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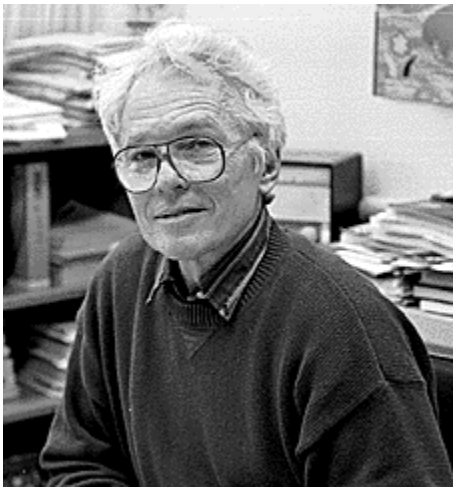
Wurster Symposium Revisits Route to DDT Ban



The first environmental activists, those who rolled up their sleeves to join the historical struggle to ban DDT, were on hand for eyewitness accounts at the April 25 program honoring MSRC's Charles Wurster for his contributions in having DDT banned in the U.S. The guests included the original alarm sounders who watched robins die after application of DDT. They included scientists who studied the affects of pesticides on brown pelicans, terns, falcons and eagles and naturalists who counted the numbers of osprey on Long Island as they dwindled from an estimated 1,000 nests in the 1940s to a low of 30 nests in the 1980s.

To achieve the ban, the "Fearsome Foursome," as they came to be known-Wurster, Art Cooley, Dennis Puleston, and the late Robert Smolker-formed the Environmental Defense Fund (EDF) With a number of elements coming together at the right time, they put together their first case in Wisconsin and began what became known as environmental policy. "It was a good thing we did take the case in Wisconsin," said Wurster. "We got to practice there for the bigger contest, the U.S. hearings held in 1972 by [then-EPA head] William Ruckelshaus."

Wurster used his knowledge of chemistry, his and Smolker's findings from experimental research at Stony Brook, and Puleston's accounts of diminishing numbers of osprey to establish the link between DDT and bird shell thinning. Cooley, who according to Wurster, was the real motivator in the group, did much of the organizing. "He made the EDF meetings enjoyable so that others would want to join," said Wurster. A chance linkage with a lawyer who was interested in EDF's findings led to their decision to bring their case to the courts. "It was the first time ever that scientists joined with lawyers to form an interdisciplinary team to take issues involving the environ-ment into civil court," said Wurster.

Besides anecdotes and historical summaries, experts at the symposium gave accounts of future prospects for endangered species and habitat protection and former EPA director Ruckelshaus, now Chairman and CEO of Browning-Ferris Industries, spoke after dinner. The program was co-chaired by MSRC's Malcolm Bowman and Art Cooley.

Grad Students Develop and Teach Novel Marine Field Course for Schools

MSRC graduate students designed and taught a field and classroom module in environmental sciences for the first time last fall to dozens of Long Island first- through sixth-graders. The 1995 summer schedule for these popular classes are already heavily booked, prompting an increase from five to 10 graduate student-teachers.

MSRC and the Stony Brook Community Fund, a local historical and environmental preservation group, co-sponsor the course to introduce young students to their own natural environment-the area's human and natural history, geology, and biology-through interactive activities. The students use a video-microscope to view marine life and a table size picture-puzzle to construct a salt marsh food web. After the class-room session, they explore a beach, looking for their own examples of different rock types, snails, crabs, and sea weeds at the water's edge.

Classes, which are adapted for various age groups, are held during the school year at the Fund's marine conservation center, located directly on a salt marsh. For information and reservations, contact the Stony Brook Community Fund (516) 751-2244.

SWAMP Thing

It's not a B-movie monster, but it does spend its active time in murky waters. It is 100 pounds of sophisticated scientific instrumentation that its owner, physical oceanographer Hartmut Peters, deploys from the aft-deck of research vessels to measure velocity and temperature fluctuations on centimeter scales as it falls into the depths.

The Shallow Water Microstructure Profiler, or SWAMP, is expensive, too. Peters' National Science Foundation grant, awarded for 1992-1995, included the cost for having this unique device engineered, a price tag that for replacement purposes would now top out over $100,000. But to Peters, it is worth every penny because SWAMP is precisely quantifying what has previously been largely left to guesstimates.

