

# COASTLINES

New York Sea Grant

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## Aquaculture Program Seeks to Preserve Native American Lifestyle



Aquaculturist Michael David grows trout in cages floating in the St. Lawrence River.  
*Photo courtesy Joe Buttner.*

By Joe Buttner and Diana Puglisi

Along the Great Lakes and St. Lawrence River, fishing and eating fish are integral to many cultural and spiritual traditions of the Iroquois people. Today, however, many of these waters and the fish found in them are contaminated with environmental pollutants that make the fish unwise—if not unsafe—to consume. Native Americans face a dilemma: How can they maintain their heritage without risking their health, particularly the health of their children?

The concern is particularly acute at Akwesasne (pronounced “ak-wuh-sas-nee”), a Mohawk community that straddles the St. Lawrence River just east of Massena, NY

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# Aquaculture Program Seeks to Preserve Native American Lifestyle

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and borders a National Priority Listed Superfund site and two State Superfund sites. In fish taken from several locations in the area, concentrations of five contaminants—polychlorinated biphenyls (PCBs), dioxin, DDE, dieldrin, and mercury—have been found to exceed both federal and New York State standards. Nevertheless, at least one prospect is positive.

Sea Grant funded researchers at the State University of New York (SUNY) College at Brockport, working with the New York State Science and Technology Foundation and Rochester Gas and Electric Corporation (RG&E), have demonstrated that aquaculture (fish farming) can be practiced by the Mohawk people at Akwesasne to produce contaminant-free fish—and help preserve the Mohawk cultural heritage.

The dramatic and positive changes that have taken place at Akwesasne began in 1989, when two independent but related events occurred. At that time, Drs. Joe Buttner and Joseph Makarewicz, along with research technician Theodore Lewis, all at the SUNY College at Brockport, began a Sea Grant funded research project investigating the uptake and retention of contaminants by fish grown in waters of the Great Lakes under conditions that simulated a commercial aquaculture operation. Concurrently, the Mohawk community at Akwesasne, the American Indian Program at Cornell University, the New York State

*The data indicate that contaminant-free fish can be grown in waters of Lake Ontario...*

Department of Environmental Conservation (DEC), the American Friends Service Committee (a nonprofit Quaker organization), and the SUNY College at Brockport entered into a cooperative arrangement to explore the potential of aquaculture at Akwesasne.

## Production of Clean Fish in Lake Ontario

In the Sea Grant study, the Brockport researchers developed a multifaceted controlled study to determine whether fish

that meet U.S. Food and Drug Administration (FDA) guidelines could be cultivated in waters of the Great Lakes. Rainbow trout (*Oncorhynchus mykiss*) were provided by DEC and grown in raceways at RG&E's Russell Station Power Generating Facility near Rochester. Black bullhead (*Ameiurus melas*) spawned at SUNY College at Brockport were reared in floating cages and pens in Braddock Bay, a Lake Ontario embayment near Greece, NY. At the end of the culture season, fish were harvested and analyzed for mirex, a persistent and prevalent contaminant in Lake Ontario. In addition, wild bullhead from Braddock Bay, wild bullhead from a nearby inland pond, and rainbow trout from Lake Ontario were collected and examined for mirex.

Bullhead maintained on mirex-laced rations were found to contain elevated levels of the pesticide, as expected. Wild fish from Braddock Bay and Lake Ontario proper also contained mirex at concentrations that approached or exceeded the FDA action level—the level of contaminant concentration at which the fish should not be eaten. Bullhead maintained on natural food in the Braddock Bay pens contained mirex at concentrations somewhat less than those observed in fish that had spent their entire lives in Lake Ontario.

