

MARINE NOTES

SPOTLIGHT ON RESEARCH

Multicosm Research: Linking Basic Science to the Real World

BY MERRILL LEFFLER

From the Chesapeake Bay to Puget Sound to the Seto Inland Sea in Japan, coastal waters have been hit with declining health in recent decades — but just how much of that decline is related to human activities remains uncertain. Experiments to answer such questions generally take place in the laboratory, and laboratory findings often have a complex and unclear connection to actual aquatic ecosystems.

In the Chesapeake, for example, countless factors affect the impact of nutrient enrichment or toxic chemicals, factors such as water circulation, turbulence, dissolved oxygen levels, biological and chemical interactions, in both sediments and water. Can realistic techniques be developed that will make it possible to extrapolate laboratory findings to the real world?

That is the aim of an ambitious, long-term research project at the University of Maryland System's Center for Environmental and Estuarine Studies (CEES). Tom Malone, director of the CEES Horn Point Environmental Laboratory and head of the Multiscale Experimental Ecosystem Research Center — or MEERC — calls it "an incredible challenge."

"Its funding by the Environmental Protection Agency," says Wayne Bell, CEES Vice-President for External Affairs, "is, to put it simply, visionary.



If successful," he adds, "it could revolutionize the way environmental policy is formulated, implemented and evaluated."

The goal is no less than trying to develop a fundamental understanding of how aquatic ecosystems function. "Our hope," says Malone, "is that from controlled experiments and simulation models we will eventually make it possible to predict how such systems respond to any type of environmental stress, whether it be nutrient enrichment, toxic chemicals,

heavy metals, sea level rise or temperature change."

Over the next five years, investigators will undertake increasingly complex experiments using various-sized experimental systems called "mesocosms." However, measuring the ecological changes in these different mesocosm environments as they respond to stresses such as nutrient enrichment is only the first step. Using simulation models to analyze empirical results represents a

(Continued on page 2)

If successful, Multi-scale Experimental Ecosystem Research Center studies could revolutionize the way environmental policy is formulated, implemented and evaluated.

MEERC, *continued*

second step. The “daunting goal,” though, as CEES scientist Mike Kemp says, is to discover if there are relational or scaling rules among the different mesocosm experiments that will enable them to extrapolate their results to real world settings

Lab Experiments and Environmental Regulations

Natural aquatic systems, no matter how small or how large, are too messy for conducting finely-tuned experiments. Biological and chemical conditions in the sediments and overlying waters, for example, are in continual flux, whether from natural cycles or the impacts of human beings. Mesocosms, on the other hand, can be controlled, thereby serving as surrogate ecosystems — whether small indoor tanks or large outdoor enclosures, they contain water, sediment and living organisms. For an experiment on the effects of nutrients or toxic compounds on phytoplankton production or fish mortality, the mesocosm can be dosed with known concentrations of each and a range of ecosystem effects measured.

Regulatory limits on contaminants have not been based on such sophisticated understanding of how ecosystems affects contaminants. Those limits are generally based on dose-response reactions — in plain words, how a species reacts to a toxic compound in a small, controlled space. Typical experiments, for example, might use a species of fish in an aquarium with controlled conditions of salinity, temperature and light. A measured concentration of the chemical in question is diluted in the water and the fish is then left on its own. How long does it take for the fish to die or to exhibit a “sublethal response,” for instance, damage to its reproductive or endocrine system? It is from such laboratory observations that regulatory agencies set toxic discharge limits.

These observations, however, do not take into account the more complex reactions a contaminant undergoes in a *real* aquatic system or an



This tank is one of 40 mesocosms at the CEES Horn Point Environmental Laboratory set up to mimic the dynamic conditions of a natural ecosystem.

ecologically complex mesocosm, reactions such as the interactive effects of the contaminant with sediment particles in the water or uptake by phytoplankton, or recycling by benthic (bottom-dwelling) organisms, let alone the effects of turbulence or the role of species higher in the food chain. Consequently, it is nearly impossible to extrapolate with predictive confidence lab findings to the real world ecosystem itself. And as a result, environmental regulations must often rely on research that is augmented by best guesses.

