

# MARINE NOTES

## SPOTLIGHT ON MANAGEMENT

# Seafood Safety in Maryland — So Far, So Good

BY MERRILL LEFFLER

In Maryland, seafood has been as safe as it can be. According to Alan Taylor of the state's Department of Health and Mental Hygiene, "the state has had no foodborne outbreak associated with its shellfish since 1939."

In spite of the facts about seafood safety, relentless reporting by print and television media over last year's *Pfiesteria piscicida* outbreak in Maryland sent alarms rippling through the entire Bay seafood industry. Though the fish and shellfish harvests from the Pocomoke River were reported to account for far less than one percent of the total Bay catch, supermarkets stopped carrying *all* Chesapeake seafood, restaurants advertised that their seafood did not come from the Bay, and the Jessup Wholesale Fishmarket, the largest on the East Coast, went into a tailspin. In fact, the organism has never been found in seafood, but only in the waters themselves.

Did the public overreact and, if so, why? How safe is the seafood that ends up at processing plants and on our tables? What protections and guarantees do we have?

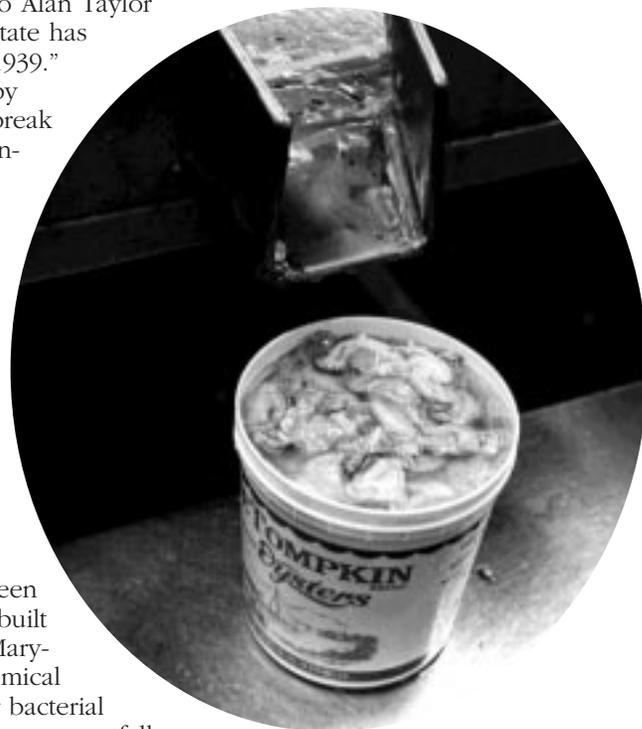
### Protecting Shellfish Waters

Mary Jo Garreis, long-time observer of the industry, says unequivocally that the region's seafood is safe. "The reason we've been so successful," she says, "is because there are large safety factors built in." Among those safety factors are periodic examination by the Maryland Department of Environment of shellfish for bacterial and chemical contaminants, as well as regular monitoring of shellfish waters for bacterial levels and surveying of land-borne sources of pollution, such as sewage outfalls and animal wastes.

Garreis speaks from 22 years of experience at the Maryland Department of the Environment where for much of that time she headed the Shellfish Certification Program, responsible for regulating the harvesting areas of oysters and clams.

"We are also fortunate that the industry itself is getting more and more educated," she says. "You would run into watermen 22 years ago when I first came to the Department who were totally insensitive to handling shellfish as a food product." That's rarely the case anymore. Television has had a lot to do with that, she says, but also the Health Department's inspections, which not only regulate but educate. The same goes for the Maryland Watermen's Association's *Gazette*. "It's one of the best educational tools for reaching watermen," she says. "They read it."

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***"The region's seafood is safe. The reason we've been successful is because there are large safety factors built in."***

## Seafood, continued

In Maryland, as in all coastal states with shellfish waters, regulation is a cooperative undertaking among the state and federal government and the industry itself. Every state, working in conjunction with the federal Food and Drug Administration, oversees harvesting areas in its waters, approves them, places them off limits when pollution is consistently high, and closes them temporarily when pollution levels rise (the result of land runoff during heavy rains).

