marine sciences research center
at the State University of New York, Stony Brook

## MSRC Newsletter Vol. 8 No. 1

### Five Year Plan Charts MSRC Course

With a modern research vessel, shore-side facilities and improved educational programs, the Marine Sciences Research Center (MSRC) will consolidate its position as one of the top-ranked oceanography institutions in the nation. These recommendations were made in the Five Year Strategic Plan for the MSRC, released in September.

Ranked **eighth** in the recent National Research Council survey of graduate programs in oceanography, MSRC is also the premier coastal research institution in the country.

The Five Year Strategic Plan recognizes the maturity and breadth achieved over the past 25 years and strongly recommends measures to strengthen the Center's undergraduate programs, provide modern waterfront and research vessel facilities, and reach out to the business, citizen and other academic communities on Long Island.

This is not the first time the MSRC has reviewed its own programs and planned for its future. "Periodically we have done this throughout the history of the MSRC," said Dean and Director Kirk Cochran. "Any organization needs to constantly reassess its mission, its status, and where it wants to be. Even though budgetary uncertainties make planning difficult, it is imperative that goals be defined," Cochran said. He added that despite the university's budget constraints, he hopes the center will receive the support it needs to retain its high ranking.

The plan therefore stresses the need for updated facilities to meet the MSRC's educational, research and outreach needs: "The Center is housed in four buildings and a portion of two others on the south campus but has never had a new building and the equipment that accompanies it. Other MSRC facilities, such as our research vessel, are aging and must be replaced. Our development of additional undergraduate programs that emphasize field courses is limited by lack of teaching laboratories and shore based facilities. [This lack] is also a limitation on increased public outreach."

The strategic plan calls for the development of a "highly visible, shore-side marine science research and education facility that will become the symbol of the University at Stony Brook's commitment to education, research and

service in the public interest for the State of New York and the local community."

In addition the plan urges replacement of the Center's 25-year old research vessel, the R/V ONRUST, with a modern vessel, capable of "extended cruises with large multidisciplinary teams of scientists using a wide variety of computer-linked electronic remote sensing and sample retrieval systems."

Other recommendations include:

- Improving analytical facilities and logistic support for research.
- Improving MSRC's Marine and Atmospheric Science Information Center (MASIC).
- Developing a lecture hall at MSRC.
- Developing additional classroom and teaching laboratories.

In emphasizing the Center's multidisciplinary programs for undergraduates, one of the plan's primary objectives is a major in environmental studies. According to the plan, "this program will teach undergraduates that multiple, often conflicting, perspectives must be brought to bear to solve environmental problems and will give them the necessary background to analyze such problems."

The MSRC foresees an enrollment of some 200 residential students and 100 commuting students in the environmental sciences major. The program is being developed in cooperation with the Environmental Studies/Living Learning Center at Gershwin College along with the Departments of Economics, Political Science, Social Science, Earth and Space Science, Ecology and Evolution, Engineering and Applied Science.

The MSRC will also develop a marine science summer semester offering both field and classroom study by the summer of 1998.

- In other areas of undergraduate study, the center will:
- Create new opportunities for undergraduate research.
- Strengthen and promote the existing Atmosphere and Ocean Sciences major.
- Provide additional resources for general education in environmental issues on campus.
- Expand educational programs within the State University of New York system.

The MSRC faces a wide range of challenges to meet the educational and technological demands of the 21st century. Maintaining its pre-eminence in

coastal research will require a continued commitment to the traditional of excellence established in the Center's first 25 years.

## WRMI Issues Recycling Reports

How much recycling is realistic for Long Island? This question will be answered in a comprehensive, six volume report, "An Assessment of Recycling on Long Island," prepared by the State University at Stony Brook's Waste Reduction and Management Institute (WRMI), a division of the Marine Sciences Research Center (MSRC).