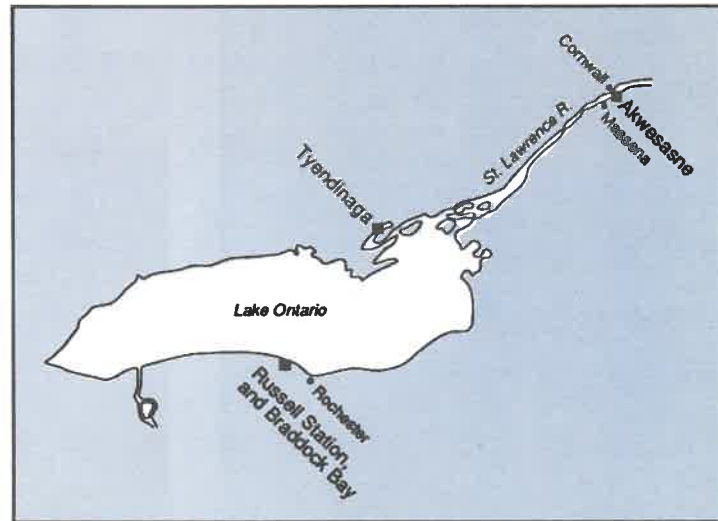
Thirty-six rainbow trout and 20 black bullhead fed contaminant-free rations were examined. Only three fish contained detectable levels of mirex—and these levels were 94 percent below the FDA action level. Clearly, mirex levels in cultured fish fed "clean" rations were most similar to those found in uncontaminated fish from inland ponds.

The data indicate that contaminant-free fish can be grown in waters of Lake Ontario by following standard aquaculture practices: starting with clean fingerlings, using

a clean feed, and growing fish in systems (such as cages and raceways) that partially isolate them from the contaminant-laden food chain and contaminated sediments. Buttner, Makarewicz, and Lewis believe that other contaminants, such as dieldrin and PCBs, may act in a fashion similar to mirex. With continued support from New York Sea Grant, they are currently studying accumulation of these other common organic contaminants in aquacultured fish.

## Aquaculture at Akwesasne

Exploring the potential of aquaculture at Akwesasne involved much more than iden-



Aquaculture sites. Artwork by Department of Design and Production, SUNY College at Brockport.

tifying aquaculture procedures consistent with local climatic conditions and available water resources. These were relatively easy to identify. Incorporating important cultural, economic, spiritual, and social considerations into the overall equation, however, was more challenging. For instance, some prospective aquaculturists desired to produce fish for their own needs, others wanted to produce fish for their extended families and the community, and a few had entrepreneurial intentions and wanted to grow large numbers of fish for retail.

Before the first fish was stocked and before the first prospective culturist was instructed, several informal exchanges occurred. Meeting with community members at Akwesasne, Buttner learned about the

views and perspectives of aspiring aquaculturists and administrative leaders, and assessed available resources. Members of the Mohawk community visited Brockport and toured aquaculture facilities on campus, including experimental ponds, a field laboratory, two wet laboratories, and a water chemistry laboratory.

The formal activities started with a one-week "how-to" course on aquaculture offered at Akwesasne in January 1990. Nearly 20 members of the community learned about aquaculture in general and about water chemistry, fabricated cages, and ultimately coalesced into a team. By June, 10 cages



Akwesasne aquaculture team (left to right): John House, student intern, Cornell University; Wally Ransom; Michael David; Michael Cadillac; Jim Ransom. Photo courtesy Joe Buttner.

were floating in the St. Lawrence and St. Regis rivers. Five cages were stocked with rainbow trout and five with black bullhead. All fish were fed commercially prepared rations. In mid-September one fish was collected from each cage and analyzed by the DEC. None of the fish examined showed detectable levels of any of over 20 priority contaminants of concern identified by the U.S. Environmental Protection Agency (EPA).

By mid-November a few hundred pounds of fish were harvested. Best growth and survival were obtained for rainbow trout reared in the St. Lawrence River. The Mohawk community celebrated its successful experience with a Thanksgiving weekend fish fry; participants truly en-

joyed the "clean" fruits (or fish) of their labor!