Why is microstructure detail of temperature and velocity important? Large-scale water movements are important and, because of their obviousness, are routinely measured by physical oceanographers. But small-scale movements (turbulence) plays an important role in the vertical transport of water-borne materials. These are a cascade of small eddies that move across density stratifications, causing vertical mixing. For example, they move across the thermocline-the layer where warmer surface water forms a distinct boundary, or barrier, atop colder deeper water. In the process, they break up the barrier, moving cold water to the surface from below and warm water in the opposite direction, and thereby transport nutrients, heat, pollutants, and particles, such as plankton.

The important process of mixing and its effect on the distributions of nutrients, particles, heat, and pollutants are currently poorly understood. Prior to the advent of SWAMP-type technology, physical ocean-ographers were limited to measuring large-scale processes using standard CTD (conductivity-density-temperature) profilers and current meters. "In the context of the biological, chemical, and geological environment, measurements of small-scale processes, like turbulence, are at least as important as the conventional, large-scale current, temper-ature and salinity measurements," said Peters, the first physical oceanographer to use a micro-profiler in estuaries. "SWAMP unveils a whole class of fine-scale processes that effect transport, leading us to redefine how we used to think estuaries work."

Sensitive probes on SWAMP generate electrical signals when deflected by water velocity fluctuations as they pass through the water column, sending signal changes. And in such shallow waters as estuaries, the probes, which are located on the head end that lands on the bottom, are vulnerable. They could be destroyed upon impact with a rock or any of the myriad pieces of auto or ship jetsam that lie at the bottom of the Hudson River. If all goes well, SWAMP lands on a nice, soft sandy bottom.

Joined by MSRC ocean engineer Tom Wilson, who provides the technical support needed for the project, Peters is readying to embark on a number of cruises. Though he does have spare parts, Peters holds his breath with each deployment, thinking about the $1,200 to $1,500 replacement costs. He'll be holding his breath again soon when he undertakes a comprehensive experiment using SWAMP from August through October, with a variety of equipment and collaborators from Woods Hole Oceanographic Institution.

New Faces/New Director

Andrei Chistoserdov joined the MSRC faculty after a Senior Research Fellowship at the California Institute of Technology, where his microbiological studies included metabolism of amines in nature. Considerable amounts of carbon and nitrogen in the marine environment are sequestered in the form of amines, released by organisms, and Chistoserdov is particularly interested in understanding the role in the marine environment of a group of bacteria that participates in metabolism of methylated amines - the methylotrophic bacteria.

John Mak came to the MSRC's Institute for Terrestrial and Planetary Atmospheres after receiving his Ph.D. at the University of California, San Diego, Scripps Institution of Oceanography and a postdoctoral appointment at Lawrence Livermore National Laboratory. While at Lawrence, he worked on various aspects of atmospheric modeling and experimental field work on the production of cosmogenic isotopes. Mak's interests are the study of trace gases in the earth's atmosphere to determine the sources, sinks, and chemistry of important species, such as carbon monoxide, methane, and carbon dioxide.

J. Kirk Cochran was named Acting Dean and Director of MSRC. Prior to assuming his new role in October, Cochran had served as Associate Dean for Research, and still has an active research team investigating deposition of air-borne contaminants in local estuaries. (see Focus on Research for description of his research.)

Faculty and Alumni Notes

Alumnus **Xiao-Hai Yan** (Ph.D. 1989), who is professor of applied ocean science at University of Delaware's Graduate College of Marine Studies, has received the prestigious 1994 Presidential Faculty Fellow (PFF) award. Through these awards, the President of the United States recognizes scholarship and leadership of some of the nation's most outstanding science and engineering faculty in the early stages of their careers.

Yan has made an impressive contribution in his work tracking the tem-perature and dynamics of the western Pacific warm pool, a large body of unusually warm water believed to be the spawning ground of the climate disturbance known as El Niño.

