COASTLINES

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INSIDE THIS ISSUE...

Correction

The photograph on Page 1 of the last issue (Vol. 22, No. 4) was captioned incorrectly. The fish shown, rainbow smelt (*Osmerus mordax*), is one of the forage fish currently stressed by changing conditions in Lake Ontario.

Gas Transfer in Estuaries: Researchers Learn How It Affects Cycling of Toxics

Using Unique Cornell Facility and Mathematical Modeling in Sea Grant Funded Study

The Tilting Wind-Water Tunnel (TWWT) in the Defrees Hydraulics Laboratory at Cornell University. TWWT is used to simulate wind/water interaction conditions in the natural environment. *Photo courtesy Dr. Chia-Ren Chu.*

By Gerhard H. Jirka and Diana Puglisi

New York's largest estuaries include Long Island Sound and the Hudson River south of Albany. The economic, aesthetic, and environmental value of these diverse and productive biological habitats, along with the overall complexity of the estuarine environment, present many research challenges.

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Toxic Gases in Estuaries

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In a New York Sea Grant funded research project, Dr. Gerhard H. Jirka of the School of Civil and Environmental Engineering at Cornell University has learned that traditional assumptions about physical processes in estuaries—specifically, assumptions about gas transfer—need to be modified. Gas transfer is a natural process that is of particular concern because it can be the primary factor determining the fate and persistence of dissolved gases and volatilizing chemicals in the estuarine environment. The persistence of these chemicals is a concern for several reasons, including the fact that they can accumulate in the aquatic environment, become concentrated in the food chain, and ultimately pose a threat to human health.

Working with Dr. Chia-Ren Chu, who was at that time a Sea Grant Scholar, Jirka used a unique facility at Cornell University's DeFrees Hydraulics Laboratory to develop a mathematical model that will improve future efforts to accurately predict the long-term behavior of dissolved gases in estuarine environments.

Gas Transfer Processes

The boundary between the surface of a waterbody and the air above it is known as the air-water interface. The transfer of gases across this boundary has implications for water quality management.

One-third of the 150 priority pollutants that have been identified by the U.S. Environmental Protection Agency (EPA) are volatilizing compounds. Examples include PCBs (polychlorinated biphenyls) and aromatic hydrocarbons. Transfer to the atmosphere represents a major escape mechanism that controls residual concentrations and long-term effects of volatile chemicals in streams, rivers, lakes, oceans, and estuaries.

Maintaining adequate oxygen transfer can also be a problem. Many polluted aquatic environments contain an overabundance of nutrients, which can support excessive growth of bacteria and microscopic animals. As these organisms grow, their oxygen consumption increases, and as a result, less dissolved oxygen remains available in the water column for larger species, such as fish. Depending on the waterbody, surface gas transfer processes can be critical for replenishing this oxygen depletion.

What's Special About Estuaries?

All kinds of waterbodies are affected by gas transfer processes, and experts have looked at these from a variety of angles. Civil and environmental engineers have focused on reaeration processes (replenishment of oxygen back into the water) in streams and rivers and have attempted to link the oxygen transfer rate to various stream characteristics. Oceanographers and limnologists (scientists who study fresh water), on the other hand, have usually considered wind to be the primary force governing gas transfer in the ocean and in large lakes. Jirka has found that in estuaries and other coastal environments, gas transfer processes are both water-driven and wind-driven, and that the influence of each contributing factor can vary considerably.

The Tilting Wind-Water Tunnel

In their Sea Grant funded study, Jirka and Chu used a new and unusual experimental facility known as the Tilting Wind-Water Tunnel, or TWWT.

Constructed between 1985 and 1989 under National Science Foundation (NSF) funding, the TWWT is a research facility dedicated to the study of gas transfer; density stratified flows simulating conditions in lakes, reservoirs, and oceans; and atmospheric boundary layers. The TWWT can be operated with water flow only, with wind flow only, and with a combination of conditions, and has a number of unique design features and sufficient size to make it ideally suited to a realistic simulation of estuarine gas transfer. The TWWT is about 65 feet long by 3 feet wide, and over 3 feet high in cross section.

The TWWT not only can generate water and air flow rates that provide turbulence conditions that approach those of an actual environment, but also can allow for different water flow conditions due to slope changes (the "tilt") and can reverse the air flow. Because stainless steel and PVC are the only materials used in the return flow area, the entire system is corrosion-free, an important feature for dissolved oxygen tests.