It is because of such experimental limitations that research labs have been using mesocosms to try to simulate conditions in aquatic systems. For some years, the Environmental Protection Agency (EPA) has supported the University of Rhode Island's Marine Ecosystem Research Laboratory (MERL) — large enclosed mesocosm tanks located on the shores of Narragansett Bay. Conditions in these tall cylinders have been designed to mimic the biology, chemistry and turbulence common to the Bay's sediments and waters.

The 14 MERL tanks make it possible to replicate experiments and to compare the effects of different contaminant concentrations. As surrogates for Narragansett Bay,

MERL mesocosms have been fairly effective in giving reasonable results. They do, however, have limitations — they are expensive to operate and they are unique to the Narragansett Bay system. According to most researchers, applications of MERL results to other ecosystems have significant limitations.

It is such limitations that the MEERC project with its differently scaled mesocosms, or multicosms, is trying to overcome.

The Multiscale Approach

“Some people originally thought that CEES was going to do mini-Chesapeake Bays,” says Karen Morehouse, Director of EPA Centers and Special Programs in the Office of Exploratory Research. There was some thought that these mesocosms were going to be exact microscale duplicates.” That is not the case at all — the multicosm concept, she emphasizes, is unique. The long-term goal is to develop models that can be used to account for the complex interaction and feedbacks of aquatic systems, whether they be Chesapeake Bay or Puget Sound. To do this means first trying to determine if there are clear physical and mathematical relationships in laboratory mesocosm experiments.

One set of mesocosms is looking at the biological and chemical responses to nutrient loading in tanks containing sediments and overlying waters. Two other sets of mesocosms are looking at the biological response of marshes and submerged aquatic vegetation (SAV) to nutrient loading. In a few years, the sediment-water mesocosms and the marsh-SAV mesocosms will be linked together physically; for now, scientists are working to understand each of these systems separately.

In this first year, the sediment and overlying water (called pelagic-benthic) experiments have focused on three sizes of mesocosms and replicates: 0.1, 1.0 and 10 cubic meters. With some forty different tanks, the researchers are watching to see how these three sizes respond to different types of nutrient loading.

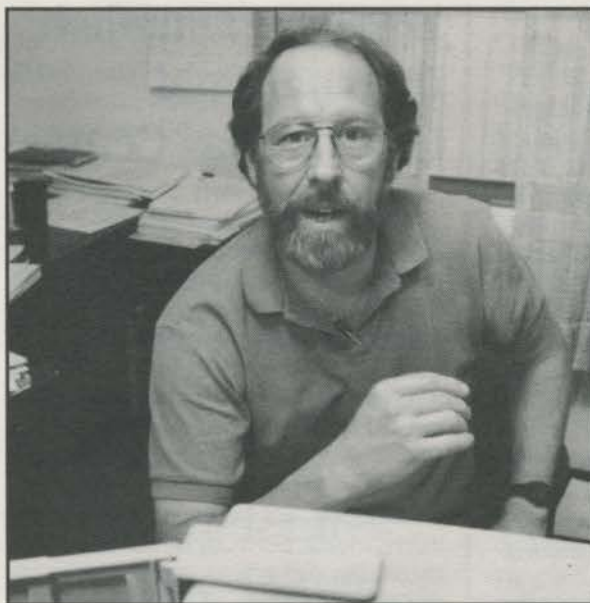
Our initial aim, says Michael Kemp, is in detailing how tank sizes and configurations affect biological responses to various types of nutrient loading; for instance, they are dosing tanks with high and low concentrations of continuous nutrient enrichment, as well as with high pulses of nutrient enrichment. Of the forty tanks, there are two separate configurations with three different volumes that have the same depth, and three different volumes that have the same ratio of diameter-to-depth, though they each differ in depth.

A Beginning

The data collected from one mesocosm would be large in itself, but the data from three different volumes, two configurations, and replicate experiments are downright massive. Though researchers are currently analyzing this first year's data, they have, says Mike Kemp, preliminary results on how planktonic, bottom-dwelling and wall growth (periphyton) communities in the different mesocosms responded to nutrient dosing.

While it is difficult to generalize, Kemp and his colleagues have been learning about the scale-dependency of mesocosm behavior.

- Under nutrient-rich water conditions associated with



CEES scientist Mike Kemp is heading a team of researchers who are trying to determine how mesocosm size and shape affects the results of an experiment.

springtime, the rate of algal production to water surface area was similar for all mesocosm sizes; however, algal production to water volume was least in the deepest mesocosms. In contrast,

- Under relatively low nutrient conditions of summertime, algal production per water volume was constant for all mesocosms, so that photosynthesis per unit of water surface area (and light energy) was highest in the deep tanks.

