SUNY RESEARCH 83
SPECIAL SUPPLEMENT
ON ECONOMIC IMPACT

SUNY's Marine Sciences Research Center

by J.R. Schubel

A satellite view of parts of coastal New York, Connecticut and New Jersey reveals the rich diversity of coastal environments on which MSRC focuses.

Draw a circle with a radius of 50 miles around the Empire State Building and you account for more than one in every 10 residents of the United States. Nearly seven million people live on Long Island alone, approximately three million in Nassau and Suffolk Counties. If Long Island were a state, it would be the 10th most populous state in the United States. If it were a nation, it would be more populous than 50 percent of all the nations in the world today.

Not one of these seven million people lives farther than 10 miles from a coastal marine environment. One can not, if one lives on Long Island. Add Manhattan, the Bronx and Staten Island, too, and the population jumps to more than nine million, every one of whom lives within 10 miles of the coast. For each of these people, the Coastal Ocean has a particular significance. New York's Coastal Ocean is a source

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of food, of recreational and of aesthetic enjoyment, a livelihood and a place to dispose of wastes. In each of these categories, New York is a leader. To quickly broaden the picture of the impact we have on the Coastal Ocean, consider these few facts:

Recreation —

Forty to 50 million people visit New York's ocean beaches every year. Gateway National Park received 10.1 million more visitors in 1982 than did Yellowstone and Yosemite National Parks combined. New York's more than three million recreational fisherpersons spend about $250 million every year in pursuit of their avocation. Long Island's recreational industry is valued at more than $2.5 billion a year and most is marine-related.

Livelihood —

New York State has over 13,000 commercial fisherpersons. The aggregate value of the fish at the dock is estimated at more than $45 million a year. Long Island is the birthplace of aquaculture in the U.S. with activities dating back to the early 1800s. Along the south shore at Great South Bay, 50 percent of the Nation's total harvest of hard clams was produced in the 1970s. This industry employs over 6,000 people and has an aggregate value of more than $100 million per year. The Port of New York and New Jersey ranks first in the U.S. in terms of total value of cargo handled. To maintain the Port's channels, some eight to 10 million cubic yards of material must be dredged each year. The only economic source of sand for the New York metropolitan area for fill and construction aggregate is submerged beneath the sea floor of the Lower Bay of New York Harbor. Historically, the Lower Bay of New York Harbor has been the world's largest open-pit mine.

Environmental concerns —

About 10 percent of the total volume of material dredged from the Port channels is "polluted" and fails to pass the criteria for ocean disposal. Ten percent of Long Island's shoreline has been designated by the U.S. Army Corps of Engineers as having "critical erosion problems." Power plants along New York's coastal waters withdraw more than nine million gallons of water per minute, pass them and small organisms they entrain through condensers and return them to the environment at elevated temperatures. Over 70 percent of sewage sludge by the entire United States which is barged to the ocean is dumped in the New York Bight Apex. The New York Bight Apex [1]is the smaller, triangular area within the Bight that extends close to the lower New York harbor.

A list of these concerns could go on and on, but the point is clear. We New Yorkers make extremely varied and intense uses of our coastal marine environments. It also is clear that these multiple uses make conflicting demands on our Coastal Ocean and that those demands cause problems. These problems become opportunities for marine scientists to serve science and society.

MSRC, a SUNY-wide center

It was in response to these problems and opportunities that the Marine Sciences Research Center (MSRC) was created as a SUNY-wide center by a resolution of the SUNY Board of Trustees in 1965. The first appointments to the Center were made in 1968; consequently, this year the MSRC celebrates its 15th birthday. By all accounts, the MSRC is an adolescent; an institution in its formative years. But over that brief span of 15 years, the MSRC has achieved a remarkable degree of distinction among oceanographic institutions. Much of its success is attributable to its special character which has been planned and nurtured carefully to fill a niche of enormous importance to New York and the Nation, and one which takes full advantage of Long Island's special qualities.

