard crab into an open basket up by the mast, then another and another.

He's clearing them out so he can get at the peelers. Called soft crabs after moulting, they are the money crabs. One of them, say a five-inch soft crab, can bring a waterman a buck fifty — for a single crab. By contrast a bushel of five-inch hard crabs brings only about 15 cents a crab — and sometimes less than that. "It doesn't take a real sharp pencil," Barnette likes to say, to figure out where the good money might be in

the crabbing business.

This work does take a real quick eye: Barnette has to read the color sign of every peeler crab he catches. Holding one inches away from his eyes, he scans for "sign," the tell-tale line of color rimming the last two links of the back paddle fin.

"We try to pick out the ones that have the white sign indication," he explains, "and separate them from the pink and the red sign." The white sign crab in his hand is five to seven days away from shedding and lively enough to keep feeding on other crabs. Barnette cracks the right claw and then the left, swiftly disarming it before dropping it gently in a covered basket. Pink sign and red sign crabs go into a third basket, also covered: they are "rank" crabs, ready to shed in two or three days. As he reads crab signs he can count dollar signs in his head.

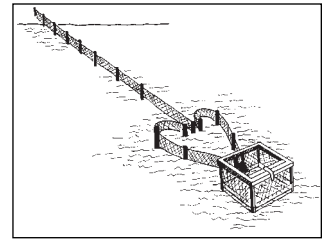
A lean, sharp-eyed waterman, Barnette went straight from high school into hand tonging for oysters and ever since has been remedial all the signs that show commercial fishing in decline on the Chesapeake. During his twenty years on the water, he has seen oystering collapse and rockfishing close down and then watched hard crabbing crowd up with watermen shut out of their traditional fisheries. In recent years he has seen a lot of watermen leave the business. "We are diminishing all the time," he says slowly. "The actual number of full-time watermen is probably at an all-time low."

How do you make a living among dwindling harvests? Ten years ago he quit hand tonging for oysters. This year he quit trotlining for hard crabs. At a buck and a half a soft crab, he



Skip Brown

Shortly after shedding, Maryland soft crabs, packed live in seagrass, are ready for market (above). Reaching from the shore, a bank trap or peeler pound (at right) uses a "leader" net to guide crabs into the "heart," then funnels them into the cage-like "trap."



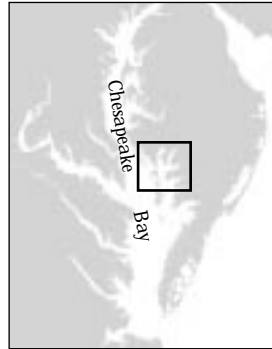
figured he could make a better living catching peeler crabs. But he knew he was gambling and gambling big.

Betting on Soft Crabs

For John Barnette, this year's soft crab season began late last fall, a time of the year when most watermen had already hauled out their crab pots and trotlines and crab scrapes and stowed them away for winter. That's when Barnette's big gamble began.

Late in October, Barnette and his wife Denise began building an 80-foot long structure out behind their white frame house down along a rural road leading into Mount Vernon, Maryland. By Thanksgiving they had the framing, roofing and most of the siding done. By Christmas, they had the concrete poured and the floors finished. Come New Year's Day, they had a shiny, green-sided, pole-shed building sitting in their backyard.

By then a lot of people were watching. Mount Vernon is a tiny town west of Widgeon, south of Bi-valve and north of Chance. This is country where farmers and watermen



John Barnette (at left) reads crab sign: a thin line on the back leg or paddle fin that changes from white through yellow, orange, pink and red. A red sign is a "rank" crab, ready to shed its shell within two or three days. Barnette catches his crabs in traps set along the south shore of the Wicomico River on Maryland's Eastern Shore (see maps above).

"When there's a big run on hard crabs, there are days you can't find a buyer, but there will rarely be a day when you can't sell soft crabs."

keep a wary eye on what other farmers and watermen are doing. In Barnette's backyard, they saw something that looked like a small barn — or yet another one of those long, low-slung chicken factories that are sprouting up alongside so many of the roads and rivers of Eastern Shore Maryland. But Barnette's building looked newer and neater and cleaner than any cow barn or chicken shed they'd seen — and the only smell came from a slight bite of river water in the air.

