

Big Fish, Little Fish

Each fall, thousands of recreational anglers come to fish the stocked salmon and trout in Lake Ontario. "One of the essential ingredients in managing a fishery is gathering data that will help maintain the delicate balance between the numbers of prey and stocked predator fish," says NYSG's Fisheries Specialist **Dave MacNeill**.

"Anglers want more fish," says **Steven LaPan**, NYS Dept. of Environmental Conservation's (NYSDEC) Lake Ontario Unit Leader at the Cape Vincent Fisheries Station. "And we're doing all



we can to improve the survival of stocked fish. In addition, production of wild Chinook salmon has increased." But do those potential trophy fish have enough alewife, smelt and other small forage fish to eat?

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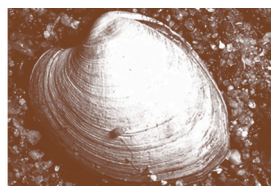
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Director
Jack Mattice
Associate Director
Dale Baker
Assistant Director
Cornelia Schlenk

COASTLINES
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Editor
Barbara A. Branca
Barbara.Branca@stonybrook.edu

Contributing Writers
Laura Bartovics
Kara Lynn Dunn
David B. MacNeill
Cornelia Schlenk
Jay Tanski
Kimberly Zimmer-Graff
Paul C. Focazio
Paul.Focazio@stonybrook.edu

Design
L.C. Graphics

Layout
Sharon O'Donovan

Production Assistant
Susan Hamill

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New York Sea Grant Institute
121 Discovery Hall, Stony Brook University
Stony Brook, NY 11794-5001
631.632.6905

New York Sea Grant Extension Offices:
Administration Office
112 Rice Hall
Cornell University
Ithaca, NY 14853-5905
607.255.2832

Great Lakes District Office
New York Sea Grant
Morgan II, Second Floor
SUNY College at Brockport
Brockport, NY 14420-2928
585.395.2638

Marine District Office
New York Sea Grant
Cornell University Research and
Extension Center
3059 Sound Avenue
Riverhead, NY 11901-1098
631.727.3910

From the Director

The recent two-week spate of media coverage, especially in the State's marine district, leads me to call attention to an important source of information about NYSG efforts – the media archive section of our Web site. The articles posted there highlight some of our most effective and topical cooperative ventures.

The media enabled us to get out the real story after the October 4 Lobster Health Symposium – that high water temperature was the major contributor to the 1999 lobster die-off in Long Island Sound. (The next *Coastlines* will provide full results.) Coverage included interviews with NYSG staff and references to Sea Grant efforts in daily and weekly newspapers (including the NY Times), a commercial newsletter, TV, radio, and on-line references.

The October 10, *NY Times* also ran an article on stormwater runoff that quoted NYSG's NEMO specialist **Eileen Keenan** as well as officials from Nassau and Suffolk Counties.

Recreational boating's \$1.8 billion impact on New York's economy, determined via a NYSG-sponsored study, was announced during the October 1 opening of the *Tobay In-The-Water* Boat Show in Massapequa, NY. The boater economics study was covered on three online business Web sites, TV, National Public Radio and a weekly LI newspaper. The boating industry has already used the report during Legislators' Day in Albany.

And on Great South Bay, NYSG's *Hard Clam Research Initiative* provided some crucial rationale for The Nature Conservancy clam seeding project in the bay. Again, TV and print media were there at the official project kick-off on October 7.

Media coverage in the Great Lakes' District tends to be a steady flow rather than sporadic bursts. Nevertheless, issues have included border crossing tips, agritourism, exotic species, the dune stewards' program and clean boating, as well as separate surveys of the charter industry, anglers and recreational boaters. And coverage has included TV, radio, the Associated Press wire service, daily, weekly and monthly newspapers, a Canadian magazine and on-line references. Perhaps this is less splashy than the two-week splurge, but it is more comprehensive.

I think you'll be impressed with the breadth and depth of NYSG's contributions to public understanding of important (frequently controversial) NYS resource issues in both the Great Lakes and marine districts. All you need to do to access current and archived media references to New York Sea Grant's research and outreach activities is point your browser to www.seagrant.sunysb.edu/Communications/pr.htm.

Have a good season.

Jack Mattice



At an August Beach Awareness Day at LI's Cupsogue Beach, NYSG's Barbara Branca shows lifeguard Ed Harris the nationally distributed NOAA/Sea Grant brochure and gives him a blue "neck tote" graphically depicting how swimmers can "break the grip of the rip." Totes were given to hundreds of beachgoers.

Photo by Paul C. Focazio

New York's Boaters Spent \$2.4 Billion in 2003



Boat on Lake Ontario.
Photo by Barbara A. Branca

New York Sea Grant's recent boater survey showed that boating has a \$1.8 billion economic impact and creates 18,700 jobs in New York State.

The national economy may go through highs and lows, but in a New York Sea Grant-funded study out this month, Cornell researchers found that the state's recreational boaters spent a whopping \$2.4 billion last year despite the poor weather last summer. The effort is the first of its kind to directly measure expenditures related to recreational boating and their impact on the state's economy. Using questionnaires sent to a sample of New York's half a million registered boaters, researchers estimate that in 2003 recreational boating had a total statewide economic impact of \$1.8 billion, accounted for approximately 18,700 jobs, and contributed \$728 million to labor income.

Researchers **Nancy Connelly**, **Tommy Brown** and **David Kay** of Cornell University's Department of Natural Resources found that for boating trip related expenditures such as launching fees, lodging, food, and gas, boaters spent over \$431 million statewide. The survey also tabulated how much boaters spent on boat pur-

chases, equipment, boat repair, insurance, and annual fees associated with the use of marinas and yacht clubs. Overall in 2003, almost \$2 billion was spent statewide on these non-trip related expenses. Of this figure, \$1.2 billion was for boat purchases.

"With these research findings, it is clear that recreational boating is big business and an important economic generator for the people of New York State," said **Jack Mattice**, New York Sea Grant Director.

"The intent of the study was not only to quantify the impact of boating, but also to provide information that will help managers, planners, and other decision makers make more informed decisions regarding coastal resource use and development," adds NYSG's coastal processes and facilities specialist **Jay Tanski** who served as project manager.

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The SUNY Buffalo School of Informatics is conducting a survey of **Coastlines** readers. Your opinion will help improve **Coastlines** so we provide you with quality articles in a reader-friendly format that make a difference. Within a few days, a sample of our readers will be mailed a survey. Carefully complete this survey and return it in the postage paid envelope.

Everyone who completes and returns the survey is eligible for a random drawing to win a \$100 gift certificate to the sports outfitter of your choice. There will be five winners selected, so your chances are very good.



