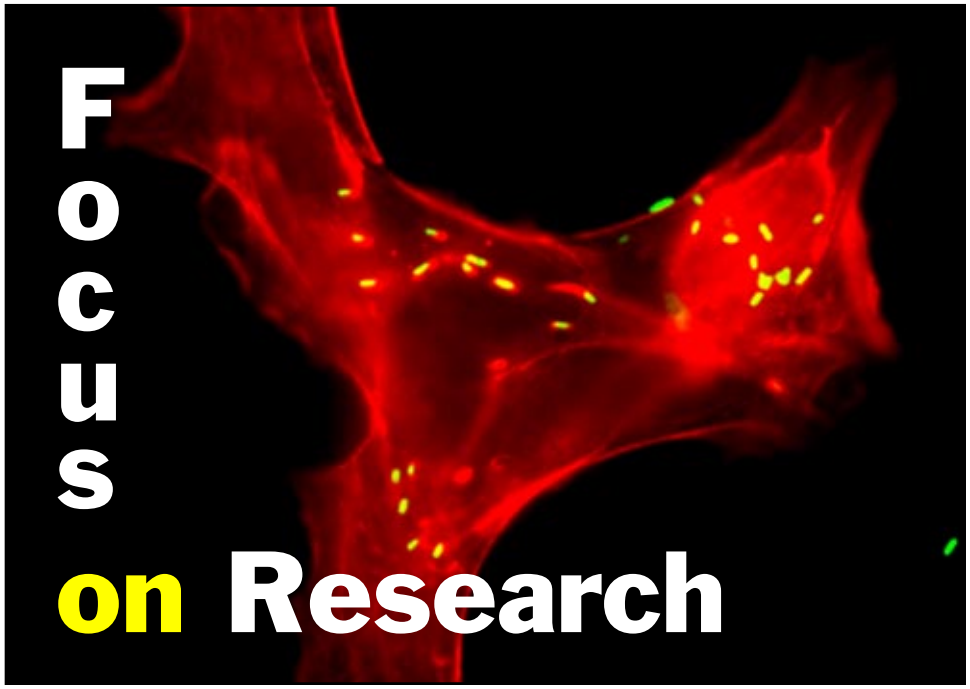
Sea Grant New York

Photomicrograph of *Listeria*, courtesy of Martin Wiedmann



Focus on Research

Sea Grant's university-based research is very special – high quality and chosen to take an unbiased look at priority questions. It has the scientific rigor of work funded by the National Science Foundation with the additional requirement of real-world stakeholder review. New York Sea Grant's research is expected to "make a difference" by providing useful results to the public, businesses, and managers. Given the variety of marine, aquatic, and coastal topics covered by our grants to top-notch physical oceanographers, food scientists, benthic ecologists, aquatic toxicologists, fisheries modelers, geochemists, and others, NYSG serves as an important resource for New Yorkers with many different interests and information needs. NYSG research also sets benchmarks within the scientific community, advancing the state of knowledge in many fields.

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Vol. 31, No. 1, Spring 2002
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Coastlines is a publication of New York Sea Grant, a cooperative program of the State University of New York and Cornell University. Sea Grant is a national network of 30 university-based programs that works with coastal communities. Our research and outreach programs promote better understanding, conservation, and use of America's coastal resources.
 For a free subscription, contact us at (631) 632-9124 or via e-mail at: ***nyseagrant@stonybrook.edu***. This newsletter is also available on NYSG's Website: **www.nyseagrant.org**.

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From the Director

After so many of these columns have praised the importance of program integration to NYSG's success, you may be wondering why this issue focuses primarily on research. Well, be advised, the next issue will emphasize outreach. And the third issue of 2002 will highlight educational activities.

Part of the reason for this acute-angle view is scope. Not everything we do is integrated, so focusing on integrated issues makes it difficult to indicate the full extent of the program or its component parts. Another part of the reason is timing. There is a time lag between initiation of research and extension of results. Thus, NYSG activities aren't always integrated at any one time. Finally, as of February 1, 2002, NYSG initiated activities under a new biennial omnibus program approved by the National Sea Grant Office. We are using this issue to highlight the efforts that will be conducted under the core research program.

We are proud of our core research program. The total number of high quality proposals exceeds the resources that we have. Thus, we are picking the best of the best. I'll let the projects speak for themselves, but I want to discuss some aspects of the competitiveness of our research.

NYSG's core research program is primarily competed among researchers from New York State institutions. This helps justify the state allocation and maintains the federal-state partnership required in the enabling legislation. Sea Grant is unique in requiring a $1 non-federal requirement for every $2 of federal monies awarded to New York Sea Grant. This policy also helps ensure the close working relationships between NYSG and its researchers and stakeholders to target important problems or opportunities with particularly useful products without requiring crippling travel costs.

NYSG also manages work that results from regional or national competitions. In parallel with the other state Sea Grant programs, we help our NYS researchers respond to National Strategic Investments competed nationally by the National Sea Grant Office. NYSG is currently managing nine such research projects. Our program also has received non-Sea Grant monies for research programs on brown tide blooms in eastern Long Island, hard clam productivity in the South Shore Estuary Reserve, and lobster mortality in Long Island Sound. In all of these cases, the specificity and breadth of the topic and the widespread expertise needed to be successful required broader solicitation. Researchers from NY as well as several other states have been funded under these initiatives.

Let me not belabor the point – NYSG's research programs are high quality science that ensure solid solutions to problems of the state, region and nation.

Photo by Ellen George

NYSG's Helen Domske addresses the assembled managers, legislators, and researchers at the Botulism Workshop in Buffalo, February 2002.

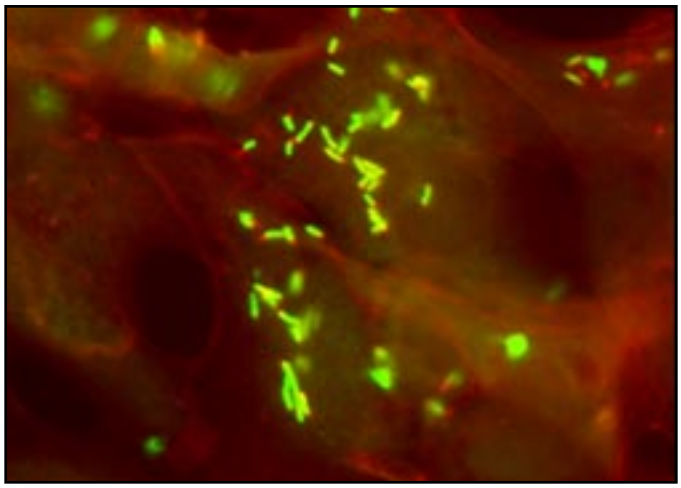
Focus on Research

continued from page 1

Photo courtesy of Martin Wiedmann, Cornell University

Michael Gray, a laboratory technician in Cornell's Food Lab, inspects his tissue culture assay.

