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IN THIS ISSUE

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CELEBRATIONS AND CONCERNS FOR THE EARTH: First Guest in Series: Novelist Peter Matthiessen

Like hatching eggs, a sickness that can't be stopped, is the way Peter Matthiessen, who has never had writer's block, describes his prolificacy. With 20 books behind him, and several more now in the making, he described his process to about 80 participants in a writing workshop on November 29. The afternoon workshop and evening reading were the first presentations in the Marine Sciences Research Center's **"Celebrations and Concerns for the Earth"** series.

"I really like to shape the book first, similar to a sculpture," said Matthiessen, who does so by making outlines. Once he forms the shape, he may rewrite as much

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Peter Mathiessen discusses writing techniques at workshop.

Photo by Maxine Hicks

State Senator Caesar Trunzo laying some of the first ashblocks. Watching (from L.) are Senators Owen Johnson, James Lack, and Kenneth LaValle and MSRC principle ashblock researcher, Frank Roethel.

BOATHOUSE DEDICATION

The first incineration ash-cement blocks were laid in a ceremony on October 2 to inaugurate the construction of MSRC's boathouse. The festivities included a welcome to a crowd of over 100 guests by MSRC Dean and Director J. R. Schubel and a description by the principal researcher Frank Roethel of the eight years of laboratory and field research behind the development of the durable and environmentally safe blocks.

University at Stony Brook President John H. Marburger, III and Provost Tilden G. Edelstein also addressed the gathering. In his address, President Marburger said that MSRC and its Waste Management Institute (WMI) "clearly had played a leadership role not only in the state, but also in the nation and the world in recognizing the need for enlightened means of reducing, recycling and reusing waste materials of all kinds."

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as 30 times. Characters in his novels are often exotic, yet they become vividly familiar through their dialog, which sometimes sings, sometimes chants, and sometimes roars in indigenous dialect. "A character has to come alive," he said. "You can't be too literal or tack on traits, or it will kill it." He draws upon his life experiences and the characters he has met, using a shamanistic approach—keeping his eyes open to receive "that feel," from a piece of dialog or feature that captures the person or sense of place.

Preferring fiction over non-fiction, Matthiessen started writing short stories for Atlantic Monthly, and only unwillingly turned to non-fiction with "Wildlife in America," a book published in 1959. With this benign entrée into the world of non-fiction, he later took on provocative questions about destructive interactions between humans and nature and about neglected social responsibilities to fellow humans.

In the evening Matthiessen read from "Men's Lives" and "Killing Dr. Watson." In "Men's Lives," Matthiessen, who has worked in commercial fishing, sein netting for striped bass, and in recreational fishing as a charter captain, explored the diminishing livelihood provided by commercial fishing. He said that he felt a sense of urgency in writing "Men's Lives" because the commercial fishermen are very poor, having to piece together off-season jobs under good conditions to make a living, and what is left of the fishery is slipping away fast.

Future **Celebrations and Concerns for the Earth** series guests:

Roger Stone, author of "Voyage of the Sanderling" on February 7

William Warner, author of "Beautiful Swimmers" on April 5

Rick Anthes, President of the National Center for Atmospheric Research on April 11 and 12

To find out more information about the series, call 632-8701.

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State Senators Owen Johnson, James Lack, Kenneth LaValle, and Caesar Trunzo also addressed the gathering, as well as Harold Berger, Regional Director of the NY State Department of Environmental Conservation, and Ross M. Patten, Managing Director of Wheelabrator Technologies, Inc., contributors of the incineration ash. "This building is research for the public good, and one that deals with complex societal needs here on Long Island," said Trunzo, who has been a staunch supporter of the project and instrumental in securing state funds for the research. WMI Director R. Lawrence Swanson thanked the four senators for their strong support and affirmed WMI's dedication to finding solutions to waste management problems. "The innovative attention to public and environmental concerns displayed in the development of these blocks are only the first of a series of such activities the Waste Management Institute expects to research," said Swanson.