Photo of Montauk Harbor.
by Sharon O'Donovan

Big Fish,



The US Geological Survey's *R/V Kaho* was used during the fisheries assessment study in Lake Ontario. *Kaho* is currently being used by NYSG-funded researcher Lars Rudstam for a Lake Ontario study on *Mysis relicta*, the most recent in a series of declining native species. *Mysis* is one of the most important prey for forage fish such as alewife and smelt. It is also a major predator on zooplankton, a primary food source for alewife and sportfish such as walleye and yellow perch.

Six species of salmon are stocked in Lake Ontario by New York State and province of Ontario – Chinook, Atlantic and coho salmon, and lake, rainbow, and brown trouts. Numbers stocked peaked

at nearly eight million fish per year in the mid to late 1980s, lowering to about five million per year since the 1990s. "Fisheries assessment data at the time of peak stocking levels suggested there may be a risk of an alewife population decline," says MacNeill. "So, in an effort to prevent an alewife population collapse, stocking levels were reduced under the suggestion of the scientific community. Stocking levels were slightly increased, though, once survey information showed that alewife were a bit more resilient than previously suggested."

Adjusting stocking levels can be a sensitive issue for some, though, especially recreational fishermen. Because Mother Nature is in the driver's seat when it comes to many of the lake's ecosystem changes – those brought on by reductions in nutrient levels or by the actions of zebra mussels and other aquatic invaders – MacNeill says, "adjustment of stocking rates is one of the few management options that fisheries managers can

utilize in an effort to manage the lake. But, the effect is at the whim of nature."

So, with salmonid stocking numbers driven by NYSDEC, using United States Geological Survey (USGS) data on alewife and other forage fish, a technical review of this process began in the Fall 2002. On the request of New York State Senator **George Maziarz**, New York Sea Grant conducted an advisory meeting in October 2002 to discuss an evaluation strategy with biologists from the US Geological Survey (USGS), NYSDEC, Ontario Ministry of Natural Resources (OMNR) and Cornell University.

First, the agencies agreed that an objective, comprehensive review of Lake Ontario's forage fish assessment program was needed. Several prominent scientists with successes in saltwater fish estimates were asked to model their studies for the review of this freshwater system. Reviewers included **Steven Murawski**, Chief of that National Marine Fisheries Service's Population Dynamics Branch in Woods Hole, MA, **Stephen Smith**, from Bedford Institute of Oceanography's Department of Fisheries and Oceans in Dartmouth, Nova Scotia, and **Jerald Ault**, Professor of Marine Biology and Fisheries at the University of Miami. **Lisa Kline**, Director of Research and Statistics at the Atlantic States Marine Fisheries Commission, served as facilitator for the review.

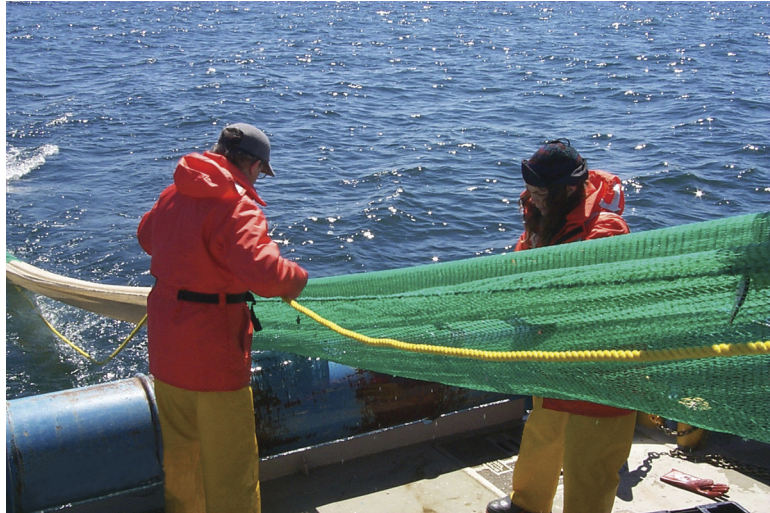
Their evaluation of USGS and NYSDEC data was discussed at an October 2003 meeting by Lake Ontario fisheries managers, researchers, agency biologists and elected officials. A number of areas were identified where forage fish survey design, implementation, and data analysis could be improved. Also, says LaPan, "it was recommended that scientists and managers collect additional data that would increase our understanding of the rapidly changing Lake Ontario ecosystem and improve our ability to predict the consequences of different fisheries management alternatives."



USGS biologists aboard the *R/V Kaho* set gillnets to gather lake trout.

Little Fish

Additional effort has been made to generate a common understanding of the forage fish count and salmon stocking issue with the different parties involved. "Fish assessment involves the assessment biologists conducting fish sampling to estimate over-



all population abundance, the research scientists specifically looking at ways to improve how assessment biologists do business, fisheries managers that use prey fish estimates in making management decisions and then you have the stakeholders whose economic interests are influenced by fisheries management decisions," says MacNeill. "It has been Sea Grant's intent to try and bring these elements together in terms of a shared understanding."

While the issues and suggestions for implementation

A "cod-end" full of alewives being lifted aboard the *R/V Kaho* using the deck crane. The "cod end" refers to the portion of the net where all the fish collect, regardless of the species caught (front cover).

The crew back-hauls a bottom trawl for alewives (left) and lifts gillnets set for lake trout aboard the *R/V Kaho* (below).

"We should all commend the USGS and NYSDEC for their cooperation in this review process," says MacNeill, "as it is always a difficult situation to be under external scrutiny. Our effort was first and foremost to provide an objective and cordial forum for the review to be conducted."

"Overall, the reviewers spoke of how exemplary a job the USGS and NYSDEC have done collecting data given their budgetary and staff constraints," says MacNeill. Reviewers were favorably impressed with the overall collaboration between the agencies and considered the USGS and NYSDEC's 25-plus year long-term data sets as reliable indicators of trends in the relative abundance of alewife and other forage species in Lake Ontario.

Reviewers also made some constructive comments to improve the accuracy of fish abundance estimates and the amount of variability in the data. These comments were related to the methodology used in sampling fish populations, ways in which the data were analyzed and how the abundance data are used to make management decisions.

Adding more sampling locations or combining data from current sample points using state of the art hydroacoustic data were among the suggestions. Realistically, MacNeill says while it will never be known how many alewife are in the lake, "there are some practical means available to better estimate prey fish abundance."

surrounding fisheries assessment may cause differences in opinions between those involved, there is a lot of room for collaboration. So, leading up to this assessment, Sea Grant and the cooperating agencies have worked actively and effectively with sportfishing stakeholders at annual educational forums. This improved dialogue with resource users has provided stakeholders with a better understanding of fisheries dynamics and problems inherent in collecting fisheries data in assessment programs. "Thanks in part to our outreach efforts," says MacNeill, "I think that workshop participants came away with a better understanding of the inherent demands and difficulties associated with fish assessment conducted by USGS and NYSDEC."

