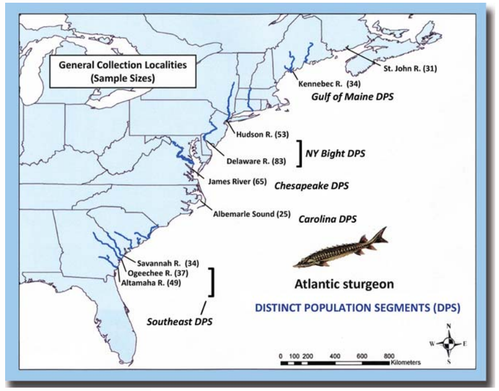

Identifying Distinct Sturgeon Population Segments

The Atlantic Sturgeon (*Acipenser oxyrinchus*), the ancient-looking fish covered with bony plates (scutes) rather than scales, was once abundant along the eastern seaboard and in major river systems from Labrador to Northern Florida. But human activities such as damming rivers, pollution and extensive harvesting have reduced the number and size of its populations and in February 2012, the Atlantic Sturgeon was federally listed as endangered.

The agencies that manage fisheries are concerned about preserving and restoring critical species. But to do this, they must first identify the **distinct population segments** or DPS of each species. Then managers can take into account any unique regional populations and preserve as much as possible natural genetic structure of each species in management and/or restoration plans. In the case of sturgeon, the DPS corresponds to the individual or combinations of estuaries along the eastern seaboard.

The key to this management strategy is genetic detective work—much of it done by pioneering researcher **Dr. Isaac Wirgin** of New York University School of Medicine (aided by NYSG funding). The map of Atlantic sturgeon's DPS was greatly dependent on Wirgin's data identifying the genetic characteristics of each distinct population segment based on the estuary of origin.

Before doing genetic analysis on sturgeon, there was no way of knowing whether or not they showed homing fidelity. But Dr. Wirgin discovered that sturgeon do "go home again"; sturgeon can live in salt water but swim into the rivers and tributaries of their birth to spawn. Using biomarkers on mitochondrial DNA, Wirgin was able to identify DPS of sturgeon by distinct genetic characteristics. His lab can identify whether a sturgeon has come from the Hudson or the Chesapeake all from a tiny clip from the fish's fin. In the 1990s, using such data, the National Marine Fisheries Service (NMFS) and the US Fish and Wildlife Service (FWS) listed the Gulf sturgeon as a threatened species, and reinforced the designation of the Gulf sturgeon as a distinct subspecies.

In 1998, because populations of the Atlantic sturgeon were so low, the Atlantic States Marine Fisheries Commission adopted a 40-year harvest moratorium. With the moratorium in place, the Atlantic sturgeon was considered a "species of concern" and not listed as endangered under the Endangered Species Act. In the years since, Wirgin has continually been analyzing sturgeon fin samples from different locations. The NOAA Observer Program which uses commercial boat observations out of Woods Hole, MA, sent Wirgin samples so he could identify the distinct population segments of origin of individual specimens from the Gulf of Maine to North Carolina. He and **Dr. Tim King** of the U.S. Geological Survey found that some adult and subadult sturgeon from all populations undergo migrations and mix in coastal aggregations. This makes them vulnerable to distant anthropogenic impacts such as coastal bycatch (the topic of another NYSG-funded project). However, most fish tend to aggregate within the geographic region of their spawning river.

Based on work by Wirgin, King and others, a review team assessed the status of the Atlantic sturgeon, and determined that four of the five DPS of Atlantic sturgeon should be listed as endangered.

— Barbara A. Branca

Trawl Workshop an International Exchange

In November 2011 New York Sea Grant (NYSG) and the US Geological Survey brought acclaimed expertise in the design of marine trawls to the Cornell University Biological Field Station on Oneida Lake. It was an award-winning partnership that earned co-organizer and NYSG Fisheries Specialist **Dave MacNeill** a USGS Great Lakes Science Center Certificate of Appreciation.

MacNeill described the workshop, funded by a Great Lakes Regional Research Information Network grant, as an unprecedented opportunity for a marine-Great Lakes exchange with **Dr. Paul Winger** and his internationally-respected fishing gear and marine trawl evaluation team from the Memorial University of Newfoundland's (MUN) Centre for Sustainable Aquatic Resources.