Here in his backyard he's built a crab factory, of sorts. He plans to hold all those crabs he is going to catch and then keep them alive long enough to shed them and sell them for a buck and a half a crab when the market's good. Since his backyard is landlocked with no access to a river, creek or cut, Barnette has to truck in his water from the Wicomico and run it through a recirculating system.

Inside his shed he's rigged pipes and pumps and assorted plumbing that send river water flowing and reflowing through dozens of wooden bins strung along two long rows and stacked in tiers two high.

The neighbors are watching because this is not the way crab shedding was done when they were growing up. Peeler crabs were first kept in wooden "floats" set out in the creeks or rivers next to a waterman's dock. And in those floats, large numbers of crabs would die come hot weather, low oxygen, red tides and mahogany tides. Watermen then tried shading their crabs by building sheds on their docks or on the shore and inside the sheds they built wooden bins to hold the crabs. To keep their crabs alive, they pumped baywater or river water or creek water through the bins. Watermen still called these flow-through contraptions "floats" and crabs still died in them whenever the quality of the river water declined. These Bayside sheds with flow-through water are called "open systems" and they probably provide most of the soft shells sold in Maryland.

Barnette, on the other hand, has built a recirculating system, a "closed system" with no flow-through connection with a creek or river. He re-pumps the same water over and over again through his crab floats. A recirculating system avoids the problems of poor quality river water, but it requires more complicated filters and

aerators. For many shedders that means plenty of new ways to foul up and kill crabs.

The crab shedding industry in Maryland is small, unlicensed and largely conservative when it comes to closed systems. There are probably fewer than 500 operators in the state, according to most estimates by state seafood specialists, and very few are using recirculating systems. In Virginia, which requires a shedding license, there are 400 crab shedders and about 100 are using closed systems. "It's new technology against the old, established way, the way Papa did it," says Barnette. "Nobody wants to be the guinea pig."

During the past decade, however, more watermen have opted to be guinea pigs in an ongoing experiment in technical outreach that seems to be slowly changing the crab shedding industry. Their partners in the experiment are scientists and specialists from the University of Maryland Eastern Shore (UMES) and the Maryland Sea Grant Extension Program. The theory of recirculating systems is hardly new: it has been widely used for decades in aquariums and research labs, but these specialists have been adapting its concepts to the constraints of small, low-cost commercial crab shedding operations. Through trial and error, through teaching and technical correction, scientists and specialists and commercial crab shedders are now creating

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Crabs, continued

closed systems that work — and work cheaply. Their working hypothesis: low-cost crab shedding could offer watermen another way to survive an era of dwindling harvests.

Before building his crab shed Barnette spent a lot of time tinkering with recirculating systems set up at the UMES and watching the work of aquaculture technician Connie Williams and aquaculture researcher Steven Hughes of the Cooperative Fish and Wildlife Research Unit. Other watermen have been taking workshops and consulting with extension specialists like Don Webster with Maryland Sea Grant Extension.

Driving the watermen is a profit motive and a survival motive. Barnette gambled on shedding his own soft shells because he could see the price was good and the market was steady and steadily expanding. "When there's a big run on hard crabs, there are days you can't find a buyer," he explains, "but there will rarely be a day when you can't sell soft crabs. You may not get the top price, but you can sell them."

His buyer, J.T. Handy Seafood in Crisfield, can always pay him because it can always freeze soft crabs and ship them anywhere in the world. "Years ago, the soft shell was consumed just in the Mid-Atlantic," explains Carol Haltaman of J.T. Handy Seafood. "Then twelve or fifteen years ago, soft crabs were exported for the first time. Over the last several years they have become much more than a regional item."

The Handy company still ships live soft shells, which have a two- or three-day shelf life, but more of their business comes from shipping chilled crabs, which last seven or eight days, and frozen crabs. Maryland soft shells are eaten in Iowa and California, and they are eaten in January as well as July. They are also eaten in England and Japan — two countries which account for 25 percent of Handy's business.