Though they have gone through changes and additions, basic regulations aimed at ensuring healthy shellfish date back to 1924, when the U.S. Public Health Service convened a conference of shellfish-producing states after outbreaks of typhoid fever in New York, Chicago and Washington, D.C. were traced to oysters polluted by sewage discharges. That meeting led to the formation of the National Shellfish Sanitation Program — in 1984, it became the Interstate Shellfish Sanitation Program (ISSP) — that set out principles for protecting public health in the harvesting and processing of shellfish.

Removing shellfish from the world of microbes is impossible. Shellfish feed by filtering solid particles from surrounding waters, including algae, microorganisms and non-living matter. Since bacteria and viruses are natural constituents of all waters, as oysters and other bivalves strain particles, they can retain large numbers of microbes.

In most cases, bacteria and viruses are neither detrimental to oysters nor to those who consume them — the mere presence of a pathogenic, or potentially disease-causing, microorganism, Garreis points out, is not sufficient to cause disease. For example, the potentially dangerous bacteria group *Salmonella* comes from naturally occurring sources as well as human and domestic animal wastes. Generally *Salmonellae* species are harmless in low numbers. At times, however, the populations of *Salmonellae* or other disease-causing bacteria or viruses do rise and, when they

do, they can pose threats to human health, especially when shellfish are eaten raw.

Bacterial and viral counts can rise for any number of reasons — poorly treated sewage discharges, domestic animal waste discharges and stormwater runoff from adjacent land. It is such elevated counts that the sanitary surveys and bacterial monitoring are designed to anticipate and to protect against.

How does the survey work? According to Garreis, the survey requires intensive property-by-property inspection in areas that drain to shellfish harvesting beds. “Its aim is to identify and, where possible, eliminate or minimize the sources of serious human or animal waste contamination,” she says. While the ISSP recommends that the survey be done at least every twelve years, this is not often enough, says Garreis, “particularly in areas experiencing rapid development.” That is why Maryland and Virginia carry out the survey every five to six years, focusing especially on the operation of waste treatment plants and septic systems and stormwater runoff from adjacent lands, a potentially serious nonpoint source of pollution.

### New Regulations Promise Safe Seafood Handling

Seafood protection only begins with water quality — making sure that harvesters, processors and transporters handle fish and shellfish under sanitary conditions is critical. As of December 18, 1997, the nation’s seafood industry came under new landmark regulations by the Food and Drug Administration that are designed to do just that.

Known as the HACCP (the Hazard Analysis Critical Control Point) program, it requires seafood processors



Skip Brown

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— including companies that pack, process or hold seafood for shipment — to thoroughly evaluate each step of their operation as it affects product safety. Because half of the seafood consumed in the United States is imported, Food and Drug Administration inspectors will also monitor seafood importers and even inspect foreign plants that must also meet HACCP requirements.

Among the seven HACCP principles, says Tom Rippen, Maryland Sea Grant Extension seafood technology specialist, are steps that require identifying critical control points where problems can occur, defining critical limits, that is, places in the process where a potential problem can be monitored and controlled, and keeping detailed records so that inspectors can easily verify that the safety program is working.

Many Maryland processors, those who voluntarily joined and helped underwrite the Maryland Seafood Quality Program, have had a head start on HACCP principles, says Rip-

pen. Working with the Maryland Sea Grant Extension Program and the state departments of Agriculture and Natural Resources, processors assure control over bacterial pathogens by doing what the federal HACCP program requires. This means setting up safety procedures at every phase of handling, from the time crabs are off-loaded at the dock, to the steaming, picking, packing and shipping of either fresh or pasteurized product. A key element of quality assurance is the Animal Health Diagnostic laboratory at the University of Maryland, College Park, which screens seafood products through random microbiological sampling.