Over the next several years, the experimental building, the air in the building, and the surrounding ground will be monitored continuously by scientists for the environmental acceptability of the ash blocks, as well as their structural integrity.

MSRC thanks the following donors for their support of this project:

American ReF-FUEL
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Forest Iron
National Solid Waste Management Association
Ogden Martin Systems, Inc.
Second District of Federated Garden Clubs of NY State
USA Recycling, Inc.
Wheelabrator Technologies, Inc.

STUDENT INTERN ADVISES LEGISLATOR ON L.I. SOUND SPECIES SIZE LIMITS

Graduate student Yuval Eshet has been working as a legislative intern for the past year, providing scientific advice for the Commission on Water Resource Needs of Long Island, chaired by New York State Assemblyman Thomas DiNapoli. DiNapoli has recently requested Eshet's and MSRC's advice on pending legislative and regulatory measures to increase size limits on several species of fish caught in Long Island Sound.

Size limits vary from state to state for many species of fish, and those limits are often based on inadequate data. Eshet and colleague Peter Merkle have developed a mathematical model that Eshet is now using in his M.S. work and in his internship to help legislators and regulators set size limits based on scientific information. The model can calculate approximate size limits needed to protect a sufficient number of females for at least one spawning so that an adequate supply of newly born offspring (the new year class) can become part of the species' population (recruitment).

Three fish species under consideration— winter flounder, summer flounder, and tautog—are under heavy fishing pressure, sought by both sport and commercial fishermen. To determine what size limit to put on each species that will allow the stock to be maintained at reasonable levels (a sustainable yield), the model incorporates several important biological parameters relating to reproduction: how long the fish lives on the average; when it is reproductively mature; its body length and estimated weight; and from weight, an estimate of how many eggs a female will produce at spawning. If a female is caught before

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ELIZABETH COSPER

Solving Basic Research Questions and Society's Problems Together

Basic research questions that also solve society's problems is the dual challenge that Assistant Research Professor Elizabeth Cosper thrives on. She has successfully achieved this dual goal by asking questions about her basic research interests, the physiology and ecology of phytoplankton, within the framework of environmental problems in coastal areas. As Assistant Research Professor in MSRC's Living Marine Resources Institute, Cosper has been investigating the causes of phytoplankton blooms that often wreak havoc in coastal waters and the development of resistance by phytoplankton to pollutants.

One phytoplankton bloom that has kept Cosper and her graduate students particularly busy for the past five years is the "brown tide," a previously unknown algal species that struck regional coastal waters at bloom concentrations for three years in a row. And when everyone thought it had finally disappeared, it suddenly reappeared as recently as this past summer. The brown tide, *Aureococcus anophagefferens*, created several significant environmental problems, destroying eelgrass beds and scallop populations. Through Cosper's continued perseverance, skills in culturing the brown tide in the laboratory, and wisdom in bringing diverse groups of scientists from many institutions together in scientific collaboration in a forum, she has greatly advanced the body of knowledge about this bloom.

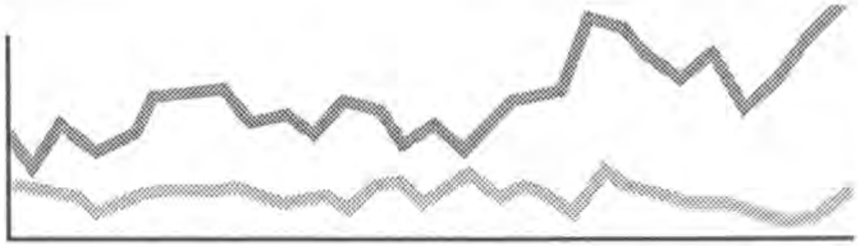
Many questions still remain about the brown tide's mysterious life history. While trying to resolve what environmental conditions caused this species to suddenly appear and to outgrow and outcompete other native species in Long Island bays, Cosper has been unraveling basic questions about its nutrient requirements; adaptability to low light levels; and on a recently expanded track, asking which zooplankton do and do not eat the brown tide and why. This last aspect, grazing selection, and its relationship to phytoplankton productivity (how many cells are produced), has brought Cosper into a collaboration with MSRC colleague Darcy Lonsdale, with whom she shares two grants, and Woods Hole Oceanographic Institute's Dr. Dave Caron.