Dr. Winger directs the MUN's state-of-the-art facility with the world's largest indoor flume tank that simulates real-world conditions for the testing of trawls. A week's worth of testing models in the tank can save months of work on the water with full-size trawls. "We are here to share what we know about fishing gear design and how you can increase both trawl and fuel efficiencies, reduce ecological impacts, and obtain the quality of data you need for fisheries science" Dr. Winger said.

Collecting fish samples with large underwater nets (trawls) provides essential information for understanding food webs and managing valuable fisheries resources. Spring-fall trawls have been cooperatively conducted by U.S. federal and state and Canadian provincial agencies on Lake Ontario since the 1970s.

The MUN Centre works with government and science agencies and commercial fisheries interests and has more than 120 different net/trawl designs and 75 sets of trawl doors for configuration testing.

Dr. Winger, his team members: **George Legge**, **Philip Walsh** and **Tara Perry**; and Great Lakes Science Center Statistician **Jean Adams**; presented models, video and data at the workshop that attracted 35 American and Canadian researchers and research vessel personnel representing all five Great Lakes. Some were newcomers to trawling; others have been trawling for 30 years and still want to know more.

"I am impressed with the diversity of responses we received about how important this work is. People are passionate about learning about trawling," said workshop co-organizer **Dr. Brian Weidel** with the USGS Great Lakes Science Center, Oswego, NY.

NYSDEC Research Biologist (and former NY Sea Grant Scholar) **Mike Connerton** Cape Vincent, NY, said, "The mussels in Lake Ontario have forced us to change the gear we use. We are looking for the very best data so we can anticipate the fishery 30 years into the future." **Gary Czypinski** of US Fish & Wildlife Service in Ashland, Wisconsin came to learn a technique for catching Asian carp which have the ability to evade the trawl. **Michael Keir** of Environment Canada came to learn how the mechanics of trawling can be used to study contaminants in fish populations.

The three-day intensive workshop included hands-on trawl exhibits that filled a yard at the Biological Station and classroom time on design configurations, hydrodynamics, fish behavior impact on catch efficiency, environmental variability, and new opportunities for evaluating trawl designs for use in the Great Lakes.

The November trawl workshop featured trawl scale models such as this one being tested in the Memorial University of Newfoundland flume tank, the largest in the world.

Dr. Brian F. Lantry, director of the USGS Lake Ontario Biological Station at Oswego, NY, called this workshop "the best and most useful I have ever attended. This type of work makes a realistic, practical contribution to science." Said MacNeill, "The trawl program well-illustrated NYSG's commitment to providing sound scientific information and its ability to form effective partnerships among agencies and the research community. Scientists from the USGS Biological Station worked hand-in-hand with us to bring this workshop to fruition."

New York Sea Grant has provided leadership in educating fisheries researchers and assessment biologists about trawl design and dynamics in the Great Lakes and abroad. After a 2008 workshop organized by NYSG with MUN and Rhode Island Sea Grant, **Dr. Tomas Juza** from the University of Southern Bohemia's Hydrobiology Institute, returned to the Czech Republic where he applied the training to designing a new trawling vessel and trawl now in use there and in several other European Union countries.

—Kara Lynn Dunn

NYSMEA's 'Share-A-Thon' A Success

New York Sea Grant and longtime partner New York State Marine Education Association (NYSMEA) share the value of the "train-the-trainer" approach to teaching marine science. A recent joint venture was the March 2012 Marine Science Share-A-Thon held at Columbia University's Teachers College, where teachers shared and acquired innovative lesson plans and other materials for students while earning professional development credits.

Attendees of NYSMEA-NYSG's teacher "Share-A-Thon" included (l-r) NYSG Long Island Sound Study Outreach Coordinator Larissa Graham, hydroponics gardening and sustainability presenter Shakira Castronovo from Manhattan Childrens School, NYSG Hudson Estuary Specialist Nordica Holochuck and I FISH NY's Melissa Cohen.
Photo by Paul C. Focazio

As chair of NYSMEA's Education Committee, NYSG Hudson Estuary Specialist **Nordica Holochuck** coordinated the event which featured lessons from over a half-dozen presenters, from an elementary "Sing Along to the Ocean" to "Beneath the Sea's Marine Careers and Scholarship" program for upper level students. Teachers checked the Hudson River's "vital signs" using near real-time data and traveled beneath the waves using Google Earth Ocean. I FISH NY's **Melissa Cohen** played a version of Go Fish! with cards illustrated with New York State fishes which teach students about fish diversity and classification. NYSG Communications Manager **Barbara Branca** offered tips for bringing hot research topics to the classroom (see p. 3 article).

