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Local Marine Environment Subject of Smithtown Teachers' Workshop

Three days in August for teachers from Smithtown Middle School were fully packed with field trips, discussion sessions, and presentations about the marine environ-ment of Long Island's north shore.

By drawing information from the local environment, the sessions at MSRC were created to help the teachers develop and expand their curriculum not only in sciences, but also the social sciences, English, and other courses. They learned about nutrient input into Long Island Sound and about Long Island's north shore geological history and features and marine life.

They toured Crane Neck beach, Flax Pond marsh and laboratory, and even had a shot at marine environmental curriculum development à la MSRC's interactive decision making computer laboratory.

MSRC faculty, graduate students, and the University at Stony Brook's Center for Excellence and Innovation in Education presented the three-day workshop. Smithtown Middle School's Joanne Pugliani summed up the benefits of such contact with MSRC, citing the experience of field trips to Flax Pond and the Flax Pond Environmental Laboratory for her seventh-grade class: While touring the laboratory, they learned of fisheries biologist David Conover's genetics research on silversides from Nova Scotia to South Carolina. "By the eighth grade," said Pugliani, "I will be teaching these same students genetics, and when I teach them, they'll have something real to relate to."

MSRC Geologist on Two-Month Deep Sea Drilling Expedition

The Amazon Fan is not a Brazilian device to keep cool. It is a natural deep water geological formation that is built of a number of channels and their levees, much like the alluvial fans at the bases of eroding mountains. This submarine fan was formed from sediments deposited by the Amazon River, which during ancient times when sea level was lower, stretched across the continental shelf and emptied at its margin.

The fan radiates 700 km outward to sea in 3,000 meters of water. In April and May this year, this fan was the site of an intensive research program-Leg 155 of the Ocean Drilling Program.

The Ocean Drilling Program, the successor to the earlier *Glomar Challenger* drilling expeditions, provides international scientists with use of the 500-foot ship, *JOIDES* Resolution capable of drilling more than one kilometer beneath the ocean floor. Facilities include onboard equipment and even publishing support services on six legs per year. MSRC geological oceanographer

Roger Flood, who served as co-chief scientist for the international team of 28 scientists aboard Leg 155 was awarded 56 days ship time and facilities. The scientists drilled 34 holes at 17 sites on the Amazon Fan, delivering over 4,000 meters of core samples.

The Amazon Fan was selected for drilling because cores from this region could provide important information on the development of submarine fans, including their potential as petroleum or gas reservoirs, as well as high-resolution records of land climate in the Amazon Basin and circulation in the western Equatorial Atlantic. The western Equatorial Atlantic is also the site of the only major current to cross the equator, the Northeast Brazil Current, and changes in the strength of this current may be important in the Earth's heat budget.

Accumulating sediments preserve records of ancient flora and fauna, reflecting the earth's climate and dynamic geological processes. The cores contain sediment and organic debris, such as plant pollen, from land erosion and debris raining down from the upper ocean, like the tests (shells) of plankton. Even records of changes in the earth's magnetic field are imprinted in the sediments.

Flood's research interest is to learn how the sediment sequences change with sea level change. The cores retrieved during the drilling have given the scientists a chance to examine sediment sequences containing high resolution records of glacial and interglacial periods and changes in sea level over the past 250,000 years. They hope closer examination of the cores will for the first time unfold a history of the climate and vegetation of the Amazon Basin and the surrounding highlands, as well as insights into how a fan sediment deposit is formed. Up to now, long-term, high-resolution climate records have come primarily from ice cores in Greenland, so these fan cores will provide the only such records from an equatorial region.

Sea Grant/MSRC Train Teachers at Summer Institute

Twenty teachers from the eastern U.S. attended an intensive two-week workshop at MSRC to learn about marine sciences. The Summer Institute, a joint effort of New York Sea Grant Institute and MSRC, was one of six regional workshops funded by the National Oceanic and Atmospheric Administration to improve science education, especially in schools with a large minority population.

MSRC faculty and graduate students and Sea Grant specialists covered such topics as marine habitats, chemistry, tides, and currents. The teachers' task was to develop six lesson plans based on the lectures, laboratory sessions, and field trips presented in the workshop. In evaluating the workshop, all of the teachers urged that this newly created Stony Brook School of Continuing Education course, CEY 520, offering three graduate credits, be continued in the future. So plans are underway to offer it again in 1995.

Ward Melville Summer Fellows Study Fish and Phytoplankton

Ward Melville fellowships are awarded each summer to two promising undergraduates. This summer, Bonnie Becker of Harvard University and Jana Davis from Yale were selected, based on their applications, and each awarded $2,000 to carry out a research project. But the selection process is a two-way street-the students read through descriptions of MSRC faculty research to see what projects appeals to them.

Bonnie Becker, who will be a senior majoring in biology at Harvard in the fall, chose to work on phytoplankton with marine biologist Ed Carpenter. She was particularly interested in the project of Carpenter's student Senjie Lin, who has been researching cell cycle proteins. These are the elusive, but specific proteins that trigger the cell to divide and appear only at the "growth" phase in the cell cycle. Identifying these proteins in the algae's cells has been difficult, but important in deter-mining growth rates, which vary with each species of phytoplankton.