Lonsdale's expertise in zooplankton, particularly the life history stages of copepods, is needed to test grazing selection for or against the brown tide species by copepod adults, juveniles, and larvae. Caron specializes in the micrograzers, smaller zooplankton, that also feed on phytoplankton. This team will be combining lab and field experiments to confirm their suspicions that the zooplankton community smaller than 5 microns, particularly protozoans, are grazing on the brown tide. Cosper also will be looking further at the effects of selenium and citric acid, which she has determined to be promoters of growth in laboratory cultures of brown tide. Citric acid is one of the constituents of detergents that was substituted for banned phosphates, so the possibility exists that this "micronutrient" has relatively recently been introduced into local waters. She is now augmenting the lab tests with field experiments to see if these micronutrients enhance growth of the brown tide in seawater.

Cosper and Lonsdale's recent collaborative grants will also enable them to investigate phytoplankton-zooplankton coupling in other algal species important to New York coastal waters. They are asking if potential blooms are controlled by grazing. "Phytoplankton-zooplankton coupling, which is probably normally very tight, may periodically become uncoupled, and these may be the times when blooms occur," said Cosper. "We now know from other research being done that the grazers are selective—they do not just sieve in everything in a certain size fraction, as was once believed, so their control of an algal species' numbers may be significant." Using radioactive tracers, Cosper and Lonsdale hope to determine the rates at which carbon is being fixed during photosynthesis, where the carbon is moving through the food chain after it is incorporated into the algal cells, and what factors such as cell size and food quality determine the selection process.

Grazing preference for certain algal species has led Cosper to focus on another area of research—resistance of phytoplankton to pollutants. Several different clonal isolates of the diatom *Ditylum brightwellii* readily develop resistance to PCBs when living in known PCB-contaminated waters in the field. In the laboratory using a sensitive strain, Cosper and her graduate students could induce resistance within 10 days to two weeks by just adding PCBs, and this resistance lasted for four years without any further treatment. The resistant strains developed larger vacuoles in their cells, which appeared to contain more lipid droplets, suggesting to Cosper that the PCBs were being sequestered inside the droplets. "The fact that *D. brightwellii* is the preferred food of grazers and may be storing PCBs in their vacuoles has important consequences with respect to bioaccumulation in the food web," said Cosper. Another species of diatom, *Thalassiosira weissflogii*, is also known to develop PCB resistance, but instead of storing the pollutant molecules in their vacuoles, appear to be keeping them out of their cells. "We need to know specifically how different species that develop resistance to contaminant organic molecules are handling them," said Cosper. Her proposed research plans include using radioactively labelled PCBs in cell cultures to determine if they do move into the diatom's lipid droplets.

All of Cosper's research programs and plans have a common link: to better understand phytoplankton ecology. Even the brown tide research that focuses on additives in detergents as growth promotors has this common thread. "Micronutrient chemistry is probably very important to algal species' composition and shifts in that composition," she said. "Many researchers won't study the local problems at coastal population centers—because the focus is not general enough and the problem too local for large funding programs." But these types of studies have always answered very basic biology questions that she has long been interested in knowing, and she can easily relate them to something of consequence to society—answers that have an impact on our coastal environment.



PETER WEYL

Viewing the Global Environment as a System with Negative Feedback

Professor Peter Weyl's way of looking at global environmental problems is different from the conventional view. His approach to understanding such large-scale problems as global warming is based on an environment that is dynamic and changing, yet has maintained stability over geologic time. Equally important in Weyl's approach to understanding large-scale environmental problems is to consider this stability in a system-wide manner that includes feedback.