Simulating an Estuarine Environment

In the Sea Grant project, Jirka and Chu ran the TWWT with water flow only, with wind flow only, and with combined wind and water flow. These conditions simulated the range of conditions that can occur in an actual estuary depending on the water velocity in a tidal cycle and on wind strength. The researchers used dissolved oxygen as the tracer gas to avoid the hazards and difficulties of applying toxic gases in the laboratory. Oxygen's behavior is representative of a wide range of gases.

Jirka and Chu measured the mean or average gas transfer rates under the different operating conditions, and also studied many details of fluid dynamics that are known to influence the transfer process. On the basis of their measurements, the researchers propose a new equation that predicts the rate of gas transfer as a function of water flow characteristics such as mean velocity and depth, and wind characteristics, chiefly the mean wind speed. Under certain wind and tidal current conditions, the gas transfer rate can depend more on wind than on water flow. Under other conditions, tidal conditions may exert the primary influence on gas transfer. Also, gas transfer may be highly time-dependent as both tidal flow and wind conditions vary. For instance, as the tidal flow varies in an estuary, gas transfer will be controlled by the tidal stream during flood and ebb events, and by the wind during the slack periods.

Jirka and Chu's model is more complex than the traditional approaches, which treated estuarine gas transfer as a function of wind speed only. The older models can lead to erroneous conclusions about the methods and magnitude of chemical transfer at the water surface in estuaries and coastal regions.

The Potential for Improving Water Quality Management

In the classic Sea Grant mode, this study offers an example of a seemingly basic and abstract research result—a mathematical model—that can actually offer immediate benefits to society. Application of the new predictive equation to typical estuarine or coastal conditions indicates that there are many factors controlling gas transfer in any given situation. The new formulation can be included on detailed transport models for different water quality constituents, as is common in engineering practice, and thus provide guidance for future development. In addition, resource managers will

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Storm Reinforces Need for Coastal Planning Information

A home on the north shore of Long Island before the December storm.

After the December storm. *Photos courtesy Jay Tanski.*

A severe coastal storm during December 10–14, 1992 caused over $200 million in damage, according to state officials, and led the President to declare New York City and Long Island federal disaster areas. On a local level, calls were renewed for coastal monitoring programs that will provide the information necessary for officials to make better decisions regarding erosion control.

The stark images of shoreside homes sliding into the pounding surf arrest the eye and linger in the mind. Yet the devastation wrought by coastal storms extends beyond these immediate impacts. This powerful nor'easter packed 90 mph-plus winds, hurled up near-record tides, breached barrier islands, and flooded extensive portions of the mainland.

"Two new breaches that opened up at Westhampton, on Long Island's south shore, appear to be at least semipermanent," says Jay Tanski, New York Sea Grant's extension specialist in coastal processes. "These breaches have the potential to increase mainland flooding, change the environmental conditions and ecology of the bays, and, possibly, affect the presently stabilized inlet at Moriches. The potential impacts are both environmental and economic."

The storm did more than breach Long Island's south shore barrier beach. According to Tanski, "Long Island's north shore was particularly hard hit, along with western portions of the south shore." As a result of erosion damage, some of the Island's prized park and recreation areas may need to be closed. Damage also occurred in New York City and parts of Westchester and Rockland counties. Portions of New York's neighboring coastal states, New Jersey and Connecticut, were declared federal disaster areas as well.

Tanski has been providing technical assistance to local governments and to public and private coastal property owners concerned about storm erosion, helping them to identify mitigation measures and alleviate their immediate problems. Tanski and Institute Director Anne McElroy have also been actively participating in deliberations of the recently formed Governor's Coastal Erosion Task Force.

This past December's storm was the fourth severe storm in two years. These recurrent events underscore the need for reliable information that can be used by coastal planners. Two reports resulting from Sea Grant initiatives in recent years help address that need (see below for more information).

PUBLICATIONS FOR EROSION-CONTROL PLANNING

Development of a Coastal Erosion Monitoring Program for the South Shore of Long Island, New York. Tanski, J. and Bokuniewicz, H. 1992. New York Sea Grant Special Report No. 106. 60 pp. $2.50. Based on reviews of existing monitoring programs in four states, presents a model erosion program encompassing beach surveys, aerial photographs, historical analysis, wave data, and numerical modeling. Can assist managers in defining and quantifying erosion problems, evaluating effectiveness of adopted and proposed management strategies, and developing a better understanding of the causes and effects of observed shoreline changes.