The aquaculture experience was repeated and expanded in 1991. A new fish, the yellow perch (*Perca flavescens*), a third river (the Racquette), and several new culturists were added. Results from 1991 confirmed observations made in 1990; rainbow trout cultured in the St. Lawrence River survived and grew the best. Production increased to several hundred pounds in 1991.

As of August 1992, nearly 10,000 rainbow trout were alive and healthy in cages

floating in the St. Lawrence River. Community members with 2 years of experience are currently sharing their insights with new culturists. In 3 years, an aquatic evolution has occurred at Akwesasne. Clean fish are being cultured by increasingly skilled members of the Mohawk community. Not all people that participated in earlier aquaculture efforts remain involved, but a cadre

of a half-dozen individuals, led by Michael ("Junior") David, Jim Ransom, and Wally Ransom, has taken the initiative. These leaders are motivating each other—and others in the community—to become more involved.

Aquaculture has provided the Mohawks at Akwesasne the means to maintain an important part of their culture, albeit in a modified form. Clean fish are now being grown and shared with members of the Mohawk community, as well as being marketed through local restaurants. In 1993, the aquaculture effort will continue to grow, when a large cage, nearly 33 feet in diameter, will be installed and stocked with thousands of fingerling rainbow trout.

## Implications for the Great Lakes

As information has been gathered, new questions have materialized that require

*Aquaculture has provided the Mohawks at Akwesasne the means to maintain an important part of their culture...*

attention. While it has been demonstrated that fish that meet FDA guidelines can be grown in waters of the Great Lakes, it has also been determined that not all sites are equally appropriate. For instance, rainbow trout stocked in cages floating in a heavily contaminated area—known locally as "contaminant cove"—during fall 1990 accumulated detectable levels of PCBs in just 10 days. More study is needed to determine the criteria for site selection, the impacts larger-scale aquaculture would have on the environment, and how these impacts could be mitigated.

What has been accomplished at Akwesasne may also be appropriate elsewhere. Native American communities (and others) throughout the entire Great Lakes basin could benefit from these efforts and experiences. In fact, the Mohawk community at Tyendinaga, Ontario, Canada is exploring the potential of fish culture in the Bay of Quinte. Cages were fabricated, installed, and stocked with sunfish (*Lepomis* sp.) and yellow perch for the first time last spring, and the first harvest is anticipated this fall.

Aquacultural ventures undertaken by Native American communities throughout the region can provide a way to grow clean, healthy fish that can help to maintain cultural traditions. The initiation of such new practices at Tyendinaga is particularly fitting. Tyendinaga has special significance to the Iroquois people as the birthplace of Degannawidah, founder of the Five Nation Iroquois Confederacy.

*Dr. Joseph K. Buttner is a research scientist and outreach specialist in the Center for Applied Aquatic Science and Aquaculture and the Department of Biological Sciences, SUNY College at Brockport.*