The enormous changes in the oceans and atmosphere through geologic time—fundamental changes in the physical, chemical, and biological processes and changes in topography and geography resulting from plate tectonics—attest to nature's inherent dynamism. In spite of these large-scale changes, varied forms of life have persisted and have not required a new cycle of evolution from primitive beginnings. "The fossil record indicates relatively continuous change and modification, and many ancient forms of life still exist," said Weyl. "Understanding global environmental change, therefore, requires understanding the mechanisms that have preserved stability in the past—so that we can estimate their limitations in the future from such potential impacts as industrialized human activity."

Weyl's ideas about a feedback-stabilized environment were first formulated in his 1966 work on geochemical feedback. In this paper he observes that "the diverse and changing interactions between the atmosphere, ocean continents, and biosphere must be stabilized by complex negative feedback mechanisms." He compares feedback in the environment to the home heating system: negative feedback turns the furnace off when it gets too warm and turns it on when it gets too cold. The thermostat provides negative feedback, reversing the direction of change when preset limits are crossed.

"The two important aspects to think about in addressing environmental change," said Weyl, "are first, that the observed changes may be part of the feedback mechanism, so it must be studied as a system, and second, that we should be asking what the important factors are that provide stability." A major emphasis in this holistic view of the environment as a system regulated by negative feedback is an exploration of how the deep oceans circulate, why most of the ocean is cold, and how it is stabilized in spite of outside disturbances. He is presently examining the distribution of ocean temperature and salinity to obtain clues about the ocean's interactions with life forms and the surface environment to provide negative feedback.

The oceans stabilize the surface environment of our planet because of their great capacity for heat and matter, according to Weyl, who has been a professor of physical oceanography at MSRC since its inception. A warming ocean would destabilize the planet's surface environment; thus, feedback mechanisms that keep the oceans cold are of critical importance. If the ocean is observed to be warming, according to him, the question that one should ask is not why it is changing but what feedback mechanism will limit and, possibly, reverse the trend.

How stable temperatures in the oceans are maintained is just one intriguing question to which negative feedback may yield answers. A similarly difficult question relating to deep ocean circulation is how oxygen is maintained in the deep oceans. Beginning with photosynthesis at the ocean's surface, organic matter is incorporated into living marine plant cells, whose growth depends on dissolved nutrients in the surface waters. The cells eventually die, decompose, and drift to the depths where the organic matter is consumed by organisms, oxidized—changed back into nutrients—and recycled to the surface. Without a resupply of oxygen at depths, this organic material would accumulate and oxygen would be completely used up. How living organisms in the deep oceans are resupplied with oxygen is a mystery. Yet biolgoical stability is maintained in this region, and Weyl points to the absence of any evidence from core samples that large-scale anoxia in the deep oceans ever ocurred.

To test his ideas, Weyl uses spreadsheet software with his personal computer to interactively analyze ocean data. He will construct conceptual models to see what is and what is not important in ventilating the deep ocean, modifying and remodifying the models. This method allows him to rapidly generate plots showing various aspects of the data to test perhaps 50 different ideas in a time frame approximating the thinking process. He hopes to demonstrate with his approach that to assume stability and ask questions about change is not useful for examining the past to plan for the future. "The point is not to argue if volcanic eruptions or meteor impacts are more likely to affect survival, but rather to investigate the feedback mechanisms that reduced the global impact of such catastrophic events," Weyl said.

Regarding global warming, Weyl believes that the important element is not the change in the global average temperature, but rather to understand the changing patterns and how they affect the deep circulation of the ocean. "The fact that the environment has been relatively stable in the past doesn't mean that we humans can do whatever we want and it won't matter," he said. "We are changing the environment at much greater rates than ever before, and we need to understand how the system has worked in the past to know if human intervention is exceeding the stabilizing ability of the planet's surface."

TESTING HYPOXIA HYPOTHESIS IN NEW YORK BIGHT

In the hot spring of 1976 a large bloom of the phytoplankton *Ceratium tripos* developed in the New York Bight—the pyramidal shaped body of water overlying the continental shelf and bordered by Long Island to the northeast, New York Harbor at the apex, and New Jersey's coast to the west. The unusual feature of this bloom was its initiation well out to sea and as far north as Cape Cod—away from any obvious nutrient source.