MSRC has several components which distinguish it from the Nation's other leading oceanographic institutions. First, MSRC has a clear and persistent focus on the Coastal Ocean — that area which spans from approximately the outer edge of the continental shelf inland to the last traces of sea salt. People have the greatest impact on the Coastal Ocean. The problems are more complex and the solutions less tidy than in the deep sea. A second distinguishing feature is that MSRC is committed to timely technology transfer into forms that can be applied readily by decision-makers to resolve complex environmental problems.

[1] For further information, see "The Ocean Dumping Quandry — Waste Disposal in the New York Bight," by Dr. Donald F. Squires, director of the New York Sea Grant Institute. This nontechnical, indepth examination of the impact of ocean dumping has recently been published by the SUNY Press.

The R/V ONRUST on a SUNY-wide education cruise from Port Jefferson to Albany. The cruise is divided into a series of half-day legs, each dedicated to the special needs and interests of an individual campus.

The MSRC has grown from a small organized research unit into a comprehensive coastal oceanographic research center with a staff of approximately 100 and an annual budget of nearly $4 million. With no educational mandate, the small research unit has expanded into a Center with programs leading to the degrees of Master of Science and Doctor of Philosophy which enroll more than 100 students from around the world. Most of the students work on problems of direct economic importance to New York.

Sponsored research support

Over the past decade, the Center's sponsored research budget has increased by nearly tenfold; from less than $300,000 in 1972 to more than $2.5 million in 1982. The Center has a broad funding base with sponsored research support from international bodies, private foundations, regional institutions, counties and municipalities, states and from every Federal agency that supports research in the marine sciences. The Center's faculty now numbers 23 on State-supported lines and 11 on research supported lines. Compared with the Nation's other leading oceanographic institutions, the MSRC still is relatively small in terms of the size of its staff. Only by concentrating its resources in a single unit — the Marine Sciences Research Center — and by that unit focusing its attention on the Coastal Ocean has SUNY been able to achieve a program of distinction in the marine sciences with a modest investment of resources.

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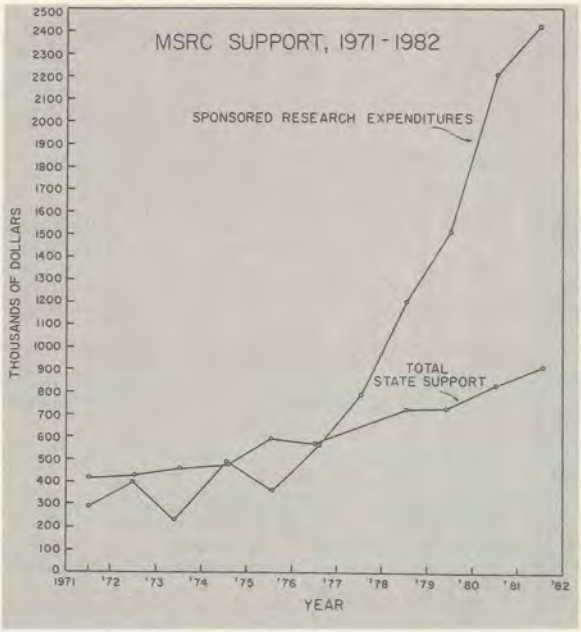

Research programs

The research of the MSRC is of several kinds. Most is of the traditional mode. Individual scientists pursue their own interests by securing support for their research through conventional funding mechanisms. MSRC scientists have been enormously successful and this activity is at the heart of the MSRC's development as a center of excellence in coastal oceanography, but it is not enough. As an organized research unit of a public university — a public service institution — the Center has an obligation to maintain a good match between society's problems — real and perceived — and the research programs it conducts. The Center has developed several mechanisms to ensure maintenance of an appropriate match.

In December 1980, the MSRC signed a Cooperative Agreement with the National Oceanic and Atmospheric Administration. It calls for the MSRC to take a national leadership role in designing and conducting coastal oceanographic research programs, in translating research results into forms readily usable by decision-makers, and in developing strategies to ensure multiple-usage of the Coastal Ocean. The latter take into account the predictable and acceptable impacts on the environment, on living marine resources and on the spectrum of uses society chooses to make of the Coastal Ocean.