"Recycling has grown tremendously on Long Island over the past decade," said WRMI Director Larry Swanson, "but we have yet to determine the most realistic recycling goals for Long Island." Swanson made his comments as the first two volumes of the report were released. Recycling on Long Island increased from approximately 25,000 tons in 1986 to over 800,000 tons in 1994. New York State has set a goal of 50 per cent waste diversion rate for the entire state by 1997.

| | 1987 | 1994 |
|---|---|---|
| Landfilled | 78% | 2% |
| Incinerated | 6% | 43% |
| Transported | 13% | 19% |
| Diverted | 3% | 36% |

**Statistics based on a waste stream size of 3.32 million tons of MSW in 1987 and 3.5 million tons in 1994. Waste diversion includes recycling and waste reduction, the $0.05 deposit law, and "don't bag it" programs. We have projected 40% diversion in 1997.**

Defining recycling is a thorny task for researchers. "But," said Swanson, "we hope to come up with a more appropriate definition of recycling based on the complexities of the waste stream. "For example," Swanson said, "plastic soda bottles you bring back to the supermarket are not considered recyclable. If you put them in your municipal recycling bin, they are."

The Institute released Volume I and Volume II, Parts A and B, which cover municipal recycling. Future volumes will concern commercial recycling; what the definition of recycling is; how to measure waste diversion if certain

materials - such as yard wastes - are not part of the waste stream; and how much recycling will be cost-effective for Long Island.

Kirk Cochran, MSRC Dean and Director, said, "For the first time, we have a tremendous amount of information about recycling on Long Island that is now collected and discussed as a whole."

The first two volumes of the report found:

- All 15 Nassau and Suffolk municipalities have mandatory source separation programs that target newspaper, glass, metal and plastic containers. All but one of the programs also target corrugated cardboard; and all but one recycle yard wastes.
- In 1994, Long Islanders recycled an average of almost two pounds per person per day.
- Shelter Island had 1994's best recycling rate of 45 per cent of its waste stream. The Town of Hempstead recycled at the greatest per capita rate - 955 pounds per person per year. At 365 pounds per person per year, East Hampton Town had the highest rate of household recyclables - newspapers and other paper, glass, plastic and metal containers collected from homes. Huntington had the best curbside household collection, with 241 pounds per person per year.
- Household wastes totaled less than 30 per cent of all recycling in 1994; yard waste totaled 40 per cent; other materials accounted for another 33 per cent. Of the household recyclables, paper accounted for well over two-thirds of the tonnages, and newspaper alone for more than half of the collected materials.
- For most of Long Island, there was a relationship between household income and the efficiency rates of collection programs.

"An Assessment of Recycling on Long Island" is available from the WRMI, 632-8704, at a cost of $10 per volume.

## Brown Tide: Why Here?

Projects involving Marine Sciences Research Center (MSRC) scientists will receive $539,944 to study what conditions create brown tide blooms. The funding comes out of the Brown Tide Initiative, a three-year, $1.5 million research program, funded by the National Oceanic and Atmospheric Administration's (NOAA) Coastal Ocean Program and administered by Sea Grant. A scientific team from eight different research institutions from Maine to Virginia will work together to uncover why the brown tide keeps happening here.

This money represents a scientific and public effort to end the threat from brown tides. Blooms of these one-celled plants have damaged shellfish and tourist areas along the east coast, from Rhode Island to New Jersey.

A decade ago, brown tides wiped out Suffolk's Peconic Bay scallop fishery. With re-seeding, the fishery came back. Brown tides continued to damage the scallop fishery, and in the summer of 1995, disaster struck again. The one-celled plant known as *Aureococcus anophagefferens* returned to the eastern half of Great South Bay, Moriches Bay, Shinnecock Bay, and throughout the Peconic Bays system with an intensity not seen since the 1980s. Peconic Bay scallop populations plummeted.

Last summer, Long Island was spared another serious outbreak of brown tide, although a brief bloom with cell counts of up to 500,000 cells per milliliter occurred in Moriches and Quantock Bays. Major brown tide blooms contain over two million cells per milliliter.

The brown tides also threatened the east end tourist economy: "There is a major financial impact from the brown tide," said MSRC Associate Director William Wise. "Visitors and boaters stay away when they read in the newspapers that it's like consomme soup out there."

Since the first severe brown tide bloom in 1985, MSRC scientists have found that a combination of drought conditions that increase water salinity and rainstorms that bring iron-rich runoff into the embayments favors this unusual organism.