Westhampton Beach: Options for the Future. Tanski, J. and Bokuniewicz, H. 1988. New York Sea Grant Special Report No. 102. 28 pp. Photocopy $1.00. Proceedings of a workshop in which national experts evaluated feasibility, potential effectiveness, relative costs, and probable impacts of six alternatives, ranging from "doing nothing" to installing breakwaters.

Both publications are available through the New York Sea Grant Communications office at 117 Nassau Hall, SUNY at Stony Brook, Stony Brook NY 11794–5001, telephone (516) 632–9124. Please make checks payable to **New York Sea Grant Institute.**

New Molecules from the Sea May Yield New Medicines — How Do Scientists Find Them?

By Jon Clardy

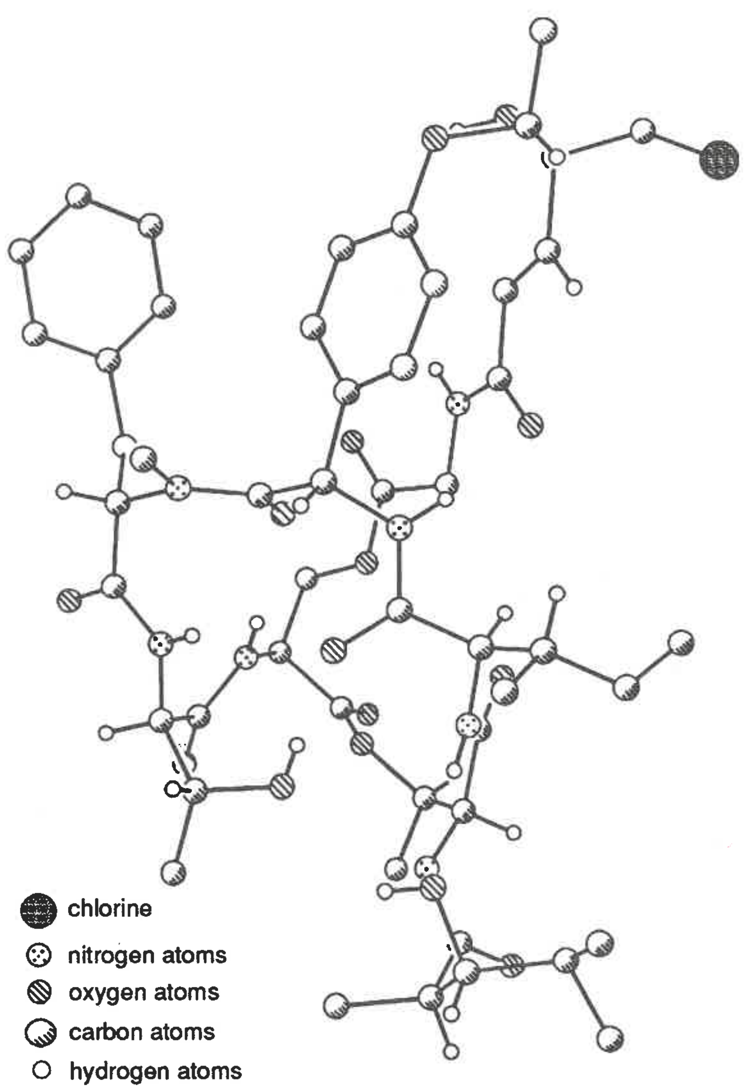
Stories of scientists searching tropical rain forests for new drugs to cure cancer, AIDS, and other diseases are now so well known they even inspire Hollywood films. But did you know that scientists around the world are turning to the oceans — especially tropical oceans — as sources of new drugs? This oceanic search has proven to be more difficult simply because we know less about the ocean and its chemical resources. Only in the last few decades have researchers been able to spend enough time underwater to investigate the oceans' organisms in any detail. Many researchers believe that marine plants and animals will prove to be an even richer source of drugs than terrestrial ones, since the biological diversity of the oceans is greater. Dr. Jon Clardy, the Horace White Professor of Chemistry at Cornell University, leads one of the groups working on marine natural products. He has been investigating pharmaceutical agents from the oceans for almost 20 years — the last 10 or so with support from the New York Sea Grant Institute.