With more than $1 million of core funds per year dedicated to it, research is the single largest component of NYSG's state and federal base budget. Competition for grant funds is high, and the selection of projects for NYSG's portfolio is a science in itself. It includes programmatic screening of preproposals submitted in response to a priority-driven *Call for Proposals,* peer review and Technical Review Panel evaluation of full proposals, and input from stakeholders. Final selection depends on technical soundness and anticipated usefulness of the results. Even if a proposal addresses a crucially important topic, if the science or methods are questionable or subpar, New York Sea Grant will not fund it. The rigor of our technical review process is highly praised and provides the foundation for NYSG's scientific credibility.



New York has tremendous research talent in its many universities and research-capable institutions. NYSG's Calls are sent to more than 300 individuals in nearly 100 institutions, usually attracting about four times as many applications as can be funded. New faculty names are continually being added to our mailing list and roster of funded investigators. Occasionally we must look beyond New York's borders to find expertise for certain topics, but funding NY faculty helps to reinforce and build their interests in addressing the state's coastal problems and opportunities.

The cost/benefit ratio and the non-federal match requirement of Sea Grant research makes it a very wise investment. A typical core research project will run about $80K per year for two years and include the hands-on training of at least one graduate student. More than 20 such efforts can be underway at any one time. Counting research funded under other initiatives in addition to NYSG's core program, that number usually climbs close to 50. Research accountability is key, being evaluated regularly via required progress reporting. Presentations at scientific conferences and peer-reviewed publications validate the work's technical quality and academic interest in the results. But, that's just the first step.

Just as important to Sea Grant is *practical* use of the proven, new information. This takes the research a vital step beyond the mandate of other funding organizations. And, that's where the extension program staff comes in. With skills in technology transfer and outreach, extension specialists know who the concerned stakeholders are and can convey the results to them in ways most effective for application — conducting business and making decisions. It is truly a unique, effective, and highly-appreciated model. New York Sea Grant is finely-tuned to develop and deliver the science you and others need to wisely utilize, conserve, develop, and enjoy our coastal resources.

— Cornelia Schlenk
Assistant Director

Photos:
Cover: Photomicrograph of *Listeria*, (yellow and green) inside an animal cell courtesy of Martin Wiedmann, Cornell University.

Above: Higher magnification of photomicrograph of an animal cell infected with *Listeria monocytogenes*, a harmful pathogen occasionally found in ready-to-eat foods such as soft cheeses and smoked fish. In order to assure consumers that such foods are safe, the government has established a "zero tolerance" for this pathogen. While the common bacteria has been known to harm people with compromised immune systems, NYSG-funded researcher Martin Wiedmann from Cornell's Food Science Department believes only a fraction of *Listeria* strains are actually responsible for human disease. In newly-funded NYSG research, Wiedmann's techniques are currently being applied to *Vibrio,* a pathogen often associated with oysters.

New Core Research

Improving the Health and Balance of New York's Waters

In February 2002, New York Sea Grant began conducting the majority of its core research projects funded with $1.15 million in NYSG's federal resources. These projects will prove critical to the health and well-being of the state's fresh and saltwater systems. The articles on pages 4 through 11 describe in some detail many of these innovative projects.

Striking a balance: managing and evaluating vitality of fisheries

Commercial production of flame retardants has increased globally over the past 20 years as has global environmental contamination by the polybrominated diphenyl ethers or PBDEs that compose them. Disposal of flame retardants through incineration and leaching gets PBDEs into soil sediments and waterways. And like PCBs to which PBDEs bear a structural resemblance, PBDEs exhibit a bioaccumulative effect in food chains of many ecosystems. In the Great Lakes, recreational and commercial fisheries could potentially transfer the neuro- and endocrine-toxic effects of PBDEs to humans. However, potential health risk assessment is hindered by limited research data on PBDEs. SUNY College at Buffalo investigators **Harish Sikka** and **Subodh Kumar** will be the first to fill this critical data gap by investigating the absorption, tissue distribution and biotransformation of metabolites in the rainbow trout. This risk assessment of PBDEs to fish will be useful to regulatory agencies in the NYS Department of Environmental Conservation and Department of Health that develop health advisories regarding human consumption of contaminated fish.

Insight into how aquatic organisms are affected by estrogenic compounds that accumulate in urban waterways is critical to managers who plan remediation of such resources. Expanding from previous unique NYSG research that developed ultra-sensitive analytical techniques to directly determine estrogen mimics in sewage effluents, surface waters and sediments, this team led by **Anne McElroy** of MSRC at Stony Brook University and **Martin Schreibman** of CUNY Brooklyn College will take some bold new steps. The team will study the effects of chronic exposure to environmental estrogen mimics using resident bottom-dwelling fish, winter flounder (*Pleuronectes americanus*) of Jamaica Bay as a model species of exposure in the field. In addition to conventional measures of endocrine disruption, this team will break new ground by also examining higher neural and endocrine centers that regulate reproductive system development in indigenous fish and their offspring. McElroy says, "This study will provide information that wastewater treatment and fisheries resources managers can use to better protect ecosystem health."

Salmon sportfishing is of economic importance to communities surrounding Lake Ontario. As native salmonid populations in the lake declined, stocking programs were used to maintain the fishery. Recently, however, there are indications that the wild populations may be showing increased reproduction. A new project led by **Patrick Sullivan** and **Lars Rudstam** of Cornell will examine Chinook salmon returning to the Salmon River to spawn in order to determine the survivorship of hatchery-reared vs. wild salmon. Using otoliths (ear stones) to determine fish age, class, and origin, the team will compare the proportion of returning adults with those migrating out to see if increases in releases from hydropower dams on the river are benefiting the wild Chinook populations. The results of this research will be valuable to fisheries managers, anglers, and ultimately the economies of the Lake Ontario region.

This same team with the addition of **John Horne** of the University of Washington, will conduct a separate project related to hydroacoustics, a tool often used by managers to assess fish populations. The researchers will measure and

analyze different sources of bias such as those associated with acoustics of different fish species, extrapolation to whole lake estimates, and variations in field measurements. The results will place hydroacoustically-based forage fish population estimates into a more accurate context which should help improve fisheries management in Lake Ontario and elsewhere.

Over the last 20 years, Great Lakes ecosystems have experienced improved water quality due primarily to concerted efforts to reduce phosphorus, a nutrient known to promote the growth of nuisance algae. The reduction in algae allowed for increased light penetration and water clarity. Then along came the invasion of the zebra mussel. Filter-feeder activities of the exotic mussel further increased the Lakes' water clarity. Cornell University researcher **Ed Mills** says these factors are acting synergistically to redirect energy production from near the lake surface to the bottom or benthic zone. Mills, along with **Christine Mayer** (Syracuse University) and **Dean Fitzgerald** (Cornell University), is conducting a project to improve understanding of this process of "benthification" by examining the consequences of such changes on benthification on fish communities and populations, the extent of submerged aquatic vegetation, and production dynamics of benthic habitats. The team will develop GIS models to help predict changes in fish communities. "This information will then be available to Great Lakes user groups and managers to support long-term planning for fisheries management," says Mills.