## Award Program Started to Promote Personal Environmental Stewardship

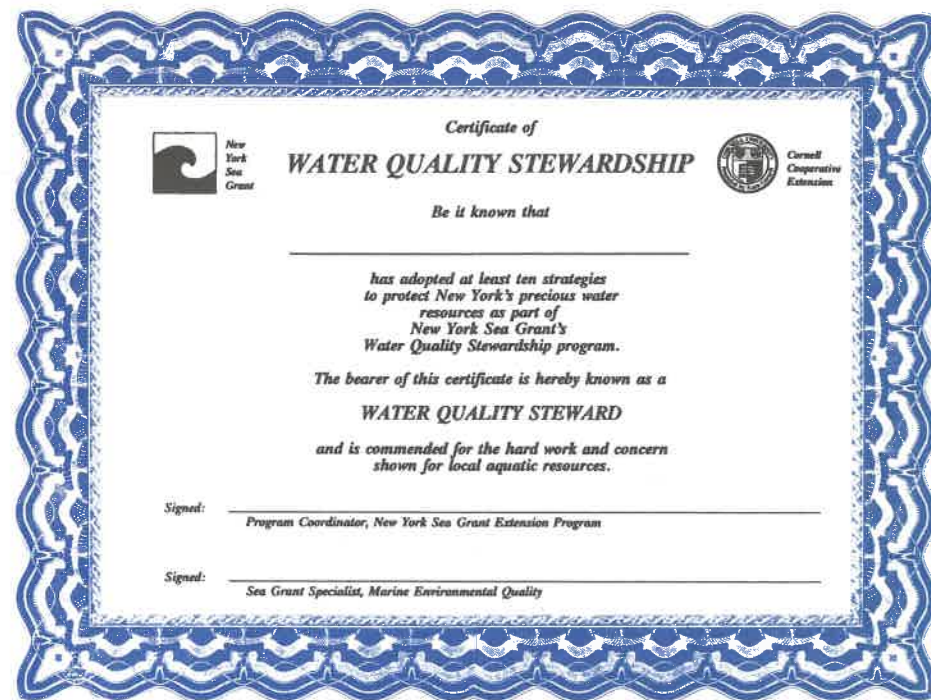
It is not unusual to see pictures of crowded landfills, industrial smokestacks belching soot into the air, and sewage, oil and garbage befouling our shores. But it is harder to picture the cumulative impact that individuals have in contributing to environmental woes. Yet, according to environmental experts, nonpoint source pollution caused each day by millions of individuals can be viewed much like individual drops in the proverbial bucket — and the result is that the bucket can very quickly overflow.

This can happen from the runoff of fertilizers and pesticides that we use on our lawns and gardens, and the chemicals that we use in our homes and cars that get flushed down pipes or thrown on the ground. These substances can leach out of the land, enter the groundwater, and degrade coastal waters, lakes, rivers, and streams.

This fall, a new, imaginative program will be started by Robert Kent, New York Sea Grant Extension's marine district coordinator, along with Melissa Beristain, marine environmental quality specialist, and Jennifer Pultz, Great Lakes environmental quality specialist. *The Water Quality Stewardship Program* seeks the involvement of every concerned individual throughout both the State's marine district and Great Lakes region to change his or her behavior and lifestyle in order to improve our coastal environment.

"We are trying to make people aware of the connections between their daily activities and water quality," explains Kent, who acknowledges that this is an important part of the Sea Grant Extension Program's public education mandate. "People often do not realize that their individual impacts on the environment, when taken together with millions of others', can have major effects. Not just in the rain forest or thousands of miles away, but right within our own communities."

The *Water Quality Stewardship Program* invites people to send for an application form that contains a 5-page check list of items covering eight different categories, including: environmentally sound gardening, water conservation, community stewardship projects, and safe disposal of toxic materials around the home. Under



Individuals who adopt ten environmentally sound practices will earn a water quality stewardship certificate and a decal they can display.

each of these headings are numerous check list items, such as: "began composting"; "left clippings on lawn to recycle nutrients"; "washed only full loads in washing machine and dishwasher"; and "participated in a water quality monitoring program," to highlight just a few.

The program's goal is for participants to be able to check off 10 environmentally sound practices that they have adopted. Every individual who succeeds in reaching this goal will earn a water quality stewardship certificate of achievement and a decal that can be displayed in his or her home, apartment, car, or boat.

"Environmental stewardship is the key," says Kent. "Citizens can't rely entirely on the government to solve all these problems. And it's not just a question of correcting problems with big businesses. All of us must start to be more sensitive to activities that have impacts on the environment. We all need to be a little bit more environmentally responsible. That's what we are trying

to encourage with this kind of program."

Persons who would like to participate in this program and live in or near the Hudson River counties south of Albany, New York City, or Long Island, should contact Robert Kent, New York Sea Grant Extension, 39 Sound Avenue, Riverhead NY 11901-1098, (516) 727-3910. Those in or near the Great Lakes region should contact Jennifer Pultz, New York Sea Grant Extension, 21 South Grove Street, East Aurora NY 14052-2398, (716) 652-5453.