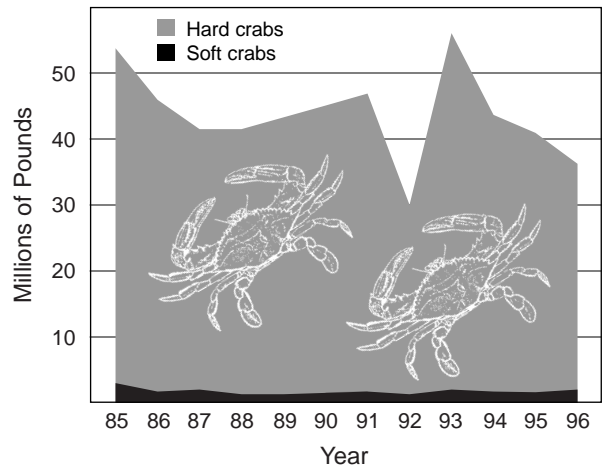
It was the gleam of global markets that made Barnette's big gamble last fall look like a great idea.

Running the Numbers

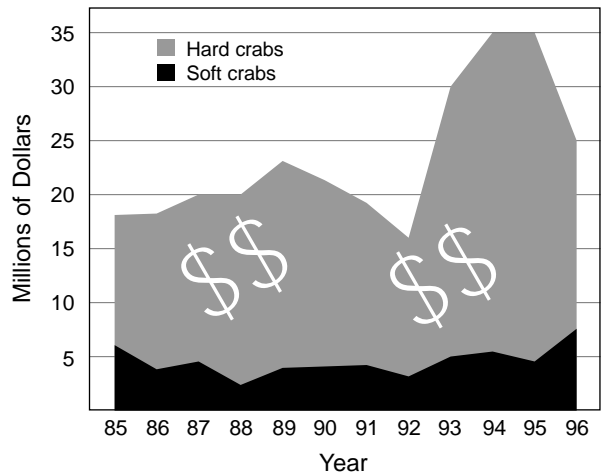
Despite a recent drop in hard crab harvests (top graph) and sales (bottom graph), soft-shelled crab production has remained small but steady over the past decade and the dollar value of soft-shells is on the rise.

Maryland soft shells are eaten in Iowa and California, and they are eaten in January as well as July.

Maryland Commercial Crab Landings



Maryland Commercial Crab Dockside Values



Learning the Game

The springtime peeler runs came late this year. Half way through May they hit the Pocomoke River, then the Little Annamesex, the Big Annamesex and the Manokin. About five days later, the peeler run hit John Barnette's traps in the Wicomoco River. Within a couple of days white sign and red sign crabs filled up his floats back in the barn, both rows and both tiers.

Then his crabs began dying in large numbers. In this kind of closed system, crab mortalities should be

around 10 percent, according to Don Webster. But John Barnette was losing nearly half his crabs.

How was he killing so many crabs? "It is a simple case of toxicity," explains Steven Hughes. Put that many crabs together and they put out a lot of crab waste, which converts quickly to ammonia, then to nitrite, then to dead crabs. "Ammonia and nitrite are toxic to these animals, and if you get them at high enough concentrations, you just simply kill them. You can kill every crab in your float system," says Hughes.



Can low-cost crab shedding help watermen survive in an era of decline?

Barnette turned to Hughes and Williams to help him keep his crabs alive. Their best advice: build into the system a biofilter that can quickly convert ammonia and nitrite to less toxic forms like nitrate. Following their theory, Barnette built a “trickling” biofilter, a small box with a rack that forms a false bottom. On the rack he packed oyster shell which helps knock solid waste out of the water as it trickles through. The shell also holds calcium carbonate, which helps buffer the acid levels of the water. Best of all, the shell soon holds newly grown bacteria: one species converts ammonia to nitrite, another converts nitrite to nitrate.

A closed system, when it is working, behaves like a small, narrowly focused ecosystem: oyster shell, bacteria, crabs and crab waste. And this ecosystem in a box does the same thing a large ecosystem does: it recycles waste and nutrients and chemicals of all kinds. “This biological filter does what nature does with a pond or a lake or an ocean,” says Hughes. And it does it fairly cheaply. “If we design a million dollar system,” he argues, “but nobody can use it, then it

doesn't help the industry.”

Biofilters may be simple to design and cheap to build but they are tricky to control — and that's what scares off a lot of watermen. The first trick is to bring a biofilter “on-line,” techno-speak that means getting the right bacteria growing and thriving. This pre-season warmup can take three to six weeks.

The second trick is to keep the system from “crashing,” techno-speak that means accidentally killing off all your bacteria. “Biofilters are kind of like diesels,” explains Webster. “They run best under a load, but they really don't like big pulses in the system.” A big pulse could be 500 crabs in the floats one week followed by 50 crabs the next week; the result of that could be a crash.