Furthermore, during the summer of 1992, researchers isolated from the waters of the Peconic and Great South Bay systems viruses that infect the brown tide organism. Laboratory experiments show the virus can infect the algae but high iron levels may delay the viral destruction of brown tide blooms.

Because scallops have a short life span -- 22 to 24 months -- and reproduce only once or twice during that time, they are particularly vulnerable to brown tides. But the algae harm other shellfish as well, including oysters and hard clams. The brown tide blooms block the available light in the water, reducing the extent of the eelgrass beds that are essential habitat for the scallops. Also, substances produced by the algae interfere with shellfish feeding mechanisms, and the shellfish starve.

Researchers will continue to look at the brown tide's place in the food chain to learn both what preys on the brown tide and what nutritents the brown tide needs. Scientists at the MSRC will also study the virus that infects *A.*

*anophagefferens* and will continue researching the environmental conditions that produce brown tide blooms.

### Focus on Research

Sergio Sañudo-Wilhelmy

For Sergio Sañudo-Wilhelmy, metals are the key to answering many environmental questions, ranging from local brown tide issues to global climate change. Thus, when Sañudo-Wilhelmy studies the cycling of metals in coastal waters, he says, "my work is focused on geochemical problems, but part of it focuses on environmental concerns."

Although he began his career in Mexico as a biological oceanographer, Sañudo-Wilhelmy's work now involves the geochemistry of marine contamination. His current projects range from calculating the transport of pollutants between Baja California in Mexico and southern California in the United States to studying global climate change by examining how anoxic conditions are reflected in the marine geologic record.

## $232,000 Grant

Sañudo-Wilhelmy recently received a $232,000 grant from the Brown Tide Initiative, part of the National Oceanographic and Atmospheric Administration's (NOAA) Coastal Oceans Program. Under the grant, he and Ph.D. students Christopher Gobler and Eric Breuer are studying the effect of metals and nutrients on the brown tide blooms. Caused by the one-celled plant *Aureococcus anophagefferens*, brown tide blooms in the eastern half of Great South, Moriches and Shinnecock Bays and throughout the Peconic Bays system have severely damaged Peconic Bay scallop populations and threaten Long Island's east end tourist economy.

"We became interested in the Peconics because we wanted to see how metals behave in a relatively simple system like the Peconic River estuary. We can compare the Hudson River system -- a big, anthropogenically perturbed estuary -- with a small, more pristine, environment like the Peconics."

Sañudo-Wilhelmy and his students are looking at the role of iron and other metals, such as selenium, and organic nutrients, such as dissolved organic carbon (DOC), which may be part of the brown tide's nutrient requirement. The project will also determine the sources of the metals and DOC to see if

they are coming from natural sources or from on-going man-made processes, such as sewage treatment plant discharges.

## Hudson Contamination

Sañudo-Wilhelmy and masters degree student Min Yang are also studying heavy metal contamination in the Hudson River estuary, with surprising results: "We are finding about 80 per cent of metals in what we consider dissolved fraction are actually associated with colloidal particles. Because of their size -- one or two nanometers -- they remain suspended in the water column and can be transported by the currents," Sañudo-Wilhelmy said. "We are finding this true of many toxic metals like mercury and lead."

This finding is important because "the models of metal transport assume all the particles sink, but there is another big fraction that doesn't sink. We do not know what the impact might be on marine wildlife, whether this association with colloidal particles increases or reduces toxicity."

He added, "the last time metals were measured in the Hudson River estuary was in 1970". Referring to news reports that the Hudson River was now cleaned up, Sañudo-Wilhelmy said, "contamination in the Hudson has declined by three or four times since the 1970s, probably because of improvements in sewage treatment. However, levels are still so high, it is still one of the most contaminated estuaries in the U.S. The level of contamination is still twice as high as other urban estuaries, such as San Francisco Bay."

On the other side of the continent, Sañudo-Wilhelmy is studying lead in the waters off southern California and northern Mexico. "Although lead is one of the most toxic elements, we do not know much about the marine cycle of lead. We needed to go to a place where they are still using lead in gasoline -- Mexico, to compare it to an area that uses unleaded gasoline -- California."