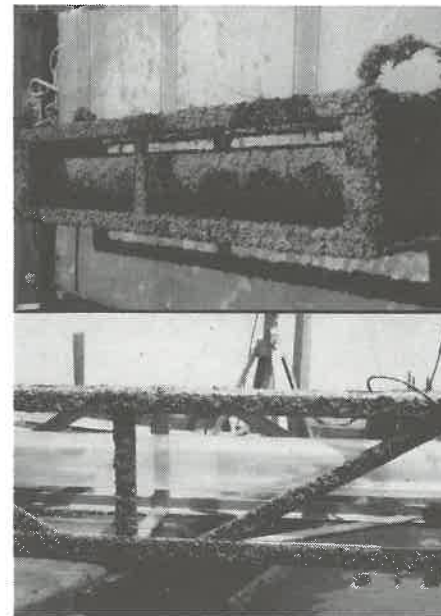
In addition, a workshop for Long Island teachers interested in environmental stewardship of coastal habitats and resources, cosponsored by New York Sea Grant and the Marine Sciences Research Center (MSRC) at the State University of New York at Stony Brook, will be held at the MSRC from 8:30 until 4:30 on Saturday, December 5. Registration is \$12 through November 27. For further information, contact Robert Kent (see above).

## NATIONAL ZEBRA MUSSEL INITIATIVE ALLOWS NEW YORK SEA GRANT TO FUND TWO ADDITIONAL RESEARCH PROJECTS

As part of a nationwide initiative promoting zebra mussel research, New York Sea Grant will fund two projects totaling nearly \$300,000 in the next two years. One researcher will study a new and potentially promising method of controlling the mollusk, and another will explore questions of how basic zebra mussel biology can affect the availability of nutrients in a freshwater ecosystem.

In *Application of Wide-Range Ultraviolet Radiation for Zebra Mussel Control*, Drs. Linda Chalker-Scott and James D. Scott of the department of biology at the State University of New York (SUNY) College at Buffalo will work jointly with James Titus of General Dynamics Electric Boat Division of Connecticut to explore the use of ultraviolet (UV) irradiation as an environmentally safe method of controlling the settlement of zebra mussels in and on industrial and utility water intake pipes. The technology, with modifications, has the potential to repel or kill other biofouling organisms in a variety of aquatic settings.

In a previous New York Sea Grant funded project, Chalker-Scott showed that relatively low doses of ultraviolet-B (UV-B) radiation will quickly kill off zebra mussel veligers (larvae) that would otherwise infil-



TOP: Biofouling on the "control" test fixture after 3 months of exposure. BOTTOM: "Active" test fixture after 3 months. Photos courtesy General Dynamics Electric Boat Division.

trate industrial and utility plants, eventually clogging internal operating systems. UV-B radiation is the type of solar radiation that actually burns the skin and poses a long-term cancer risk in humans. "Although our current work has shown that acute doses of UV-B have been ineffective for controlling adult zebra mussels, it is likely that chronic doses would eventually kill them," says Chalker-Scott. Because of the adult mussels' opaque shells, they are essentially immune to UV radiation. However, Chalker-Scott notes, "in order to feed, the mussels must open their shells, thus exposing their soft internal tissue to the effects of the UV." She believes that chronic exposure could kill adult zebra mussels, by forcing them either to accumulate lethal doses of UV during feeding, or to starve if they keep their shells shut to avoid the UV. While in open water, the mussels could escape the deadly effects of the UV light, but when lodged in pipes they would have a difficult time trying to do so.

### Zebra Mussel Information Clearinghouse Awarded \$197,000 for 1992-1994


Sea Grant's Zebra Mussel Information Clearinghouse, located at the Brockport extension office, will expand its operations in the next two years, according to Charles O'Neill, project director and Sea Grant extension specialist. O'Neill reports that a federal grant from the National Sea Grant College Program (NSGCP) has been received for \$131,000 and that an additional grant of \$66,000 has been obtained from the Empire State Electric Energy Research Corporation (ESEERCO). As a direct result of these grants, the Clearinghouse will now be able to provide technical information and educational programming beyond the Great Lakes basin. Also, Canadian government and industry have contributed to the Clearinghouse, making it not only national but international in scope.