The final report on Lake Ontario's forage fish assessment program is planned for early this fall. Discussions are underway to consider options for follow-up inter-agency meetings.



All photos courtesy of the USGS Lake Ontario Biological Station

— Paul C. Focazio



Rudstam's research team included former Sea Grant scholar Robert Klumb, seen here in summer 2000 collecting gametes from spawning alewives.

Photo by Simi Sangari

Alewife: Unlocking unknowns of a key species

Alewife is the cornerstone of Lake Ontario's ecologically and economically valuable salmon sport fishery. Data on the abundance of this key prey species are used by management agencies such as the NYSDEC and US Fish and Wildlife Service to help set sustainable stocking levels for a variety of salmon and trout species. "Alewife supports major sport fisheries contributing millions of dollars to the local economies, and we're just

starting to look at what governs the production of the species," says Cornell University's **Lars Rudstam**, lead investigator on a related NYSG-funded study.

Rudstam, based at the Cornell Biological Field Station on Oneida Lake in Bridgeport, NY, says, "We can't predict effects of the changing ecosystem on alewife without understanding where they grow up." So, he and a team of Cornell researchers collaborated with fisheries biologists and scientists to gather new information and summarize data already collected on the distribution of small alewife in the nearshore and embayments of Lake Ontario. "To evaluate fish recruitment, we need to know where the major nurseries areas are for young alewife," says Rudstam.

The team – including Cornell's **Ed Mills**, Canada Centre for Inland Waters' **Ora Johannsson**, NYSDEC's **Clifford Schneider**, USGS's **Bob O'Gorman**, and USFWS's **Sandra Priest** – discovered that the nearshore, rather than the protected embayments, are the primary nursery areas for alewife in the lake. "Embayments probably contribute very little to the production of young alewife," says Rudstam. "And so, this study is our first step towards understanding recruitment dynamics and, in turn, alewife production."

These nursery areas are also the most affected by the invasive zebra mussels. "A mussel-induced decrease in food for larval alewife could be problematic," says Rudstam, "as alewife need to grow large enough by fall to survive the winter." However, he notes that abundance of larval alewife were similar in data taken before (1977-78) and after (1997-98) the arrival of these filter-feeding mussels in the Great Lakes. "The nursery area may be affected by zebra mussel grazing more than

the offshore, which may lower the area's productive capacity for larval alewife," he says. But, similarities between current and past abundance levels of larval alewife suggest that the early larvae are only marginally being affected by zebra mussels. Whether later alewife growth is affected remains to be seen."

Before this study, embayments and the nearshore were not included in data collection, both because of their small area relative to the rest of the lake and the fact that large research vessels traditionally used on Lake Ontario do not operate in shallow water. "What we've done here is update the methods used to gather this information, improve the understanding of alewife's early life history habitat requirements, and better define their link in the lake's food chain," says Rudstam.

NYSG's Fisheries Specialist **Dave MacNeill** adds, "Despite the importance of alewife to the Lake Ontario sportfishery, this is the first study conducted that addresses alewife recruitment." In addition to providing a better understanding of alewife early life history, MacNeill says this research will help managers to more accurately set stocking levels for salmon.

— Paul C. Focazio



Klumb (left) and Cliff Schneider, a NYSDEC fisheries biologist at the time, picked up alewives from gillnets set in the nearshore of Lake Ontario in summer 1997. Klumb is now a Fisheries Biologist with the US Fish & Wildlife Service in South Dakota.

Photo by Nijole Pauliukonis



Lab aquaria at the Cornell Biological Field Station (left) were used in summer 2000 to rear larval alewives (middle). Alewife in their juvenile life stage (far right) were studied to see if they use Lake Ontario's inshore areas and embayments as nursery grounds.

Photos by Rob Klumb

Ted Bestor: Report from Sushi Central



Ted Bestor with a tuna wholesaler at a stall within the Tsukiji Market — “The Fish Market at the Center of the World.”

Ever since his father’s appointment as a visiting Fulbright professor brought **Ted Bestor** to Tokyo as a teenager in the 1960s, he has been immersed in Japanese culture. Then, in the late 1980s, Bestor became hooked on fish and on Tokyo’s famed seafood market, Tsukiji (rhymes with “squeegie”). While on the faculty at Cornell University, Bestor completed a NYSG-funded project in the mid-1990s which examined interactions between Atlantic fishing communities and the world’s largest market for fresh and frozen fish, focusing on many products from the Northeast such as bluefin tuna, sea urchin, lobster, and monkfish.

Now, as a Professor of Anthropology and Japanese Studies at Harvard University, Bestor has completed the definitive book on Tsukiji. This huge, bustling landmark on an average day handles over 2,300 metric tons of seafood from around the world. At Tsukiji’s auctions, seafood swiftly changes hands and moves on to the marketplace’s hundreds of specialized stalls, which in turn sell to sushi chefs, fishmongers, food processors, catering firms, supermarket chains, and almost every other sector of the Japanese food industry.

According to the book jacket of *Tsukiji: The Fish Market at the Center of the World*, published this summer by the University of California Press, “Bestor brings to life the sights and sounds of the marketplace, Tsukiji’s rich internal culture, its central place in Japanese cuisine, and the mercantile traditions that have shaped the marketplace since the early seventeenth century.”

Bestor’s NYSG project “Atlantic Fishing Communities and Japanese Seafood Markets: An Ethnographic Analysis of Socio-Economic Integration,” was the first systematic effort to examine the socio-economic structure and cultural contexts that frame the international seafood trade and that link Atlantic fishing communities to Tokyo’s Tsukiji Market. His book, based on research extending from the late 1980s to the present, and carried out not just at Tsukiji but also

in other parts of Japan, and in the Northeastern U.S., Korea, Taiwan, and Spain, examines – and explains – the complex social institutions that organize Tsukiji’s daily seafood auctions and the supply lines leading to and from them.

Bestor’s illustrated and entertaining book gives a clear analysis of the seafood market process, while also painting a picture of Tsukiji from many perspectives. What can be learned from this book and applied to the American seafood industry? The book provides a roadmap of how Tsukiji works and how it handles imports, and people in the trade can apply the detailed account of the marketplace as a whole to their own part of the seafood industry. Bestor’s book also compares Tsukiji to other markets. He notes that New York’s Fulton Fish Market, although the largest in North America, handles a fraction of the tonnage of Tsukiji’s trade and is set up quite differently. “Fulton Fish Market doesn’t have an auction system,” says New York Sea Grant’s seafood specialist **Ken Gall**, “but it, too, has a complex system of relationships that has influenced the domestic seafood marketplace in New York City and the surrounding region for over a century.” To Bestor, some of the most interesting facts about the market revolve around how supply lines are organized, and almost constantly re-organized. “Fulton, like Tsukiji, is inevitably part of a much larger social and cultural environment,” says Bestor. “Markets like these don’t simply feed cities, they are part of the soul and spirit of cities, and they cast influence over entire maritime economies.”