Kemp says these findings suggest that results from mesocosm experiments should be scaled to real world conditions by depth in spring but by volume in summer. The implication is that seasonal variations in nutrient and light availability may change the appropriate scaling criteria for mesocosm experiments.

While these studies on the scaled behavior of sediment and overlying water communities are one major element of the MEERC project, two others are marsh mesocosm studies, headed by Court Stevenson, and SAV ecosystem studies, headed by Laura Murray. Their research is exploring how mesocosm complexity influ-

ences marsh and SAV productivity and nutrient retention.

During this first year, Stevenson and Murray have been asking questions that surprisingly, they say, have not been asked before. For example, how does ecosystem complexity affect responses to nutrient loading on marsh plants and on submerged aquatic vegetation? Does the ability of plant communities to absorb and transform nutrients vary with the form (dissolved vs. particulate) and the route of delivery, for example, groundwater vs. surface water? How do water circulation and the abundance of animals at

higher trophic levels affect the responses of plant communities to nutrients and other climatic effects?

As a first-step simulation of marshland, Stevenson is employing large rectangular tanks of sediments planted with one or several species of grass. Nitrate-rich groundwater slowly seeps through the sediments, which are also on the receiving end of water that replicates tidal effects. The initial version of these experimental systems works effectively, maintaining healthy plant communities over long periods of time. "This year we will vary plant species composition," says Stevenson, "and examine response to groundwater nitrate under different tidal regimes."

"We're excited about these experiments," he says, "because nobody has ever replicated tidal marsh systems with groundwater inputs being varied while varying species composition. We believe," he adds, "we are carving out new ground."

Research that Is Truly Exploratory

"CEES scientists are asking very basic questions," says Karen Morehouse, "questions that have to

(Continued on page 4)

MEERC, *continued*



be asked. Our applied research is a house of cards if we don't have the answers." While nobody has done this kind of

research, Morehouse points out, the political and scientific risks in such work are considerable. Such research requires long-term funding, meaning there are no quick answers — not an inconsequential issue in a climate in which politics often requires short-term results. Although Congress required EPA to set aside funding for exploratory research in 1979, "it is often difficult," she says, "to justify research support that is not immediately applicable." MEERC, like three other EPA-funded research centers, is eligible for continued funding over ten years.

"We may find that you cannot extrapolate anything meaningfully from the lab to the real world," says Morehouse, "though we know that if CEES comes up with anything, it will be valuable. Unless we understand the basic way that aquatic ecosystems operate, then we have no business setting standards and regulations." This kind of research is essential, she believes, for EPA and other regulatory agencies.

"Understanding the system and predicting effects gives us a better chance of setting accurate regulations and defending them. After all," she adds jokingly, "EPA is famous for making indefensible decisions."

It is years too soon to know whether CEES researchers can successfully develop models to characterize the wildly complex dynamics of these mesocosms and then discover if there are rules that enable them to extrapolate among differently-scaled systems. The answers may depend on increasingly sophisticated mathematics and, perhaps, luck — but that is another story. ■

Japanese Establish International Coastal Seas Center

The governments surrounding Japan's largest coastal sea — the Seto Inland Sea — have joined together to form an international center for the study and management of coastal seas around the world. Named the International Center for the Environmental Management of Enclosed Coastal Seas (EMECS), the Center will serve as a repository for coastal seas information, act as the hub of a large international network of scientists, managers and others, and assist in the regular staging of EMECS conferences. At the inaugural ceremony for the Center, in Kobe, Japan, David A.C. Carroll, Secretary of the Maryland Department of the Environment, addressed a large audience of representatives from Japanese industry, government and academia, and a number of international members of the EMECS network. Wayne Bell, Vice President for the University of Maryland's Center for Environmental and Estuarine Studies (CEES), moderated a panel on coastal seas science and policy. Both Carroll and Bell serve on the EMECS Center's Board.