The grants from NSGCP and ESEERCO will allow the continuation and improvement of the Clearinghouse's library and expansion of the newsletter *Dreissena polymorpha Information Review*. The overall objectives are:

- to provide interested parties in the United States and Canada with a central clearinghouse for information on the biology of the zebra mussel, monitoring, and control techniques;
- to provide a central North American clearinghouse for current research; and
- to provide other zebra mussel information centers throughout North America with access to current research and technologies.

The Clearinghouse was originally established in September 1990 as the New York Zebra Mussel Information Clearinghouse with funds from ESEERCO, the Monroe County (NY) Water Authority, Eastman Kodak, the Electric Power Research Institute (EPRI), the Great Lakes Sea Grant Network, and New York Sea Grant. During its first two years of operation, the Clearinghouse focused on disseminating information in the Great Lakes region. Since then, zebra mussels have spread beyond the Great Lakes basin into the Hudson, Illinois, Ohio, Tennessee, and Mississippi rivers, and have become a national topic of concern in the United States and Canada.

For more information on Clearinghouse resources, contact Charles O'Neill at the Zebra Mussel Information Clearinghouse, 250 Hartwell Hall, SUNY College at Brockport, Brockport NY 14420-2928, (716) 395-2516.



### COASTLINES

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### New York Student Wins Sea Grant Association Award

Graduate student Arnoldo Valle-Levinson has won this year's Sea Grant Association Student Abstract Award in the Ph.D. category in Environmental Studies, for his abstract entitled *Effects of Mixing on Stratification and Exchange in Long Island Sound*. Valle-Levinson, a doctoral student working under the guidance of Dr. Robert Wilson at the Marine Sciences Research Center, SUNY at Stony Brook, was among 86 students from around the United States submitting abstracts. Only 11 winners were chosen out of a possible 15, and Valle-Levinson was the only winner from New York State.

The award categories were: coastal processes and ocean engineering; environmental studies; fisheries and aquaculture; human dimensions; and technology development, biotechnology, and seafood technology. Undergraduate, master's, and doctoral level abstracts were evaluated separately.

Valle-Levinson will be awarded a \$250 check from the Sea Grant Association, and New York Sea Grant will provide travel support for him to attend the American Geophysical Union meeting in San Francisco in December. The Sea Grant Association honors meritorious Great Lakes and marine-related research through its annual national award competition.

### NEW PROJECT ASSISTANT NAMED

Trent R. Schneider has been hired as the New York Sea Grant Institute's new project assistant. For the past 18 months, Schneider worked as a program assistant for New York Sea Grant Extension, serving as liaison between the public and the Long Island Sound Study.

In his new position as part of the Institute's administrative staff, Schneider will be involved with obtaining, summarizing, and analyzing information on completed research projects and scholarships, helping in the effort to make the results of the research projects Sea Grant funds accessible to user groups. Cornelia Schlenk, Sea Grant's assistant director, notes, "While Trent's skills and effectiveness as a member of our Extension staff will be missed, his experience will be utilized in his new role with the Institute, strengthening the tracking of our research activities."

Schneider holds a bachelor's degree in Environmental Studies from Rollins College, Winter Park, FL.