Finding a new drug is a complicated process, and as is common today in science, different groups of researchers specialize in different parts of the process, and collaboration is a key to success. Clardy's group has specialized in determining the precise three-dimensional molecular structure of biologically active compounds. The structure of a molecule is like the blueprint for a house, clarifying what the different parts are, how they're interconnected, and how they're arranged in space. Once you know the structure of a molecule you can begin to understand how it works, plan how to make more, and even envision how to design an improved version. Molecules are much too small to be seen with the naked eye, so their structures have to be deduced from various measurements. One of the most useful measurements, X-ray diffraction, is the technique that Clardy's group uses. The details of the technique are complex, but the concept is simple: to see something as small as a molecule requires using light with very small wavelengths. X-rays are light rays with small wavelengths — small enough so that, with the assistance of computer analyses, scientists can see the atoms that make up a molecule. Two examples will illustrate how the Cornell researchers operate.

Neamphine: Cancer-Fighter from a Sponge

A few years ago, Clardy got a call from his good friend and colleague Dr. Ray Andersen, a marine natural products researcher at the University of British Columbia. Andersen had isolated a very interesting compound from a species of sponge (*Neamphius huxleyi*) that had been collected in Papua New Guinea. The crude extract of the sponge was interesting because it demonstrated extremely high cytotoxic ("cell-killing") activity when tested for compounds that might be useful in the treatment of cancer. Using cytotoxicity as a guide, Andersen's group purified the crude extract to yield a compound that it called neamphine, after the scientific name of the sponge. Unfortunately, the sponge yielded only a small amount of neamphine, and Andersen's group had a limited supply. The cytotoxicity testing had to be abandoned so that the remaining material could be analyzed. Could Clardy's lab use X-ray diffraction to figure out the structure of neamphine, Andersen wanted to know.

The answer was "yes." Ms. Linda Brinen, a Sea Grant Scholar at Cornell, used X-ray diffraction to explore neamphine's complete three-dimensional structure. The chemical formula for neamphine was not known and that fact complicated the analysis. A number of possible formulas and related structures had to be systematically explored until Brinen discovered the right one.



A computer-generated perspective drawing of salinamide.

Unfortunately, to establish whether neamphine would ever be medically useful, the researchers needed additional quantities of material. This is a common problem in marine natural products research — scientists get an interesting lead but lack sufficient material to decide how potentially useful it really is. Even for natural compounds with demonstrated utility, the issue of supply can be vexing, as it has been with taxol, a potent anticancer compound from the Pacific yew. Clardy decided that, tempting as going to Papua New Guinea to collect additional sponges might be, total chemical synthesis would be a more practical way to obtain additional neamphine. Fortunately, Dr. Yael Asscher, a talented organic chemist from Israel, was scheduled to spend a year in Clardy's laboratory, and was delighted to work on the synthesis, or manufacture, of neamphine. Her synthesis, which took considerable experimentation, was completed just a few days before she had to return to her homeland. As a result of her efforts, reasonable quantities of neamphine are now available, and several industries are investigating its potential utility. One of Asscher's synthetic compounds related to neamphine has shown even greater cancer-fighting potential than neamphine itself.

The Salinamide Story

The discovery of penicillin in mold more than 60 years ago set off a rush to find new drugs from soil microbes. The search largely bypassed marine microorganisms, but this omission is rapidly being corrected. The problem of obtaining enough material from marine organisms such as sponges has led a number of researchers to explore marine microbes. Microbes can be grown in the laboratory, a virtue that has made them the organisms of choice for the pharmaceutical industry. One of the most active researchers working with marine microbes is Dr. Bill Fenical at the Scripps Institute of Oceanography. He and one of his students, Ms. Jackie Trischman, found that a microbe isolated from the surface of a jellyfish from the Florida Keys produced a new compound, which they called salinamide.

Salinamide proved to be a potent killer of certain human cancer cells as well as being an extraordinarily active agent against tissue inflammation. But what exactly was salinamide? To answer that question, Dr. Tom Stout, then a graduate student Sea Grant Scholar in Clardy's laboratory, figured out the structure of salinamide using X-ray diffraction. The structure turned out to be too complex for a rapid synthesis, but did suggest ways in which salinamide could act. These ideas are now being tested in several laboratories.

Both neamphine and salinamide demonstrate that marine organisms are terrific "chemists," producing a variety of compounds that could be useful in human medicine. Sea Grant funded research is bringing some of this promise closer to reality.