Alumnus **Hans Dam Guerrero** (Ph.D. 1989), now Assistant Professor in the Department of Marine Sciences, University of Connecticut, gave a talk at MSRC in October titled, "Coagulation and Bloom Dynamics of Phytoplankton."

Presentations given by marine geologist **Henry Bokuniewicz**, physical oceanographers **Malcolm Bowman** and **R. Lawrence Swanson**, and marine biologist **Peter Woodhead** are included in the published proceedings of "The East River Tidal Barrage," a symposium held at Columbia University in 1993 to explore a novel way to solve hypoxia in western Long Island Sound. The volume (742) was published in December 1994 by The New York Academy of Sciences.

Marine ecologist **Alessandra Conversi** was elected reviewer for ICES Journal of Marine Sciences, special issue with the Proceedings of the ICES Zooplankton Symposium. She presented a poster jointly authored with Atmospheric Scientist **Sultan Hameed**, "Interannual Variations of Zooplankton Biomass at Station P: Possible Climatic Modu-lations?" at the ICES Symposium on Zooplankton Production in Plymouth, England in August. In September, she presented a poster jointly authored with **R. L. Swanson** at the Long Island Sound Research Conference at the University at Stony Brook titled, "Comparison of Bottom Dissolved Oxygen

Fluctuation in the New York Bight and in the Western Long Island Sound over the Last Twenty Years."

Atmospheric scientist **Jane Fox** gave an invited talk in a special session, "Comparative Planetary Aeronomy" at the Fall American Geological Union meeting in San Francisco in December. Her talk was titled, "Sources of planetary ionization." She also gave an invited talk at a "Venus II" conference in Tucson in January. The talk titled, "The Venus ionosphere: Solar cycle variations and nightside maintenance mechanisms," will be the basis of a book of the same title to be published by the University of Arizona Press.

Fox has been appointed associate editor of the *Journal of Geophysical Research (Planets)* for a three-year term beginning January 1995. She received a grant from NASA Planetary Atmospheres Research and Analysis Program for "Excited Species in Planetary Atmospheres," in the amount of $243,000 for 1995-1997. Fox also served on a review panel for NASA Space Physics (Thermosphere, Ionosphere, Mesosphere) in November 1994.

Director and Professor of MSRC's Institute for Terrestrial and Planetary Atmospheres, **Marvin Geller**, received the Editor's Award of the Journal of the Atmospheric Sciences for "outstanding leadership in initiating, executing, and implementing the JAS Special Issue on results from the Upper Atmosphere Research Satellite (UARS)..."

Chemical oceanographer **Cindy Lee** was elected to serve as the first DIALOG (Dissertations Initiative for the Advancement of Limnology and Oceanography) mentor in December in Bermuda. DIALOG is an American Society for Limnology and Oceanography-sponsored meeting for recent Ph.D. recipients in biological ocean-ography. Lee discussed careers generally and gave specific advice about future endeavors such as peer-reviewing papers and personal interactions with program managers.

Lee's graduate student **Silvio Pantoja** presented their research results from a spring cruise off the coast of Chile at the Max Planck Institute in Bremen, Germany in September.

Biogeochemist, **Mary Scranton** and geologist **Roger Flood** participated in the third cruise in the Navy research submarine NR-1. They were looking for methane seeps near the Wilmington Canyon and found lots of methane, but no visible seeps.

Scranton and **Anne McElroy**, director of New York Sea Grant and aquatic toxicologist, hosted high school girls in January as part of the GEMS (Girls Exploring Math and Science) program, sponsored by the University at Stony Brook and Eastern Suffolk BOCES.

Marine microbial ecologist **Gordon Taylor** received a grant from the Long Island Lighting Company for "Development of a Natural Marine Product to Mitigate Biofouling in Water Intake Systems and Heat Exchangers." The $150,000 grant is for 1994-1996. Taylor also received a one-year grant from Northeastern Regional Aquatic Center for "Continuing Studies of the Role of Bacteria and Microalgae in Unexplained Juvenile Oyster Mortalities" with MSRC marine biologist **Monica Bricelj** and Susan Ford from Rutgers University. In November **Charles Wurster** attended the Convention on Inter-national Trade and Endangered Species (CITES) in

Ft. Lauderdale. Following the CITES meeting, Wurster attended a Board of Directors meeting of the Defenders of Wildlife in Washington, D.C.