Trent R. Schneider

### WATER QUALITY RADIO ANNOUNCEMENTS HIT THE AIRWAVES

*If you can hear this, you live in what is known as a watershed area. What this means is that your everyday products and practices can contribute to the pollution of those waterways close to your heart and home. To fight water pollution follow this simple tip from Sea Grant: Use salt to scour and disinfect sinks and tubs. Save our waterways by reducing your use of toxic household cleaning solutions. For further information contact the Sea Grant office nearest you. Be part of the solution in stopping water pollution.*

—example of a Sea Grant radio PSA

There's a good chance radio listeners in the New York metropolitan area this summer have been tuned in to Sea Grant's 30-second public service announcements (PSAs) explaining watersheds, activities that may negatively impact water quality,

and personal actions that will help protect water quality. The radio spots were sent to stations from Westchester to Suffolk counties, as well as stations in Connecticut and New Jersey. They will continue to be broadcast through the fall.

In addition, a series of 30-second PSAs explaining to homeowners how they can care for their lawns and gardens naturally, while reducing risk of contaminating local waters with pesticides and chemical fertilizers, has also been distributed for broadcast.

The first series of 30 PSAs was produced by the New York Sea Grant Extension Program in cooperation with the New Jersey and Connecticut Sea Grant Programs. New York and Connecticut also helped produce the second series of 10 PSAs, along with University of Connecticut Cooperative Extension and Cornell

Cooperative Extension of Westchester, Nassau, and Suffolk counties.

Both series were coordinated by Melissa Beristain, New York Sea Grant's marine environmental quality extension specialist. Selected radio stations from the tri-state region were sent prerecorded tapes or written PSAs. According to Beristain, each of the participating stations will air at least one week of PSAs.

These spots were also adapted and distributed by the Washington (state), North Carolina, Virginia, and Rhode Island Sea Grant programs to radio stations in their areas.

The 30-part watershed series was produced by Gayle Marriner, and the 10-part gardening series was produced by June Marclely-Connell. Both are media producers from Long Island who donated much of the time they spent on the project.



### New Publications from NY Sea Grant

Please send requests for the following publications (including checks payable to New York Sea Grant, unless otherwise noted below) to:

Communications  
New York Sea Grant Institute  
115 Nassau Hall  
SUNY at Stony Brook  
Stony Brook NY 11794-5001

Or call (516) 632-6905 for further information.

#### Fact Sheets, Directories, and Guides

**Clean Water Shopping Guide.** New York Sea Grant Extension. Pocket card listing consumer alternatives to commercially produced general cleaning, dishwashing, laundry, drain cleaning, and floor polishing products.

#### Report

**Development of a Coastal Erosion Monitoring Program for the South Shore of Long Island, New York: Proceedings of a Workshop Held November 13-14, 1990.** J. Tanski and H. Bokuniewicz (eds.). 1992. Special Report #106. 60 pp. \$2.50. Checks payable to Cornell University.

#### Video

**Gill Netting.** New York Sea Grant Extension, East Hampton Baymens Association, and Terra TV Productions. 1992. 30 minutes. VHS. Purchase price \$10. Checks payable to Cornell University.

#### Journal Reprints

**Ecology of smallmouth bass (*Micropterus dolomieu*) in the nearshore of Mexico Bay, Lake Ontario.** R. J. Danehy and N. H. Ringler. 1991. *First International Smallmouth Bass Symposium*, pp. 66-72. Not available from New York Sea Grant.

**Evidence for mechanisms of the hypotriglyceridemic effect of n-3 polyunsaturated fatty acids.** M. E. Surette, J. Whelan, K. S. Broughton, and J. E. Kinsella. 1992. *Biochimica et Biophysica Acta*, 1126:199-205. Free.

**Resource allocation and population genetics of the bay scallop, *Argopecten irradians irradians*: effects of age and allozyme heterozygosity on reproductive output.** V. M. Bricelj and M. K. Krause. 1992. *Marine Biology*, 113:253-261. Free.

**Seasonality and abundance of ichthyoplankton in Great South Bay, New York.** D. M. Monteleone. June 1992. *Estuaries*, 15(2):230-238. Free.

**Spawning by hatchery-origin lake trout (*Salvelinus namaycush*) in Lake Ontario: data from egg collections, substrate analysis, and diver observations.** J. E. Marsden and C. C. Krueger. 1991. *Canadian Journal of Fisheries and Aquatic Sciences*, 48(12):2377-2384. Free.