Stateside, Ted Bestor has spoken to dozens of people in the American fishing industry, primarily in New England. He has worked with the American Seafood Institute in Port Judith, RI, especially on its export trade promotion program. He welcomes comments and questions about Tsukiji, and can be reached at bestor@wjh.harvard.edu. His website, which includes Tsukiji information, is www.people.fas.harvard.edu/~bestor.

— **Barbara A. Branca**



A bustling stall at Tokyo’s Tsukiji market.

All photos courtesy of Ted Bestor

Dr. Tettelbach collects seawater to measure phytoplankton chlorophyll as part of one of several funded research projects.

Photo courtesy of Dr. Steve Tettelbach



Mercenaria mercenaria



The story of the Long Island south shore hard clam industry's boom to bust harvest since the late 1960's is no secret. Figuring out what can be done about it has been a mystery, however. While much has been learned through research, seeding efforts, and demonstration projects in the past decades, the clams (*Mercenaria mercenaria*) have not rebounded. A complicating factor is that the ecosystem is probably quite different now than it was during the 10 years (1969-78) when more than 500,000 bushels were pulled annually from Great South Bay alone. So, to make progress toward restoration, we need to determine what conditions are limiting hard clam abundance *today*. Since 1999, with support from Congressmen Michael Forbes and Felix Grucci and others, New York Sea Grant has been spearheading what became an \$810,500 co-funding partnership with NOAA's National Marine Fisheries Service, the South Shore Estuary Reserve, and the Port Authority of NY and NJ, to do just that.

So far, three intensive research projects, designed and conducted by nationally-reputed shellfish experts, have shed new light on the situation. The results have been shared with state and federal agency representatives, town shellfish managers, and other groups interested in hard clams and shellfish restoration.

A Southampton College student prepares field samples for tissue analyses.

Photo courtesy of Dr. Steve Tettelbach

Hard clams filter phytoplankton as their main source of food. However, if these small algal cells are less than 4-5 μ m in size, they cannot be captured very efficiently. The <3 μ m size brown tide alga, *Aureococcus anophagefferens*, also can inhibit clam feeding through a toxic effect when its cells are at high

densities. What are we finding in the estuary these days? Field sampling from fall 2000 to fall 2001 revealed large differences in phytoplankton composition between several south shore estuary sites, with those in the center portion (Bay Shore, Babylon, and Patchogue) having higher percentages of the very small plankton, including some brown tide. In 2002, study areas in Copaigue, Babylon, and Patchogue also mostly had phytoplankton in this very small range, but with insignificant numbers of brown tide cells.

We know from previous research that growth of seed and adult clams is affected by poor food, but what about reproduction? Quantitative techniques examining field collected samples showed that the timing of peak reproductive condition and spawning is not



Watch

off-schedule and occurred May to July, just as it has historically. However, the nutritional status of hard clams was poorest at sites where very small plankton (including brown tide) predominated, causing them to have a much lower relative reproductive output compared to other areas sampled. This has important implications for restoration efforts. Watershed-scale changes in nutrient levels and ratios may be necessary to enhance the phytoplankton more beneficial to hard clams, but we do not know enough about the interactions and overall ecosystem effects to recommend a specific course of action at this point. On a smaller scale, however, spawner sanctuaries (areas where reproductively mature clams are protected from harvest) could be targeted to areas with phytoplankton species that are a good food source for hard clams.

One of several platforms holding submerged tanks for filtering and growth experiments.

Photo courtesy of Dr. Robert Cerrato



to simulate the growth and development of hard clam populations under various environmental conditions. With its current low levels, recovery time for the hard clam population will be on the order of a decade or more, even if harvest is stopped and conditions are optimal. At densities of 0.5-1 clam/m² the population will have a hard time recovering due to reproductive difficulties, and some areas are currently at or below that range. Adding clams to the system should positively influence these factors, but we need to keep the food situation in mind. The model offers a valuable tool that can be used to make predictions about the expected effects of specific environmental conditions and management options.

The multi-year Hard Clam Research Initiative is providing science-based information to agencies and organizations directing considerable attention and resources toward restoring shellfish populations in NY's estuaries. Two new, additional research studies are currently underway. Please see www.seagrant.sunysb.edu/HardClam for more information.

— **Cornelia Schlenk**

Research Roster

The Hard Clam Research Initiative scientist teams include experts from five states and Canada:

Robert Armstrong¹
V. Monica Bricelj²
Stuart Buckner³
Robert Cerrato¹
Roger Flood¹
Christopher Gobler^{4, 1}
Raymond Grizzle⁵
Eileen Hofmann⁶
John Klinck⁶
John Kraeuter⁷
Jeffrey Levinton¹
Darcy Lonsdale¹
Glenn Lopez¹
Roger Newell⁸
Dianna Padilla¹
Eric Powell⁷
Stephen Tettelbach⁴

¹ **Stony Brook University, NY**

² **National Research Council, Canada**

³ **Town of Islip, NY**

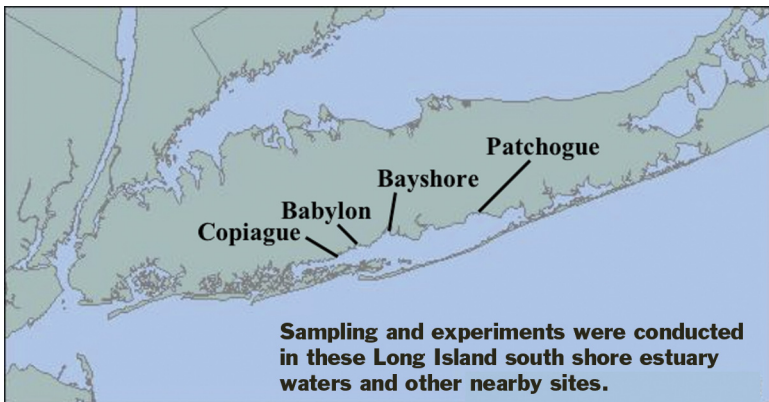
⁴ **Southampton College of Long Island University, NY**

⁵ **University of New Hampshire, NH**

⁶ **Old Dominion University, VA**

⁷ **Rutgers University, NJ**

⁸ **University of Maryland, MD**

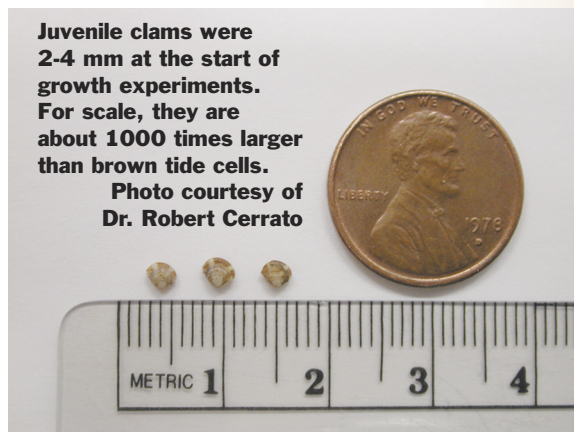


Another novel approach was investigated through controlled experiments that showed the presence of adult clams had a positive effect on the growth of juvenile clams, apparently due to increased food quality. This means that clams themselves seem to be able to change the composition of the phytoplankton towards more nutritious species just through their own feeding activity. Ecosystem interactions are complicated (e.g., the researchers also discovered that hard clams are effective consumers of a copepod that also grazes on phytoplankton), but planting large numbers of adult hard clams to have a high filtration rate could be a strategy to enhance the recovery of this species.