Focus of Research - J. Kirk Cochran

Graduating from Dr. Karl Turekian's "gladiator school of geochemistry" at Yale University taught MSRC oceanographer Kirk Cochran to think rapidly on his feet, to defend his ideas vigorously, and to use radioactive nuclides (radionuclides) as tracers to study oceanic processes. Many radionuclides, such as those formed from the decay of uranium and thorium, are naturally occurring and others have resulted from human activities such as the testing of atomic weapons. Each radionuclide has a known rate of decay, and its chemical characteristics govern how it behaves in the environment. For example, some radionuclides, such as uranium, remain in solution, but others, such as thorium, tend to adhere to particle surfaces. Thus radionuclides can be used as tracers of a variety of earth surface processes. Their property of radioactivity also makes them useful to determine the rates of such processes.

Thorium is particularly useful in studying the fates of particles in the oceans. Particles can be added to the oceans by rivers or the atmosphere or may be produced in situ by biological activity. Thorium has a strong affinity for particle surfaces and can be rapidly scavenged from seawater. The rate of scavenging of thorium atoms, the rate of particle sinking through the water column and the rate of sediment accumulation all can be determined through measurements of the different forms or isotopes of thorium.

Thorium is even helping to determine the flux of particulate organic carbon for Cochran and his research team as part of the National Science Foundation-sponsored Joint Global Ocean Flux Study (JGOFS).

JGOFS has as its general goal an understanding of the processes controlling the flux of carbon and associated biogenic elements in the ocean. Carbon dioxide dissolved in sea water is used by marine plants to make organic matter. When the plants die or are grazed, carbon-rich particles can sink out of the surface ocean to depth. In the open ocean, much of the sinking organic matter decomposes en route to the sea floor, but a small percentage makes it to the bottom. Thorium isotopes produced in sea water from uranium decay can attach to these sinking particles. "We know the rate of production of thorium from uranium decay and we can measure how much thorium decays in solution. The remainder is scavenged and removed on sinking particles," said Cochran. If we measure the organic carbon-to-thorium ratio on those particles, we can estimate the particulate organic carbon flux from the thorium data. This gives us an independent check on other methods of estimating fluxes, such as with sediment traps."

Another of Cochran's research interests is using radionuclides to determine the chronologies of marine deposits. Together with colleagues David Hirschberg and Bruce Brownawell, he has used lead-210 in salt marsh peat cores to determine chronologies of contaminant input from the atmosphere to the coastal ocean. Lead-210, a radioactive form of lead, is produced naturally in the atmosphere from the decay of radon gas. It attaches to aerosol particles and is deposited by

precipitation at the earth's surface. High salt marshes are seldom flooded by the tides and receive lead-210 and contaminants such as heavy metals from the atmosphere. They thus preserve a record of the atmospheric fluxes of contaminants. "Atmospheric transport of contam-inants represents a non-point source input to the coastal ocean," said Cochran, "and it's often difficult to independently estimate the magnitude of this source and to separate it from other non-point source inputs. The salt marsh record offers an opportunity to characterize the atmospheric source." By taking peat cores in marshes from New York City to Long Island's east end, Cochran and his colleagues used lead-210 to date the various layers in each core to determine the chronologies of contaminant inputs. Stable lead concentrations showed a maximum in input in the 1970's, corresponding to the phasing out of leaded gasoline in the U.S.

Cochran and his colleagues compared the lead-210 and contaminants data from the peat cores with similar data from subtidal sediments of Long Island Sound. "The contaminant burdens in sediments of Long Island Sound reflect all the possible sources of contaminants - point and non-point sources" said Cochran. "We can use the salt marsh core data to estimate the fraction of contaminant supplied by the atmosphere." The results show that significant amounts of metals are supplied by the atmosphere to the Sound. For example, about 80% of the input of stable lead to the sediments of Long Island Sound is via the atmosphere. "These results have implications for coastal managers" observed Cochran. "A non-point source such as atmospheric transport requires a regional management plan and must be tackled in a different way from point sources."