As a result, says Rippen, processors in the Chesapeake Bay have been doing a very good job of delivering quality product. "There has been only one suspected illness due to commercially packed seafood," he says, "and even that is not conclusive." That is not the case nationally, where the Food and Drug Administration estimates that more than 100,000 citizens are sickened by tainted seafood each year.

A key difference between HACCP and the state's Seafood Quality Pro-

gram is the record keeping system that HACCP requires, and that must be open to inspection by state and federal regulators. And it is this record keeping, Rippen thinks, that will present the most difficulty for many Maryland processors because their operations are relatively small.

Nevertheless, the aim of the HACCP seafood safety program is to detect problems before they occur and not afterwards, he says, and we need to assure the public that the early warning system is working. HACCP should go a long way toward providing that assurance.

### **The Question of Toxin-Producing Algae and *Pfiesteria***

The recent appearance in the Chesapeake Bay and in North Carolina's coastal waters of *Pfiesteria* has raised new concerns about seafood safety.

Toxin-producing algal blooms elsewhere are not new. There are stories, for example, that Indians taught New England colonists to stop eating shellfish when the water turned red. In terms of seafood management, "we've been dealing with harmful algae in the U.S. since the 1920s," says

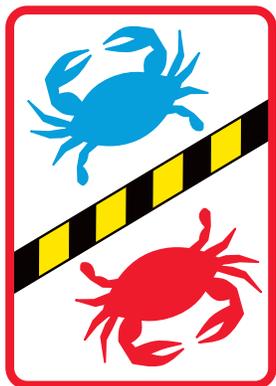
Rippen. What appears to be changing are the number and extent of such harmful algal blooms in coastal waters. Many scientists argue that blooms are increasing world-wide, something which could cause many more problems for those responsible for guarding public health.

Resource managers in the Chesapeake Bay have not had to worry much about monitoring for toxin-producing algae. Unlike many other parts of the country, where harvesting waters are regularly shut down, particularly during warm weather, the Chesapeake Bay seafood industry has not experienced any large-scale closures due to these harmful algal blooms.

Coastal waters throughout North America — in Canada, the Gulf of Maine, the Gulf of Mexico, the Pacific Northwest — often see massive blooms of dinoflagellates or diatoms, single-celled algae that because of their pigments can turn the water red, brown, mahogany or even different hues of green. While most dinoflagellates (classified as protists) do not release harmful toxins, a small number of species do. During "blooms," periods where the densities are extremely

## **Handling Seafood Safely**

Safe seafood depends on safe handling. "Safe Food Depends on You," a training program that includes a series of posters (pictured below) and video presentations, aims at teaching entry-level workers proper food-handling practices. Underwritten by the USDA Cooperative State Research, Education and Extension Service, the program was developed by specialists with the Delaware Cooperative Extension Service, the Maryland Cooperative Extension Service and the Maryland Sea Grant Extension Program.



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## Seafood, continued

high, toxigenic algae can harm fish and the other animals that consume them, including humans.

The health effects resulting from dinoflagellate toxins go under such names as Paralytic Shellfish Poisoning, Neurotoxic Shellfish Poisoning and Diarrhetic Shellfish Poisoning. Amnesic Shellfish Poisoning, caused by domoic acid, differs in that it is caused not by a dinoflagellate but by a diatom, a single-celled plant. Whether caused by plant or protist, taken together these illnesses can cause a range of symptoms, from gastrointestinal disorders that may last a relatively brief time to those that are potentially more serious and, in rare cases, even lethal.

The ISSC recognizes the threat posed by biotoxins and requires that states with a history of biotoxin events have special monitoring plans. State agencies in these affected regions regularly monitor for toxin-producing algae. If a bloom appears and reaches a certain density, shellfish waters — and in some cases other fishing grounds as well — are closed and only reopened when the bloom has passed and shellfish have purged the toxin.

Unlike toxins in other algae, there is no evidence that the toxin in *Pfiesteria*-like species remains in shellfish and finfish, including those that make it to market. There are no documented cases of anyone become sick from eating seafood taken from areas where the organism is found. Still, because of fish kills and impacts on human health that have resulted from contact with the organism in the environment, Maryland has taken a conservative approach and closed waters where *Pfiesteria* has been found, not only to harvesting, but to swimming and recreational fishing. A high level of public concern has



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spurred new federal efforts to fund research into the subject, research that will better detail the real level of risk.

