Marine Sciences Research Center

NEWSLETTER

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Symposium culminates five years of Amazon research

An international symposium held in September in Niteroi, Brazil was the final exchange of the results of four cruises and five years of Amazon continental shelf studies. The project, named AmasSeds (A Multidisciplinary Amazon Shelf SEDiment Study) was carried out by five groups distributed among six Brazilian and eight American institutions and universities. Two of those five teams were based at and administered by the Marine Sciences Research Center—the sedimentology team headed by Charles Nittrouer and the bio-geochemistry team headed by Robert Aller.

The purpose of the study was to learn about the dynamic interactions between the Atlantic Ocean and the Amazon River, one of the world's largest river systems, which discharges over a trillion cubic meters of water, a billion tons of sediment, and nearly a billion tons of dissolved solids annually. Once the discharged nutrients, metals, and other organic and inorganic materials

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Pt. Jeff Ferry crew aids MSRC Long Island Sound "PULSE" study

Initial interpretation of data obtained from this past year's PULSE study of Long Island Sound water and sediments, is telling MSRC's Robert Aller and a team of researchers that something important happens during the annual spring bloom. And almost as interesting as the data, was the means of determining the time of the spring bloom—with the help of crew members aboard the Bridgeport-Port Jefferson ferry.

PULSE is an outgrowth of the now completed five-year U.S. Environmental Protection Agency (EPA) National Estuary Program's Long Island Sound Study, whose goal was to understand the processes of oxygen depletion in both the water column and the sediments in the western Sound. While phytoplankton blooms—bursts of plant growth—are natural events, like the yearly spring bloom in Long Island Sound, the western Sound is stressed with too many nutrients. This can initiate blooms atypical for their massive size and time of appearance.

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Robert Aller and Magali Gerino ▶ taking sediment samples from Long Island Sound for the PULSE study.

Amazon research (continued from page 1)

reach the ocean, they undergo dynamic geological, chemical, physical and biological processes that are found only at the mouths of very large rivers, such as the Amazon and only a handful of other large rivers in the world. The large discharge of sediment particles, for example, greatly influences plant growth and creates fluid muds that dramatically alter sediment transport and its deposition to form the strata of the delta floor.

The shoreline of the Amapa coast north of the Amazon River. Changes in discharge or oceanic processes caused a stage of coastal erosion followed by accretion, as indicated by the modern and ancient shorelines evident in this photograph.

To understand oceanic processes, both ancient and current, the researchers gathered samples of seawater and sediment from several miles out on the continental shelf to the shore and took continuous cores across the continental shelf and inland several miles onto the coastal plain.

This type of grand-scale study could only be achieved through a large, international multidisciplinary project like AmasSeds. Besides all the accumulated knowledge, over its lifetime, the project has produced numbers of masters and Ph.D. theses, published articles, and student exchanges, including several Brazilian students for MSRC.

Josephine Aller was the third faculty member who participated in the project and atten-ded the symposium, and students John Jaeger, Mead Allison, Panas Michalopoulos, and Kristin Chaloupka.■

PULSE (continued from page 1)

Following their explosive growth, the plant cells die and decay, then drift down to the sediments, delivering a large pulse of food for the the small animals and microbes that live there. It is the equivalent of a spring harvest after an impoverished winter. But while providing a bountiful food source for the sediment animals, the large dose of decaying matter is also responsible for depleting oxygen in the sediments. If oxygenated water is not circulated through the affected area, the result can be a large-scale die-off of sedentary animals.

Sampling oxygen in the water column during the EPA study was relatively easy, but the sediments give up their secrets grudgingly. "It is very difficult to measure dynamic chemical processes, such as oxygen distributions, in the sediments," said Robert Aller, who, along with a team of MSRC scientists, was responsible for the sediment studies.

Over the past year, the team has been trying to coordinate sampling the sediments at the time of the annual spring bloom to see how algal decay and decomposition alter the chemistry in the sediments and affect the health and activities of animals living there. They needed to know the exact time of the spring bloom by collecting water samples every few days and counting phytoplankton cells. But taking water samples so frequently in all types of sea conditions would have been impossible to do—until the ferry company's vice president and general manager, Fred Hall, offered to let his chief engineers Chris Hayden, Dave Sweetser, Scott Belfield, and Harold Jacobson, collect samples every few days during ferry crossings for the duration of the study.