The key to controlling a biofilter, especially during a huge pulse like the spring peeler run, is constant monitoring. Working with funding from the Rural Development Center at UMES, Hughes and his staff have been helping Barnette and other crab shedders all summer with field testing and lab analyses and record keeping for ammonia, nitrate, nitrite, oxygen, pH, temperature, and salinity.

All the monitoring helped stop the dying. “Their water quality monitoring was the real thing. It gave you a weekly window into whether your system was coming on line,” explains Barnette, who quickly learned how to read new kinds of crab signs. “There are little indicators now that I can recognize and know, hey, there is a problem coming on: I need to start doing something different — now.”

And he did. While his neighbors kept a wary eye on Barnette, he kept his sharp eye on his system: tinkering, adjusting, buffering, diluting. As a result he ended up shedding and selling most of his Wicomico crabs the rest of the summer. “We had three heat waves when the guys who were

pumping water out of the creeks, they were losing 50 percent of their peelers,” he says. “During those hot spells we were shedding 80 to 90 percent of ours.”

A Winning Hand?

Can low-cost crab shedding help watermen survive in an era of decline? The hypothesis behind this experiment in university outreach is still being tested, awaiting more evidence from other guinea pigs like Barnette.

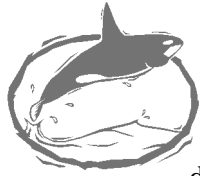
Data on how many watermen are shedding crabs with either kind of system are still hard to come by, but anecdotal evidence indicates that some of Barnette's wary neighbors seem to be quietly following his lead. “There were definitely more closed systems coming on line this last year,” says Tom Rippen, seafood specialist with Maryland Sea Grant Extension.

The experiment is clearly working for Barnette, a waterman who has the temperament to handle all the trials and errors of aerators and biofilters and protein skimmers. “I killed some crabs when I first got started,” he says. “Nobody that has ever been in the aquaculture business has ever made everything right the first time. If something doesn't go wrong, how do you know what to fix?”

Around Labor Day he closed down his shedding system and went potting for eels as he always does this time of year. But as he pulled his eel pots this fall, he was already planning in his head what to fix for next spring, when the first peeler runs would start hitting the Wicomico. “I've learned that you have to diversify,” he says, “in order to survive.”

The evidence in his case indicates there may be an environmental ethic as well as a hypothesis at work in this experiment. “There is a limit to this resource,” argues Barnette, who has seen what happened with oysters and rockfish in the Chesapeake. “And in my way of viewing it, we are maximizing the value of the resource.” At a buck fifty a soft crab, watermen who switch to peelers simply don't have to catch as many blue crabs to make a good living off the Bay's last great fishery. ✓

Year of the Ocean



Recognizing the importance of our oceans and marine environments, the United Nations has declared 1998 the International

Year of the Ocean as an opportunity for governments, institutions and individuals to act together to protect the ocean environment. Globally, the range of activities will include education, research and conferences.

One major activity set up to celebrate the Year of the Ocean, will be a research vessel relay that circumnavigates the globe. Research vessels from various countries will pass the UN flag from ship to ship as they travel their regularly scheduled research cruises and scientists on board the ships will be interviewed about their ocean research. A virtual expedition on the Internet will follow the activities and cruises of the research vessels and provide extensive information about the social, cultural, economic, ecological and other aspects of the regions and oceans where the vessels are working. Ocean-going and virtual expeditions will be linked by satellite. For those areas without Internet access, educational kits consist-

ing of video programs, CD-Roms and printed materials will be available. All educational kits will include teacher manuals and student assignments for different educational settings and situations.

Most of the activities related to the Year of the Ocean will run from January through December 1998. If you would like to help celebrate and conserve our oceans and marine habitats, contact Ocean 98, Koopmanstraat 1, P.O. Box 5807, 2280 HV Rijswijk, Netherlands, or visit their website: <http://www.ocean98.org>.

Shellfish Software

The New Jersey Sea Grant Marine Advisory Service (MAS) recently introduced ClamFarm, a new software program that could potentially revolutionize the hard clam culture industry from Massachusetts to Florida. Developed by Gef Flimlin, a marine agent with MAS, and Jeff Davidson of the Atlantic Veterinary College on Prince Edward Island, Canada, the innovative software program is designed to be a simple and effective business tool for shellfish growers.