The bloom occurred just below the developing pycnocline (a density stratification formed by a layer of warmer, fresher surface water over cooler, saltier deep water). It was then pushed toward New Jersey shores by intense southerly winds and was trapped along the New Jersey coast. There, the increasing number of cells, perhaps aided by nutrients from the Hudson River plume, consumed more oxygen than they generated. Dying cells settled to the bottom where they formed an ooze-like film. The activity of bacteria consuming the dead algae lowered dissolved oxygen (hypoxia) in bottom waters over some 8,600 km^2, and resulted in the largest open coastal oxygen depletion event recorded up to that time, devastating the surf clam population and severely depleting ocean quahogs and sea scallops.

This past spring, meteorological conditions in the Bight started to look strangely similar to those of 1976. Based on 15 years' experience studying connections between meteorological conditions in the Bight and hypoxia events, R. Lawrence Swanson, Director of MSRC's Waste Management Institute, became alerted to the situation. Independently, Elizabeth Cosper, who is actively involved in bloom research (see "Focus on Research"), also became alerted. The two long-time New York Bight researchers, recognizing their common concerns, joined forces and designed a series of cruises with graduate students Bob Chant, Arnaldo Valle-LeVinson, and Allen Milligan and technical specialist Michael Doall to monitor bottom oxygen levels in the Bight through the summer.

Aboard the R/V ONRUST, the team sampled a large area of the Bight to measure dissolved oxygen and to search for *Ceratium tripos*. They also looked for another important cue for potential hypoxia—formation of a relatively deep pycnocline that develops early in the spring, similar to the pattern in 1976. This was indeed found, but as the summer progressed, stormy, cooler weather took over and stirred up the deeper waters so that severe hypoxia never developed.

Cosper and Swanson did not find a bloom of *Ceratium tripos*, but did find hypoxia in the apex of the Bight, and particularly, along a part of the New Jersey shore known as a "hot spot" for hypoxia. In 1987 the Environmental Protection Agency closed the 12-mile sewage sludge dump site, located in the Bight apex, partly because of the recurring hypoxia problems. But, according to the results of Cosper and Swanson's study, the cessation of sludge dumping has made little difference in dissolved oxygen (DO) levels in most of the Bight—the average DO over the area is nearly the same as it was during dumping.

What accounts for this lack of rebound after cessation of sludge dumping? Swanson and Cosper believe that the dominant factors controlling DO levels are the nutrient inputs from the Hudson River estuary fueling phytoplankton blooms, in concert with the stratification caused by freshwater input and the summertime oceanographic conditions of the Bight, particularly the spring and summer physical processes that determine the time and depth of pycnocline formation. The scientists predict that severe hypoxia is likely to occur in the Bight in years when the spring is very warm, followed by calm, hot summers that allow the cooler, denser salty waters of the ocean to become trapped under the warming freshwater from the Hudson River.

Cosper and Swanson plan to continue their joint study of the Bight to learn more about its physical properties and their relationship to phytoplankton blooms, particularly the impacts of hypoxia and blooms along New Jersey beaches and some Long Island beaches. They also hope to compare dissolved oxygen data from in the five-year Long Island Sound study to dissolved oxygen data obtained in the Bight in hopes of understanding more about their differences and similarities.

FACULTY NOTES

Dr. Steven Morgan and Dr. Gordon Taylor have just joined MSRC's faculty. Morgan, who is Assistant Professor with the Living Marine Resources Institute, studies the life history dynamics of marine invertebrates and fishes. Assistant Professor Taylor's interests lie in marine microbiology, microbial ecology, plankton trophodynamics, and marine biofouling.

MSRC has three visiting professors this fall. Professor Sergei A. Ostroumov from Moscow State University, U.S.S.R. is working with MSRC Dean and Director J.R. Schubel, Associate Professor Nick Fisher and visiting professor Mark Garrell of Adelphi University on environmental problems in Eastern Europe. Dr. Ostroumov's visit is sponsored by the Moscow-SUNY Exchange Program and MSRC.