Please send requests for the following publications (including checks payable to Cornell University) to:

New York Sea Grant Communications  
Sweetman Hall  
SUNY College at Oswego  
Oswego NY 13126-3599

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

#### Fact Sheets, Directories, and Guides

**A Great Lakes Sea Grant Resource List on Zebra Mussels and Other Nonindigenous Species.** A Great Lakes Sea Grant Network publication compiled by Ohio Sea Grant Communications. May 1992. 1 p. Free.

### Do You Want to Stay on Our Mailing List?

- If so, we need to hear from you by **December 31**.
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## Zebra Mussel Research

Continued from Page 5

The new project will include expanding the testing of UV parameters to a freshwater field situation, using equipment originally designed to evaluate the effect of chronic UV radiation on marine life.

The effectiveness of the UV device has already been studied by General Dynamics Electric Boat Division, working in collaboration with Worcester Polytechnic Institute, Miami Marine Research and Testing Station, and Duke University. In this work, a prototype containing two xenon arc lamps (150 and 450 watts) was placed into a clear quartz tube allowing the passage of UV waves. The entire apparatus was purged with nitrogen gas to overcome hydrostatic pressure when submerged and to ensure dry operation in case small leaks developed. A virtually identical "control" unit—lacking only the UV source—was also constructed. Both were submerged for several months. The surface continually exposed to UV radiation remained free of all forms of biofouling, while the control unit was heavily encrusted with a variety of organisms.

Similar field testing on zebra mussels during the next 12 months will help establish just how practical this UV control system will be in a real-world application.

**Phosphorus Budget to be Studied.** Phosphorus, a naturally occurring substance that is known to play a major role in the growth of microorganisms in freshwater ecosystems, will be one focus of a New York Sea Grant funded study by Dr. Joseph C. Makarewicz, department of biological sciences at the State University of New York (SUNY) College at Brockport. According to Makarewicz, changes in phosphorus availability to microorganisms such as phytoplankton will ripple up the aquatic food web. In his New York Sea Grant funded research project, *Phosphorus Budget of a Zebra Mussel Population*, Makarewicz will determine how much phosphorus accumulates in zebra mussel shells and tissues, as well as the rate at which phosphorus flows through a population of zebra mussels located in the Erie Canal. He will compare this information to estimates of the phosphorus discharge and concentration (phosphorus load) to a downstream site as a means of determining the importance and impact of the mussels within the Erie Canal.

If zebra mussels excrete phosphorus at rates similar to zooplankton, they may do so at rates that will provide greater phosphorus availability. Another possibility Makarewicz will investigate is whether zebra mussels "lock up" phosphorus in their shells or body tissue, making phosphorus less accessible to the rest of the ecosystem.

In the future, Makarewicz also hopes to

develop a computer model of the phosphorus budget for a zebra mussel population. A conceptual understanding of the fate and transport of phosphorus in the zebra mussel population will be directly applicable to other aquatic ecosystems.

### 3rd Intern't'l Zebra Mussel Conference Set for Toronto

A 4-day conference that will highlight current research into the biology and impact of the zebra mussel, along with the latest control options and systems, is set for February 23 to 26, 1993 at Westin Harbour Castle, Toronto, Canada. According to conference organizers, this will be the only major zebra mussel conference to be held in North America in 1993.

The conference is sponsored by the Great Lakes Sea Grant Network, the Electrical Power Research Institute (EPRI), the American Water Works Association (AWWA) Research Foundation, the Canadian Ministry of Natural Resources, the Canadian Ministry of the Environment, Ontario Hydro, and the Canadian Department of Fisheries and Oceans. It combines conferences previously held separately by the Great Lakes Sea Grant Network, EPRI, and various Canadian agencies.

For further conference information contact one of the program organizers, Chris Brousseau (416) 832-7113 or Renata Claudi (416) 506-6874.



## New York Sea Grant

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