Photo by Barbara A. Branca

Aquatic invaders such as these exotic mussels along Lake Erie's shoreline have played a role in the improved water clarity of the Great Lakes. Cornell University's Ed Mills will now examine the trend toward the benthification of the Great Lakes.

Photo by Susan Hamill

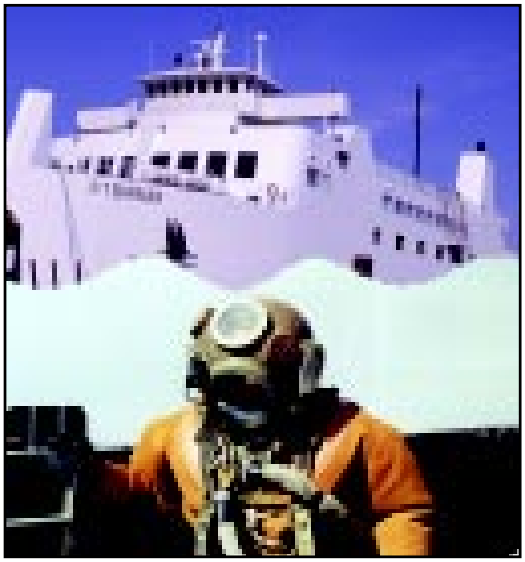
SBU researcher Duane Waliser and Fred Hall, VP and General Manager of the Bridgeport & Port Jefferson Steamboat Company, examine the acoustic doppler current profiler about to be installed beneath the *PT Barnum*.

Underwater exploration: tracking ecosystem health and public safety

With millions of people living in its watershed, economic and recreational activities place many demands on the Long Island Sound ecosystem. One major concern is the condition of low dissolved oxygen or hypoxia that is stressful to a wide range of aquatic organisms. Hypoxia usually occurs when large amounts of decaying organic matter consume dissolved oxygen over the course of the summer. To deal with hypoxia, management plans have focused on reducing nutrient input into the Sound. However, not all hypoxia can be correlated to nutrient loading. Deficiencies exist in understanding the impacts of summertime water stratification and their influence on the Sound's hypoxia. In their current research project, SBU's **Duane Waliser** and **Robert Wilson** are looking to fill in the gaps. By using a specially-equipped commuter ferry in conjunction with a moored data profiler, the team is developing a unique comprehensive real-time observation program to measure environmental variables such as near-surface water temperature, salinity, and dissolved oxygen. Year-round sampling along the Bridgeport-Port Jefferson Steamboat Company's ferry track as well as on-board meteorological data will be used to update hydrodynamic models of Long Island Sound. "The Bridgeport-Port Jefferson Steamboat Company is providing an extremely valuable resource by letting us

Continued on page 6

Photos by Susan Hamill



Experienced diver Dick Smith prepares to dive beneath the *PT Barnum* where he will attach the profiler that will record conditions in Long Island Sound for the Waliser-Wilson project.

sample the Sound from their vessel," says Waliser. "Up until now, there have been no long-term measurements of such data over the central Sound. These data are crucial for understanding the development and demise of summertime water column stratification, and thus the indirect impact of atmospheric forcing on hypoxia."

Many bacterial nonpoint source pollution (NPS) problems in coastal communities are attributable to people, pets, livestock and waterfowl. Fecal coliform bacteria (*Escherichia coli*) as an indicator of contaminated surface water leads to the closure of shellfish harvest areas and recreational beaches. Says lead PI **Emerson Hasbrouck** from Cornell Cooperative Extension of Suffolk County, "Evidence shows that *E. coli* found in the gastrointestinal systems of different animal species or groups varies in genetic identity and these genetic differences can be used to identify the source of specific strains of *E. coli*." The team will develop and modify novel molecular methodologies using Pulsed Field Gel Electrophoresis. This technology will help establish and validate DNA bacterial libraries that will pinpoint sources of coliform bacteria. Ultimately these libraries will help managers in targeting specific best management practices to the actual source of contamination.

Botulism, an emerging issue in Lake Erie, is a bacterial disease that can wipe out entire flocks of waterfowl. The role of fish in the recent botulism-induced waterfowl mortalities, however, is unknown. Cornell University investigators **Paul Bowser** and **Rod Getchell** will sample fish in their natural habitats for the gene coding of the botulism toxin produced by the causative agent, *Clostridium botulinum*. (*See related article, pages 12-13.*)

Healthy shellfish: hard clam and oyster research

Scientific tools for industry, government, and agencies do not exist for rapidly and reliably differentiating virulent from non-pathogenic *Vibrio parahaemolyticus* strains that can potentially compromise safety of shellfish harvested in NY's waters. This pathogen, most often transmitted by oyster consumption, is responsible for about 5,000 illnesses annually nationwide. Standard detection methods of the pathogen are expensive and tedious. They do not allow rapid screening of either seafood or seawater samples. Current methods require time-consuming culturing of the bacteria and may not detect emergent pathogenic strains. Cornell University's **Kathryn Boor** and **Martin Wiedmann** will develop new and novel tissue culture-based assays for distinguishing *V. parahaemolyticus* that have the actual ability to cause pathogenic effects from those bacteria that merely exhibit the genetic characteristics that are associated with virulence. Says Boor, "Our results will allow regulatory, public health, and seafood industry laboratories to acquire more rapid and reliable data reflecting the pathogen status of oyster harvest areas."

In a study that will help scientists and managers rigorously test techniques for stocking young hard clams in Long Island waters, Cornell Cooperative Extension of Suffolk County's **Gregg Rivara,** Stony Brook University's **Robert Cerrato** and NYSDEC's

Photo by Anita Kusick

What are some ways to make hard clam populations recover in Long Island's waters? Stony Brook University's Robert Cerrato (pictured) and Cornell Extension's Gregg Rivara will investigate with the help of six Suffolk County towns.

Debra Barnes will work cooperatively with six different Suffolk County towns led by **John Aldred** of East Hampton. The unique research team will examine the survivability of early small vs. later larger seed clams in a variety of environments and whether either method provides a good means to help the recovery of hard clam stocks. Hard clam harvests from Long Island's south shore waters are at an all time low, dropping consistently since a record 700,000 bushels were yielded just 25 years ago. "If we can demonstrate similar survival rates, then public shellfish enhancement programs and commercial clam farms can modify their practices to plant smaller seed beginning earlier in the season" says Rivara. This technique would increase output of hatcheries and nurseries and lead to a possible overall increase in yield at harvest.

Understanding the why: environmental analysis and response

Climate change with attendant rising sea levels and intense storms will put extremely valuable real estate and environments in lower Manhattan and adjacent areas in New Jersey at an even higher risk for serious flooding. SBU researchers **Malcolm Bowman**, **Roger Flood**, **Douglas Hill,** and **Robert Wilson** are exploring the feasibility of using storm surge barriers to protect these densely populated coastal areas. With co-funding from the City of New York, the team will establish if placing such barriers across the Verrazano Narrows, Upper East River and entrance to Arthur Kill could protect the region without undue adverse effects on the coastal environment outside or behind the barriers. "The Europeans have protected their low-lying cities from North Sea storm surges quite effectively," says Bowman. "Using various storm-surge numerical models and high resolution elevation-bathymetry databases, our study will provide planners with the information needed to see if similar engineering structures would work this side of the Atlantic."