New methods of detection will be essential. Traditional monitoring programs are based on identifying toxin-producing species and examining seafood for toxins. For *Pfiesteria*-like species, new techniques will be needed for detecting not only the organism but the toxin itself. Fortunately, research to date shows no evidence that *Pfiesteria* contaminates seafood, says Rippen. Indications are that the toxin is unstable, unlike many other biotoxins, and breaks down quickly.

A priority need, according to Yonathan Zohar, a molecular biologist and director of the University of Maryland Biotechnology Institute's Center of Marine Biotechnology, is encouraging the development of molecular probes that will ensure early detection. By using probes that could signal the presence of toxins, those charged with monitoring the region's waterways could detect a problem before fish die or people fall ill.

New technologies may offer the best promise for guarding against unforeseen problems as they arise. The current approach of temporarily closing areas during *Pfiesteria*-related fish kills will offer the public protection at least until such technologies are developed. What will remain the same is the need for continued vigilance. ✓

## Maryland Sea Grant Names Assistant Director

The Maryland Sea Grant College is pleased to announce the appointment of Jonathan G. Kramer as Assistant Director for Research, effective January 15, 1998. Kramer brings to Sea Grant a broad, interdisciplinary background that includes marine sciences, biological oceanography, microbiology and molecular biology.

He received his B.S. in Environmental Sciences in 1979 from the University of Massachusetts, his M.S. in Marine Environmental Sciences in 1982 from the State University of New York, Stony Brook, and his Ph.D. in 1988 in Marine Estuarine Environmental Sciences from the University of Maryland, College Park. He did his doctoral work under the late Ian Morris at the University of Maryland Center for Environmental Science.

Since 1993 Kramer has held an appointment as a Research Assistant Professor at the University of Maryland Biotechnology Institute's Center of Marine Biotechnology in Baltimore. His studies there have centered chiefly on marine picoplankton in laboratory and field-based investigations to which he has applied modern molecular biological theories and approaches.

## Zebra Mussel Conference

A conference on "Zebra Mussel and Aquatic Nuisance Species" will be held March 16-19, 1998 in Sacramento, California.

The registration for the conference is \$350, and for the Zebra Mussel Information Workshop \$100. A business exposition will be held in conjunction with the conference as well as a one-day tour to the Oroville-Thermalito Complex.

For more information, contact the conference administrator, 1027 Pembroke Street East, #200, Pembroke, ON K8A 3M4 Canada, phone (800)-868-8776, e-mail: profedge@renc.igs.net or check the world wide web: <http://www.zebraconf.org>.

# William Hargis Receives Mathias Medal

For his long years of studying and helping spread knowledge about the biology of the Chesapeake Bay, William Hargis, Jr., was awarded the Mathias Medal this past September by Virginia Sea Grant, Maryland Sea Grant and the Chesapeake Research Consortium. The Mathias Medal is named for now retired U.S. Senator Charles "Mac" Mathias who is considered the "father" of the contemporary Chesapeake Bay Restoration Program.

The award was developed to recognize scientists who apply their expertise for the public good and who delve into practical policy issues. Sea Grant is founded on the principle that providing scientifically based information to solve marine issues in a public way is essential to the health of our industries, our coastlines and the education of our people.

"The Mathias Medal... is a prestigious award," said Hargis. "I have worked very closely with two of the four recipients, and I know they have performed distinguished service for the Bay. I am sure Eugene Cronin and Donald Pritchard felt honored to receive it. I certainly do too."

A life-long resident of the Chesapeake Bay area, Hargis has worked for nearly 40 years to promote the

study of marine sciences in Virginia. He served as Director of the Virginia Institute of Marine Science of the College of William and Mary for 22 years, during which time he greatly increased student enrollment and personnel. He changed the nature of the institute from a fisheries science laboratory to a multi-disciplinary program. He recruited scientists in the fields of chemical, physical and geological oceanography, engineering, environmental science and microbiology-pathobiology.