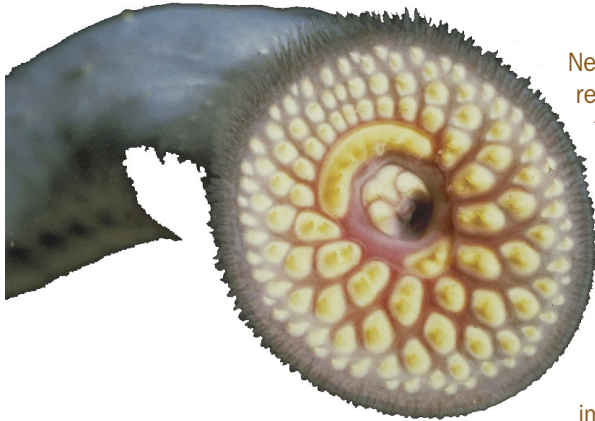
Additional results and conclusions came from the research group that developed a mathematical model

Juvenile clams were 2-4 mm at the start of growth experiments. For scale, they are about 1000 times larger than brown tide cells.

Photo courtesy of Dr. Robert Cerrato



Sea Lamprey: Lake Ontario's native son?



The results of New York Sea Grant research suggest that the parasitic sea lamprey, a species usually considered invasive with its immense economic impact on commercially and recreationally important fishes of the Great Lakes, may be native to Lake Ontario.

The lamprey's powerful mouth parts make it adapted for attaching to fish, including Chinook salmon (on cover) and lake trout (below).

Courtesy of the Great Lakes Sea Grant Network

In research described in the recent *Transactions of the American Fisheries Society*, John Waldman of Queens College of the City University of New York, and **Isaac Wirgin, Cheryl Grunwald** and **Nirmal Roy** of New York University's Department of Environmental Medicine analyzed mitochondrial DNA of sea lampreys (*Petromyzon marinus*) from 10 locations along Great Lakes and Atlantic coasts.

Genetic comparisons were made of lamprey populations along hypothesized colonization pathways. Pronounced differences in gene frequency patterns between lampreys collected along the rivers of the Atlantic Coast and those in the Lake Ontario watershed, together with arguments against the viability of lamprey colonization via the Erie Canal, strongly support the idea of natural lamprey colonization by one of at least three hypothesized pathways following the retreat of the glaciers.

The sea lamprey lives throughout the North Atlantic Ocean, spawning in rivers in Europe and North America, and parasitizing a wide variety of fish. Each of the Great Lakes with the exception of Lake Ontario has documented dates of observed invasion of the sea lamprey in the twentieth century. The first sighting of the species in Lake Ontario was 1835, 12 years after the completion of the Erie Canal.

Some investigators have concluded that the canal was the means of entry of the fish into the lake. But some have held a contrary view that sea lampreys are indigenous.

This research team's genetic evidence suggests that the sea lamprey may have colonized Lake Ontario right after the Pleistocene (about 10,000 years ago) by one of three hypothetical pathways: the Delaware-Susquehanna drainage, the Hudson-Mohawk system or the St. Lawrence River, the lake's present outlet.

Throughout the Great Lakes, parasitic sea lampreys cause a loss of revenue in both the commercial and recreational fishing industries. Numerous ongoing programs to eradicate or at least deplete their numbers are in effect. Their lack of homing behavior (failure to return to rivers in which they spawned) has sometimes exacerbated eradication methodologies. However, if sea lampreys are indigenous to Lake Ontario and therefore part of the lake's ecosystem, management policies aimed toward intense suppression might need reevaluation.

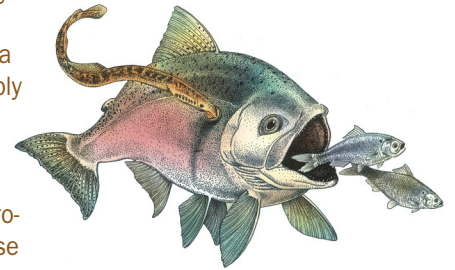
"This is a most interesting study that offers additional support for the theory of an indigenous sea lamprey population in Lake Ontario," says **Dave MacNeill**, New York Sea Grant Fisheries Specialist located at SUNY College at Oswego along Lake Ontario's eastern shore. MacNeill offered further insight into the unique relation-



ship between sea lamprey and other fish. Some speculation surrounds the relationships between sea lamprey and native fish such as lake trout and Atlantic salmon that were likely the preferred targets for lamprey. It's possible that historically there was a stable parasite/prey relationship between lamprey and these large fish, with few lamprey induced mortalities and a low incidence of scarring observed on fish. As commercial fishing and spawning habitat destruction on lake trout and Atlantic salmon reduced their populations—and the sizes of fish in the lake—the frequency of lamprey attacks per individual trout and salmon likely intensified. This resulted in more mortalities in these fish and their eventual extinction from Lake Ontario. In a sense, the initial stable parasite/prey relationship may have shifted to a predator/prey relationship. It is also likely that stream temperatures increased from deforestation; this could have improved lamprey reproductive success while reducing that of Atlantic

salmon which require lower temperatures. These speculations raise some interesting questions. If the sea lamprey is native, does this weaken the case for lamprey control? Perhaps, perhaps not. Control efforts regarding any injurious species are targeted to optimize control efficacy at a level that is also economically sustainable. In other words, total eradication would be economically unfeasible so a certain amount of lampreys would inevitably remain. Given the economic damage that sea lampreys inflict upon recreational and commercial fisheries, continued lamprey control would be considered to protect economic revenues generated by these fisheries.