Malcolm Bowman will investigate ways to mitigate flooding of New York's urban coastlines.
Photo by Barbara Branca

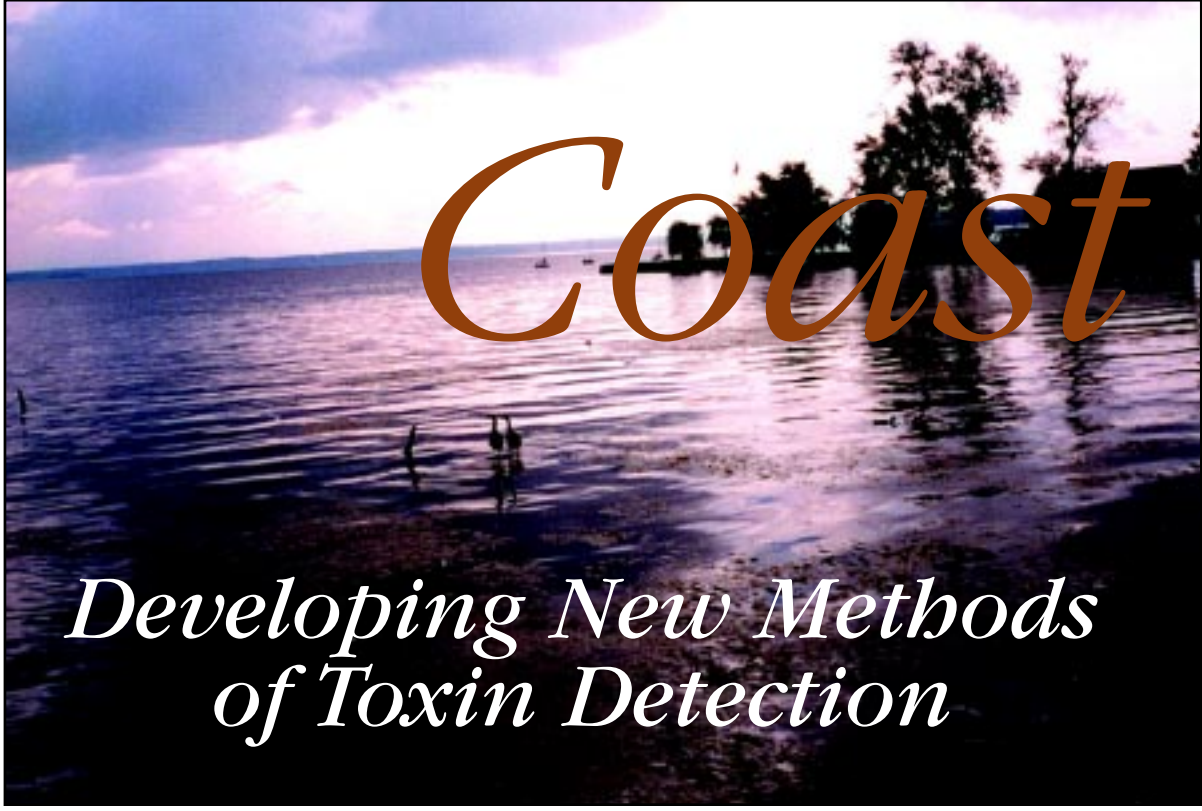
SBU investigator **Robert Cerrato** will develop a revolutionary technique for benthic habitat identification and mapping. This innovative method will help replace the fairly standard approaches benthic ecologists have used over the past several decades for underwater community structure analysis and habitat identification. Cerrato's multi-stage approach incorporates the use of side-scan sonar, multi-beam acoustics, sediment grain size analysis, and other geophysical survey tools with data about the living community. Using an integrated approach to differentiate among various benthic habitats will benefit the design and power of scientific research and monitoring projects, and environmental impact studies that are vitally important to resource managers.

Photo by Anita Kusick

Wetlands that fringe Long Island's shorelines are the focus of Steve Goodbred's research.

Salt marshes are inherently ephemeral coastal habitats sensitive to changes in their physical environment. Management strategies seek to address the loss of wetlands, but lack an understanding of how marshes are likely to respond to environmental changes caused by growing coastal urbanization. In a newly funded project, SBU's **Steven Goodbred** and **J. Kirk Cochran** will evaluate the physical characteristics of several wetlands in the diverse coastal areas of Long Island. As a function of physical regime, some marshes may show markedly different sensitivities to environmental change. Keystones identifying the most significant and robust factors that contribute to marsh stability, and lynchpin factors sensitive to change, will be defined to create a framework for making educated decisions between conservation, development, and remediation.

— Barbara Branca, Patrick Dooley, Paul C. Focazio, Cornelia Schlenk and Lane Smith
contributed to this article



These birds are wading in a blue-green algal bloom in shallow water. Are most blooms near shore? Dr. Greg Boyer's results from last summer should give a clue.

Photo by Xingye Yang

Coast

Developing New Methods of Toxin Detection

Algae and cyanobacteria blooms are a worldwide problem. Australia and Brazil report bloom toxins that can cause severe sickness—even death. A NYSG researcher is making breakthroughs in toxin detection so we can monitor for safe waters in NY and elsewhere.

In New York's vast marine and freshwater systems, algae and plankton form the critical base of each ecosystem's food web. But these living communities are dynamic. In the water column, the dominant plankton changes with each season. When one particular species dominates the usually mixed plankton community, the ecosystem experiences a "bloom" –sometimes with harmful effects especially if the species produces toxins that get into the food chain. Under bloom conditions, certain freshwater plankton can threaten the quality of the drinking water supply. In the ocean, toxins from harmful algal blooms can cause contamination and closure of economically important shellfish beds.

Sea Grant Scholar **Xingye Yang** collects algae with a pole sampler.

Photo by Greg Boyer

In a series of related projects, New York Sea Grant researcher **Dr. Gregory Boyer** of SUNY College of Environmental Science and Forestry is designing and developing cutting-edge technologies to detect these harmful toxins from algae. His earlier project focuses on a method of detecting one group of toxins, the saxotoxins. Saxotoxins can occur in blooms of *Alexandrium*, a microscopic organism known as red tide that is found along the Atlantic coast from Maine to the Gulf states. Shellfish that feed on toxin-producing algae and then are, in turn, consumed by humans can cause a condition known as paralytic shellfish poisoning, or PSP. Symptoms of PSP include tingling, numbness, fever, drowsiness, and in most severe cases, respiratory failure and even death. PSP is a major problem for the shellfish industry because the closure of shellfish beds exposed to the toxic algae means economic loss of several million dollars each year. Monitoring programs that protect the public from PSP can cost up to $200,000 annually nationwide and are labor-intensive requiring specialized personnel.