He has also served on innumerable state, regional, national and international boards, advisory councils and task forces which established new policies, studies and institutions to work with marine science. In particular, Hargis worked cooperatively for decades with L. Eugene Cronin, who headed up the Chesapeake Biological Laboratory (CBL) and with Donald W. Pritchard, who directed the Chesapeake Bay Institute (CBI). While VIMS focused on lower Bay issues, CBL focused on the upper Bay and CBI on physical and chemical studies. The three institutions thus pooled their efforts and resources to conduct Bay-wide research that addressed regional issues. For example, following Hurricane Agnes, they co-

ordinated the first system-wide study of a major storm on a North American estuary.

As three of the first four Mathias Medal winners, says Hargis, their awards honor their collaborative efforts as much as their individual contributions. Hargis also credits the times and an emerging public interest in oceanography for some of the success he was able to achieve.

"It was a good time to be in the business," he says. "We at the Institute made major contributions to the understanding of biological phenomena and the coastal environment. Most of my life I have spent around the Bay — my mother was a Tangier Island girl. It's been a great source of satisfaction to me to have worked so closely with the estuary that I love."

## Ellen Fraites Wagner Award

The Chesapeake Bay Trust has announced the establishment of the Ellen Fraites Wagner Award. The award will recognize individuals or groups that have forwarded the Trust's mission of promoting public awareness and participation. The late Ellen Fraites Wagner worked closely with former governor Harry Hughes to establish the Bay Trust.

Nominations, in the form of a one- to two-page letter, should be addressed to the Trustees of the Chesapeake Bay Trust and mailed to 60 West Street, Suite 200A, Annapolis, Maryland 21401. The award will be presented at the Second Annual Tributary Teams Conference in College Park on Saturday, January 24, 1998.

Ellen Fraites Wagner was instrumental in a number of university-government partnerships, including the Coastal and Environmental Policy Program and the international EMECS conference held in Baltimore in 1993. "Ellen was a special person," says Chris D'Elia, director of Maryland Sea Grant. "She had a deep commitment to the Bay and the watershed. We miss her greatly, and this award will help to keep her with us."



*William Hargis (center), pictured at left, received the 1997 Mathias Medal in recognition of his research and policy contributions. Next to him are previous Mathias Medal recipients Eugene Cronin (left) and Donald Pritchard (right).*

# Two Maryland Students Become Knauss Fellows

Graduate students Kelly Greene and Tom Shyka are this year's Maryland recipients of Knauss Marine Policy Fellowships. Greene is in the Masters program in Environmental Science and Policy at Johns Hopkins University in Baltimore, while Shyka is in the Masters program in Marine-Estuarine-Environmental Science at the University of Maryland.

The Fellowship Program, begun in 1979 and coordinated by the National Oceanic and Atmospheric Administration's (NOAA) National Sea Grant Office, provides graduate students across the nation with an opportunity to spend a year working with policy and science experts in Washington, DC. Fellows are competitively selected from a list of graduate students recommended by the directors of the 30 Sea Grant programs in individual states.

For her fellowship year, Kelly Greene will work full-time with the staff of the Senate Committee on Commerce, Science and Transportation, Subcommittee on Oceans and Fisheries. Greene worked for four years at the National Weather Service before beginning her graduate work with Bjorn Gunnarson of the Depart-

ment of Geology and Environmental Engineering as her major advisor. She is currently working with the Chesapeake Bay Program's Modelling Subcommittee. Greene received her undergraduate degree in Marine Science from the University of Miami, Coral Gables, Florida, in 1991.

Tom Shyka will spend his fellowship year working in NOAA's National Ocean Service, in the Office of Coastal Resource Management, in the Marine Sanctuary Program, where he will work on coral reef restoration in the Florida Key's Marine Sanctuary and on other management issues in various sanctuaries around the country. A Masters student in the Marine, Estuarine, Environmental Science program at the University of Maryland, Shyka currently works part-time for the Maryland Sea Grant College where he assists in grants management. With advisor Kenneth P. Sebens, in the Department of Zoology, Shyka has focused his graduate work on various aspects of coral feeding and growth.