The DOS software is very easy to use and follows a Windows style of presentation. The program allows growers to input their planting re-

gime, including seed source and size, lease and plot used, predator screen size, and other environmental parameters from the time of planting. Growers can later add comments about situations and occurrences that impact the crop. Information can be converted to graphs and accessed in report form. ClamFarm is a unique management program that can assist the industry by projecting the success or failure of an operation and providing documented comparisons of production cycles.

ClamFarm can be ordered through the New Jersey Sea Grant Marine Advisory Service for \$44.95, which includes the disk, a hard copy manual and shipping and handling. The MAS also plans to hold at least one training program on the software this year and those who purchase the program will be notified about the training session(s). For more information or to order, contact the NJ Sea Grant MAS office in Toms River, by phone (908) 349-1152, or by e-mail: flimlin@aesop.rutgers.edu.

A Few Words about Maryland Seafood

In response to concerns over the safety of Maryland's seafood, the state's Secretary of the Department of Health and Mental Hygiene, Martin P. Wasserman, M.D., has issued the following statement in order to reassure the public.

As this state's highest ranking medical official, and a physician, it is my duty to take whatever steps are necessary to preserve the health of all Marylanders. The events surrounding the presence of a one-celled microorganism called Pfiesteria in three Eastern Shore rivers have caused a great deal of concern about the safety . . . of those who rely on Maryland waters for food, recreation and livelihood. In light of these concerns, allow me to restate with all confidence that Maryland's seafood remains safe. . . .

This means that the seafood you buy at the grocery store and order in restaurants is safe to eat. I will stake my professional credibility on this point, as has Dr. Joann Burkholder of N.C. State University, the leading Pfiesteria researcher in the United States.

Martin P. Wasserman, M.D.
Secretary, Department of Health and Mental Hygiene

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<http://www.mdsg.umd.edu/MDSG>



Sea Grant

End Notes

Kudos

■ Zohar Named COMB Director

The University of Maryland Biotechnology Institute's (UMBI) Center of Marine Biotechnology (COMB) has named Yonathan Zohar as its director. Zohar joined the COMB faculty in 1990 as an associate professor and became aquaculture coordinator and full professor in 1993.

An internationally recognized authority in the field of fish reproductive endocrinology, Zohar has developed several methods to induce farmed fish to spawn in captivity. He holds three patents, for both hormonal and gene-based methods of manipulating ovulation and spawning in fish and for using ultrasound as a method of administering vaccines and antibiotics to mass populations of farmed fish.

While his own research focuses on technologies related to aquaculture, in his new position Zohar will oversee research and training, manage the budget and seek grants for all programs at COMB. "I want COMB to continue to thrive as a leader in excellent research in marine and aquacultural biotechnology," says Zohar. "We emphasize not only research and education, but also development and industrial relevance."

■ UMCES Breaks Ground for New Laboratory

The University of Maryland Center for Environmental Science broke ground in September for its new Appalachian Laboratory located at Frostburg State University. The new facility will house a joint, multi-disciplinary program in environmental science, education and management of the Bay watershed which is a joint effort of UMCES, the University of Maryland, College Park and Frostburg State University. This partnership will provide critical scientific input for managing the terrestrial and freshwater environment and the natural resources of Maryland and for restoring the water quality of the Chesapeake Bay.

■ HACCP Coordinator Receives Vice Presidential Award



The Association of Food and Drug Officials and Seafood HACCP Alliance Project Coordinator Steve Otwell each received the Vice President Al Gore Hammer Award at the September 22 meeting of the Association of Food

and Drug Officials of the Southern States meeting. The award is part of the Vice President's National Performance Evaluation Project which promotes efficiency in government services and departments.

Sea Grant programs across the country have played a significant role in the Seafood HACCP Alliance efforts. HACCP, the Hazard Analysis Critical Control Point program, is a set of mandatory seafood inspection guidelines from the U.S. Food and Drug Administration that will go into effect on December 18, 1997. This new federal program requires all seafood processors, regardless of size, to maintain accurate records on their processing operations. For more information visit the Mid-Atlantic Sea Grant HACCP website: <http://www.mdsq.umd.edu/MDSG/Extension/HACCP/>.