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FACULTY AND ALUMNI NOTES

Alumnus **Greg Marshall** is about to embark on a two-month sojourn in the waters of South Africa, working with National Geographic to attach mini-cameras to great white sharks. These small (8.5" long by 4" wide), streamlined video cameras do not interfere with the animals' locomotion, pop off of the animals after a given time, float to the surface, and emit a signal so they can be retrieved. The film gives the scientists a remora's-eye-view from the shark's belly. "We are learning a lot of interesting things about these animals using this monitoring technique," said Marshall. "For example, how they move through the water and how they approach their food."

▲ *Alumnus Greg Marshall fixing mini-camera onto the back of an alligator.*

This past summer, Marshall was featured in a 30-minute National Geographic "Explorer" program entitled, "Crittercam," about the mini-camera he invented and has been perfecting on a number of aquatic, hard-to-track animals. The camera is attached remotely using a dart gun, just like marker tags are attached to fish. For the great white sharks, he will be attaching them either from a submerged cage or boat.

After obtaining his Masters degree from MSRC in 1988, Marshall began attaching cameras to sea turtles and sharks in the waters off Belize in Central America. As other scientists heard of his work, they sought his collaboration in monitoring a variety of animals around the globe, including fur seals and elephant seals for University of California scientists.

Once Marshall attaches his cameras to the white sharks, he plans to stop off in Botswana to attach cameras to crocodiles. Marshall and his collaborators presented papers on these monitoring studies at the Marine Mammals Conference in Galveston in November.

Malcolm Bowman presented an invited paper, "Observations and modeling of mesoscale ocean circulation near small islands," at a UNESCO-sponsored workshop, "Small island oceanography in relation to sustainable economic development and related coastal area management," in Martinique, West Indies in November.

Vincent Breslin and **Frank Roethel** attended the 2nd International Ocean Pollution Symposium at Qinghua University, Beijing, China, in October.

Breslin presented a paper titled, "Deterioration of toxicity of HDPE and CDPE starch-plastic composite films in the marine environment." Breslin also presented a paper "Physical and chemical characterization of MSW composts," at the 4th Annual Composting Council Conference in November in Washington, DC.

Robert Cess was invited lecturer at the Summer Colloquium on Clouds and Climate, National Center for Atmospheric Research in Boulder, Colorado in July. His talk was titled, "Use of satellite observations for GCM validation: cloud feedback".

Cess also gave the following presentations or lectures: "How can UAV measurements benefit both

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Faculty Notes (continued from page 3)

FANGIO and the Single Column Model Group," at the Meeting of the DOE Technical Oversight Group in La Jolla, California in August; "The greenhouse effect and global warming," at the Institute for Study of Planet Earth, at the Unviersity of Arizona in Tucson in October; and a keynote address at the National Science Foundation Workshop on the role of clouds in climate in Reno, Nevada in November.

Cess presented the following invited papers in September and October: "Surface-satellite-model shortwave comparisons," at the DOE ARM/CHAMMP Workshop in Fort Collins, Colorado; "Improving cloud-climate interactions in general circulation models," at the DOE/CAS 6th Science Team Meeting in Beijing, China; and "Cloud-radiative feedback in GCMs," at the International Cloud-Radiation Workshop, International Association of Meterology and Atmospheric Physics in Washington, DC.

David Conover was invited to serve as rapporteur for the 2nd International Flatfish Symposium in Texel, The Netherlands in October. He and students **Jeff Buckel** and **Jed Brown**, presented papers at the annual meeting of the American Society of Icthyologists and Herpetologists, in Austin, Texas in June.

Conover's student **Tom Hurst** was awarded a fellowship beginning in September from the Electric Power Research Institute and the Sport Fishing Institute to study the problem of winter survival in young striped bass in the Hudson River.

J. L. McHugh's paper, "The Magnuson Act and the Mid-Atlantic Fisheries," was published in November in the Underwater Naturalist, Bulletin of the American Littoral Society, Volume 22.