Before Boyer began working on new methods for PSP detection, the laboratory standard was the use of High Performance Liquid Chromatography (HPLC) coupled with a rather complex laboratory protocol vulnerable to methodological errors — post-column chemical reactions system or PCRS. Since 1999 with NYSG funding, Dr. Boyer has developed and constructed a portable

Boyer uses a pole integrated water sampler while Honglin Gao, a visiting scholar from the South China Sea Institute of Oceanography, reads the dissolved oxygen meter.

Photo by Elizabeth Patchett

Watch

Boyer and an assistant take water samples; 20% of water samples taken from 100 different sample locations in NY waters tested positive for cyanobacteria toxins with microcystin being the most common. Several samples exceeded the WHO guidelines of 1 part microcystin per billion. Photos by Jamie Lescinski

prototype PSP analyzer that employs an electrochemical replacement for the PCRS portion of the test. His technique, electrochemical oxidation coupled with fluorescent detection or ECOS, is less temperamental and more cost-effective than the traditional HPLC-PCRS detection method. Currently, the method that couples HPLC with ECOS is undergoing international interlaboratory trials and there is interest in this technique from nearly a dozen countries that have PSP-related problems in their waters. Boyer's ultimate goal is acceptance and validation of this methodology by the Association of Analytical Communities.

Building on the success of the PSP protocol, in his newly-funded research beginning in early 2002, Boyer is now developing analytical techniques to measure field concentrations of anatoxin-a, in New York State's freshwater sources of drinking water. Anatoxin-a and microcystin are two of over 60 different and extremely bioactive toxins produced by blue-green algae, or cyanobacteria blooms. Because these organisms are primary producers in freshwater lakes, they are eaten by other organisms creating the potential for their toxity to transfer up the food chain. The World Health Organization has established an allowable level of only 1 part microcystin per billion in drinking water. Current detection methods for these toxins are costly, complicated, labor intensive and may require tests on live animals.

As with the PSP toxins, the ability to detect and quantify cyanobacteria toxins such as anatoxin-a involves a multi-tiered laboratory approach. As was done for the PSP toxins, Boyer is currently developing antibody assays and standards for anatoxin-a, establishing background data on the distribution of such toxins and toxic algal species in Lake Ontario and elsewhere. Says Boyer, "We are developing effective monitoring measures that can be employed by water quality managers, conservation agents and health officials to rapidly screen for the presence of cyanobacterial toxins." The monitoring measures will include an antibody "dipstick" style test resembling a home pregnancy kit. Boyer will also investigate to what extent zebra mussels act as a key vector for the transfer of organic materials such as algal toxins into crabs, fish and other organisms higher in the food chain.

For the long term, Boyer's cheaper, easier and more reliable methodologies for detecting PSP toxins will move toward international acceptance and his work with cyanobacteria will improve drinking water testing methodologies and establish baseline data on their occurrence and impact on freshwater ecosystems.

—Patrick Dooley, Project Assistant
Barbara Branca, Communicator

SUNY Plattsburgh undergraduate Trevor Carpenter uses a plankton net aboard Lake Champlain Research Consortium's *R/V Monitor*.

Selected Publications

Dr. Boyer's NYSG-funded research on a PSP toxin analyzer has resulted in nearly a dozen peer-reviewed journal publications to date as well as several doctoral dissertations and other university-based articles. Here is a sample of selected publications. Find a complete list at: www.nyseagrant.org

Boyer, G.L. and X. Hu. 1996. The electrochemical detection of PSP toxins. *Canadian Technical Report of Fisheries and Aquatic Sciences* 2138:1-5.

Boyer, G.L. and G.D. Goddard. 1999. High performance liquid chromatography coupled with post-column electrochemical oxidation for the detection of PSP toxins. *Natural Toxins* 7(6):353-359.

Boyer, G.L., and L.E. Brand. 1998. Trace elements and harmful algal blooms. Pages 489-508 in D.M. Anderson, A.D. Cembella, and G.M. Hallegraeff editors. Physiological Ecology of Harmful Algal Blooms. Springer-Verlag, Berlin.

Boyer, G.L., J.J. Janiszewski, and X. Hu. 1998. A comparison of electrochemical methods for the HPLC analysis of PSP toxins. pages 515-518 in B. Reguera, J. Blanco, M.L. Fernandez, and T. Wyatt, editors. Harmful Algae. Xunta de Galicia and Intergovernmental oceanographic commission of UNESCO 1998.

Goddard, G.D., K. Haya, and G.L. Boyer. 1999. Electrochemical oxidation system for the analysis of Paralytic Shellfish Poisoning (PSP) toxins in natural shellfish samples. Pages 58-62 in Proceedings of the Sixth Canadian Workshop on Harmful Marine Algae.

Hu, X., and G.L. Boyer. 1996. Effect of metal ions on the quantitative determination of hydroxamic acids. *Analytical Chemistry* 68(10):1812-1815.

Hu, X., and G.L. Boyer. 1996. Siderophore-mediated aluminum of uptake by *Bacillus megaterium* ATCC 19213. *Applied and Environmental Microbiology* 62(11):4044-4048.

Shifting fisheries management toward a multi-species approach

The job of managing our coastal marine fisheries is a difficult and complex one. Off the coast of New York the waters of the mid-Atlantic continental shelf are home to many species that are important to commercial and recreational fisheries. Bluefish, striped bass, summer flounder, Atlantic mackerel, squids, and many other species contribute millions to New York's economy. The state's marine resources provide jobs, tasty seafood, and outstanding recreational opportunities.

With the help of previous and current New York Sea Grant funded research, the job of managing our precious marine resources is made easier and more effective. Researchers at Stony Brook University's Marine Sciences Research Center (MSRC), with funding from Sea Grant, have been studying New York's mid-Atlantic ecosystem for many years. Their efforts have advanced the scientific understanding of the functioning of this complex ecosystem. The added knowledge is directly applicable to improving management of our coastal marine resources.

Management of marine fisheries is accomplished through the development of Fishery Management Plans (FMPs). It is a complex process that requires accurate information about the ecology and economics of the fishery. The goal of an FMP is to provide for conservation of the resource while balancing the interests of those who harvest and benefit from the resource.

The challenge is that only incomplete knowledge of the mid-Atlantic coastal shelf ecosystem is available to consider when developing FMPs. The species that are harvested interact with each other in many ways and form complex food webs, which are poorly understood and are influenced by fishing activities. Historically, management plans have taken a single species approach, with each species having its own management plan. This approach fails to take into account the competitive and predator-prey interactions that research has shown are important to the structure and function of continental shelf populations, food webs, and the carrying capacity of the ecosystem. Therefore, there is growing recognition that fisheries management needs to shift towards a multi-species ecosystem-based approach.