Visiting professor Alberto Figueiredo, from Universidade Federal Fluminense, Brazil, is a collaborator on the AMASSedS (A Multidisciplinary Amazon Shelf Sediment Study) project with MSRC's Professor Charles Nittrouer.

During his sabbatic leave at Kyoto University to work on modeling animal aggregations, Professor Akira Okubo attended the International Congress of Ecology in Yokohoma from August 24-30 and on August 29 chaired a symposium, "Modelling Biological Invasions."

Professor Ed Carpenter recently received a NATO award in the amount of $35,000 to conduct a research workshop in Bamberg, Germany from May 25-30, 1991 on the biology and ecology of the nitrogen fixing cyanobacterium, *Trichodesmium* .

MSRC Associate Director Bill Wise was coordinator of the Coastal Society's 12th International Conference in San Antonio, Texas October 21-24. The conference theme was "Our Coastal Experience: Assessing the Past; Confronting the Future."

Professor Charles Nittrouer was awarded a National Science Foundation grant for his proposal titled, "The Accumulation of

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Biogenic Silica and Organic Carbon in the Continental Shelf Deposits of the Ross Sea." He also organized a special session for AMASSedS at the Fall American Geological Union meeting in San Francisco.

Assistant Research Professor Vincent Breslin presented two papers, one titled, "Innovative Uses for Stabilized Incineration Residues" at the 2nd Annual Northeast Conference on Solid and Medical Waste at Atlantic City, NJ from September 12-14 and the other titled, "Use of Incinerator Residues in Shore Protection Devices" at the First Hazardous Waste Treatment and Prevention Technologies Conference, October 9-10 in Niagara Falls, NY.

John M. Olin Fellow Doreen Monteleone and Assistant Professor Darcy Lonsdale received a U.S. Environmental Protection Agency grant titled, "Potential Impacts of Hypoxia on Lower Trophic Levels in Long Island Sound and Consequences for Fishery Productivity."

Monteleone and Dr. Edward D. Houde of University of Maryland's Chesapeake Biological Laboratory received a grant from the Maryland Department of the Environment titled, "Development of Otolith-Marking Methods to Estimate Survival and Growth of Early Life Stages of Natural and Hatchery-Produced Striped Bass in the Patuxent River."

Professor J. L. McHugh's 1988 publication, "Can we manage our Atlantic coastal fishery resources - II?" has just arrived from Marine Fisheries Review, 50(4): 41-45.

MSRC Dean and Director J. R. Schubel was appointed to the Governor's Task Force on Coastal Resources by NY Governor Mario Cuomo.

Professor Emeritus Donald W. Pritchard was the first recipient oN Dec. 5 of the prestigious Mathias Medal, given in recognition of special contributions made to protect, understand, and restore the Chesapeake Bay and to forge links between scientific knowledge and public policy.

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she has reproduced—if the size limit is set too low—the number of eggs she would have contributed to recruitment will be lost to the population. If this happens to a large enough portion of females, the stocks can be significantly reduced.

Once the biological parameters for the fish and the desired yield are incorporated into the model, it will calculate what the size limit should be. The present size limit of seven inches for tautog does not allow any of the females to reproduce even once. If the size limit is increased to 12 inches, the same size limit being used by Connecticut, 80% of the females would be able to reproduce once, according to Eshet. For winter flounder, the present size limit of nine inches for recreational fishing and 10 inches for commercial allows about 50% of the females to reproduce once, too low to provide a substanable yield.

The New York State law setting size limits for winter flounder was recently amended to increase the minimum size for recreational fisheries to nine inches in 1991 and to 10 inches in 1992. The commercial size limit will increase to 10 inches in 1990 and 11 inches in 1991. These new size limits, developed by the legislature in consultation with Eshet, should provide adequate protection to winter flounder stocks to permit this species to continue and should provide a substantial fishery as well.

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