The MSRC does not take advocacy positions on environmental questions. It sticks to what it does best — science. But it constantly searches for ways to use science to serve society by improving the effectiveness with which advances in science and technology can be factored into environmental decision-making. Recent examples of MSRC's efforts are described briefly.

Environmental management programs

In 1982, the MSRC initiated with support from the William H. Donner Foundation a new program — the Coastal Ocean Science and Management Alternatives (COSMA) Program — to expand and institutionalize the Center's already extensive activities in using science to assist decision-makers. The program concentrates on developing and evaluating new and more effective tools and techniques for using scientific data and information in environmental management. COSMA also will undertake a series of projects, each an important interdisciplinary problem of at least regional interest. Problems to be investigated through COSMA must be approved by an Advisory Board. Once a problem has been selected, a project director is appointed and a working group selected with representatives from each of the disciplines required for a rigorous, interdisciplinary analysis. Often this will require that COSMA draw upon the full force of the SUNY system — a role appropriate for a SUNY-wide center. The working group is charged with responsibility for identifying the full range of plausible management alternatives and for assessing the public health, environmental, ecological, economic and sociopolitical impacts associated with each alternative. Finally, the results of the analysis are cast in forms that facilitate appropriate comparisons and in terms that are readily usable by decision-makers.

MSRC scientists have nearly completed an assessment of dredging and dredged material disposal alternatives for the Port of New York and New Jersey through COSMA. Other potential COSMA problems now being considered include Long Island's declining hard clam fishery and erosion of Long Island's south shore.

In 1982, the U.S. National Oceanographic Data Center (NODC) designated the MSRC as its coastal oceanographic Data Development Facility and charged it with leadership in developing and testing mechanisms to facilitate the use of oceanographic data and information in environmental decision-making that affect the Coastal Ocean. Initial efforts carried out in collaboration with COSMA have concentrated on exploiting the power, simplicity and availability of the personal computer as a tool to facilitate decision-making. This past year, the

The final phases of MSRC's Coal Waste Artificial Reef Project involved dumping 500 tons of coal waste in the form of blocks from this bottom-dumping barge to form an artificial reef.

MSRC has been developing a computer-assisted data and information system for the Port of New York and New Jersey using the personal computer. Within the past few months, it was asked by the Federal Maritime Administration to develop a similar system for the Port of New Orleans.

Averting problems

One of the more important roles MSRC plays — one which perhaps only universities and a small number of private and national research laboratories can fulfill — is to identify potential problems, long before they become crises, while they are still at a stage that *Herman Melville* would have called "Loomings" — indistinct images on the horizon. And having identified a "Looming," the next steps are to design an appropriate research program, secure the necessary funding, carry out the research and cast the results of that research into forms readily usable by decision-makers to prevent the "Looming" from becoming a crisis. The role is that of a problem averter. It is akin to the practice of environmental preventive medicine, and it is a practice that receives considerable attention within the MSRC.

The last June National Academy of Sciences' report on acid rain, coupled with the likelihood of early and recurrent oil crises, suggest strongly that the Nation's air quality standards and criteria will be made more stringent and that our dependency on coal will increase substantially in the near future. A result will be the production of enormous volumes of coal wastes, fly ash and scrubber wastes, which we will have to dispose of in an environmentally acceptable manner. Because of research started seven years ago by MSRC scientists, a potential waste disposal crisis for Long Island and for many other coastal areas throughout the world can be averted.