Research funded by New York Sea Grant responds to this need. In a new project currently underway, **Dr. Timothy Essington** of MSRC will study the role of squids in the continental shelf ecosystem. Based on what is currently known about the mid-Atlantic food web, it is clear that squids play a central role. Squids such as longfin inshore squid (*Loligo pealeii*) and

northern shortfin squid (*Illex illecebrosus*) are key links in the food web because they are important as both prey (of adult fish) and predators (of juvenile fish). The research will use field and lab studies and modeling to determine in more detail the influence of squid in the mid-Atlantic food web and the effects of squid harvesting. The field studies will collect stomach contents of squid and their predators, and the lab studies will measure the bioenergetics of captive squid. The data collected will be used to develop models of squid bioenergetics and trophic interactions. Essington's research objectives include improved descriptions of predator-prey interactions between squid and their fish predators, and quantifying predatory demand of squid and fish. Without taking into account the predator prey interactions of squid and fish, single species FMPs could lead to unexpected and undesirable responses of the ecosystem to fishing. Data from Essington's research could be used to help prevent that from happening.

Previously funded Sea Grant research has also illustrated the need to manage fisheries with a multi-species approach. A pair of projects conducted by **Dr. David Conover,** of MSRC, focused on bluefish (*Pomatomus saltatrix*) predation on the continental shelf. Bluefish grow very rapidly compared to other continental shelf species. As young of the year (YOY), bluefish are larger than YOY of other species and prey heavily upon them. Bluefish predation on YOY fish can have a major impact on the recruitment of many commercially, and recreationally important species such as striped bass and billfishes. The details of bluefish life history illuminated by Conover's research improved scientific understanding of another component of the continental shelf food web. Without taking into account the interactions between bluefish and their prey, single species FMPs could fail to meet the goals of conserving the fishery and providing a sustainable resource for the future. With the help of New York Sea Grant funded research, the job of managing our marine natural resources will be a little easier.

— Lane Smith
Project Assistant

Essington and Sea Grant Scholars Michelle Staudinger and Mary Hunsicker at MSRC's Flax Pond Lab where squid research is getting underway.

The Mid-Atlantic Fishery Management Council in cooperation with the Atlantic States Marine Fisheries Commission is responsible for developing fishery management plans for the mid-Atlantic region. The FMPs are submitted to the National Marine Fisheries Service who implements them. Learn more about FMPs at: www.mafmc.org/mid-atlantic/fmp/fmp.htm

Selected Publications

Dr. Conover's NYSG-funded research on bluefish has resulted in two dozen peer-reviewed journal publications to date as well as several doctoral dissertations and other university-based articles. Here is a sample of selected publications. Find a complete list at www.nyseagrant.org

Buckel, J.A., B.H. Letcher, and D.O. Conover. 1998. Effects of a delayed onset of piscivory on the size of age-0 Bluefish. Transactions of the *American Fisheries Society* 127(4):576-587.

Buckel, J.A., D.O. Conover, N.D. Steinberg, and K.A. McKown. 1999. Impact of age-0 bluefish *(Pomatomus saltatrix)* predation on age-0 fishes in the Hudson River estuary: evidence for density-dependent loss of juvenile striped bass *(Morone saxatilis). Canadian Journal of Fisheries and Aquatic Sciences* 56(2):275-287.

Buckel, J.A., M.J. Fogarty, and D.O. Conover. 1999. Foraging habits of bluefish, *Pomatomus saltatrix,* on the U.S. east coast continental shelf. *Fishery Bulletin* 97(4):758-775.

Buckel, J.A., M.J. Fogarty, and D.O. Conover. 1999. Mutual prey of fish and humans: a comparison of biomass consumed by bluefish, *Pomatomus saltatrix,* with that harvested by fisheries. *Fishery Bulletin* 97(4):776-785.

Munch, S.B., and D.O. Conover. 2000. Recruitment dynamics of bluefish *(Pomatomus saltatrix)* from Cape Hatteras to Cape Cod, 1973-1995. ICES *Journal of Marine Science* 57(2):393-402.

Scharf, F., J.A. Buckel, F. Juanes, and D.O. Conover. 1998. Predation by juvenile piscivorous bluefish *(Pomatomus saltatrix):* the influence of prey to predator size ratio and prey type on predator capture success and prey profitability. *Canadian Journal of Fisheries and Aquatic Sciences* 55:1695-1703.

Botulism Primer

Avian botulism is a disease caused by *Clostridium botulinum*. Type C botulism has caused the die-off of thousands of waterfowl across the western United States. Type E botulism has been somewhat restricted to fish-eating birds in the Great Lakes. The neurotoxins produced by the bacteria cause effected birds to show signs of weakness, dizziness, inability to fly, muscular paralysis, and respiratory distress. Some infected birds drown. Great Lakes species most affected by the disease include loons, grebes, and gulls. Type E botulism has also been documented in recent mortalities in Lake Erie fishes, including alewives and round gobies.

Human botulism is typically caused by eating improperly canned or stored foods and normally involves type A or B botulism toxin. The toxin in food is killed by cooking and smoking fish and waterfowl at temperatures high enough to destroy the toxin produced by the botulism bacteria.

Anyone finding a diseased or dead fish or bird should call a fish or wildlife management agency. For more information, see: www.seagrant.sunysb.edu/botulism

Botulism Workshop Sets Research Agenda for 2002-03

Disease-Fish-Bird Connections, Lake Levels, Water Temperatures

Why have increasing numbers of birds and fish been dying along Lake Erie?

More than 100 interested people gathered to discuss that question at the second Botulism in Lake Erie/ Binational Workshop, held in Buffalo in February. The workshop, was sponsored by New York State Assemblyman Richard Smith, New York Sea Grant, Pennsylvania Sea Grant, Ohio Sea Grant and the Great Lakes Program at the University of Buffalo. The focus of the workshop was twofold: 1) to present an historical perspective on the birds and fish known to have died from Type E botulism along Lake Erie's American and Canadian shores since 1998, and 2) to develop a research agenda to answer the lingering question of why these deaths are occurring and the implications related to broad ecological and human health issues.

"We must move quickly to determine and pinpoint the problem," **Assemblyman Smith** said. "Sea Grant with its federal network that crosses state lines can pull all the information together and use sound scientific data to inform the general public. Lake Erie is a sparkling jewel and a regional asset with sports fishing opportunities that are the greatest in the world. The lake must be constantly monitored for future generations so they can enjoy the benefits of fresh and clean water."

"New York Sea Grant is pleased to play an instrumental role with Pennsylvania Sea Grant in bringing together the stakeholders interested in how botulism affects the Great Lakes system," said New York Sea Grant Director **Jack Mattice.**

Photo by Dale Baker

Eric Obert, Pennsylvania Sea Grant and Helen Domske, NY Sea Grant organized the Botulism Workshop.

"The work we have done with the brown tide, lobster and hard clam research projects establishes a model for researchers to follow in dealing with botulism."

With funding support from Congressional and state legislators, brown tide, lobster and hard clam projects are helping to uncover the science behind the water-based ecological changes affecting New York State's seafood industry.