Akira Okubo attended the August Larval Ecology meeting in Port Jefferson, and gave a talk titled, "Hydrodynamics and chemoreception," at the Chemical Ecology Symposium in August.

Mary Scranton attended the August Gordon Conference in Chemical Oceanography and presented a poster titled, "Cycling of acetate and propionate in the water column of a permanently anoxic estuarine basin."

Prasad Varanasi presented the following papers:

"Infrared spectroscopy of high latitude atmospheric layers," at the Symposium on High Latitude Optics in Tromso, Norway in July.

"Intensity and linewidth measurements on atmospheric molecules at low temperatures and high resolution," at the Atmospheric Spectroscopy Applications Colloquium held in Reims, France in September.

"High resolution measurements on selected greenhouse gases at atmospheric conditions using a Fourier Transform Spectrometer," with Z. Li and V. Nemtchinov, at the 4th Workshop on Atmospheric Science from Space using Fourier Transform Spectroscopy, in Paris in September.

"Environmental infrared spectroscopy in the laboratory," at the International Symposium on Optical Sensing for Environmental Monitoring in Atlanta, Georgia in October.

"High-resolution laboratory data on the infrared lines of methane and other hydrocarbons needed in studies of the Jovian atmosphere," at the 25th Annual Meeting of the Division of Planetary Atmospheres of the American Astronomical Society in Boulder, Colorado in October.

Varanasi has also been awarded a Department of Energy, University Research Instrument Program grant for "An experimental facility for obtaining the much needed infrared spectroscopic data in global warming studies," for September 1993 to August 1995.

Charles Wurster attended a White House briefing by U.S. Trade Representative, Mickey Kantor, and Vice President, Albert Gore, on the North Atlantic Free Trade Agreement (NAFTA) in October.

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OPEN HOUSE

MSRC's second annual Open House, held on October 23, offered hands-on events, games, working displays, and demonstrations on marine subjects for the whole family. Next year's Open House will again take place in October.

MSRC's first annual Writer's Festival

Artists, writers, poets and photographers numbering more than 100 came to the Center's first Writer's Festival on October 16. They heard MSRC Director Jerry Schubel, NY Assemblyman Steven Englebright, and Long Island resident authors Dennis Puleston, Peter Matthiessen, and Louis Simpson discuss Long Island's unique natural setting—a source of artistic inspiration worthy of protecting. They attended workshops, on poetry, journalism, photo essay, and science and nature books; and reassembled for a reception to discuss the day's topics, view photo contest entries, and honor the contestants.

The winner of the juried photo contest for best in show and People and the Environment category was Marcia Slatkin for her entry, "Osprey;" and winners of the distinction awards were Tom Randall's "Rangescape" for the Land category and for the Sea, Leslie Adler's "Point Adolphus."

Participants' responses indicated a repeat performance is in order, so look forward to the 2nd Annual Writer's Festival next autumn.■

Participants at the 1st Annual Writer's Festival

PULSE (continued from page 2)

Aller and his team have found that in less than two weeks following the delivery of the bloom's pulse of organic matter, the oxygen penetration into the sediments decreased by about 75%—to about 2 mm deep. This means that any chemical processes in sediment beyond 2 mm that depend on oxygen may slow down or stop. On the other hand, the burrowing, feeding and other "bioturbation" activities of the animals, which rely on the decaying organic matter as a food source, increased following the bloom.

Understanding the disappearance of oxygen from the system and how it affects organisms under natural conditions may help scientists understand what happens when hypoxia from summer blooms is triggered by nutrient enrichment, such as in the western Sound. "While we learned a lot about seasonal changes throughout the Sound during the EPA study, it was clear that we needed to focus more on particularly important periods when nutrients are naturally abundant, like the spring bloom," said Aller. "We are extremely grateful for the efforts of the ferry company to help understand these natural processes."

This study, being conducted by Aller, Cindy Lee, Josephine Aller, Kirk Cochran, Magali Gerino, David Hirschberg, Mark Green, Ian Stupakoff, Kristin Chaloupka, and Hanguo Wu, is a precursor project for a U.S. Department of Energy study of the cycling of organic matter and carbon dioxide on the open continental shelf where blooms occur.■

Nicholas Fisher

Tracing metals in the marine food web

Cadmium, zinc, mercury, tin, lead, and copper are some of the more worrisome metals contaminating some coastal embayments near urban centers. Other metals are important components of radioactive wastes, such as plutonium, strontium, and cesium. They can enter sea water from the atmosphere—a result of accidents, like Chernobyl, and from weapons testing fallout—or are directly introduced by intentional marine disposal of low-level radioactive wastes.