Abstracts

■ Third International Symposium on Aquatic Animal Health

Baltimore, Maryland, August 30-September 3, 1998. Abstracts are currently being sought for this meeting, which is the first major international forum to focus comprehensive attention on a diversity of aquatic animals, including fish, shellfish, marine mammals and sea turtles, from a diversity of habitats including aquaria, aquaculture and the wild. Papers will cover a wide range of subject areas. The deadline for submitting abstracts is March 15, 1998. For more information, visit the symposium website at: <http://www.som1.ab.umd.edu/AquaticPath/isaahweb>. For additional information contact Sarah

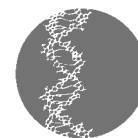
Poynton or Sylvia Lee, Division of Comparative Medicine, Johns Hopkins University School of Medicine, by phone (410) 955-3273, fax (410) 502-5068, or e-mail: wellfish@welchlink.welch.jhu.edu.

Noteworthy

■ *Pfiesteria* on the Web

Maryland Sea Grant College and the Aquatic Pathobiology Center of the University of Maryland, Baltimore have joined to produce an extensive web page that focuses on fish health and *Pfiesteria piscicida*: <http://www.mdsq.umd.edu/fish-health>. Among the topics included are *Pfiesteria* and human health, *Pfiesteria* and seafood and *Pfiesteria* studies on Chesapeake Bay. The site includes a *Pfiesteria* bibliography as well reports by the Technical Advisory Committee on Pocomoke River Fish Health and a map of suspected and confirmed *Pfiesteria* locations in Maryland, Virginia and Delaware. There are numerous links to related information including a page on Harmful Algal Blooms.

■ DNA Sequencing Facility



The University of Maryland's Biotechnology Institute's Center for Agricultural Biotechnology has a well-equipped and cost effective DNA sequencing facility. The fee-for-service laboratory is open to members of the University System of Maryland and the USDA. Operated by two trained technicians, its principle instrumentation consists of two ABI DNA sequencers (model 373A, both with stretch upgrades). Services provided include DNA sequencing reactions with user-provided template, electrophoretic fractionation of reactions, and automated base-calling. For more information, contact Suwei Zhao or Kongyi Jiang, Plant Sciences Building, Room 5129, UMCP, phone (301) 405-5222, e-mail: suezhao@eng.umd.edu or jiang@umbi.umd.edu.

Calendar

November 7-9 — Education Meeting

Washington, DC. Mid-Atlantic Marine Education Association (MAMEA) 1997 Conference. MAMEA is an organization of people whose goal is to improve education about all aspects of the marine environment. MAMEA is an affiliated chapter of the National Marine Educators Association. The conference will permit participants to exchange ideas, learn about new teaching techniques, current research efforts and national, regional and local issues pertaining to the use and survival of various marine environments. For more information, contact Susan Hurstcalderone, Science Coordinator, Blessed Sacrament School, Washington, DC, phone (202) 966-6682, fax (202) 966-4938.



December 4-5 — Restoration Workshop

St. Petersburg, Florida. Restoration Genetics Workshop. This workshop will serve as a forum for discussing current approaches to plant selection, propagation and translocation and their effects on plant population structure in constructed sites and in nearby populations. Although the workshop will focus on coastal and wetland communities in Florida, the principles being discussed are important to habitats in other regions of the nation as well. This workshop will be of value to those involved in restoration-ecology research. For more details, check the conference website at <http://www.ifas.ufl.edu/~conferweb/> or call John Stevely, Florida Sea Grant, (941) 742-4524 or David Crewz, Florida Marine Research Institute, (813) 896-8626.

January 13-15 — Habitat Restoration



Charleston, South Carolina. National Conference on Goal Setting Criteria for Coastal Habitat Restoration. The objective of this conference is to improve restoration efforts by facilitating the use of clearly defined project goals and criteria for judging project success. The conference will provide concise overviews of the frameworks under which restoration occurs and case studies that demonstrate the use of habitat restoration as a viable coastal management tool. To register, visit the conference website, <http://www.csc.noaa.gov/lcr/text/restcon.html>, or contact Pace Wilber by phone, (803) 974-6235, or e-mail: pwilber@csc.noaa.gov.

Maryland Marine Notes (current and back issues since 1995) is also available on the web at <http://www.mdsg.umd.edu/MDSG/Communications/MarineNotes>

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