The botulism research agenda established for 2002-2003 at the Buffalo workshop includes investigating:

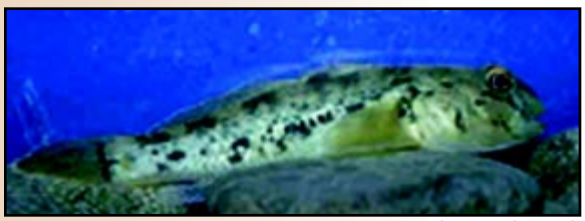
1) the links between round gobies and quagga mussels and botulism-infected fish,

2) how low water levels and warmer lake temperatures affect the activation and transfer of botulism, and

3) how botulism relates to broader ecological and human health concerns.

To develop an agenda for the research needed to identify the source of and possible corrective strategies for dealing with botulism outbreaks, highly-respected scientists and researchers from the U.S. and Canada presented

Photo by David Jude



NYSDEC's Ward Stone believes the round goby plays a key role in the transfer of botulism.

data on the recent outbreaks of botulism along Lake Erie. According to NYSDEC bird mortality survey in 2000, the predicted mortality of merganser ducks was close to 2,500 while a Canadian Wildlife Service report of 1999 estimated 5,400 merganser deaths along the Canadian shore. To a lesser degree several other species of birds have been affected including loons, grebes, ducks, and gulls. Multiple fish species and mudpuppies (aquatic salamanders) have also died of the disease.

Researchers considering the historical connections to the disease are looking at data on a mid-1980s outbreak of botulism in Lake Michigan. That outbreak appears to have been an isolated incident. Ohio agencies are just beginning to see evidence of botulism-related bird and fish deaths along Ohio's stretch of Lake Erie.

Areas of study that Lake Erie researchers would like to pursue include how anaerobic conditions, lake levels, and water temperatures affect the development of botulism and what role is played by the exotic species introduced to the lakes through the ballast of commercial freighters.

Ward Stone, NYSDEC's senior wildlife pathologist, told conference attendees at the February Sea Grant conference that he has identified the type E botulism bacteria in several species of dead birds, including a bald eagle, collected along Lake Erie. He believes

Photo by Ellen George

Gordon Fraser, Director of the Great Lakes Center, Buffalo State College and Dale Baker, Program Leader and Associate Director of New York Sea Grant.

the round goby, an exotic species of fish often consumed by several species of birds, plays a key role in the transfer of the disease. Although type E botulism has not been identified as a problem in Lake Ontario, Stone will be examining several dead lake sturgeon found along that Great Lakes' shoreline.

Among those attending the botulism conference were representatives of New York, Pennsylvania, and Ohio Sea Grants, the NYSDEC, the Pennsylvania Game Commission, the PA Fish and Boat Commission, the National Water Research Institute, Environment Canada and Health Canada. Private stakeholders represented fishing, sports and conservation organizations, including the New York Walleye Association, the Niagara River Musky Association, and the Erie County Federation of Sportsmens Clubs.

— by Kara Lynn Dunn
Prepared from material supplied by Helen Domske, NYSG Coastal Education Specialist

Photos by Ellen George

NYS Assemblyman Richard Smith (front row, far right) helped sponsor the well attended Botulism Workshop.

Dr. Rod Getchell of Cornell University at podium.

Cutting Edge Research Begins

Drs. Paul Bowser and Rod Getchell with the Department of Microbiology and Immunology at the College of Veterinary Medicine at Cornell University are working on a New York Sea Grant-funded research project to study the prevalence of the botulism bacteria, *Clostridium botulinum,* in fish in the lower Great Lakes.

The primary objective of the project is to determine the level and extent of *C. botulinum,* in healthy, moribund, and dead fish in areas of confirmed botulism outbreaks and in unaffected areas in Lake Erie and Lake Ontario. Answers will be sought to the questions:

- **Are bacteria more likely to be present in healthy, moribund or dead fish?**
- **Is one species of fish more likely to carry the bacteria?**
- **Does the toxin form in fish prior to or after death?**
- **Are fish carrying the bacteria associated with waterfowl death events?**

The researchers are working with the New York State Department of Environmental Conservation to collect fish, primarily carp and round gobies, for examination from both lakes. Tests will assess the cause of death as well as other pathogens present in the fish. Sampling will also take place during active outbreaks of botulism in waterfowl. Gene-testing diagnostics will be used to test fish with positive samples sent to the Veterinary Diagnostic Laboratory at the University of Pennsylvania's New Bolton Center for additional testing. **(See also page 5, column 2.)**

Researching Lobster Health in Long Island Sound

New York Sea Grant hosted the second meeting in a series of Long Island Sound Lobster Health Symposia as part of Sea Grant's continued effort to support research into the causes of the mass lobster die-off that occurred in 1999. **Gordon Colvin** (pictured above), NYSDEC Marine Fisheries Bureau Director and member of the Atlantic States Marine Fisheries Commission (ASMFC) Lobster Management Board led the opening ceremony, and **Patricia Kurkul,** NMFS NE Regional Administrator, delivered the keynote address. This gathering was a textbook illustration of inter-agency cooperation through the *ad hoc* Steering Committee for Lobster Disease and Research that was appointed by the ASMFC, and is presently chaired by **Dr. Anthony Calabrese,** NMFS Milford Fisheries Laboratory.

An important goal of this meeting was to inform the participants about the general status of lobster health and the fishery in Long Island Sound, and report on planned research to investigate the causes of the lobster die-offs. This was also an opportunity for lobster fishers to voice concerns and comment on continued changes in the fishery.

Seventeen scientific research projects are being funded to determine possible adverse effects resulting from changes in lobster endocrine and immune systems, pesticide application, long term changes in environmental parameters including rising sea temperatures, reduced dissolved oxygen, an0d changes in the levels of ammonia and sulfide. Funds are also being used to continue research on the *Paramoeba* that was found in dead and dying lobsters in 1999. The incidence of shell disease in eastern LIS is of major concern to lobster fishers in those areas, and funds are also being directed to learn about the bacterial colonies associated with the disease.

Anthony Calabrese (foreground), chair of the lobster steering committee, Jack Mattice (hand raised), Director of NYSG and committee member, and Carl LoBue (far left with tie), NYSDEC Marine Resources' lobster specialist participated in the Lobster Health Symposium.

Photos by Jason Powers

The symposium participants were a virtual kaleidoscope of stakeholder groups in LIS, including lobster fishers, agency staff, researchers, lobster dealers, students and environmental advocates. The participants were asked to complete an evaluation sheet to help Sea Grant staff improve the meetings that are held in the future. Respondents were interested in the presentations dealing with anthropogenic and environmental impacts such as possible effects resulting from reductions in the water quality from sewage outfalls.

John Makowsky, formerly a lobsterman from Connecticut, raises a question.

Respondents were generally supportive of using a regional approach to study the 1999 lobster die-off, and suggested the coordinators incorporate national and international research supplemented with input from the industry. A regional approach will require participation from scientists and industry representatives based in Maine, Massachusetts, and Canada, since New York is the southern limit for American lobsters. Such an undertaking was initiated on the second day when the researchers met to discuss their work with the hope of applying techniques used in other geographic regions that experience similar problems.