Sea Lamprey on Chinook Salmon.
Artwork by Jan Porinchak



— **Barbara A. Branca**
David MacNeill

Boater Spending *continued from page 3*

Background photo of Gone Fishing Marina, Montauk.
Photo by Sharon O'Donovan

As one of the nation's major boating states, boating is a key recreational industry in virtually all areas of New York, especially the marine waters, Hudson River, Great Lakes, St. Lawrence River, the Finger Lakes, and Lake Champlain. The economic data will be used to develop tools that will allow managers to better evaluate the impact of boating on a regional scale.

The New York Sea Grant study broke out expenditure and economic impact figures by major boating region and boating major water body:

Trip related expenditures:

- \$173 million associated with trips to regions bordering the Great Lakes and Finger Lakes
- \$54 million associated with trips to Hudson River area
- \$162 million associated with trips to the New York City/Long Island Metropolitan area

Non trip related expenditures:

- \$661 million associated with the economic regions bordering the Great Lakes and Finger Lakes
- \$194 million associated with the Hudson River region
- \$907 million associated with the New York City/Long Island Metropolitan area

Total Economic Impact by region:

- \$600 million associated with the economic regions bordering the Great Lakes and Finger Lakes

- \$184 million associated with the Mid-Hudson and Capital District Regions
- \$843 million associated with the New York City/Long Island Metropolitan Area

The study was conducted in 2004 with the aid of an advisory panel of agency and boating industry experts from around the state. The estimates were based on a mail survey of 6,000 boaters registered in New York State in 2003. These figures may be conservative for the marine region since data indicate boating activity may have been suppressed due to the weather that year. "June 2003 was one of the wettest on record and the threat of Hurricane Isabel striking New York's marine coast in September resulted in many people pulling their boats early, further shortening the season," said Tanski. In addition, the figures do not include spending by transient boaters and others who are not registered in the state. Additional expenditures are most likely made in water bodies bordering other states, especially around Long Island and New York City. Non-motorized boaters, such as kayaks, canoes and small sailboats, are also likely to have made economic contributions throughout New York, but were not included in the study since they are not registered by the state.

For a downloadable copy of the report, go to New York Sea Grant's home page www.nyseagrant.org and follow the links.

— **Barbara Branca**
Jay Tanski

CURRENTS

Celebrating New York's Estuaries

For National Estuaries Day, celebrated each year in late September, three of NYSG's marine district extension staff participated in activities geared to inform New Yorkers about the importance of the estuarine environment.

Along Long Island Sound

In recognition of National Estuaries Day, Saturday, September 25, 2004, The Waterfront Center (www.thewaterfrontcenter.org), in cooperation with the Kips Bays Boys and Girls Club and the Boys and Girls Club of Oyster Bay – East Norwich, hosted an exciting day for children to learn about and protect estuaries. Kids kayaked, cleaned up the beach, and seined for the plants and animals that live in the marine habitat.

To make the event most meaningful, organizers created a program that included implementing a stewardship activity that the children created themselves. The Waterfront Center, directed by **Amy Cross**, hopes to increase public awareness of the Long Island Sound and motivate people to participate in the Sound's restoration.

As part of National Estuaries Day, the Hempstead Harbor Protection Committee kicked off its "My Pet Protects Hempstead Harbor" campaign, a campaign that not only educates people about the damage pet waste can do to the harbor, but provides the means for them to do something about it.

"Dogipot" Pet Waste Disposal Stations newly installed in key locations around the harbor will help ensure that residents do the right thing. With several nearby trails, parks, beaches and sidewalks, there is an easy path for bacteria and viruses from pet waste to enter the harbor. To block that path, each station has a dog waste bag dispenser and an educational sign attached to a single pole. The campaign's slogan is "Protect Hempstead Harbor - It's Your Doody!" These stations will serve as a pilot program for possible expansion to other member municipalities from the Committee. Both projects were funded through the small grants program.

— **Kimberly Zimmer-Graff**
Long Island Sound Outreach Coordinator



Phillip Coffin, (center with green hat) New York Restoration Project, celebrates National Estuaries Day by leading local kids in a seining activity at Swindler Cove Park on the Harlem River.

Photo courtesy of NYRP

In New York-New Jersey Harbor Estuary

Building on the success of last year's events, the Harbor Estuary Program once again sponsored a harbor-wide celebration of National Estuaries Day. New York Sea Grant coordinated planning, produced educational materials and administered \$25,000 in funding for the events. More than sixteen organizations in the metropolitan region hosted family-oriented events designed to bring the area's residents to the water to experience the estuary.

Among the activities offered were canoeing on the Gowanus Canal; catch-and-release fishing on the East River; a nature photography workshop for kids in Brooklyn; a Teacher's estuary education open house in Manhattan; water quality testing demonstrations in the Bronx; seining for aquatic organisms in Yonkers; ecological boat tours on the Hudson River, Harlem River and Jamaica Bay; and many more. Participants in these activities have responded with such enthusiasm that this celebration of the Harbor Estuary is likely to become an annual event.

— **Laura Bartovics**
Outreach Coordinator
NY/NJ Harbor Estuary Program

EstuaryLIVE in the Peconics



Riverhead High School students cheer on the efforts of New York Sea Grant's Peconic Estuary Program educator Shana Miller (front row, left in blue) and PEP's Suffolk County Coordinator Laura Bavaro (front row right in green).

Each September over the past couple of years, the Estuary Live Webcast has been the featured event for National Estuaries Day. This year, Peconic Estuary in New York's eastern Long Island was one of seven featured estuaries from around the country. New York Sea Grant's **Shana Miller**, Technical Outreach Specialist for the Peconic Estuary Program (PEP) was one of the participating naturalists as the event went live via the Web the morning of September 23 from the Suffolk County Marine Environmental Learning Center in Southold, NY.

Thousands of students nationally viewed Estuary Live, a free interactive field trip to some of the nation's estuaries that students and the public viewed by registering at www.estuarylive.org. The Peconic Estuary Live web cast was informative, interactive and a true collaboration with participants from the Peconic Estuary Program, NOAA's New York Sea Grant, US EPA, NYS Department of Environmental Conservation, Suffolk County, Cornell Cooperative Extension of Suffolk County, and the Riverhead and Quogue school districts.

Kicking off the web cast was Peconic Estuary Program Manager **Vito Minei** who explained why The Nature Conservancy named Peconic Estuary one of the "Last Great Places." The EPA's **Rick Balla** explained to students from Riverhead High School and Quogue Elementary School why the Peconic Bay system is an "Estuary of National Significance" and what is being done to protect and restore the "habitats and inhabitants" of the estuary.

Along a splendid stretch of beach on the sunny fall day, **Gill Lankshear's** elementary students got up close and personal with various Peconic critters like horseshoe crab, sea star, whelk and hairy sea cucumber with help from CCE's **Stacy Myers**. **Lance Mion's** marine science students showed their knowledge of the bay's algae under the direction of **Laura Bavaro** of the Peconic Estuary Program and DEC's **Karen Chytalo** both of whom actually munched on some of the bay's sea lettuce.