Shyka received his Bachelors degree in Biology, with a concentration in Environmental Science, from Colby College in Maine. Before beginning his graduate studies, he worked at marine laboratories in the U.S. Virgin Islands and in California. In his first year at Maryland, as a NASA/Maryland Sea Grant Summer Fellow in Remote Sensing of the Oceans, he worked with Frank Hoge at NASA's Wallops Island facility.

The process for selecting Knauss Fellows begins with the submission of applications by candidates recommended for their excellence by Sea Grant Directors across the nation. The National Sea Grant office then conducts a rigorous review



process and awards fellowships to the top candidates. This year the Fellowship program received fifty-four nominations and presented twenty-seven awards. Maryland was one of three programs with two Fellowship awards.

Over the years, Knauss Fellows have gained experience in the legislative and executive branches of the federal government in locations such as the office of U.S. Senators and Representatives, on Congressional subcommittees and at agencies such as the National Science Foundation and NOAA. Fellowships run from February 1 to January 31 and pay a stipend of \$30,000.

The application deadline for next year's Knauss Fellowship Program is September 1, 1998; however it is useful for those interest in applying to contact Maryland Sea Grant in early spring for guidance and possible volunteer project opportunities.

For more information, or an application brochure, contact: Susan Leet, Maryland Sea Grant College, 0112 Skinner Hall, University of Maryland, College Park, Maryland 20742, phone (301) 405-6375, e-mail: leet@umbi.umd.edu. Fellowship information can also be found on the web: <http://www.mdsg.umd.edu/NSGO/Knauss.html>.



# End Notes

## ***Pfiesteria* Workshop Held**



The identification of *Pfiesteria piscicida* in several Chesapeake Bay tributaries last year has led to a multitude of questions about its biology, behavior and toxicity. To facilitate an exchange of scientific information, the University of Maryland's Center of Marine Biotechnology (COMB) hosted a technical workshop on *Pfiesteria* and *Pfiesteria*-like species at the Columbus Center at the end of October 1997. The workshop — supported by the U.S. Department of Agriculture, Maryland Sea Grant and others — specifically aimed at bringing together experts in toxic algae and *Pfiesteria* with researchers trained in molecular biology.

Presentations by JoAnn Burkholder, Don Anderson, Ed Noga and others outlined the basic information we now have about *Pfiesteria* and related organisms. Presentations by a team of medical experts described what suspected human health effects have been seen so far, and depicted what occurred with domoic acid, a toxin produced by a marine diatom that caused sickness in Canada and the northern coasts of the U.S.

For a copy of the report, write the Center of Marine Biotechnology, 701 East Pratt Street, Baltimore, Maryland 21202 or the Maryland Sea Grant College, 0112 Skinner Hall, University of Maryland, College Park, Maryland 20742. COMB is one of four centers in the University of Maryland Biotechnology Institute.

## **RFP for Harmful Algal Bloom Research**

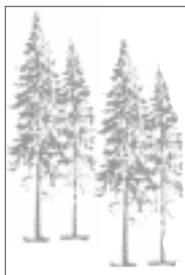
Harmful algal blooms, including highly toxic species, have increased in frequency, intensity and severity in U.S. coastal areas over the past sever-

al decades. Recent outbreaks, suspected to be due to *Pfiesteria piscicida* and related species, of fish lesions and fish kills in the estuaries of the Mid- and South-Atlantic states, as well as recent red tides and mass fish kills off the Texas coast, represent the most recent and visible examples of this growing threat to U.S. coastal resources, coastal economies and public health.