Fisheries and Environmental Quality Workshops

In the first of two regional conferences cosponsored by New York Sea Grant this fall, nearly 100 participants learned about the relationship between fish abundance and changes in environmental quality attributable to human activities.

Research discussed at the conference, which was held at the Marine Sciences Research Center (MSRC) of the State University of New York (SUNY) at Stony Brook, showed that while marine habitat and water quality degradation may account for population declines in the oyster, Atlantic salmon, sturgeon, bay scallop, and striped bass fisheries in the mid-Atlantic, overfishing is an important factor contributing to the decline of several important marine fish species, including summer and winter flounder, along with striped bass.

Gordon Colvin, director of the Division of Marine Resources, New York State Department of Conservation (DEC), told the conferees, "Debate whether overfishing or habitat degradation deserves primary blame for reduced abundance serves little utility. Both problems need to be addressed simultaneously to safeguard or rebuild these important common property resources."

In fact, those in attendance learned that the high variability of natural mortality (as opposed to fishing mortality) makes the role of water quality and habitat destruction difficult to determine. Greater understanding of natural mortality, along with knowledge of how particular species use different marine and estuarine habitats, will be required if resource managers are to better understand and predict the effects of further coastal development on important coastal fisheries.

Drawing upon recent research findings and expertise to render some "educated guesses" about the impact that habitat changes might have on finfish populations in the coastal waters of New York and New Jersey, the conference identified several problems. These included population shifts away from urban areas, posing new threats to nearshore waters; poor integration between land use planning and marine water quality goals; and lack of coordination between regulatory agencies charged with improving or protecting marine water quality.

The New York conference was sponsored by New York Sea Grant, the Living Marine Resources Institute (LIMRI) of the MSRC, and the New York/New Jersey Harbor Estuary Program (NY/NJ HEP). The second conference was held at Monmouth College, Monmouth, New Jersey. Conference organizers included Dan Grosse, Hudson River Foundation and public participation coordinator for NY/NJ HEP; Mark Malchoff, NY Sea Grant; John Tiedemann, New Jersey Marine Sciences Consortium Sea Grant Program; and Bill Wise of LIMRI-MSRC.

Underwater Archaeology in New York's Great Lakes

By Pat Peterson

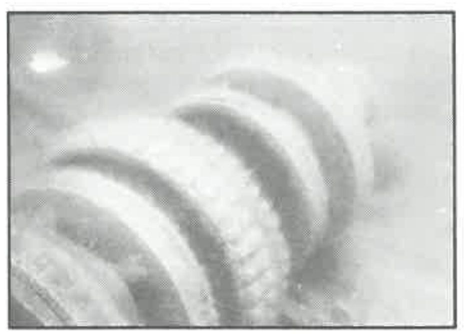
Historical preservation brings to mind beautiful antique buildings, colonial homes, and scenic lighthouses. Preserving these structures intact helps keep a perspective of what it was like to live 100 or 200 years ago. But, our maritime history also includes ships that have sunk during storms or wars. As more and more people are enjoying the sport of scuba diving, there is a need to educate people about protecting and preserving these underwater historical treasures too.

During the spring of '92, 45 underwater diving enthusiasts gathered for a 3-day seminar in Oswego to learn how to inspect, map, and preserve Lake Ontario's shipwrecks. Duncan Mathewson, III, a professional archaeologist from Florida, affiliated with the National Center for Shipwreck Research (NCSR), led the seminar. According to Mathewson, "We want to figure out all the wonderful wrecks . . . not treasure hunt." Mathewson stressed that because there are so few professional underwater archaeologists, they must rely heavily on volunteer divers who begin their training by successfully completing seminars such as the one in Oswego.

Seminar participants were divided into groups to simulate a dive and the record-keeping that goes along with it. Participants found that for each hour spent underwater, 3 to 6 hours are spent mapping, reporting, and evaluating the dive. After the simulation dive, a NCSR exam and evaluation were conducted.