Coal waste artificial reef project

In 1976, MSRC scientists anticipated that the Nation would run short of oil in the 1980s, that many oil-fired power plants would convert to coal and that coastal areas could have serious problems disposing of the resulting coal wastes as raw waste products. The Center proposed combining the fly ash (fine-grained powder) and the calcium sulfate scrubber waste (which has the consistency of toothpaste) with additives to produce stabilized blocks and to test their suitability as construction materials for artificial reefs. The first tasks were to determine whether stable blocks could be produced and whether contaminants would be leached from them. Technology was developed to produce stable blocks for a range of waste components and curing conditions. Extensive laboratory tests showed that water forced through the blocks under pressure did not purge contaminants from the blocks. The blocks locked up contaminants far better than expected. The next step was to determine whether organisms

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would settle and grow on and in the blocks in nature and whether these organisms would take up contaminants. In 1977, a small experimental reef of stabilized coal waste blocks was placed in an estuary near the Stony Brook campus. Control reefs made of concrete blocks and natural rocks were constructed nearby. Three years of monitoring demonstrated that the coal waste blocks supported a lush growth of plants and animals, as abundant and diverse as the flora and fauna on the concrete blocks and on the natural rocks; and that these organisms were not enriched in contaminants.

The final test was to demonstrate the feasibility of transferring the block-making technology to the factory floor and then to construct a large reef in the ocean composed of 500 tons of coal waste as 18,000 blocks, each the size of a standard concrete block. The reef was constructed on September 12, 1980, in the Atlantic Ocean in 70 feet of water about four miles southeast of Fire Island Inlet on Long Island's south shore. Former Governor *Hugh L. Carey*, then New York State Energy Research Development Authority Commissioner *James LaRocca* and State University Center at Stony Brook President *John H. Marburger* threw over the first block. An extensive research and monitoring program of this reef has demonstrated that blocks made of stabilized coal wastes not

At left, MSRC staff member checks cultures of seaweed at the Center's Flax Pond Laboratory as part of the Marine Biomass Program. Above, MSRC staff member works with local high school students to make periodic measurements along Long Island's south shore.

only are an environmentally acceptable method for disposal of coal wastes, but can enhance our uses of the environment for recreational fishing. Small experimental reefs have been constructed in Chesapeake Bay and Lake Ontario by MSRC's scientists working in collaboration with local institutions. The waste disposal strategy now has been tested in fresh water, brackish water and full sea water and with support from appropriate State and Federal regulatory agencies and management agencies. A film — "To Build A Reef, the C-WARP Project" — is available that describes the development and findings of the Center's Coal Waste Artificial Reef Project.

Because of the unusual ability of stabilized coal wastes to "lock-up" contaminants, MSRC scientists now are stabilizing sewage sludge and some industrial wastes with coal wastes and conducting extensive tests in the laboratory to determine whether they could be disposed of safely in that form.

Seaweed energy

Through the New York Sea Grant Institute's Marine Biomass Program, MSRC researchers are investigating the feasibility of developing commercial seaweed "energy farms" in the coastal waters of New York. This project is an important part of the over-all plan to reduce dependency on foreign sources for our energy needs. On an energy farm, seaweeds would be cultivated, harvested and then fermented to produce methane, alcohol or natural gas. Growth rates of nine major species of local seaweed were determined in tank cultures at the Flax Pond Laboratory's greenhouse. Based on their seasonal growth patterns, chemical composition and digestibility, three or four species have been selected as the most attracive candidates for biomass farms. The biology of these species are being studied in greater detail and faster growing, hardier strains will be developed. Preliminary work has been conducted with cultivating these seaweeds offshore in small raft-like structures. MSRC biologists are working with Stony Brook engineers on an experimental test farm that will be deployed in Long Island Sound this fall to investigate the economic feasibility of large-scale marine biomass farms.