Presence of these proteins in the cell indicates that it is about to divide, and the average number of cells in a population that are in this phase can be used to estimate the species' growth rate. The researchers use a technique employing a "labeled" antibody for the cell's division-trigger proteins. Once inside the cell, this antibody with a fluorescent component attaches to the protein, which then appears fluorescent under a special microscope.

While most of Lin's work has been with flagellates, Becker has been concentrating on diatoms. Getting the antibody inside their cells has been difficult, but Becker succeeded. She has gone on to culture four different species, including a flagellate, and will try to measure growth rates comparing the standard counting method to the new technique. Becker, who will continue to work on this problem as part of her senior research project at Harvard, is refining the technique in culture so that it can later be applied in the field.

Jana Davis, who will be a senior at Yale University this fall, has an interest in the physiological ecology of fishes, so she fit in nicely with David Conover's research group. Conover and his student from the University's Ecology and Evolution Department, Jean Morrissey; Research Assistant Professor Eric Schultz; and technician Amir Ehtisham, have been comparing a slow growing population of silversides (Menidia menidia) from South Carolina to a fast growing population from Nova Scotia to test the counter gradient theory.

This theory predicts that at latitudes where the growing season is shorter, fish compensate by growing faster during the growing season. They found in laboratory experiments that their silversides do just that, and that the differences are genetically based.

The southern fish consume less food and utilize their food less efficiently than their northern counterparts, which accounts for their growing slower. Davis' task was to calculate assimilation efficiency, looking at the fraction of energy removed from a given meal. She collected fecal material from the fish, which are maintained on a carefully monitored diet, so she knew the amount of energy consumed. To know how much of the consumed energy was actually used in

metabolism, she measured the percentage of organic matter contained in the fecal material by extraction and combustion techniques.

After leaving Conover's laboratory, Davis began investigating which graduate programs she will apply to. While visiting various universities, she reported to Conover that she met a lot of people who spoke highly of his work on silversides. Undoubtedly, having done research with a well recognized scientist will help her in gaining admission.

"It definitely gives students an advantage in applying to graduate school when they have already done some research," said Conover. As is often the case in the summer fellowship program the benefits seem to be mutual. Conover also spoke highly of Davis. "She did very good work and wrote an exceptional paper on her findings."

Faculty and Alumni Notes

Cynthia Decker (Ph.D. 1992) has finished two years at the Washington D.C. Office of Naval Research, the first year as a New York Sea Grant-sponsored John A. Knauss marine policy fellow. She now serves in NY State Department of Environmental Conservation's Bureau of Marine Habitat Protection as coordinator for the Environmental Protection Agency's Peconic Estuary Program.

Mark Wiggins (M.S. 1986) is this year's Alumni Association Faculty/Staff Award recipient. The award is in recognition of outstanding service to MSRC students. Wiggins has been a Field Specialist at MSRC since 1987, facilitating smooth operations between the scientific party and the bridge crew on the R/V *ONRUST* and aiding students with design and imple-mentation of sampling equipment.

Robert Aller attended the joint Australia-USA-Papua New Guinea-Indonesia Project Tropics Workshop in Honolulu in July. Also in July he attended the lecture series at Kristineberg Marine Research Station, organized by University of Götteburg, Sweden. Aller completed a cruise aboard the R/V *Edwin Link*, using the Johnson Sea Link I submersible to study biogeochemistry and the benthic biology of the Cape Hatteras slope in late August.

Ed Carpenter and graduate student **Senjie Lin** attended the ICES-sponsored workshop on phyto-plankton species-specific growth rates in Aveiro, Portugal June 25 - 29. Carpenter and Lin participated in a research cruise on Spanish and Portuguese ships along with scientists from Norway, Sweden, The Netherlands, Spain, and Portugal to compare techniques. Carpenter was also invited to a workshop in Kristineberg Sweden September 5 - 20, with funding from the government of Sweden to research the biology of dinoflagellates.

Lin and graduate student **Kristen Romans** attended the International Workshop in Molecular Biology Research in Marine Sciences held in Italy August 29 - September 3.

Graduate student **Ajit Subramaniam** was chief scientist on a week-long cruise on the R/V *Cape Henlopen* from Lewes, Delaware, August 29 - September 6, in a study of the biology of the marine cyanobacterium, *Trichodesmium*. Also participating were Carpenter's Research Specialist **Andy Parrella** and students **Ly Williams**, and **Melina Laverty**, among others.

Robert Cess participated in a Department of Energy workshop on cloud shortwave absorption. The September 13 meeting held at MSRC, was organized in response to recent surprising findings by Cess and his former student V. Ramanathan, professor at Scripps Institution of Oceanography, that clouds absorb considerably more radiation than previously thought. Their findings are forcing reconsider-ation of current global warming predictions (see Focus on Research).

Daniel Conley attended the NATO Advanced Science Institute, "Mobile Particulate Systems," in Cargese (Corsica, France) July 4 - 15.