According to Mathewson, a conservative estimate places 100,000 shipwrecks in U.S. waters and he estimated there may be as many as 400 shipwrecks off Fort Ontario, located on the southeastern shore of Lake Ontario in Oswego. Dale Currier, Director of Safety and Research of the Oswego Maritime Foundation, reports that as a result of the spring seminar, divers from the Oswego program began preliminary mapping of a shipwreck 3 miles west of the city and a quarter-mile offshore. According to Currier, the American steamer *David W. Mills* ran aground Monday, August 11, 1919 at 5:30 a.m. on Ford Shoals and eventually sank into a nearby spot in 30 feet of water. This ship, which had a wooden hull, a length of 202 feet, and a capacity of 925 gross tons, was abandoned with engines and boilers left aboard.

Oswego divers have completed a rough site map and video for the *Mills*. In addition, they found a large wooden rudder and an anchor 300 yards north of the ship. Currier attributes the new finds to increased underwater visibility. "We are usually limited to 10 feet visibility in Lake Ontario, but this year we've been able to see more than 50 feet, which is almost unheard of," he says.



An underwater picture of the anchor capstan (wench) from the *Mills*. *Photo courtesy Dale Currier.*

The Oswego program was sponsored by New York Sea Grant, the Oswego Maritime Foundation, the Great Lakes Dive Association, the Underwater Archaeological Society, and the National Center for Shipwreck Research.

Because of the success of the Oswego program, an informational meeting was also sponsored by Sea Grant last fall, in western New York. Dale Currier, Frank Dengate of the Niagara Falls Aquarium, and Sea Grant specialists David White and David Greene introduced the concept of underwater archaeology. According to White, "We are really excited that over 120 people turned out for this first step."

As a result of this meeting, divers, educators and two professional archaeologists recently met to discuss the possibility of forming a Niagara frontier underwater preserve association. The purpose of the group would be to educate both the diving and general public of the value of and proper treatment of underwater preserves. Plans include networking with other groups such as town historians and holding a training session like the one held in Oswego.

On an international basis, the "Great Lakes Regional Conference on Underwater Cultural Resources Policy" was held in February at Michigan State University. Over 70 primary stakeholders from the states bordering on the Great Lakes and Ontario, Canada were invited to the 2-day conference. Those who attended were leaders/managers in the following 7 major categories: maritime archaeology, historic preservation, maritime museum services, recreational diving, commercial diving, natural resource management and federal resource management.

David White, along with four other New York representatives, participated in the group decision-making process. According to White, "The objective of this conference was to reach a consensus of responsible behavior for underwater cultural resources, to be used in the development of legislation and policy by Great Lakes governments." Conference proceedings and policy guidelines will be available from Michigan Sea Grant.

In addition to New York and Michigan, many Sea Grant programs are involved in various aspects of underwater archaeology, historic preservation, and resource management. These include, but are not limited to, the Florida Sea Grant College Program, the Illinois/Indiana, Minnesota, and Woods Hole Oceanographic Institution Sea Grant Programs and the Wisconsin Sea Grant Institute.

For more information on Lake Ontario underwater archaeology, contact David White, New York Sea Grant, Swetman Hall, SUNY College at Oswego, Oswego NY 13126–3599, telephone (315) 341–3042. For information on the program in western New York, contact David Greene, New York Sea Grant, Cooperative Extension Center, 21 S. Grove Street, East Aurora NY 14052–2398, telephone (716) 652–7874.

Sea Grant Pubs

New Publications from NY Sea Grant

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Or call (516) 632–9124 for further information.

Journal Reprints

Applications of boundary integral equation methods for two-dimensional non-linear water wave problems. P. Liu., H.-W. Hsu, and M. H. Lean. 1992. *International Journal for Numerical Methods in Fluids.* 15:1119–1141. Free.

DNA fingerprints of a gorgonian coral: A method for detecting clonal structure in a vegetative species. M. A. Coffroth, H. R. Lasker, M. E. Diamond, J. A. Bruenn, and E. Bermingham. 1992. *Marine Biology.* 114:317–325. Free.

Food of the alewife (*Alosa pseudoharengus*) in Lake Ontario before and after the establishment of *Bythotrephes cederstroemi.* E. L. Mills, R. O'Gorman, J. DeGisi, R. F. Heberger, and R. A. House. 1992. *Canadian Journal of Fisheries and Aquatic Sciences.* 49(10):2009–2019. Free.

Seasonality and the scheduling of life history at different latitudes. D. O. Conover. 1992. *Journal of Fish Biology.* 41(B):161–178. Free.

Please send requests for the following publications (including checks **payable to Cornell University,** unless otherwise noted below) to:

New York Sea Grant Communications
Swetman Hall
SUNY College at Oswego
Oswego NY 13126–3599

Or call (315) 341–3042 for more information.