The late Ian Morris, who at the time of his death headed CEES, helped launch the original study of coastal seas around the world and the EMECS efforts which were to follow. As noted in a speech by Kaihara, Governor of Japan's Hyogo Prefecture, and a leader in establishing the EMECS Center, Morris visited Japan during the 1980s as part of a

As *Marine Notes* goes to press, we are witness to the widespread destruction and loss of life in Kobe, Japan, from a ferocious earthquake. From those of us who were recently in Japan and from the Maryland Sea Grant College, we send our heartfelt sympathies to the people of Kobe who are living through this terrible devastation. — *Jack Greer*

comparative study of coastal seas management in Asia, Europe and the U.S. That study helped spark the international effort which was to become the EMECS network.

The first of the EMECS conferences, which brought experts from around the world together to focus on coastal problems and policies, was held in Kobe, Japan, in 1990 and the second in Baltimore, Maryland, in 1993. The third conference will take place in Stockholm, Sweden, in 1996.

Another of Morris's inspirations, the University of Maryland System's Coastal and Environmental Policy Program (CEPP), has played a lead role in the EMECS effort, bringing together the expertise of several units, most notably CEES, the School of Public Affairs (UMCP), and the Maryland Sea Grant College. Jack Greer, outgoing CEPP director, attended the inaugural ceremonies in Japan on behalf of the University.

The University of Stockholm has the lead for the next EMECS Conference, under the direction of Professor Bengt-Owe Jansson. For additional information about the EMECS effort, please contact the Coastal and Environmental Policy Program at CEES (410) 228-9250 or Sea Grant (301) 405-6376.

Blue Ribbon Panel Releases Report

The Blue Ribbon Panel appointed by Governor William Donald Schaefer and chaired by Harford County Executive Eileen Rehrmann, has released its report on *Alternative Funding Strategies for the Chesapeake Bay Tributary Strategies*. The report is being passed to Governor Parris Glendening, who has resolved to continue Maryland's commitment to restore the Chesapeake Bay.

The Blue Ribbon Panel is comprised of experts from the private sector — including investment bankers and other finance experts — as well as representatives from state and local government, including the Mayor of the City of Bowie and the County Administrator of Calvert County. Governor Schaefer

MARYLAND'S TEN TRIBUTARY AREAS



charged the committee with exploring creative financing mechanisms to help raise funds needed for meeting the main goal of the Bay restoration effort: to reduce the flow of nutrients into the estuary and its tributaries by 40%.

The Panel was assisted by the University of Maryland's Coastal and Environmental Policy Program (CEPP), which has established an Environmental Finance Center, with support from the U.S. EPA. CEPP and the Finance Center are transdisci-

plinary efforts involving the Maryland Sea Grant College, the School of Public Affairs, the Center for Environmental and Estuarine Studies, and other units of the University.

Copies of *Financing Alternatives for Maryland's Tributary Strategies*, are available from the Office of the Governor, State House, Annapolis, Maryland 21401, or from the Maryland Sea Grant College, (301) 405-6376. The report includes a menu of financing options that will be useful for local governments and others interested in raising additional funds for nutrient-reduction programs.

D'Elia Moderates NASULGC Panel

At the November 7, 1994, meeting of the National Association of State Universities and Land Grant Colleges (NASULGC) in Chicago, Chris D'Elia,

director of the Maryland Sea Grant College, moderated a panel entitled, "Taking Science to Policy in the Clean Water Act."

The panel was presented by NASULGC's Board on Oceans and Atmosphere (BOA), and included Donald Boesch, president of the University of Maryland System's Center for Environmental and Estuarine Studies; Cliff Randall, Virginia Polytechnic Institute; Elise Hoerath, Esq., National Wildlife Federation; Ann Swanson, Chesapeake Bay Commission; and Barry Gold, House Science Committee.

According to NASULGC, "The BOA program was extremely timely and relevant. The distinguished panel of experts representing the major interests involved in clean water issues engaged in a very thoughtful, comprehensive and highly informative discussion of the role and nature of science in policy making."

MEES Student Receives Knauss Fellowship

A graduate student in Marine-Estuarine-Environmental Sciences (MEES) at the University of Maryland, Catherine Stokes, is the recipient of this year's Knauss Marine Policy Fellowship in Maryland. As a fellow, she will work full-time for one year, beginning in February 1995, in the Installations and Environment section of the Office of the Assistant Secretary of the Navy at the Pentagon. This office establishes policies for the Department of the Navy for some 200 installations, primarily in the coastal zone, overseen by the Navy and the Marine Corps. The policies deal with areas such as natural and cultural resources conservation, pollution prevention, estuarine water quality, marine mammal monitoring and other environmental planning activities. Stokes's job will include management of the Navy's Environmental Education and Outreach Initiative program.