In order to address the increased need for research in this area, a multiple agency group (NOAA, NSF, EPA, ONR, USDA and NASA) is announcing the opportunity to conduct field research, modeling and laboratory studies on harmful algal blooms (HABs). Called the Ecology and Oceanography of Harmful Algal Blooms (ECOHAB) Program, it will support coordinated, well-integrated, interdisciplinary field studies by research teams. Individual studies will also be supported to develop predictive models and address gaps in knowledge related to mechanisms that regulate harmful algal species.

For more information, check the worldwide web, <http://es.epa.gov/ncerqa/rfa/ecohab.html>, or contact Kevin Sellner, ECOHAB Coordinator, NOAA Coastal Ocean Program, (301) 713-3338, ext. 127, e-mail: [ksellner@cop.noaa.gov](mailto:ksellner@cop.noaa.gov).

## **Study Launched at AEL**



As the Chesapeake Bay restoration effort moves upstream, tracking the effects of land use on water quality, it has been moving inexorably toward the Appalachians, the mountain spine that defines the western edge of the watershed. For years we have known that forested lands send far fewer nutrients to the Bay than do lawns, golf courses, farms or urban areas. Now we are turning more attention toward

the forests and the changes that face them.

The forests that cover the Appalachians have been hard hit, especially by invasive Gypsy moths (but also by harvesting, acid rain and foraging deer) — all of which weaken their ability to absorb nitrogen and phosphorus. Researchers like Keith Eshleman at the University of Maryland's Appalachian Environmental Laboratory (AEL, part of the UM Center for Environmental Science) are finding that a forest's nutrient-reducing performance may vary widely from year to year, depending on defoliation from Gypsy moths and other factors.

To study the link between these large landscapes and water quality in the Chesapeake region, the U.S. Environmental Protection Agency has awarded AEL \$698,000. The project is part of AEL's growing expertise in the area of watershed science and management. For more information, contact Alexis Henderson at UMCES, (410) 228-9250, ext. 614.

## **D'Elia Chair-Elect of CSSP**

Maryland Sea Grant Director Chris D'Elia is the new Chair-Elect of the national Council of Scientific Society Presidents (CSSP). CSSP is an organization of presidents, presidents-elect and recent past presidents of about sixty scientific federations and societies whose combined membership numbers well over 1.4 millions scientists and science educators.

Since 1973, CSSP has served as a strong national voice in fostering wise science policy, in support of science and science education, as the premiere national science leadership development institute, and as a forum for open, substantive exchanges on current scientific issues.

D'Elia has been a member of CSSP since serving as the president of the Estuarine Research Federation. His term as Chair-Elect at CSSP will begin in January 1999.

# Publications

## National Shellfish Register

Skip Brown



The seventh edition of the *National Shellfish Register* is now available. According to federal officials it shows an increase of 2.1 million acres and 1,058 shellfish growing areas during the period covered by the register, 1991-1995, as compared to 1990 figures.

The National Shellfish Register has been issued every five years since 1966. The new edition includes information on harvests, restoration efforts, and many types of pollution problems which impact commercial shellfish production in some 4,230 areas throughout the U.S. The register is a cooperative effort among the nation's shellfish-producing states; federal agencies, such as the U.S. Food

and Drug Administration and NOAA; and the Interstate Shellfish Sanitation Conference. In addition to printed copies, the register and data contained in the report are available both on the internet, at <http://www-orca.nos.noaa.gov/projects/95register>, and on CD-ROM.

Titled *The 1995 National Shellfish Register of Classified Growing Waters*, this edition includes for the first time an evaluation of shellfish restoration efforts, and the potential to upgrade harvest classification for each growing water area. The register covers nearly 25 million acres of estuarine and non-estuarine waters and also includes categories of data collected in previous editions such as growing area name and location, harvest classification, area, and the types of pollution sources contributing to harvest limitation.

For more information or to obtain a copy of the report or the CD-ROM, contact: National Oceanic and Atmospheric Administration, National Ocean Service, SEA Division, 1305 East-West Highway, 9th Floor, Silver Spring, Maryland 20910-3281, phone: (301) 713-3000, [shellfish@seamail.nos.noaa.gov](mailto:shellfish@seamail.nos.noaa.gov)

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