Fact Sheets, Directories, and Guides

Developing Interpretive Signs for Visitors. D. Kuehn. 1993. 16 pp. $1.00.

Family Boating: Preparing for an Emergency. D. Greene. 1993. Four-fold brochure. Free.

1993 Knauss Fellows

By Trent R. Schneider

Two New York Sea Grant Scholars have been awarded Dean John A. Knauss Marine Policy Fellowships for 1993. The Knauss Fellowships provide a unique educational experience for graduate students by supporting a working experience for a year in the executive or legislative branches in Washington, DC. The experience provides practical, hands-on policy-making training on marine and Great Lakes issues, and broadens the students' understanding of how marine issues are addressed and resolved at the federal level.

Jonathan Jed Brown, who recently received a master's in Marine Environmental Sciences from the State University of New York at Stony Brook, will be serving in the office of New Jersey Congressman Frank Pallone, Jr. Brown will be involved in the Merchant Marine and Fisheries Committee matters, reviewing important bills such as the Marine Mammals Protection Act, the Magnuson Act, and the Oil Pollution Act.

Sean Downing, who recently received a

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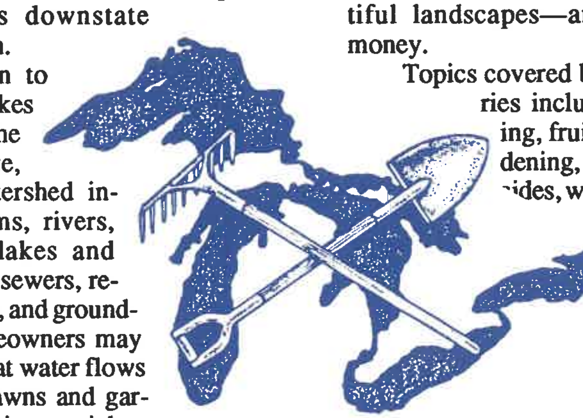
Great Lakes: Great Gardening Packet Available

By Jennifer Pultz

Twelve detailed fact sheets that provide homeowners in the Great Lakes watershed with information on managing yards, gardens, and properties in order to help, and not hurt, local water supplies, are now available from New York Sea Grant. The new packet, *Great Lakes: Great Gardening*, complements the *Sound Gardening* fact sheet series that was developed for New York's downstate coastal region.



In addition to the Great Lakes themselves, the region's large, complex watershed includes streams, rivers, connecting lakes and ponds, storm sewers, recharge basins, and groundwaters. Homeowners may not realize that water flows away from lawns and gardens, and that it may pick up pollutants and carry them to local surface waters or groundwaters. Even small amounts of chemicals, multiplied by thousands of lawns and gardens, can add a significant burden to the environment.

The *Great Lakes Gardening* approach offers specific, easy-to-follow guidelines that will help homeowners make a difference in the quality of Great Lakes water resources. The practices discussed can also contribute to successful gardens and beautiful landscapes—and save time and money.

Topics covered by the fact sheet series include organic gardening, fruit and vegetable gardening, composting, herbicides, watering, soil fertility, pest management, landscaping, and lawn care.

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be able to use such improved models to predict chemical distributions in estuarine regions and to reach better management decisions about water quality and potential remedial measures in the event of accidental chemical spills.

Dr. Gerhard H. Jirka is a professor in the School of Civil and Environmental Engineering at Cornell University. Ms. Diana Puglisi was the assistant communicator at the New York Sea Grant Institute.

Great Lakes: Great Gardening

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Great Lakes: Great Gardening is available for $2.00 per packet. For more information or for copies, please write or call: New York Sea Grant, 21 South Grove Street, East Aurora NY 14052, (716) 652–7874.

Knauss Fellows

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master's in Environmental Engineering from Cornell University, was given an executive branch appointment with the Office of Global Programs, NOAA/US Global Change Program. Downing will be helping to coordinate the efforts of the Integrative Modeling and Prediction Working Group in a major project designed to integrate climate modeling efforts around the country.

The New York Sea Grant Institute regrets to inform *Coastlines* readers that our editors, Avery Klauber and Diana Puglisi, are leaving. Their diligent efforts to provide interesting, accurate, and timely information about Sea Grant activities in New York were appreciated by all, and we hope you join us in wishing them well in their new careers.

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