Catherine Stokes is currently working as a graduate assistant at Horn Point with researchers Michael

Kemp and Peter Sampou on community metabolism in the shallow waters of the Chesapeake Bay. In 1993, she was Chief Scientist with the Environmental Monitoring and Assessment Program in the Environmental Protection Agency, where, she says, "I became aware of the urgent need for increased communication between scientists and policy makers when designing such programs."

She plans to continue on to law school after the fellowship and completion of her M.S. in the MEES program. Two degrees and the Knauss experience, she feels, will prepare her to become a strong partner in policy decisions and program design in the field of environmental planning and policy.

The Knauss Marine Policy Fellowship Program, begun in 1979 and coordinated by NOAA's 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. Over the years, fellows have worked in the legislative and executive branches of the federal government in locations such as the offices of U.S. Senators and Representatives, on Congressional subcommittees and at agencies such as the National Science Foundation and the National Oceanic and Atmospheric Administration. Fellowships run from February 1 to January 31 and pay a stipend of \$30,000.

Sea Grant Directors around the nation submit applications for students they feel are strong candidates for a Knauss Fellowship to the National Sea Grant Office which conducts a rigorous review process. This year there were 57 applicants and 25 awards. The application deadline for next year's fellowship program is September 1, 1995. 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.

Research, Etc.

Bay Area Experts to Assist EPA

Five Chesapeake Bay area experts are among sixty-eight individuals appointed to the National Advisory Council for Environmental Policy and Technology (NACEPT) by U.S. Environmental Protection Agency (EPA) Administrator Carol Browner. They are Donald Boesch, president of the University of Maryland Center for Environmental and Estuarine Studies (CEES); Robert Costanza, director of the CEES/CEPP International Institute for Ecological Economics; Margo Garcia, Virginia Commonwealth University; Michael Haire, Maryland Department of the Environment; and Ann Powers, Chesapeake Bay Foundation.

Administrator Browner has asked the committee to advise EPA on a "place-based" approach to environmental management that will respond to the environmental needs of specific ecosystem and human communities. This request stems from the "Edgewater Consensus," a strategy developed earlier this year in Edgewater, Maryland, by EPA assistant administrators (including Robert Perciasepe, Assistant Administrator for Water and former Maryland Secretary of the Environment).

CEES Initiates Watershed Ecology Program

At a recent workshop at the University of Maryland, Frostburg, participants set research, management and education priorities for a new Watershed Ecology Program to be located at the University of Maryland's Center for Environmental and Estuarine Studies (CEES) Appalachian Environmental Laboratory at Frostburg. Workshop participants included University System scientists and Maryland state agency officials. The Ecology Program is a collaborative effort among CEES, the Frostburg campus and the Agricultural Experiment Station of the College Park campus.

The Watershed Ecology Program will be housed along with the CEES Appalachian Environmental Laboratory in a new building planned for construction on the Frostburg campus.

Sea Grant Now On-line



Publications and Other Information. New on the World Wide Web (www.mdsg.umd.edu) is information provided by the Sea Grant Programs of the Mid-Atlantic. Those cruising the information highway will be able to call up articles from Maryland's bimonthly newsletter, *Maryland Marine Notes*, and other materials from the Sea Grant programs of New Jersey, Delaware, Maryland, Virginia and North Carolina. The Sea Grant Mid-Atlantic Gopher is also up and running and can be reached at gopher.mdsg.umd.edu. For additional information, call Dan Jacobs at Maryland Sea Grant (301) 405-6379, or e-mail us at mdsg@mbimail.umd.edu.

Sea Grant represents a remarkable source for information about marine topics, from marine mammals to jellyfish. Sea Grant programs in the coastal and Great Lakes states produce videos, books, magazines, newsletters, scientific journal reprints, fact sheets, posters and other materials. Sea Grant publications from around the country are available from the Pell Depository at the University of Rhode Island, phone (401) 792-6539.

Those visiting Annapolis can check out a number of computer and other resources at an extensive University of Maryland display, which will be up during the legislative session in the House Office Building.

Weather and Satellite Information. The Maryland Sea Grant College also has a variety of current weather maps and satellite imagery for North America available via the computer internet. The Sea Grant remote sensing lab's computer, call "kestrel," is one of five "mirror sites" of the University of Illinois Weather Machine that provide many types of current weather imagery for the U.S.