Introduced by the lively host of the web cast, **Gayle Marriner-Smith**, CCE's **Chris Pickerell** donned a wet suit and used an underwater camera to give a fish-eye view of the bay. **Steve Schott** gave students a tour of the eelgrass greenhouse and explained how this important grass acts as a nursery in the Peconics, why it has been depleted, and what is being done to restore it.

At the shellfish hatchery, bayman **Fred Fiedler** told students first hand about the ecological, economic and cultural importance of shellfish. CCE's **Gregg Rivara** discussed how brown tide algae virtually wiped out a once nationally significant bay scallop shellfishery. Helped by **Mike Patricio**, kids got a glimpse of shellfish larvae through microscopes. Aquaculturist **Otto Schmid**, CCE's **Kim Tetrault**, and Quogue fourth graders demonstrated the workings of CCE's successful "SPAT" program which aims to encourage community members to become stewards of the environment by restoring shellfish to the bays around which they live.

— **Barbara A. Branca**

Miller (right) explains to a Riverhead high school student on the live broadcast how boaters can help keep the Peconics clean. The student is holding a bilge sock, which can absorb up to two quarts of oil and fuel from a boat's bilge compartment, preventing discharge into surrounding waters.

Photos by Paul C. Focazio



How to Protect an Estuary

New York Sea Grant's Shana Miller and a chorus of school kids signed off the web cast with these recommendations to protect Peconic estuary:

The don'ts:

- › Don't litter
- › Don't release balloons

The do's:

- › Participate in beach clean-ups
- › Practice catch and release fishing
- › Use bilge socks on boats
- › Tell others about estuaries

Throughout the web cast, students from 31 classrooms around the country sent a steady stream of questions, many of which the naturalists answered on air as time allowed. EstuaryLive is sponsored by the National Oceanic and Atmospheric Administration (NOAA), NOAA's National Estuarine Research Reserve System, the U.S. EPA's National Estuary Program and many other local sponsors. The September 23 web cast also featured estuaries in North Carolina, Weeks Bay, Alabama and Waquoit Bay in Cape Cod, Massachusetts.

Angler “Talks Up” Great Lakes Fishing

Three new interactive exhibits at the Seaway Trail Discovery Center along Lake Ontario in Sackets Harbor promote fishing in New York’s freshwaters. Visitors may push 12 buttons to hear the talking angler characters speak about trout and salmon fishing on Lake Ontario, salmon fishing on the Salmon River, and carp angling on the St. Lawrence River.

NYSG’s **David White**, who was photographed as the Salmon River Angler, comments, “All of the new fishing exhibits are a fun way to educate the public about New York’s Great Lakes-St. Lawrence Seaway region. I think even non-anglers will enjoy hearing about the lake and rivers.”

The Lake Ontario exhibit features a father and son conversation about a charterboat trip on the boy’s birthday. NYS Assemblyman **Robert Oaks**, who provided funds for the exhibit, comments, “My district represents nearly one-third of the Seaway Trail’s ten New York counties and the sportfishing and charter industries are vital components of our regional economy. This new angling exhibit at the Discovery Center introduces and excites travelers about Lake Ontario as one of the finest sportfishing destinations in the country.”

Fran Verdoliva, manager of the NYS DEC’s Salmon River Fish Hatchery, co-authored the Salmon River Angler script. It likens Chinook salmon to powerful Mack trucks, and Coho and Atlantic salmon to Porsches – fast, acrobatic runners.

Englishman **Bernie Haines**, a river guide who has fished worldwide is the face and voice of the St. Lawrence River Carp Angler exhibit. “The St. Lawrence is among the ten best places in the world to fish for carp,” Haines says.

Assemblyman Oaks, the Village of Pulaski, Town of Richland, Oswego Co. Dept. of Promotion and Tourism, Whitaker’s Sports Shop, and the St. Lawrence County Chamber of Commerce made the exhibits possible.

— Article and photo by Kara Dunn



The two Daves.



Diane Oleson presents the Clearinghouse poster at the 13th International Aquatic Invasive Species Conference in Ennis, Ireland. Photo by Chuck O'Neill

New York Sea Grant’s **Chuck O'Neill** and **Diane Oleson** brought a little bit of Sea Grant’s National Aquatic Nuisance Species Clearinghouse to the international conference held in September 2004. O'Neill gave a presentation on the Clearinghouse and both he and Oleson prepared a poster to communicate to conference goers the Clearinghouse’s mission of providing information on invasives to researchers and stakeholders worldwide.

This year the Institute of Technology in Sligo, Ireland hosted the 13th International Conference on Aquatic Invasive Species. This annual conference is widely considered the most comprehensive international forum for the review of scientific knowledge on the impacts of aquatic invasive species, introduction of new technologies for their control and discussion of public education policy and outreach initiatives to prevent new introductions.

The Clearinghouse Goes Emerald

Says O'Neill, “Aquatic invasive species have become a worldwide problem as the global economy has increased the transport of raw materials and finished products from continents to continent.” Formed in 1990 under O'Neill, the Clearinghouse started as NYSG’s comprehensive source of zebra mussel information. But with additional funding from the National Sea Grant Program and the power industry, the Clearinghouse went beyond zebra mussels. It now addresses more than 30 marine and freshwater species in a continually updated library and searchable database of around 7,000 documents. Information on specific organisms, ballast water, exotic aquatic organisms, and global invasive species policy issues can be found at www.aquaticinvaders.org. Oleson is editor of the Clearinghouse quarterly newsletter, *Aquatic Invaders*.

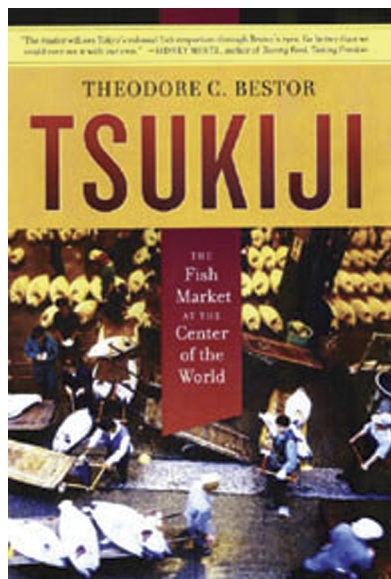
O'Neill is no stranger to Ireland having been a guest speaker at “Zebra Mussels in Ireland: An International Workshop” held in Galway in February 1998. His expertise in the area of aquatic invasives has recently earned him a spot on NY Governor **George Pataki’s** New York Invasive Species Task Force.