Another suggestion was to include more discussions from lobster fishers at future meetings. This will be achieved by working with the lobster fisher associations to organize short forums as part of their regularly scheduled association events, with participation from the researchers. Visit *www.nyseagrant.org* for additional information or contact NYSG Extension at 631.727.3910.

— Antoinette Clemetson
NYSG Fisheries and Lobster Outreach Specialist

LastWave

Ordering Publications

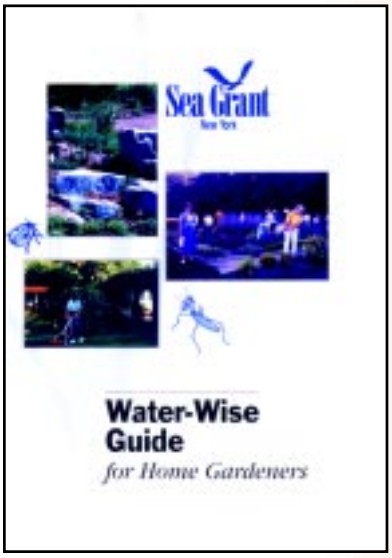
Please send requests for the following publications along with a self-addressed label and check payable to:

New York Sea Grant Institute
Communications/ 121 Discovery Hall
Stony Brook University/ Stony Brook, NY 11794-5001
(631) 632-9124

New York Sea Grant Publications

Water-Wise Guide for Home Gardeners. Nordica Holochuck. 2001. *$1.00.*

The Drought Severity Index of NOAA's Climate Prediction Center shows conditions of severe drought for the Hudson River Valley and Long Island this spring. There are moderate drought conditions for much of northern New York and the southern tier. So for gardeners who wish to conserve water resources this growing season, this book has some helpful hints.



Journal Reprints

NEW

Impacts of nutrients and grazing mortality on the abundance of *Aureococcus anophagefferens* during a New York brown tide bloom. Christopher J. Gobler, Marc J. Renaghan, and Nathaniel J. Buck. 2002. *Limnology and Oceanography* 47(1):129-141. *$1.00*

NEW

Microbial food web interactions in two Long Island embayments. Katie Rose Boissonneault-Cellineri, Mausmi Mehta, Darcy J. Lonsdale, and David A. Caron. 2001. *Aquatic Microbial Ecology* 26:139-155. *$1.00*

Physicochemical speciation of iron during coastal algal blooms. Christopher J. Gobler, John R. Donat, John A. Consolve III, and Sergio A. Sañudo-Wilhelmy. 2002. *Marine Chemistry* 77:71-89. *$1.00*

Credit Where Credit is Due...
We omitted a photo credit in ***Late Fall '01 Coastlines Vol. 30 /No. 3.*** The picture of Sea Grant Scholar Betsy Damaske on page 13 is courtesy of Theodore W. Lewis.

An online view that's all new!

Newly hatched this Spring at the redesigned **nyseagrant.org:**

- Want to brush up on your NYSG history? Check out "NYSG@30" to chart our efforts in education, fisheries, seafood safety, coastal businesses, water quality, and aquatic invaders.

- What's up with some of of our new initiatives—

  NYSG's Web site on botulism, a bacterial disease affecting Lake Erie's fish and waterfowl, includes downloadable fact sheets and meeting proceedings, related research, and other newsworthy items.

  Read more on outcomes from the 2nd annual LI Sound Lobster Health Symposium. Web offerings include the meeting's background materials, summaries of all 19 Initiative projects and over a dozen fact sheets.

- Also online: More on the newly-funded suite of research (spotlighted in this issue our NOAA Environmental Hero for 2002 Ed Sander, the lowdown on recent events such as Great Lakes Underwater '02, an update on our Lake Ontario fisheries study, and the new archive of succulent "Seafood Corner" recipes.

American Shad

When the white blossoms of the shad bush burst forth each spring, it's time for the American shad to return to New York's rivers. Like salmon and striped bass, shad spend their adult lives at sea and return to the rivers of their birth to reproduce. Most of the local shad available in NY is caught when the fish migrate into the Hudson and Connecticut Rivers in April and May. But shad is available in NY markets from May through October.

According to NYSG fisheries specialist Dave MacNeill, populations of American shad existed in the Great Lakes and its tributaries because of stocking efforts back in the 19th century. Today, rare sightings are in the St Lawrence, if at all. But American shad runs are on the increase in the Hudson River. Hudson Valley specialist Nordica Holochuck reports that weekend festivals and shad bakes to celebrate the shad's return are a special "rite of spring" hosted by several Hudson River communities each May.

The American shad has a deep body, silvery to blue-green in color, and large scales. A Native American legend says that the shad began as an unhappy porcupine who complained to the Great Spirit and was turned inside out and cast into the water. This legend helped explain why the shad is often considered the world's boniest fish!

Boning shad is quite an art so you are better off buying shad already cut into fillets. Be prepared for a unique culinary experience. Shad's scientific name is ***Sapidissima***, meaning "most delicious." Because they are caught during their spawning migration, the females are full of delicious roe. But, females are also more desirable because they are larger and fatter.

Broiled Shad with Herbs & Onions

Seafood Corner

Ingredients

2 pounds shad fillets, skin on
1/4 cup olive or vegetable oil
2 tablespoons lemon juice
1 tablespoon grated onion
1 teaspoon paprika
1 1/2 teaspoons salt
1/4 teaspoon crushed thyme
dash of salt
chopped parsley
lemon wedges

Shad can be prepared in a variety of ways. It is moderately fatty with a delicate rich flavor especially suited to pan-frying, broiling, baking, hot smoking, or grilling. Shad roe is best pan-fried or sautèed and was traditionally served with scrambled eggs as a breakfast treat. Because shad was historically available only during the run, a variety of methods are used to preserve it. Pickled and smoked shad products and planked shad can be enjoyed at spring shad festivals and purchased from specialty markets during the season.

Method

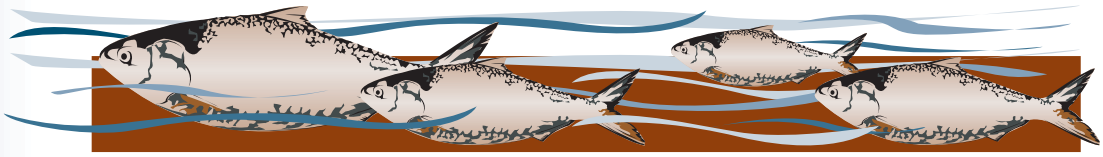
Cut fillets into serving-size portions if necessary. Combine all ingredients except fish, parsley and lemon wedges to make a sauce. Place fish, skin side up, on well-greased broiler pan. Brush with sauce. Broil about 3 inches from heat source for 5 minutes. Turn carefully and brush other side with sauce. Broil 5-7 minutes longer or until fish is lightly browned and flakes easily when tested with a fork. Sprinkle with parsley and garnish with lemon wedges.

Serves 4. Preparation time 20 minutes.

Courtesy of New York Seafood Council.

Notes by

— Barbara A. Branca and the New York Seafood Council



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