His study of sewage treatment plant discharges in the same area will compare the impact of various types of sewage discharges on the marine environment. Sewage effluent in Tijuana, Mexico is discharged close to shore and brought back onto shore by the waves, Sañudo-Wilhelmy said, while San Diego's sewage treatment plant has an ocean outfall that creates more dispersion. "We can see the San Diego plume over a wider area, and we are comparing the impact on metal transport."

## Heavy Metals

His research on sewage treatment plant discharges has raised questions about the ultimate fate of heavy metals in the marine environment. The metals in untreated sewage, he said, are largely in a non-toxic form. Although

advanced treatment reduces the total amount of heavy metals discharged, it also oxidizes them, which makes them toxic. "This is something engineers need to consider: it is not just how much heavy metal is in the effluent but in what form."

Finally, Sañudo-Wilhelmy is studying molybdenum and vanadium sulfide precipitates as indicators of global climate change. Scientists believe, he said, that the world's deep oceans were anoxic during glacial times, because the deep ocean circulation controlled by the push of water in the North Atlantic was reduced.

## Global Warming

"Some scientists believe that with global warming it will rain a lot in the north Atlantic. This would reduce the density of the water in that area and cause the deep water formation to slow down or stop and deprive the deep ocean circulation of the push it requires. Other scientists say that is not true."

Geologists find high concentrations of molybdenum and vanadium in the sediments and believe deposition occurred during anoxic events in the ocean. They therefore use the sediment record as an indicator of global climate change. But Sanudo-Wilhelmy maintains that "even when there was no deposition occurring, the ocean could still have been anoxic because there are other kinds of sulfide species that can keep metals in solution in the water even under anoxic conditions."

Because changes observed in the fossil record occur over thousands of years, Sañudo-Wilhelmy is studying an anoxic-oxic system that has a much shorter cycle -- the Chesapeake Bay. Parts of the Chesapeake Bay are anoxic in the summer and oxic during the rest of the year. "I am trying to determine under what conditions molybdenum and vanadium precipitate so we can correlate this information with the fossil record."

Sañudo-Wilhelmy expects this work will allow a more accurate assessment of ocean anoxia and global climate change.

Why is Sañudo-Wilhelmy's work so diverse? "I don't want to get bored." He added that variety and creativity go hand-in-hand. "Most of the work done here is on practical problems. We try to solve them but we also need to have something new for the scientific community. I like the interaction with the students -- the students at Stony Brook are quite good. It makes things easier."

## WOMEN'S AQUATIC NETWORK

Wed. May 28,1997

Rm 120 MSRC

Reception 5:30

Program 6:00 pm

The National Estuary Program: New York Perspective

NANCY STEINBERG

Hudson River Foundation-New York/New Jersey Harbor

KIMBERLY ZIMMER

New York Sea Grant-Long Island Sound Study

CYNTHIA DECKER

New York State Department of Environmental Conservation-Peconic Estuary

June

Canoe the Nissequogue

Info: MARCI BORTMAN-632-8704

## Faculty and Alumni Notes

*October 1996 - April 1997*

Robert Cess attended the joint U.S. Department of Energy (DOE) and Chinese Academy of Sciences Climate Change conference in Beijing August 12 to August 14 along with Sultan Hameed. Also, November 19 Cess briefed the DOE environmental sciences division on solar absorption by clouds. November 12 and November 13, Cess attended the annual conference comparing large numerical climate models: Feedback Analysis of General Circulation Models and in Observations (FANGIO). The conference, held at

MSRC, included researchers from Russia, France, Germany, Canada and the United States.

Henry Bokuniewicz attended the Estuarine Research Foundation meeting from September 16 to September 19 and presented "Risky Business: Managing Contaminated Sediments."

Kamazima Lwiza attended the American Geophysical Ocean Sciences meeting in San Diego, February 67. He also attended the Mid-Atlantic Physical Oceanography and Meteorology meeting in Newark, Delaware, October 17 and October 18.

Josephine Aller published "The Distribution and Seasonal Characteristics of Benthic Communities on the Amazon Shelf as Indicators of Physical Processes" in Continental Shelf Research. She also published "Seasonal and Spatial Patterns of Deeply Buried Calanoid Copepods on the Amazon Shelf: Evidence for Period Erosional/Depositional Cycles" in Estuarine, Coastal and Shelf Science.