Jane Fox served on the panel on Definition of the NSF Planetary Astronomy Program at the NSF in May. Also in May, she gave a talk at the spring AGU meeting in Baltimore titled, "Anomalous mass-28 ion densities in the Venus nightside ionosphere."

Marvin Geller, was on the panel that published a National Research Council report titled, "Atmospheric Effects of Stratospheric Aircraft, an evaluation of NASA's interim assessment." The panel chairman was called to testify about their findings before the U. S. House of Representatives' Subcommittee on Technology, Environment, and Aviation and the Committee on Science, Space, and Technology. Geller co-chaired the international group that authored the chapter, "Airwave Effects" for the World Meteorological Organization/United Nations Environmental Program publication, Scientific Assessment of Ozone-1994. The document is used by the Montreal Protocol, which attempts to curtail omissions that deplete stratospheric ozone.

Duane Waliser participated in a Summer Institute for the National Oceanic and Atmospheric Association's Postdoctoral Program in Climate and Global Change in Steamboat Springs, Colorado, where he presented "Ocean-Atmosphere Coupling and Surface Temperature Regulation." In August, he presented "Four-Dimensional Ocean and Atmosphere Conditions Associated with Ocean Hot Spots" as an oral paper at the TOGA COARE International Workshop, Toulouse, France in August. At this meeting he also presented "Shortwave Feedbacks and ENSO: Forced Ocean and Coupled Ocean-Atmosphere Modeling Experiments" as a poster.

Dong-Ping Wang was invited by the Chinese government to the International Workshop on Science Frontiers and the Priority Setting of Natural Science Foundation of China, held in Beijing in August. After the workshop, he was invited to the Palace to meet with the President and Party Chairman, Jiang Zemin (photo, L) to discuss the opportunities and problems of basic science research in China.

Focus of Research - Robert Cess

Accounting for Clouds' Contributions to Climate Change

Since 1980, atmospheric scientist Robert Cess has been working on a budget problem with important implications for Earth's climate-the fate, or the pluses and minuses, of solar radiation entering our atmosphere. He has been trying to calculate what fraction of the radiation entering the top of the atmosphere (about 30 km above the Earth) actually strikes the planet's surface and how much is reflected back to space or absorbed by clouds on the way. Now, in an insightful coup, he has produced the best data set ever describing a major puzzle in the radiation budget-how much solar radiation clouds absorb.

"We found that clouds absorb a lot more incoming sunlight-50% more-than the theoretical models indicate," said Cess. "At the moment, we have no idea what the physical mechanism is to account for it."

Atmospheric scientists, like Cess, depend on general circulation models (GCMs), to understand the complex global climate system and to predict how it may change under different conditions. They include in their models what is known about the climate and use their best calculations and assumptions based on the physical laws where real data are lacking. One of the largest uncertainties in the models has been the role of clouds.

As part of his Department of Energy (DOE) project, Cess has been comparing the many existing GCMs, to understand and improve the accounting for clouds. The models are good, bad, or mediocre, depending on how well the calculations and assumptions approximate the real world. "Previously, there has not been good agreement between the GCMs and known measurements, such as the amount of tropical precipitation, the strength of subtropical jets, and the temperature of the middle atmosphere," said Cess.

But when MSRC colleague Minghua Zhang entered Cess's new data set into the computer model used at the National Center for Atmospheric Research, surprisingly, a number of parameters fell into line with real measurements.

The idea that yielded the new data set gradually came to Cess as the result of his involvement with another project, NASA's Earth Radiation Budget Experiment (ERBE). He had accumulated five years of top-of-the-atmosphere satellite data which describe the amount of solar radiation reflected back to space. Previously, the best information for radiation absorption by clouds was obtained by combining data collected by aircraft flying above and below the clouds. But the cost of this method meant limited flight time and limited amounts of data.

By matching the ERBE data with existing surface measurements from a number of weather stations located around the Earth, Cess realized he could pin down real numbers for global solar absorption by clouds. "It was so obvious, but nobody had thought to do it," said Cess. "Lots of people have looked at the satellite data, but that only gives us part of the picture. Not until we put that data together with the surface measure-ments did we have the whole picture of what the clouds absorb."

His data set has improved two other important climate models, at the United Kingdom Meteorological Office and the Canadian Climate Centre. These results have sent the entire community of global climate modelers back to the drawing board. "Everyone is anxious to understand the physical causes for this," said Cess. "They want to know why we were so far off in our original calculations. Right now, we haven't the vaguest idea."

"It has been a very exciting development," said Cess, a fact underscored by the quickly called DOE workshop with an invited list of a dozen of the world's leading atmospheric scientists, held recently at MSRC. The thrust of the meeting was to decide on the next step-what experiments to perform to determine the mechanism of the phenomenon. And that next step, according to Cess, will be to determine over what wavelengths the radiation is being absorbed to learn more about the physical characteristics of this phenomenon. One known in all of the new developments is that Cess will remain at the forefront of this next phase, as well as many more to come.