"This pilot program is a good opportunity to network with colleagues and for NYSMEA members new and old to learn some unique educational techniques," says Holochuck. She sees this event as a catalyst to inspire similar resource sharing events throughout the NY Harbor Estuary watershed and along LIS.

In May 2012 Holochuck was honored for her contributions made to NYC science education through her work with NYSMEA. "I was very pleased to be nominated for and receive the 2012 Science Council of New York City (SCONYC) Resnick Award by NYSMEA, a longtime Sea Grant partner and one of SCONYC's nine member organizations," said Holochuck.

—Paul C. Focazio

Last Wave

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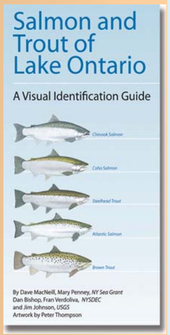
Wurch, L.L., S.T. Haley, E.D. Orchard, C.J. Gobler, and S.T. Dyhrman. 2011. Nutrient-regulated transcriptional responses in the brown tide forming alga *Aureococcus anophagefferens*. *Environmental Microbiology* 13(2):468-481.

Guides and Brochures

MacNeill, Dave, Mary Penney (New York Sea Grant); Dan Bishop, Fran Verdoliva (NYSDEC); and Jim Johnson (USGS). Artwork by Peter Thompson. *Salmon and Trout of Lake Ontario: A Visual Identification Guide*, 2012. New York Sea Grant Brochure. New York Sea Grant Extension Program. Oswego, NY. 8 panels.

This brochure identifies each trout and salmon species in the Lake Ontario watershed based on the accurate color artwork of Peter Thomson. Pictures of each of the nine species are correctly labeled with its distinctive features and seasonal coloration patterns. Unlike line art found in other publications, this unique 14" x 17" 4-color brochure suitable for the angling public is printed on waterproof paper and folds down to 3.5" x 8.5" to store easily in a tackle box. Contact Oswego office for more info. 315.312.3042 or download at http://www.seagrant.sunysb.edu/glsportfish/pdfs/SalmonTrout-LakeOntario2012.pdf



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Sound Research "Gets to the Bottom" of Hypoxia, Red Tide

Aside from the problem of LIS hypoxia, Dr. Christopher Gobler is also investigating an emerging issue: the causes and impacts of recent blooms of the red tide organism *Alexandrium fundyense* in the Sound. *A. fundyense* produce saxitoxin which may be ingested and accumulated in shellfish. The consumption of contaminated shellfish by humans or other predators, can cause paralytic shellfish poisoning (PSP) and thus presents a serious human health threat.

Gobler and his team report that from 2007 through 2011, *A. fundyense* has been detected at over 50 locations across NY and CT with the largest blooms being found in Northport Bay and other locations in NY with large nitrogen loads. Blooms in Northport persisted for up to six weeks achieving high cell densities, and forcing month-long annual closure of shellfish beds due to high saxitoxin concentrations in mussels and wild soft shell clams. Blooms have recurred annually and the researchers documented that a persistent cyst bed was established in Northport Bay in 2008 and has remained there since. In the cyst stage of *A. fundyense's* life-cycle, the cells can persist until conditions are right for them to bloom again.

In two recent journal articles, the research team reported that *A. fundyense* blooms in Northport were supported by a source of wastewater nitrogen such as septic systems or the sewage treatment plant which discharges into Northport Harbor. Also, warmer than average atmospheric temperatures in the late winter and early spring and cooler late spring temperatures can contribute to extended periods of temperatures optimal for *A. fundyense* growth and thus may have also contributed toward the large blooms. The researchers further suggest that allelopathic chemicals produced by *A. fundyense* that inhibit other algae may also aid in bloom formation. Finally, preliminary findings indicate that organic matter loading may also contribute toward bloom formation. Together all of their findings suggest that sewage-derived nitrogen loading, above average spring temperatures, organic matter loading, and the production of allelochemicals can all promote intense and toxic *A. fundyense* blooms in NY estuaries.

A portion of the funding for these projects came from two Sea Grant programs: Connecticut and New York which receive federal funding through the National Oceanic and Atmospheric Administration (NOAA). Most of the funding came from the Long Island Sound Study, a cooperative effort between the EPA's National Estuary Program and the states of Connecticut and New York to restore and protect the Sound and its ecosystems.