— **Barbara A. Branca**



Experience Autumn @ nyseagrant.org

- Download proceedings from Sea Grant's fourth "Botulism in Lakes Erie and Ontario" workshop, the report on "Recreational Boating Expenditures in 2003 and Their Impacts," and materials from early-October 2004's fourth annual Long Island Sound Lobster Health Symposium.
- Learn more about our renewed partnership with regional and national organizations to promote cleaner boating across the state. As part of the effort, 260 marinas and all NY's Coast Guard Auxiliary and US Power Squadron units received clean boating packets.



As part of May 2004's Great Lakes Student Summit, SUNY ESF student Meaghan Dye (pictured at right) and US Fish and Wildlife technician Mike Goehle (not pictured) used equipment to shock a variety of fish, scoop them up in nets, and identify them aboard a boat alongside the *Niagara Clipper* for students. The fish were later released into the Buffalo River. Photo by Paul C. Focazio

Note: This picture was mistakenly replaced with another in "Powering the Future," the Coast Watch feature in the Summer 2004 *Coastlines* (pages 8-9).

LastWave

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Journal Reprints

Effects of background concentrations of *Aureococcus anophagefferens* (brown tide) on growth and feeding in the bivalve *Mercenaria mercenaria*. D.I. Greenfield, D.J. Lonsdale, R.M. Cerrato and G.R. Lopez. 2004. *Marine Ecology Progress Series* 274:171-181. Free

Mitochondrial DNA analysis indicates sea lampreys are indigenous to Lake Ontario. J.R. Waldman, C. Grunwald, N.K. Roy and I. Wirgin. 2004. *Transactions of the American Fisheries Society* 133:950-960. Free

The occurrence of cyanobacterial toxins in Lake Champlain. G.L. Boyer, M.C. Watzin, A.D. Shambaugh, M.F. Satchwell, et al. 2004. *Lake Champlain: Partnerships & Research in the New Millennium* 241-257. Free

Importance of Lake Ontario embayment and nearshore habitats as nurseries for larval fishes with emphasis on alewife (*Alosa pseudoharengus*). R.A. Klumb, L.G. Rudstam, E.L. Mills, C.P. Schneider and P.M. Sawyko. 2003. *Journal of Great Lakes Research* 29(1): 181-198. Free

Sea Grant Publications

Biological Pollution of the Great Lakes: The Nonindigenous Aquatic Species Issue. C.R. O'Neill, Jr. 2004. Fact Sheet. \$1.00

Proceedings: Jamaica Bay's Disappearing Marshes. National Park Service, B. A. Branca, editor. 2004. Free

Guidelines for Reducing the Spread of "Fishhook waterfleas" (*Cercopagis pengoi*). D. MacNeill, M. Snyder, K. Schulz, J. Makarewicz and D.R. Baker. 2004. Fact Sheet. Free

Recreational Boating Expenditures in 2003 in New York State and Their Economic Impacts. N.A. Connelly, T.L. Brown and D.L. Kay. 2004. Survey. \$5.00

And available from bookstores and on line booksellers

Tsukiji: The Fish Market at the Center of the World. Theodore C. Bestor, University of California Press, July 2004. *California Series on Food and Culture*. ISBN 0-520-22024-2 (paper) \$24.95; ISBN 0-520-22023-4 (cloth) \$60.00. (412 pages, 69 illustrations, 6 maps, 11 tables, glossary, appendix on visiting Tsukiji, bibliography, index).



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Squid

Of the world's many squid species, it's the longfin, *Loligo pealei*, that finds a perfect home year 'round in the cool ocean waters surrounding Long Island. Just how squid and other commercially important fish interact in the deep water habitat was the subject of NYSG research conducted by Tim Essington, formerly of Stony Brook University's Marine Sciences Research Center (now at the University of Washington) and SG Scholars Mary Hunsicker and Michelle Staudinger.

The team found that in deep, offshore waters, squid consume the young of summer flounder, monkfish, bluefish, and whiting, especially in the winter and spring when squid are at their largest and young fish at their smallest. But squid themselves, in turn, are a major part of the diet of large bluefish, large whiting, and are important for all sizes of summer flounder. The important roles of squid in the food chain both as predator and as prey should be factored in when developing fisheries management plans for it and other marine species.

However, in recent years, squid has become an important harvested species as New York commercial fishermen have landed approximately 10 million pounds on Long Island. Much of the local squid catch is processed for export, but a significant number of large squid are sold locally.

Although consumed worldwide, squid has only recently become popular in the US. Squid is remarkable in that an unusually large proportion of this mollusk—80 percent—is edible including its tentacles, arms, and fins. Its firm, delicately flavored flesh is low in fat. The body of a small squid is often cooked whole and stuffed, while larger squid are cut into strips or rings, as in the popular Mediterranean-style calamari. Squid can be baked, boiled, deep fried, sauteed or used in salads and pasta sauces. It is easy to cook and will be tender and sweet if you follow this simple rule: Cook squid quickly at high heat (as in Bestor's recipes) or simmer at low heat for at least 30 minutes. Anything in between is likely to have a tough or rubbery texture.

*Bringing
Science to
the Shore*

Grilled Squid with Black Sesame (Ika Goma-Yaki)

squid, cleaned, skinned and filleted lengthwise
(if using frozen squid, make sure it is fully defrosted)
salt
egg whites
2-4 tbs. black sesame seeds
lemon wedges

Method

Squid needs to be cooked quickly over a hot fire; cook this over the hottest possible charcoal fire. If cooked too long, squid becomes tough. To enhance the tenderness, score both sides of the flesh with a very sharp knife. The Japanese technique is to score the outside in a cross-hatched pattern about 1/16 inch deep and 1/8 inch apart and to score the inside flesh lengthwise every inch or so. Because squid shrinks and curls when it is cooked, use skewers to keep it flat. Two long metal skewers inserted at angles lengthwise along the edges meeting at the tip of the squid should do the trick. Sprinkle salt on the inside of the squid, brush the outside with egg white and dredge in sesame seeds. Grill over hot heat, first the outside (sesame seed side) for about 2 minutes, then turn over and complete cooking for one more minute. Do not over cook. Serve immediately with lemon wedges.



New York Sea Grant

121 Discovery Hall
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Seafood Corner

Marinated Grilled Squid (Ika Aji-Yaki)

squid, cleaned, skinned and filleted
lengthwise (if using frozen squid, make
sure it is fully defrosted)
cup mirin (sweet cooking sake)
cup soy sauce
your choice of: lemon juice, grated
ginger, or finely chopped garlic

Method

Prepare the squid fillets (scoring) as above. Make marinade with sweet cooking sake, soy sauce and your choice of lemon juice, grated ginger, or finely chopped garlic. Marinate squid fillets for 30 to 45 minutes. Insert skewers after marinating. Follow grilling instructions above. Cook over very hot charcoal. Don't overcook.

*Traditional Japanese recipes adapted by
Victoria and Ted Bestor*

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