Larry Swanson and the Waste Management Research Institute released the first of a series of six reports on waste diversion on Long Island. In August, Swanson was an expert witness during a U.S. Supreme Court trial involving a dispute between New York and New Jersey over ownership of Ellis Island. Swanson testified about the accuracy of determining mean high and mean low water lines using modern technology. He also gave evidence as to the likely accuracy of the determination of those same boundaries 150 years ago.

## Recent Graduates

May 1996

**Melina F. Laverty (M.S.)**

- Advisor: Edward J. Carpenter
- Thesis: The distribution of nitrogenase within *Trichodesmium spp.* and its relationship to colonial and cellular structure

**Carl Jon Paul LoBue (M.S.)**

- Advisor: Steven G. Morgan
- Thesis: The Hudson River estuarine plume front and its implications on larval transport

### Honoratha K. Lwiza (M.S.)

- Advisor: Bruce J. Brownawell
- Thesis: Spatial distribution of PCBs on the surface sediments of Hudson estuary

### Lianchu Zhang (M.S.)

- Advisor: Bruce J. Brownawell
- Thesis: The history of atmospheric inputs of polycyclic aromatic hydrocarbons and chlorinated pesticides to salt marsh peat deposits surrounding western Long Island Sound

## August 1996

### Chin-wen Chang (Ph.D.)

- Advisor: Dong-Ping Wang
- Thesis: Skill assessment of Gulf Stream frontal eddy simulation

### Dongjie Cheng (Ph.D.)

- Advisor: Robert L. deZafra
- Thesis: Analysis of ground-based mm-wave observations of ozone at the South Pole

### Robert Daehyun Cho (M.S.)

- Advisor: Robert K. Cowen
- Thesis: Vertical distribution of ichthyoplankton in the New York Bight

### Carol M. Cleveland (M.S.)

- Advisor: Robert M. Cerrato
- Thesis: Age structure and distribution of the surf clam *Spisula solidissima* population in New York State waters along the south shore of Long Island, New York

### Felix J. Edwards (M.S.)

- Advisor: Robert K. Cowen
- Thesis: Relationships between otolith and larval development in the smallmouth flounder, *Etropus microstomus*

### Mark A. Green (Ph.D.)

- Advisor: Robert C. & Josephine Y. Aller
- Thesis: The biogeochemical mechanisms driving calcite and aragonite saturation states in Long Island Sound sediments: the effects on juvenile bivalves, benthic foraminifera, and carbonate debris preservation

### Daniel E. Lewis (M.S.)

- Advisor: Robert M. Cerrato
- Thesis: The relationship between shell microgrowth patterns and physiological energetics of *Mya arenaria*

### Jerry Chih-Ching Liu (M.S.)

- Advisor: Jeannette Yen
- Thesis: Effects of morphology on the biomechanics of the high speed escape reaction of copepods: developmental and species differences

### Xiaodan Lu (Ph.D.)

- Advisor: Robert D. Cess
- Thesis: Effects of cloud-radiative forcing on atmospheric responses to tropical SST anomaly: observation and simulation

### Mark R. Reiss (M.S.)

- Advisor: Peter Woodhead
- Thesis: Effects of environmental parameters on sex composition of catches of Cape Hake, *Merluccius capensis*, off Namibia

### Jeffrey M. Schell (M.S.)

- Advisor: Steven G. Morgan
- Thesis: Plasticity in the timing of vertical migrations by crab larvae and megalopae in different tidal regimes

### William G. Wallace (Ph.D.)

- Advisor: Glenn R. Lopez
- Thesis: Acclimation and adaptation to pollutants: effects on metal trophic transfer

### Wen-xiong Wang (Ph.D.)

- Advisor: Nicholas S. Fisher
- Thesis: Assimilation and bioaccumulation of trace elements by the mussel *mytilus edulis*

## Wufeng Zhou (M.S.)

- Advisor: Duane E. Waliser
- Thesis: Removing satellite equatorial crossing time biases in OLR and HRC datasets