— Barbara A. Branca

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...CoastWatch

Continued from page 1

winters, increased zooplankton grazing might lead to a suppression of the spring bloom and thus a decline in the amount of organic matter delivered to the benthos.

They conducted two types of experiments: field observations of zooplankton grazing and controlled mesocosm (tank) experiments with varying temperatures. In the field, the research team observed that the 2010 and 2011 spring blooms occurred in early February with the peak of spring phytoplankton bloom coinciding with the lowest seawater temperature and equal temperatures from surface waters to the bottom (i.e., no stratification). Microzooplankton grazing occurred on all dates, even when seawater temperatures were approaching 0°C. However, in the two years of mesocosm experiments, the warmer temperature treatment resulted in fewer phytoplankton and higher zooplankton grazing. The research indicates that suppression of the spring bloom with increased winter temperature may result in less carbon at the bottom potentially improving the hypoxia problem because of decreased respiration in the benthos, but also potentially decreasing productivity of benthic fisheries.

Drs. Kamazima Lwiza and **Gordon Taylor** with NY Sea Grant Scholars **Elizabeth Suter** and **Ling Liu** have been looking at the interaction of biological and physical factors controlling dissolved oxygen. Their goals have been to determine the variability in dissolved nutrients such as nitrogen and phosphorus, and to examine the roles of phytoplankton biomass, and bacterial production and mortality on bottom water oxygen content.

They made direct measurements of microbial biomass and activity during sampling cruises during the summers of 2009 and 2010 and also conducted statistical analyses of historical data. Respiration in bottom water samples was highest in the middle of summer 2009, including on days when hypoxia occurred. Furthermore, respiration in the very small particle-size fraction was negatively correlated with dissolved oxygen concentrations, suggesting that respiration associated with smaller particles and organisms is an important contributor to bottom water oxygen depletion. Respiration in this size fraction was also highly correlated with bacterial abundances, suggesting that bacterial respiration was one of the most important processes in depleting oxygen concentrations.

Chemical analyses indicate that nitrogen has increasingly become a limiting factor in phytoplankton blooms relative to phosphorus in LIS. There were modest decreases in dissolved inorganic nitrogen (DIN) while dissolved organic nitrogen (DON) increased, thus leaving total nitrogen relatively unchanged. Between 2002 and 2010, diatom abundances have declined in favor of nondiatom groups of phytoplankton. The researchers speculate that this is due to the Sound's changing chemistry: diatoms prefer DIN while other groups, such as dinoflagellates, prefer DON and also have a higher phosphorus requirement.

Collectively these observations are helping to create a biogeochemical numerical model to provide managers with a better understanding of hypoxia's drivers and therefore a better means of predicting hypoxic events in Long Island Sound. By specifically addressing microbial responses in the numerical model for the first time, seasonal hypoxia was modeled more accurately.

Dr. Mark Altabet of the Department of Estuarine and Ocean Science, School of Marine and Technology, University of Massachusetts, Dartmouth has been looking at the geochemistry of dissolved gases in the Sound to gain insight into oxygen exchange between surface and bottom waters. His results, to be reported at a future STAC meeting, will help the researchers put the chemical, physical and biological pieces together to create a more complete model of LIS hypoxia.

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Sea Grant New York

Director
James Ammerman

Associate Director
Katherine Bunting-Howarth

Assistant Director
Cornelia Schlenk

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Managing Editor/Writer
Barbara A. Branca
Barbara.Branca@stonybrook.edu

Web Content Manager/Writer
Paul C. Focazio
Paul.Focazio@stonybrook.edu

Contributing Writers
Kara Lynn Dunn

Layout and Production
Sharon A. O'Donovan
LC Graphics

Publications
Leigh Hubbard

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

For a list of NYSG's offices and staff, click on "Contact Us" > "Staff" at www.nyseagrant.org

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

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From the Director...

Long Island Sound is truly America's Urban Estuary, with more than 23 million people living within 50 miles of its 600 mile coastline. The economic value of Long Island Sound to the local economy is nearly $9 billion per year, and it has been the subject of research and restoration efforts for many years. The year 2012 will also mark the release of a major synthesis volume focused on Long Island Sound research findings and their management implications.