Users around the country offload an average of one gigabyte of data every day, with usage continuing to increase. Most of the images are updated hourly and an archive of the last 48 hours of data is maintained.

In addition to standard products, kestrel offers many unique weather maps for selected cities across the country. Available weather products include: surface analysis and radar summaries for the entire U.S. and selected cities; visible and infrared satellite images from GOES-7; upper-air constant pressure charts (up to 40,000 ft); 3- to 60-hour forecast maps for the U.S.; 6-panel images of surface observations.

To access kestrel through anonymous ftp, type the following:

```
Anonymous ftp
ftp kestrel.umd.edu
login: anonymous
password:
<you@your.host.name>
cd/pub/wx
```

To access kestrel through the World Wide Web, type the following:
WWW

```
ftp://kestrel.umd.edu/pub/wx
```

For more information on kestrel, contact Scott Gennari, developer of the system, at the following e-mail address: gennari@kestrel.umd.edu.

Maryland Marine Notes Volume 12, Number 7

Maryland Marine Notes is published six times per year by the Maryland Sea Grant College for and about the marine research, education and outreach community around the state.

This newsletter is produced and funded by the Maryland Sea Grant College Program, which receives support from the National Oceanic and Atmospheric Administration. Editor, Sandy Harpe. Send items for the newsletter to:

Maryland Marine Notes
Maryland Sea Grant College
0112 Skinner Hall
University of Maryland
College Park, Maryland 20742
phone (301) 405-6376
fax (301) 314-9581



End Notes

Noteworthy



■ **Call for Papers.** The Chesapeake Bay National Estuarine Research Reserve — Maryland (CBNERR-MD) in conjunction with the Jug Bay Wetland Sanctuary (JBWS) will hold the first CBNERR-MD Research

Meeting. Abstracts are sought for 15-minute talks that pertain to research and/or resource management projects in any of the three CBNERR-MD components or other related projects. One-page abstracts are due *March 15*. For details about submission, contact: David Nemazie, Research Coordinator, CBNERR-MD, CEES, P.O. Box 775, Cambridge, MD 21613, phone (410) 228-9250, ext. 615, fax (410) 228-3843, internet: DNEMAZIE@HPEL.UMD.ED.

■ **Kudos.** Sea Grant Extension Agent *Rich Bohn* has been appointed to a two-year term on the Northeastern Regional Aquaculture Center's Technical Advisory Council. Other members of the Advisory Council include *Tom Handwerker* (UMES), *Ken Paynter* (UMCP) and *Eric May* (Maryland Department of Natural Resources).

■ **Presentations.** On December 6, *Jack Greer*, outgoing director of the Coastal and Environmental Policy Program and assistant director of the Maryland Sea Grant College, made a presentation to the U.S. EPA's Environmental Finance Advisory Board (EFAB). EFAB is comprised of private sector and government finance experts, and advises EPA on innovative methods for funding environmental mandates and projects. Greer made the presentation on behalf of five regional Environmental Finance Centers (EFCs), established by EPA to encourage and support technology transfer by universities in the area of environmental finance. The University of Maryland (EPA Region III) was named as the second of five EFCs now operating in the U.S.

■ **Request for Proposals.** The Power Plant Topical Research Program within the Maryland Department of Natural Resources is requesting preproposals for the FY96 funding year. The funding level for this solicitation is \$100,000. For details about the topic areas relevant to the goals of the program and how to submit a preproposal, request CBRFP-8 from Joanne Woodard at (410) 974-3767. The closing date for submitting preproposals is February 17, 1995.

■ **Teacher's Institute.** The Mid-Atlantic Operation Pathfinder Summer Institute is designed to enhance the teaching skills of elementary and middle school minority teachers or teachers of minority students. The 12-day institute, to be held August 1-12 at Sandy Hook, New Jersey, will provide teachers with the opportunity to experience hands-on learning in oceanography and coastal processes.

Twenty educators will be selected from the mid-Atlantic region for participation in the Institute. Teachers will receive three graduate credits for the course and a stipend, room, board and travel expenses.