The MSRC also responds to crises when they occur. In January 1980, the barrier island along Long Island's south shore was breached near Moriches by a winter storm. That day, MSRC received a call for help from Suffolk County Executive *Peter Cohalan*. The following day MSRC scientists began to install instruments in Moriches Bay to assess the effects of the breach on flooding of coastal areas, on salinity levels within Moriches Bay and on how the increases in salinity would affect hard clams and other living marine resources in the back bay area. They also took a longer view of the problem. The 1980 breach at Moriches was not the first time Long Island's barrier island had been breached, and it would not be the last. There was a need for a predictive tool which decision-makers could use to arrive quickly at a decision whether or not to repair a breach. Quick action could save enormous amounts of money. Such a predictive tool has been developed. It is a computer model which simulates the hydraulics of Moriches Bay and Inlet. This model can be used to determine the probable environmental impact of any future breach of the barrier island, not only for Moriches Bay, but also for the other bays along Long Island's south shore.

Dredging management

One of the most crucial problems facing the Nation's ports — large and small — concerns the management of dredging and disposal operations. The persistent shoaling of navigation channels makes dredging imperative in order to maintain navigable waterways for commerce and recreation, but the disposal of dredged sediment can be especially troublesome if the sediments are contaminated.

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Subaqueous burial of dredged sediment beneath the sea floor may be one way to better isolate and contain contaminated sediments as well as to restore the disposal site to its original condition. Such a project has never been done, but MSRC biologists, geochemists and geologists have collaborated to show that the technology is available to construct a deposit of dredged sediment in a pit and to cover the deposit with sand to reclaim the sandy sea floor at the site. They have designed such a research project for New York Harbor. The first stage of the operation has been completed successfully.

New York Sea Grant partnership

MSRC scientists designed at the request of the New York Sea Grant Institute a comprehensive plan for an interdisciplinary study of the Great South Bay. When the study was designed in 1978, the objective was to improve our understanding of the processes that made the Great South Bay the world's most productive hard clam factory and to make that knowledge available to decision-makers in forms appropriate for development of strategies to conserve this important resource and industry. By the time the study had begun, the objective had shifted to acquiring this knowledge to rehabilitate a fishery that was in serious trouble. Over the past five years, more than $800,000 have been provided through the New York Sea Grant Institute, and more than $1 million in all, for this important study. Most of the research has been carried out by scientists at the MSRC.

The MSRC's close and effective partnership with the New York Sea Grant Institute has played a key role in the development of the MSRC as a comprehensive center of excellence in coastal oceanography and, as a result, in its ability to respond effectively to New York's problems and opportunities. It was through Sea Grant's professorship program that the MSRC was able to initiate new programs in shellfish biology and seaweed mariculture. It was through the New York Sea Grant Institute's ability to respond quickly and its willingness to invest in high risk research with potentially high payoff that the MSRC has been able to launch a number of its most important projects; projects which have developed into large, multi-year interdisciplinary studies with substantial support from several agencies.

The MSRC is working with the New York Sea Grant Institute to establish within the Center an aquaculture and fisheries experiment station — the first in the Nation! The station could play enormously important roles in stimulating one

MSRC graduate student Monica Bricelj checks cultures of phytoplankton she uses in her experiments on shellfish feeding behavior.

of New York's most promising high technology, growth industries — aquaculture — and in revitalizing and stabilizing its important fisheries and in developing new fisheries. The experiment station would have programs of research, education and public service and would have a diagnostic facility which would be an activity of the New York State College of Veterinary Medicine at Cornell University.

In its most recent five-year review mandated by the State Education Department, two distinguished reviewers stated:

> "The Marine Sciences Research Center is rapidly acquiring international stature as one of the very best coastal oceanography centers in the world. Its location is excellent. The variety of adjacent coastal domains, proximity to a major urban influence and economic importance of marine resources of the waters in the vicinity of Long Island are uniquely extreme for any comparable stretch of coastline in this country."

While the geographical focus of the Center's research activities is New York's Coastal waters, the MSRC's faculty, students and staff work in coastal environments throughout the world. The MSRC has worked with developing countries to plan for the orderly development and conservation of their important coastal areas in ways that are consistent with their economic priorities. It has worked with developed countries to conserve, and when necessary, to rehabilitate important coastal areas. As a result of its activities here and abroad, the acronym MSRC has come to stand not only for the Marine Sciences Research Center, but also for the center that is Making Scientific Research Count.