Profiled in this issue are five recently-completed Long Island Sound research projects administered jointly by New York and Connecticut Sea Grant with funding provided by the Long Island Sound Study, the EPA National Estuary Program for Long Island Sound. Three of these projects focused on various aspects of the hypoxia, or low dissolved oxygen, that plagues the western Sound in the summer. A fourth looked at winter temperature impacts on the Sound's food web, and the fifth examined red tide blooms in Long Island's North Shore embayments. These projects have been an outstanding example of the collaboration between the two Sea Grant Programs, and the Long Island Sound Study, in which the Sea Grant Programs lead the peer review process and administer the projects. An additional set of six projects started in 2011. And another request for proposals for Long Island Sound research was recently released. These research projects focused on Long Island Sound address important scientific issues that will contribute to "Sound" management for the benefit of all the region's citizens.

Also in this issue is an important story about Atlantic Sturgeon, an ancient species whose population has seriously declined. With New York Sea Grant (NYSG) support and using novel molecular methods, **Dr. Issac Wirgin** has been able to distinguish several distinct population segments of Atlantic Sturgeon, which has important implications for their management. Another "fish story" from the Great Lakes describes a recent trawl workshop conducted by NYSG Fisheries Specialist **Dave MacNeill** and colleagues to improve stock assessment in Lake Ontario and the other Great Lakes. The US Geological Survey presented Dave with a certificate of appreciation for this workshop. In addition, several NYSG educators and communication staff recently participated in a "Share-A-Thon" at Columbia Teachers College with their partners in the New York State Marine Education Association.

Finally, it is not too late to provide input for the new NYSG strategic plan—just contact me.

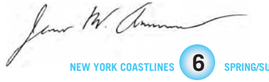

Photo credits: top courtesy Theresa Hattenrath-Lehmann; center courtesy Jennifer George; bottom and large photo Barbara A. Branca

CoastWatch...

In every season, from near shore or far, under fair skies or a fast-moving front, graduate students collect samples from Long Island Sound. From top to bottom: Sea Grant Scholar Theresa Hattenrath-Lehmann and grad student Ryan Wallace study red tide in Northport Harbor; Sea Grant Scholars Laura Treible, Jennifer George and Theresa Hattenrath-Lehmann study winter productivity from aboard the *r/v Seawolf*; Sea Grant Scholar Elizabeth Suter analyzes microorganisms from the *Seawolf's* rosette sampler.

Sound Research "Gets to the Bottom" of Hypoxia, Red Tide

Since Spring 2009, the Sea Grant programs of Connecticut and New York have been tracking five funded research projects that examined some of the most serious threats to the ecological health of Long Island Sound (LIS), an Estuary of National Significance. The researchers, several of them at Stony Brook University (SBU), were awarded nearly $820,000 in research grants to address the long-term problem of LIS's low oxygen conditions (hypoxia) as well as emerging issues of red tide and the effects of climate change on the Sound's ecosystem. Recently, several researchers presented results from the two-year projects to the EPA LIS Study's Science and Technical Advisory Committee many members of which are resource managers throughout the LIS watershed.

Several projects examined hypoxia, each taking a complementary research direction, whether investigating the chemical, physical, or biological factors that contribute to the low oxygen conditions at the bottom of LIS.

Drs. Robert Wilson and **Brian Colle** along with NY Sea Grant Scholar **Sean Bratton** at SBU's School of Marine and Atmospheric Sciences (SoMAS), and **Dr. Daniel Codiga** of the University of Rhode Island have looked at the relationship between summertime storms and hypoxia. They hypothesize that these systems are a primary agent responsible for mixing bottom waters and determining oxygen levels. Using existing meteorological data, they evaluated to what extent relevant factors like wind speed, wind direction, and air pressure cause water in the Sound to either mix or stratify in layers. Results show that variation in the wind direction over the western Sound accounts for a major fraction of the variance in the duration and extent of hypoxic events. They found that high pressure patterns with winds from the east/northeast result in the highest percentage of total mixing events. These mixing events are strong determinants of fluctuations in dissolved bottom oxygen and the duration of the hypoxic event. Measurements of hypoxic event duration provide good metrics for gauging the impacts of hypoxia on living resources. However they also found that the duration and intensity of stratification events are not closely linked to those of hypoxic events.

Also at SoMAS, **Drs. Darcy Lonsdale** and **Christopher Gobler** along with NY Sea Grant Scholars **Jennifer George**, **Xiaodong Jiang** and **Laura Treible** have examined seasonal temperature differences and the effects on the Sound's food web. The spring phytoplankton bloom is an annual event in LIS and an important source of organic matter to the benthos (animals living at the bottom of LIS). The researchers hypothesized that during warm

Continued on page 2