Nick Fisher and his graduate students are interested in metals in the marine environment from the standpoint of how they affect organisms that concentrate them, as well as from the standpoint of how the organisms affect the movement of the metals in the marine environment. Fisher is especially interested in the base of the food web, because phytoplankton can greatly accumulate these metals from the water and can introduce them into marine food webs, they can influence metal transport in the ocean water column, and can themselves be nourished or poisoned by metals.

Fisher's research group is studying the efficiency of metal transfer in marine food chains. Once in sea water, the dissolved metals, which attach readily to particles, adsorb onto particle surfaces, including the cell surfaces of phytoplankton, where they may be transported into the cell. These metals are then transferred to organisms that eat the phytoplankton, and on rare occasions, can reach dangerous concentrations in seafood.

Another reason Fisher is concerned particularly with metals at the base of the food web is that phytoplankton are potentially very sensitive to high levels of metal concentrations, and if such accumulation is destructive to the phytoplankton community, there can be a ripple effect on the entire marine community. "At very high concentrations, metals can kill cells or slow their growth," said Fisher, "but in most waters, even in fairly contaminated waters, it appears that metals are below levels that are toxic to the phytoplankton and animals. The question is which ones behave in which way, and why? We think we are making some progress in answering this question."

Many factors influence the extent of metal toxicity to the phytoplankton. "Of paramount importance is what fraction of the metal is in a form available for uptake by the phytoplankton," said Fisher. Metals can form complexes with other substances that may inhibit uptake by the phytoplankton. "Copper is generally easily complexed by dissolved organic matter in water," said Fisher. "The total dissolved copper concentration in a harbor may be very high, but 99% of it may be complexed by organic matter such that it is not concentrated appreciably in the organism and therefore does not affect it."

Fisher also focuses primarily on the base of the food web because these organisms' sinking debris—the organic remains of dying cells—is the dominant mode by which metals flow from surface waters into deeper waters in the open ocean. "What happens when an organism dies—how does it fall apart? What processes influence its decomposition in the water column? How fast does it decompose? What eventually happens to the elements bound to that particle?" asks Fisher, whose group is actively studying these questions. Once the metals reach the sediments, their high affinity for sediment particles may retard cycling back into the water column, an important factor in determining the fate of some radioactive metals—plutonium, for example—dumped on the seafloor.

Fisher recently received a grant from the Office of Naval Research to look at the behavior of radioactive wastes in the relatively shallow, icy Kara Sea in the Russian Arctic, where the Russians disposed of or lost radioactive materials in cannisters since the 1960s.The U.S. and Norway, as well as other countries, are concerned that this material might leak from containers and possibly enter the food web, including seafood harvested for human consumption.

Fisher expects to find the highest concentration of radioactive contamination in or near the sediments, so his focus will be on the benthic, or sea floor-related, community in these waters. He will primarily look at clams and echinoderms, such as seastars, to determine to what extent they can concentrate radioactive cobalt, cesium, and plutonium, either from their water or their food, and whether they can transfer the contamination from one trophic level to another.

Fisher's team has already completed a great deal of work on the accumulation and retention of metals in crustaceans and molluscs, with the help of his former students John Reinfelder and Byeong-Gweon Lee and current students Randy Young and Wen Xiong Wang—all of whom Fisher credits with contributing much to the current knowledge in these areas.

A long-held interest in international cooperation, which stems from Fisher's earlier work with the United Nations-affiliated International Atomic Energy Agency, has continued with his current spearheading of an international program to look at contamination in the northwest Black Sea. This is believed to be the most severely contaminated body of sea water in the world.

Fisher recently led a MSRC delegation to establish the program, which will include technology transfer, classroom teaching and shipboard and laboratory research, with scientists from Russia, the Ukraine, Hungary, Romania, Bulgaria, and the United Nations .