New Jersey Sea Grant invites applications from educators in New Jersey, Delaware, Maryland, Virginia and North Carolina. For an application or information, contact: Rachel Salas Didier, New Jersey Sea Grant Education and Outreach Program, Building 22 - Sandy Hook Field Station, Fort Hancock, New Jersey 07732, (908) 872-1300.

Publications, Etc.

■ **Children's Nature Video.** The Maryland Department of Natural Resources has a new educational video which teaches children about nature. Called *Out of the Egg*, this 30-minute video follows the adventures of three curious junior rangers who set out with Ranger Bill to solve the mystery of what's inside an egg the children find hidden in the grass. Filmed in Maryland's Patapsco Valley State Park, the story teaches children

about various owls, snakes, turtles, ducks and even the unusual legless lizard, also known as a glass snake. The video features original music by the musical group Magpie and is suitable for ages four and older.

Out of the Egg sells for \$14.95 and is available at any state park or forest or by calling (800) 784-5380. Proceeds from sales of the video go to fund stewardship of Maryland's state forests and parks.

■ Chesapeake Steamboats.



According to a new book from Tidewater Publishers, the steamboat era (1813-1963) on the Chesapeake matched in glamour and excitement the steamboats' history on the Mississippi. Written by David C. Holly, *Chesapeake Steamboats: Vanished Fleet* begins with the building of the first steamboat on the Bay in the shadow of bitter struggle over monopoly on the Delaware and the Chesapeake. It continues with stories of the genius of early engine builders, legends arising from dramatic steamboat excursions and resorts, the personalities of many steamboats and their masters, the railroads' near achievement of monopoly on the Bay, and the denouement when trucks and automobiles eclipsed the role of the steamboat.

The book is available from local booksellers or directly from the publisher by calling (800) 638-7641.

■ **Toxics Report.** *Chesapeake Bay Environmental Effects Studies Toxics Research Program, 1993 Workshop Report*, a proceedings listed in last month's *Marine Notes* as available from the NOAA Chesapeake Bay office, is also available from Maryland and Virginia Sea Grant, which jointly administered the research program. Anyone interested in a copy can contact the Maryland Sea Grant office, (301) 405-6376, or the Virginia Sea Grant office, (804) 924-5965.

Calendar

FEBRUARY

3-5 — Environmental Education Solomons, Maryland. "Inventing the Future: A Vision for Tomorrow" is the theme for the 10th annual Maryland Association for Environmental and Outdoor Education (MAEOE) teacher conference. The symposium, co-sponsored by the Maryland Writing Project and the Maryland Geographic Alliance, will feature workshops by leading authorities on environmental education topics such as aquaculture, environmental theater, water conservation and schoolyard habitats. Other conference activities will include a poster session, field trips and special presentations by photographer Dave Harp and the musical group Magpie. For infor-

mation about the conference, contact JoAnn Roberts, Chespax Coordinator, (410) 535-7371.

26 — Striped Bass Symposium Virginia Beach, Virginia. A special symposium titled "Management of Striped Bass and Striped Bass Hybrids" will be conducted during the Southern Division of the American Fisheries Society's Mid-year Meeting in Virginia Beach. The symposium, which will address both inland and coastal stocks of striped bass, as well as striped bass hybrids, will include 15-minute individual presentations followed by a group session wrap-up. For more information, contact the chair of the Striped Bass Committee, Roger McCabe, by phone (817) 799-2516, or fax (817) 867-6839.

Change of Editorship

After serving as both editor and art director of *Maryland Marine Notes* for twelve years, I have decided to step down as editor. It has been rewarding yet exhausting to produce a newsletter ten times a year, especially since it expanded from 8 to 12 pages. The time has come for someone else to take on editorship of *Marine Notes*, which began bi-monthly publication as well as electronic distribution last year. I will try my hand at other kinds of projects, while Jack Greer, also director of our communications program, gets to do more writing and editing and a little less administering. Beginning with the next issue, Jack will take over as editor, and I will be art director of *Marine Notes*. We are looking forward to working together on a quality publication that we hope will provide valuable information to those interested in marine research, policy, education and outreach.

— Sandy Harpe



Printed with soybean ink on recycled paper containing 10% postconsumer waste.

Maryland Sea Grant College
0112 Skinner Hall
University of Maryland
College Park, Maryland 20742

Forwarding Postage Guaranteed
Address Correction Requested

Non-Profit Org.
U.S. Postage
PAID
Permit No. 10
College Park, MD